Time Series Analysis of Farmland Price Using Longitudinal Data

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1. Objective

The objective of this study is to investigate the dynamics of farmland prices in Japan using longitudinal data. We use econometric methods such as a threshold autoregressive model to study the dynamic properties and the determinants of farmland price.

2. Method

The method of this study is as follows: (i) Estimating the relationship between farmland price and rent with using longitudinal data for one hundred years (1903-2002); (ii) Investigating whether the present value model can explain the dynamics of farmland prices; (iii) Estimating the error correction model and threshold autoregressive model of farmland prices; (iv) For each region, estimating the long-run relationship equations and the adjustment terms; and (v) Identifying the effects of decreasing rice prices on the farmland market using an impulse response function.

3. Outline of the results

(1) For (i), Fig. 1 presents the nexus between farmland prices and rents. This figure indicates the existence of structural change between the pre-war (1903-1945) and post-war (1946-2002) periods. Therefore, we estimate the long-run relationship regression incorporated with the structural change of the dynamics of farmland price. The result of the estimation (Table 1) indicates that structural change exists and estimates β are almost unity for both post-war and one hundred years.

(2) For (ii), unit root and cointegration tests are conducted (test results are omitted). These tests reject the probabilities of spurious regression. Therefore, this result indicates that the present value model can explain the long-run properties of farmland prices.

(3) For (iii), in the short-run, the dynamics of farmland prices often deviate from the long-run equilibrium relationship. We therefore estimate the error correction model and the threshold autoregressive model. Table 2 shows the results of a test for symmetric adjustment toward equilibrium. The test results indicate that the null hypothesis is rejected and the movements of farmland prices toward the long-run equilibrium relationship are an asymmetric process. The speed of convergence from downward deviation is faster than that from upward. In other words, the dynamics of farmland prices in Japan have downward rigidity.

(4) For (iv), Table 3 shows the estimation results of long-run relationship regressions. Estimates β represent near unity for all regions, so farmland price in Japan reacts to rent elastically. Therefore, the present value model can explain the movements of farmland prices for each region. On the other hand, the adjustment terms are from 5.4 years to 16.7 years and are varied among regions. Therefore, once economic shock occurs, the dynamics of farmland prices may be different among each region.

(5) For (v), impulse response function analysis implies that rice price fluctuations do not have only instantaneous but also permanent effects on farmland prices and rents (figures are omitted). This study's policy implication of is that we should pay attention to that policy change such as which leads to decrease rice prices, has not only temporary but also permanent effects on farmland market.

4. Presentation and application of research results

Fujie, T. (2004) "Five Essays on the Nature of Farmland Market and Agricultural Household Behavior." Ph.D. dissertation, Kyoto University.

Fujie, T. et al.(mimeo) Dynamics of Farmland Price in Japan:1903-2002.

Table 1. Estimation Results of Long-run Relationship

	α	β	D	$Adj.R^2$
All Period	2.596	1.009	1.390	0.860
(1903-2002)	(6.802)	(24.346)	(20.389)	
Post-War	3.529	1.066	—	0.935
(1946-2002)	(11.774)	(28.504)		

Notes: 1. Estimation Regression is $lnP_t = \alpha + \beta\, lnR_t\,(+Dum) + u_t$.
2. Figures in parenthes represent t value. D is dummy variable representing strucutural change if $D = 1$ (1903-1945), $D = 0$ (otherwise).

Table 2. Test Results of Symmetric Adjustment toward Equilibrium

	γ_1	γ_2	$H_0:\gamma_1=\gamma_2=0$	$H'_0:\gamma_1=\gamma_2$
All Period	-0.295	-0.323	9.425	0.035
(1903-2002)	(-2.440)	(-3.591)	[0.000]	[0.852]
Post-War	-0.370	-0.634	29.068	2.559
(1946-2002)	(-2.654)	(-7.148)	[0.000]	[0.116]

Notes: 1. Test equation is $\triangle u_t = I_t\,\gamma_1 u_{t-1} + (1-I_t)\,\gamma_2 u_{t-1} + \omega_t$, where $I_t=1(u_{t-1}\geqq 0)$, $0(u_{t-1}<0)$. $\triangle u_t$ represents the error correction term EC_t of error correction model $\triangle lnP_t = \beta_1 \Sigma_t \triangle lnR_t + \eta EC_t + \varepsilon_t$.
2. ( ) and [ ] represent t and p value respectively. Test statistics of H_0 and H'_0 are Φ statistics.

Table 3. Estimation Results of Long-run Relationship Region

Region	α	β	$Adj.R^2$	Adjustment Term (Year)
Hokkaido	3.626	0.924	0.885	8.33
Tohoku	5.913	0.752	0.816	6.83
Kanto	3.564	1.088	0.922	16.66
Hokuriku	5.346	0.848	0.880	10.34
Tozan	5.259	0.884	0.862	–
Tokai	5.011	0.924	0.924	8.43
Kinki	3.679	1.089	0.917	–
Chugoku	5.357	0.827	0.879	–
Shikoku	6.285	0.758	0.865	13.62
Kyushu	4.417	0.929	0.941	5.43

Notes: 1. Estimation equation is $lnP_t = \alpha + \beta\, lnR_t + u_t$. For all regions, coefficients α and β are significant at 1%.
2. Adjustment term is year unit, and is estimated from error correction term of error correction models.
3. "-" means blankets because of not satisfying robustness of estimation results.

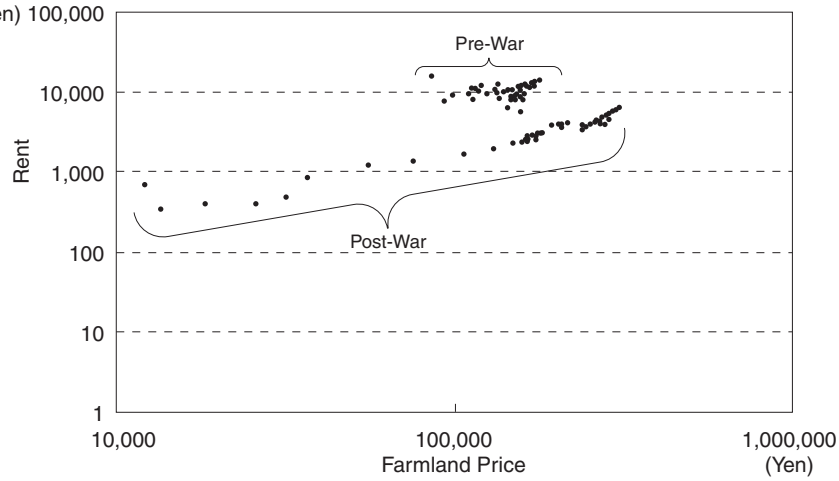

Fig. 1. The Relationship between Farmland Prices (*P*) and Rents (*R*) (1903-2002)

Note: Both axies are expressed as log scale. Data series are deflated and the base year is 1960.
Sources: Ohkawa,K and N. Takamatsu. "National Income", Ohkawa, K. *et al* (eds.) *Estimates of Long-Term Economic Statistics of Japan Since 1868*,1966, Toyokeizai-Shinposha. Umemura, M. *et al.* "Agriculture and Forestry", Ohkawa, K. *et al* (eds.) *Estimates of Long-Term Economic Statistics of Japan Since 1868*,1966,Toyokeizai-Shinposha. Japan Real Estate Institute. *Survey on Agricultural Land Price and Farm Rent*. Economics and Social Research Institute, Cabinet Office, Government of Japan. *Annual Reports on National Accounts*.

Studies on Trends in Agriculture and Agricultural Policy in Korea

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1. Objective

As the globalization of trade intensifies, there has been intensive negotiation of bilateral Free Trade Agreements (FTAs) and Economic Partnership Agreements (EPAs) in parallel with WTO multilateral trade negotiations. Following the EPA concluded with Mexico in 2004, Japan is also moving ahead with discussions with Korea, ASEAN member countries and some others.

2. Method

As Korea has been at the front of negotiating countries, MAFF asked PRIMAFF to do a study on its agriculture and policy as soon as possible. Taking this into account, PRIMAFF established a special team consisting of researchers from inside and outside the country to gather and analyze information gained by publications, websites, and study tours in Korea.

3. Outline of the results

The results of the research were as follows.

(1) Economic growth and agriculture in Korea

Korea has been attaining a rapid economic growth under industrialization since the 1960s, and has almost reached to the forefront of advanced countries. On the other hand, the share of agriculture, forestry and fisheries as part of its economy has been declining gradually. The decreased share of added value by agriculture and number of agricultural workers were mainly caused by increased agricultural labor productivity, largely attributed to total factor productivity (TFP). Although technological innovation, such as an introduction of new crop varieties and chemical fertilizers, was a major factor of increased TFP until the 1980s, the increased efficiency achieved by structural adjustment was a main reason for it since then (Table 1).

Table 1. Growth Accounting in the Sector of Agriculture, Forestry and Fisheries in Korea

Fiscal Year	Growth Rate of Labor Productivity	Growth Rate of TFP	Contribution of Capital Equipment	Contribution of Land Equipment
1953-02	4.03	3.11	0.37	0.55
1953-60	0.72	0.68	0.48	-0.43
1960-70	3.68	2.98	0.41	0.28
1970-80	1.71	1.51	0.21	-0.01
1980-90	6.96	5.27	0.25	1.44
1990-02	5.91	4.24	0.54	1.13

Notes: 1. Time and education level are not taken account into labor input.
2. Contribution of capital equipment and land equipment means growth rate multiplied by distribution rate.
3. TFP means "Total Factor Productivity".