The Relative Decline of Agriculture in China

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by

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ABSTRACT

This paper attempts to determine the impacts of three major factors: (a) price changes, (b) factor endowment changes, and (c) technological change on the relative decline of agriculture in China. However, the results suggest that only the price ratio has significant and positive impact on agriculture's GDP share in China. Nevertheless, the variable of the price ratio explains the model well with about 99 percent of R^2 value. The irrelatedness of other variables may require further investigation and explanation.

Keywords: *Relative decline, agriculture, price ratio*

JEL code: O13

1.0 INTRODUCTION

A large country like China always faces with the question how to feed its growing abundance of population. The question describes well the importance of agriculture in the country's development. Without other options, China is elected to be an agrarian society because of its fundamental requirement of food security, profusion of natural resources (especially land) and its ability to value-add its surpluses through other important industries. Agriculture's economic role is rather a backbone and a feeder of raw material to the more accelerating industrial and services industries. Having described so, it is apparent that agriculture's GDP share declines relative to the growth of sector and services industries during economic development.

In China, liberalization of domestic agricultural market and international trade with the rise of farm prices had an enormous influence on production during the implementation of the Reform of Agricultural Policy (1979-1993). Production surplus was much in 1984 and enabled the country to export for the first time. Its agriculture's GDP share was proudly accounted for 44.59 percent in that year. Ever since then, China has become one of the major food exporters in the globe. By the end of the reform in 1993, China's agricultural sector was a largely free-market sector. However, it did not stop the relative decline of agriculture in China and recorded 31.12 percent of share in GDP in that year. For the following years, a more rapidly growth in non-agricultural sector saw continuous decline in agriculture's GDP share of just about 20 percent in 2006.

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Given such transformation of agriculture's GDP share along with China's economic development, previous studies (Ling *et al.*, 2007; Harrigan, 1997; Martin and Warr, 1993; Woodland, 1982; Kohli, 1978) suggested that causes of the decline in the agricultural sector can be decomposed into three components: (a) price changes, (b) factor endowment changes, and (c) technological change. Income, population, and preference changes will result in a shift on demand for food relative to other goods and further reflect in relative agricultural commodity price changes. Differences in the rates of technical change in each sector can affect comparative advantage of each sector. In factor endowment, changes in aggregate supplies of capital and labor may determine the change in comparative advantage.

This paper serves as a first hit by attempting to determine the impacts of price changes, factor endowment changes, and technological change on the relative decline of agriculture in China. The next section discusses the theory underlying the relative decline of agriculture and inclusion of new variables. Next, models with specific estimation procedures are elaborated and followed by presentation of results in the next section before conclusions.

2.0 ESTIMATION METHOD AND DATA

With such objective, it is conveniently simple to follow the theoretical model of revenue function discussed by Dixit and Norman (1980) and estimated by previous studies (Ling *et al.*, 2007; Harrigan, 1997; Martin and Warr, 1993; Woodland, 1982; Kohli, 1978). Besides of its simplicity in analytical properties, a Translog functional form does not impose input-output separability (Lopez, 1985). The Translog revenue function can be expressed as:

$$\ln R(\theta P, X) = a_0 + \sum_i a_i \ln \theta_i P_i + 1/2 \sum_i \sum_j a_{ij} \ln \theta_i P_i \theta_j P_j + \sum_k b_k \ln X_k + 1/2 \sum_k \sum_m b_{km} \ln X_k \ln X_m + \sum_i \sum_k c_{ik} \ln \theta_i P_i \ln X_k \quad (1)$$

where

R is total revenue;

P_i is prices of output;

X_k is quantities of factor endowments;

θ's is technological progress; and

a's, b's and c's are parameters to be estimated.

A differentiation of Equation (1) with respect to the log of the price of agricultural output yields a simple equation as below,

$$S_a = a_0 + a_1 \ln(P_a / P_n) + a_2 \ln(\theta_a / \theta_n) + a_3 \ln(K / L) + a_4 \ln(NR / L) \quad (2)$$

where

S_a is share of agricultural sector of GDP;

P_a is prices of agricultural output;

P_n is prices of non-agricultural output;

θ_a's is technological progress (R&D) in agricultural sector;

θ_n's is technological progress (R&D) in non-agricultural sector; and

factor endowments that include capital (K), labor (L), natural resources/land (NR).

While variables were identified in Equation (2), the data of 1961-2006 was collected from USDA (2008) and FAO (2008). However, similar problem like Ling *et al.* (2007) was encountered in getting R&D index (to show technological progress) for the interested time series. Ling *et al.* (2007) suggested time trend to represent the technological progress, instead of difficulty to obtain full time series data of R&D index. The time-series data is subjected to stationary tests. If the data is non-stationary, the error correction model (ECM) will be employed in the estimation of Equation (2). However, if the data is stationary, the Ordinary Least Squares (OLS) will be used to estimate Equation (2).

3.0 RESULTS

Firstly, the data series were tested with augmented Dickey-Fuller (ADF) test and the results were presented in Table 1. When the data series were at level, all the computed ADF test-statistics are greater than the critical values (-2.9281 at 5% and 10% significant level). It means that data series have unit root problem and they are a non-stationary series. However, these results are not reliable because the Durbin-Watson statistics are small. The data series may have autocorrelation problem Hence, ADF test was further conducted for the data series and found that they are stationary after the first difference ($I(1)$).

Table 1: Augmented Dickey-Fuller test statistics of unit roots

Variable	**Level**	**First Difference**
Agriculture's GDP share	0.2637	-6.0153
$\ln(P_a / P_n)$	0.7343	-5.5791
$\ln(K / L)$	-0.6739	-8.3375
$\ln(NR / L)$	-1.9046	-5.9970
Critical value [a]	-2.9281	-2.9297

Note: [a] 95 percent confidence level.

Subsequently, first order autoregressive error specification on Equation (2) was estimated by OLS as below:

$$S_a = a_0 + a_1 \ln(P_a / P_n) + a_2 \ln(\theta_a / \theta_n) + a_3 \ln(K / L) + a_4 \ln(NR / L) + a_5 AR(1) \qquad (3)$$

where other variables are as described earlier, and

$AR(1)$ is first order autoregressive error specification.

The estimated results of Equation (3) are depicted in Table 2. It is very obvious the price ratio ($\ln(P_a / P_n)$) is the only variable that is significant amongst other variables. The positive sign of the coefficient (0.2396) indicates that there is positive relationship between the price ratio and agriculture's GDP share in China. With an increase in the relative agricultural prices, it is likely that there would be an increase in agriculture's GDP share in China.

Table 2: Estimates of the Translog agriculture's GDP share equation

Variable	**Coefficient**	**t-Statistic**
Intercept	0.5137	(28.5160)***
$\ln(P_a / P_n)$	0.2396	(25.4771)***
$\ln(K / L)$	0.0021	(0.8180)
$\ln(NR / L)$	0.0221	(1.6284)
T	0.0006	(1.4378)
AR(1)	0.6726	(4.6500)***
Durbin-Watson	2.1100	
R^2	0.9977	

*Note: Significance level is denoted by *** for 1%.*

4.0 CONCLUSIONS

This paper attempts to determine the impacts of three major factors: (a) price changes, (b) factor endowment changes, and (c) technological change on the relative decline of agriculture in China. However, the results suggest that only the price ratio has significant and positive impact on agriculture's GDP share in China. Nevertheless, the variable of the price ratio explains the model well with about 99 percent of R^2 value. The irrelatedness of other variables may require further investigation and explanation.

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