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Equilirium Model in Price Behavior and Agricultural Production

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농업 생산과 농작물 가격에 관한 균형 모델

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Abstract : This study mainly deals with price behavior developed in a agricultural location model (or closed model) considering the production and demand aspects. The short-run situation of price and output is associated with the yearly fluctuation of yield from agricultural production. Demand is generally regarded as constant in the short-run because of being inelastic over short time. The long-run situation is associated with a period in which all related variables can be varied. Then a price behaviors from the two contrasting closed models have been further explored in the long-run economy. Agricultural price for each activity in the closed model is affected by change in agricultural production. Also, falling agricultural price is connected with lower rents and lower land values.
Key Words : agricultural production, price, comparative statics, expected and guaranteed model, land use

요 약 : 본연구는 생산과 수요 양면을 고려한 농업입지모델에서 농작물 시장가격의 단기 및 장기적 변화를 고찰한다. 농작물 가격과 생산량의 단기적 변화 상황은 생산량의 연간 변화량에 의해서 결정되는 것으로 파악하면서 수리적 모형을 제시한다. 장기적 모형에서 농작물의 가격은 여러 가지 농업을 둘러싼 환경 및 변수(수요, 생산량, 생산비용, 운송률)의 변화를 고려하였다. 또한 예상 수익 모델(expected return model)과 보장 수익 모델(guaranteed return model)을 각각 제시하면서, 농작물의 생산량과 가격의 장기적 변화를 조사한다. 농작물 가격 하락은 지대 및 토지 가격의 하락과 관련된다.
주요어 : 농업생산, 가격, 비교정학, 예상 및 보장 모델, 토지이용

1. INTRODUCTION

The purpose of comparative static analysis is to discern whether small parametric shifts have implications for the equilibrium of a model. In particular, if many variables are interrelated and, therefore, causal paths are difficult to distinguish, the technique of comparative statics is very useful. However, this analysis does not always accurately expose the process of adjustment as the economy moves from one equilibrium state to another

The quantitative approach in comparative statics is adopted in this study, rather than the preferred qualitative approach, because many variables are entangled and, therefore, are difficult to sign.

Equilibrium price and output are further associated with agricultural economy in the short and long-run. The two closed models are put together to reflect general farmers' behavior on agricultural price and land use. Through the basic closed model under environmental certainty, price behavior in the long-run is further considered by comparing each price that results from the two contrasting closed models.

2. THE STRUCTURE OF THE CLOSED MODEL

The production-oriented model assumes the independency of the four parameters, yields(E_i), prices(p_i), cost(a_i), and transportation rates(f_i). Such an assumption is not characteristic of real economic conditions, even for an abstract, simplified model, and the interrelationships of all

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factors influencing the spatial distribution of land use cannot be understood. Moreover, this assumption of parametric independence can lead directly to erroneous comparative static predictions. In particular, the price parameters are assumed to be exogenously set at the market town. When any other parameters are assumed to shift, none of the three prices is allowed to respond in the production-oriented model. This is quite an reasonable property for an economic model.

This unreasonable assumption can be systematically illustrated within the production-oriented model.

$$k_{12} = [\, E_1(p_1 - a_1) - E_2(p_2 - a_2) \,] \,/\, (E_1 f_1 - E_2 f_2) \qquad (1a)$$

Also, k_{23} is brought about by letting $R_2 = R_3$

$$k_{23} = [\, E_2(p_2 - a_2) - E_3(p_3 - a_3) \,] \,/\, (E_2 f_2 - E_3 f_3) \qquad (1b)$$

Finally, $k_{3,max}$, the extensive margin of production, is determined by letting the rent for activity *3* equal to zero

$$k_{3,max} = (p_3 - a_3)/f_3 \qquad (1c)$$

If the price of each crop is derived from equations (1a), (1b), and (1c), parametric dependency on the supply side of the model can be identified as follows:

$$\begin{bmatrix} p_1 \\ p_2 \\ p_3 \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} + \begin{bmatrix} 1/E_1 & 1/E_1 & E_3/E_1 \\ 0 & 1/E_2 & E_3/E_2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} (E_1 f_1 - E_2 f_2)k_{12} \\ (E_2 f_2 - E_3 f_3)k_{23} \\ f_3 k_{3,\max} \end{bmatrix} \qquad (2)$$

Equation (2) indicates that the price p_1 of crop 1 is a function of seven other parameters, the price p_2 of crop 2 a function of five other parameters, and the price p_3 of crop 3 a function of two other parameters when the radius k_{12}, k_{23}, and the extensive margin $k_{3,max}$ are known.

Previous studies based on the Von Thünen's model have not examined the interdependency between the variables. Jones (1979), who constructed a model regarding rent change in supply and demand interaction, fixed it by assuming that prices are determined in the national scale. Although Cromley(1982) recognized the interdependency in the production-oriented model, the underlying mechanism for this interdependency was rarely clarified.

In addition to the internal problem of the production- oriented model, Jones et al (1978) and, more recently, Samuelson (1983), and Nerlove and Sadka (1983) have questioned the validity of the model with regard to the role of demand. They have discussed that von Thünen did not acknowledge an active role of market demand in determining bid rent so that the model takes market demand as perfectly inelastic. Their argument goes to the production-oriented model described in the above, rather than von Thünen's analysis. Although he did not include a clear role of market in his framework, it appears that he recognized the role of demand. These two major concerns in the model, unspecified market demand and erroneous assumption regarding involved parameters, lead to develop a closed production-oriented model.

The analysis assumes that market demand for each activities is linear in price. Current research provides only partial equilibrium and not general equilibrium solutions for activity prices, land areas, and outputs, because it does not concern with other conditions prevailing agricultural market, but focuses on a set of producers and consumers for a particular crop or closely related crops. In addition, by not formally introducing a production function for each activity, the analysis remains manageable.

To begin with, a general market demand

function for crop i can be specified as follows, in order to outline the interaction between demand and supply for agricultural products in the market.

$$Q_i^d = f(p_1, p_2, ..., p_n, ,P,I, T) \quad (3)$$

where Q_i^d is the quantity demanded of crop i, $p_1, p_2, ..., p_n$ are the prices of the n crops in the market, and P, I, and T denote the size of population, the level of income, and taste, respectively. This general form of demand equation is simplified to a linear relationships between the quantity demanded of a particular crop and the prices for all crops, holding constant population size, income and tastes.

Consider the following three demand curves:

$$Q_1^d = a_1 - \beta_{11}p_1 - \beta_{12}p_2 - \beta_{13}p_3 \quad (4a)$$
$$Q_2^d = a_2 - \beta_{21}p_1 - \beta_{22}p_2 - \beta_{23}p_3 \quad (4b)$$
$$Q_3^d = a_3 - \beta_{31}p_1 - \beta_{32}p_2 - \beta_{33}p_3 \quad (4c)$$

where the demand curve intercepts a_1, a_2, and a_3 > 0, coefficients for in-market effect β_{11}, β_{22}, and β_{33} > 0, and coefficients for cross-market effect β_{12}, β_{13}, β_{21}, β_{23}, β_{31}, *and* β_{32} = ≥ 0. In turn, such equations can be easily transformed to a linear relationships between the price of a particular crop and the quantities demanded of all crops. That is, the three demand relationships can be respecified as:

$$p_1 = \delta_1 - \lambda_{11}Q_1^d - \lambda_{12}Q_2^d - \lambda_{13}Q_3^d \quad (5a)$$
$$p_2 = \delta_2 - \lambda_{21}Q_1^d - \lambda_{22}Q_2^d - \lambda_{23}Q_3^d \quad (5b)$$
$$p_3 = \delta_3 - \lambda_{31}Q_1^d - \lambda_{32}Q_2^d - \lambda_{33}Q_3^d \quad (5c)$$

where the intercept, own-demand, and cross-demand terms are maintained in order. Equations (4a), (4b), and (4c) and equations (5a), (5b), and (5c) are respectively linear transformations of one another. However, the versions given in equations (5a), (5b), and (5c) are easier to use, in order to express the interconnection between supply and demand in this study and thus are used for further analysis.

The quantities Q_1^d, Q_2^d, and Q_3^d in the market is set equal to its counterpart among the quantities Q_1^s, Q_2^s, and Q_3^s in order to construct a closed production- oriented model Then, after the substitution of Q_1^d, Q_2^d, and Q_3^d into equations (5a), (5b), and (5c), the following market-clearing expressions for three crops can be determined by equating each price of equation (2) with the appropriate price in each of the demand curves.

$$\delta_1 - (\lambda_{11}E_1 - \lambda_{12}E_2)\pi k_{12}^2 - (\lambda_{12}E_2 - \lambda_{13}E_3)\pi k_{23}^2 - \lambda_{13}\pi E_3 k_{3,max}^2 = a_1 + \{(E_1 f_1 - E_2 f_2)k_{12} + (E_2 f_2 - E_3 f_3)k_{23} + E_3 f_3 k_{3,max}\}/E_1 \quad (6a)$$

$$\delta_2 - (\lambda_{21}E_1 - \lambda_{22}E_2)\pi k_{12}^2 - (\lambda_{22}E_2 - \lambda_{23}E_3)\pi k_{23}^2 - \lambda_{23}\pi E_3 k_{3,max}^2 = a_2 + \{(E_2 f_2 - E_3 f_3)k_{23} + E_3 f_3 k_{3,max}\}/E_2 \quad (6b)$$

$$\delta_3 - (\lambda_{31}E_1 - \lambda_{32}E_2)\pi k_{12}^2 - (\lambda_{32}E_2 - \lambda_{33}E_3)\pi k_{23}^2 - \lambda_{33}\pi E_3 k_{3,max}^2 = a_3 + f_3 k_{3,max} \quad (6c)$$

The distance of indifference k_{12}, k_{23}, and the extensive margin $k_{3,max}$ from market cannot be directly obtained from the above equations. Instead an iterative-solution method is used to calculate the approximate values of k_{12}, k_{23}, and $k_{3,max}$. In the first, arbitrary values are assigned to k_{12}, k_{23}, and $k_{3,max}$, and then the iterative process is repeated until the values are converged on a stable values within an acceptable tolerance level (0.00001). Then, the equilibrium prices p_1, p_2, and p_3 in each agricultural market can be derived through the price vectors of the equation (2) or equations (5a), (5b), and (5c). The equilibrium outputs Q_i are simply obtained by multiplying together the appropriate yield E_i per unit area and the appropriate land area A_i of each crop.

3. PRICE BEHAVIOR IN THE SHORT AND LONG-RUN

This section focuses on an economic analysis of equilibrium price and output to be derived from the closed model. Under two situations, the short-run and long-run agricultural markets, the behaviors of price and output of a crop will be further examined in the context of the interaction of supply and demand curves to demonstrate the utility of the closed model. The short-run situation of price and output is associated with the yearly fluctuation of yield from agricultural production. Demand is generally regarded as constant in the short-run, because the demand for agricultural goods is assumed to be inelastic over short time periods. The long-run situation, on the other hand, is associated with a period in which all related variables can be varied: yield can change due to technology advancement; non-land production cost and transportation rate from the supply can change; and demand due to income, population, and the taste of the population can also change.

In the short-run, when yield is increased or decreased due to yearly weather variability, supply curves are shifted and determine new equilibrium prices and outputs. The shift of the supply curve reflects a yield increase, and the resultant equilibrium price and output determined in the intersection of supply and demand is changed from p_0 to p_1 and from Q_0 to Q_1.. Yield decrease, on the other hand, moves the curve in the opposite direction. This shift determines new equilibrium p_2 and Q_2. Meanwhile, in the demand curve an interrelationship between price and output to determine the degree of elasticity is subject to input data, as shown in equations (5a), (5b), and (5c). The demand curve has somewhat of a steep slope because the output change has a tendency of inelasticity to price change. The interaction of supply and demand in the Figure reveals that a small increase in production from the supply-side can result in a large decrease in price. The falling price means that the yearly fluctuation in output can create an income maintenance problem for farmers in the short-run.

Those situations of yield change in the short-run were already examined in the comparative statics of the closed model elsewhere(Lee, 1996). Just consider the equilibrium price and output of crop 1 subject to the yield change of crop 1; p_1 and Q_1 are shifted as forecast in the short-run economic analysis. Consequently, the comparative statics of yield change corresponds with the method of a general economic analysis in the short-run. There is, in fact, no time dimension in the closed model, but the correspondence suggests that the comparative statics of the closed model can also be used effectively to analyze short term trends in agricultural product prices.

In the long-run, the impact of actual or potential changes in demand and supply are considered, and a yearly fluctuations of yield are ignored. The comparative statics of the closed model can also provide insight into long term

Table 1. The Change of Prices and Quantities in the Long-run

Scenario No.	P_1	P_2	P_3	Q_1	Q_2	Q_3
1	5.8848	4.0417	4.6952	1701π	13323π	17076π
2	6.0795	4.3230	4.7084	1427π	22634π	15303π
3	5.7872	3.6863	4.7315	1340π	35081π	12389π

analysis of agricultural product prices. Let's first consider a demand shift, holding the supply structure constant, in order to easily predict the effects of changes in supply and demand. This situation would lead to a higher price and an increased output as seen in the demand change of the previous section. Then the supply curve moves creates a new equilibrium p_2 and Q_2. Further movement of supply and demand curves creates p_3 and Q_3. The equilibrium prices continue to fall and, therefore, the equilibrium outputs keep being increased.

The falling prices in the long-run suggest that the supply shifts due to technological advancement in production surpass the increases in demand for agricultural goods due to population growth. However, the spatial arrangement of each crop is not considered here in order to focus on the long-term trends for equilibrium prices and outputs. The first scenario represents the results from the input data denote an initial equilibrium status. The second scenario represents the equilibrium price and quantity due to supply and demand shifts in which the intercept in the demand curve of crop 2 is changed from δ_2 = 6 to 7.5 and its yield is increased from E_2 = 10 to 12. The third scenario represents the results of further shifts of supply and demand in which the intercept δ_2 = 8.5, the transport rate f_2 is reduced from 0.05 to 0.03, and the yield E_2 = 12.5 each in appropriate units.

Note, in particular, the behavior of the prices and outputs for crop 2 from the Table, because it is more difficult to discern the underlying causes for the results of the other crops that are placed in indirect effects for the change of crop 2. Scenario 2 reveals a higher values with respect to both equilibrium price and output than does scenario 1. The equilibrium status in scenario 2 implies that the magnitude of the demand shift is much larger than that of the supply shift and, consequently, the equilibrium price is higher than the price in scenario 1. In scenario 3, however, as the supply shift proceeds further from the cost reduction and yield increase, the new equilibrium price is considerably lower in spite of the further demand shift and the output is also increased. This situation clearly reflects the expected long-term trends of price and output for agricultural products. Therefore, such change in the long-run has an implication; that is, without an intervention in agricultural product prices, market forces would drive some farmers out of business due to technology advancement in agriculture.

4. EQUILIBRIUM OF TWO CLOSED MODELS

Equilibrium solution for the closed model are also specified by first solving for E_1^*, E_2^*, and E_3^* per equations (7a), (7b), and (7c), and then by substituting E_1^* for E_1, E_2^* for E_2, and * for E_3 in equations (5a), (5b), and (5c).

$$E_1^* = \phi E_{11} + (1-\phi)E_{12} \tag{7a}$$
$$E_2^* = \phi E_{21} + (1-\phi)E_{22} \tag{7b}$$
$$E_3^* = \phi E_{31} + (1-\phi)E_{32} \tag{7c}$$

This operation leads to iterative solutions for k_{12}, k_{23}, and $k_{3,max}$. Prices p_1, p_2, and p_3 are easily obtained by placing the values k_{12}, k_{23}, and $k_{3,max}$ into equation (2). Land areas A_1, A_2, and A_3 and outputs Q_1, Q_2, and Q_3 are then computed as before.

In order to consider the model for market demand, the production-oriented guaranteed return model is used. Computationally the closed model is much more complex than the closed expected return model in its equilibrium solution. Because each price to be derived in this closed model is not linearly expressed, a calculation of the price vector using the equation (8), as in equation (2), is rather complex.

$$[E_{11}E_{32} - E_{12}E_{31}]/\{[(E_{11} - E_{12})/(p_3 - a_3 - f_3k)] + [(E_{32} - E_{31})/(p_1 - a_1 - f_1k)]\} = [E_{11}E_{22} - E_{12}E_{21}]/\{[(E_{11} - E_{12})/(p_2 - a_2 - f_2k)] + [(E_{22} - E_{21})/(p_1 - a_1 - f_1k)]\} \quad (8)$$

In order to simplify this problem, the fact that equilibrium output and price are simultaneously determined by the interaction of supply and demand in the agricultural market is incorporated, and the iterative method for the equilibrium solution is adopted in this analysis of the closed model.

First, three linear demand curves of equations (5a), (5b) and (5c) are rearranged as follows:

$$Q_1^d = (\delta_1 - p_1 - \lambda_{12} Q_2^d - \lambda_{13} Q_3^d) / \lambda_{11} \quad (9a)$$
$$Q_2^d = (\delta_2 - p_2 - \lambda_{21} Q_1^d - \lambda_{23} Q_3^d) / \lambda_{22} \quad (9b)$$
$$Q_3^d = (\delta_3 - p_3 - \lambda_{31} Q_1^d - \lambda_{32} Q_2^d) / \lambda_{33} \quad (9c)$$

The initial values for iteration use exogenous prices p_1, p_2, and p_3. The use of exogenous prices initially bring a disequilibrium and does not correspond with the same amount of $Q_1^S = Q_1^d$, $Q_2^S = Q_2^d$, and $Q_3^S = Q_3^d$ for three crops in the market. A convergent process. solves this disequilibrium. The price is pulled down, if the initial price for each activity results in a greater quantity supplied than quantity demanded, whereas the price is pulled up if the price of each activity results in a smaller quantity supplied than quantity demanded. This convergent process between supply and demand is iterated until the equilibrium price and output converge on within a tolerance level. The value of 0.1 for a tolerance criteria for both quantities is used for this convergence. Compared to the values of quantities in fact, price and distance values are relatively small so that the level of higher convergence values (1 or 10) or smaller values (0.001 or 0.0001) rarely influences the price change of each crop. The input prices used in the production-oriented model were used as exogenous values with this solution method.

In the two types of closed models, market price which is a primary interest to the current research was endogenously derived. Therefore, variations in price for each activity as well as variations in land size are emphasized in this behavioral account of agricultural decision-making.

The degree of optimism μ is included to compute land size and price based on the two closed models in order to incorporate various behavioral perspectives. Actually, the computation for land size proceeds by using equations the following equations (10a), (10b), and (10c).

$$A_1 = \pi k_{12}^{2\mu} + [2\pi\int_0^{k1^*} x13(k)kdx + 2\pi\int_{k1^*}^{k12^*} x12(k)kdx]\ (1-\mu) \quad (10a)$$

$$A_2 = \pi(k_{23}^2 - k_{12}^2)\mu + \{\pi(k_{12}^*)^2 - \pi(k_1^*)^2 - 2\pi\int_{k1^*}^{k12^*} x12(k)kdx + \pi[(k_{23})^2 - (k_{12}^*)^2]\}\ (1-\mu) \quad (10b)$$

$$A_3 = \pi(k_{3,max}^{\ 2} - k_{23}^2)\ \mu + \{\pi(k_1^*)^2 - 2\pi\int_0^{k1^*} x13(k)kdx + \pi[(k_{3,max})^2 - (k_{23})^2]\}(1-\mu) \quad (10c)$$

The price for each activity can also be obtained by combining the prices obtained from each closed model.

$$P_{ib} = \mu P_{ie} + (1 - \mu)\ P_{ig} \quad (11)$$

Where P_{ib} is the price of activity i based on a farmer's general behavior, P_{ie} is the price from the closed expected return model, and P_{ig} is the price from the closed guaranteed return model.

5. THE LONG-RUN PRICES IN TWO CLOSED MODELS

The closed version of the von Thünen model has been associated with the short-run and long-run in agricultural market analysis. Price and quantity behaviors in the two closed models are examined in this section.When applying the analysis in the short-run, a conceptual difficulty arises. Farmers' expected return strategy is based on an assumption of average and long- run return, whereas the guaranteed return strategy is based on a similar assumption for reducing risk resulting from annual climatic fluctuations. Price and output are examined only in the context of the long-run in the two closed models.

Many variables including demand, yield, non-land production costs, and transportation rate can be changed in this simulation. The following four scenarios sequentially are utilized to better examine the long-run effects in the agricultural market in order to examine the behaviors of prices and quantities. The simulated results are shown in Table 2.

The first case utilizes input data and provides a baseline for the other three cases resulted from changes in crop 2. The intercept δ_2 is changed from 7 to 8 in the second case. The production cost α_2 of Table 2 is also changed from 2.0 units to 1.6 units and the intercept is changed to δ_2 = 8 in the third scenario. In the fourth scenario, the variables of supply and demand are further changed: δ_2 = 8.5, E_{22} = 22, α_2 =1.6, and f_2 = 0.025. All the scenarios were examined with respect to environmental probability Φ = 0.7, and all other parameters were held constant. The numerical results from both models heavily depend on the data employed as well as climatic probability. Note, in particular, the price and output for activity 2 because the other prices and outputs that were derived indirectly from the changes in activity 2 are very complex to interpret.

The equilibrium price and output in both models was brought with the shift in the intercept term in scenario 2. As only demand was increased in this simulation, equilibrium prices went up. However, in the simultaneous changes in supply and demand in scenarios 3 and 4, the equilibrium prices were much lower than the price in scenario 1 and outputs continued to increase. These findings correspond with those of the long-run simulation of the closed model under environmental certainty. The price of crop 2 in the expected return was higher than that in the guaranteed return model for all cases. This higher price of crop 2 gives an idea that farmers who seek the maximum expected return have more advantage of income or rents than

Table 2. Price and Quantity Behaviors in the Closed Models (Φ=0.7)

Scenarios	P_1	P_2	P_3	Q_1	Q_2	Q_3
1						
(E.R)	6.1515	4.0824	2.5891	1,215.2π	6,656.4π	140,651.4π
(G.R)	6.1340	3.7342	2.5914	1,217.3π	7,492.5π	140,451.4π
2						
(E.R)	6.2269	4.2145	2.5949	1,178.8π	8,740.8π	140,162.6π
(G.R)	6.2855	3.8548	2.5972	1,154.1π	9,604.9π	139,962.6π
3						
(E.R)	6.2550	3.8639	2.5972	1,164.9π	9,582.7π	139,965.5π
(G.R)	6.2949	3.5068	2.5996	1,146.8π	10,440.4π	139,765.7π
4						
(E.R)	5.9977	3.1127	2.6024	1,240.3π	12,586.2π	139,431.8π
(G.R)	5.8766	2.8099	2.6043	1,278.1π	13,313.3π	139,262.0π

farmers who adopt the guaranteed return strategy. However, farmers' financial stress is related more closely with the falling prices shown in the long-run analysis than with price differentials due to their adopted strategy. The problems of the falling prices in the long-run economy were emphasized by Ekelund and Tollison(1986). Further the implication of the falling agricultural price was indicated by Benischa and Binkley(1994), and Barry(1984), who argued that falling price is connected with lower rents and lower land values.

6. CONCLUSION

In order to construct the basic form of the closed version of the von Thünen model in a two-dimensional economy, this study first discusses a major deficiency in the production-oriented model. The deficiency is related to the structure of the model where market demand is not considered. This study, in particular, demonstrates the nature of interdependency of price variable with other variables within the production-oriented model. Then, a general linear demand equations were introduced to simultaneously consider supply and demand and these were connected with supply-side equations in terms of price and output. Actual solutions for price, land area (or distance from the market), and output for each activity in the closed version proceeded by an iterative method.

Also, the price behaviors between the expected return and the guaranteed return models were examined in the long-run economy. Since only one activity was simulated in the situation, it was difficult to generalize the results for all activities but higher prices were commanded in the expected return model compared to the guaranteed return model.

Only one market and uniform production costs are in particular noted for further research of this study. In real world there are various market sizes (e.g., local, regional, national, and global markets), as pursued in many real applications of the von Thünen theory, with regard to transaction for agricultural products. The closed models, based on von Thünen's model, have a broad range of application for agricultural land use and economic behaviors in the market.

The price of each activity determined in the closed models, where the variable was endogeneously transformed from the status of an exogenous variable in the traditional von Thünen model. However, yield variable, which was associated with climatic variability but still remains as exogenous variable, can be considered more satisfactorily in a production-function model. The incorporation of the production-function can transform the variable of yield into being endogenous. In the production-function model the interrelationships between one or more inputs (e.g., wage, technology, soil type, and climate) and output (yield) can be further examined. Eventually, the interrelationships can be related to price and land use of the closed models by considering the output level.

Finally, throughout the closed models land use and price was supposed as taking place in the complete free economy, but government policy aimed at price stabilization for agricultural products is found worldwide in many forms nowadays. Therefore, the examination of the effects of the government policy with regard to the closed models may provide more realistic perspective in agricultural location theory.

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