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Using a General Dynamic Econometric Framework to Specify the Appropriate Model in Studying Agricultural Production Structure: A Case Study of Crop Production in Iran

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ABSTRACT

This paper shows the role of the general dynamic model in empirical research of production technology in agriculture. The model is a first order autoregressive multivariate specification, first developed by Anderson and Blundell. This model is general enough to nest several simpler dynamic as well as static models within it. Therefore, it provides a framework for applying classical testing procedures and identifying the appropriate specification in the empirical econometric model of production. The usefulness of the general dynamic model is shown by estimating the production structure in the Iranian crop sector. The results indicate that the Iranian crop production is best characterized by a long-run static model derived from a non-homothetic translog specification which incorporates non-neutral technological change and allows for structural change after the Islamic Revolution of 1979.

Keywords: Crop sector, General dynamic, Model specification, Production structure.

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INTRODUCTION

The importance of correct specification of econometric models and/or consequences of their misspecification are well discussed in the econometric literature. Misspecification may occur due to an incorrect specification of the functional form, and/or an incorrectly specified set of explanatory variables (Greene 1990; Kennedy 1990). Specification errors resulting from an incorrectly specified set of independent variables even in a correctly specified functional form can not be ruled out. Dynamic misspecification in the form of omitted lagged dependent and/or independent variables in a static model of agricultural production technology is an example of the latter form of the specification error.

Several studies of production technology show the effects of the choice of functional form in determining technology parameters and their economic implications (Baffes and Vasavada 1989; Berndt and Khaled 1979; Shumway and Lim 1993; Salami 1996). These studies use various testing procedures to discriminate among different competing forms and to avoid the first type of specification error. The present study is in line with these studies by addressing the second type of model specification error. In particular, the study presents a modified version of the general dynamic model originally developed by Anderson and Blundell (1982) which can accommodate several simpler forms of dynamic models as well as a static model. Such a general model can be used to specify the correct set of explanatory variables and, hence, to prevent dynamic as well as structural specification errors. The applicability of the model is illustrated by analyzing the

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crop production in Iran.

Study Background

In a static specification of production and dual cost/profit models, the implicit assumption is that the observed production technologies operate at cost-minimizing/profit-maximizing input levels where all inputs are fully adjusted to their long-run equilibrium levels within one period, usually one year, so that the need for any dynamic adjustment process is ruled out. There is a debate in the literature on the appropriateness of this assumption in modeling production structure and factor demand in agriculture, as it is thought that this assumption may introduce specification errors. The fact that certain factors in agricultural production are of quasi-fixed nature (they are fixed in the short-run and variable only in the long-run) makes adjustment for an instantaneous equilibrium decision more expensive. As such the assumption of complete, instantaneous, and costless adjustment of inputs in response to changes in factor prices, technology, and/or demand shock within one production period is unrealistic (Brown and Christensen, 1981; Kulatilaka, 1985; Berndt and Fuss, 1986; and Yee, Hauver, and Ball, 1993). Further, the short-run input fixity may also make current output as a function of past levels of inputs and output in addition to the current levels of these variables, thus requiring the presence of lagged variables in the model (Hendry *et al.* 1984). In addition, past output may become an effective factor in determining the current output level because of the notion of a learning curve (Berndt 1991).

Two basic approaches have been followed in the literature to relax the assumption of long-run static equilibrium and to consider dynamics into models to overcome this type of misspecification. The first approach is based on the assumption of a partial static equilibrium. In this case it is assumed that the production unit is in static equilibrium with respect to a subset of (variable) inputs given the observed level of the remaining subset of (quasi-fixed) inputs, and the levels of the latter subset are predetermined with respect to the variable inputs. Studies based on this approach utilize short-run cost/profit models (Brown and Christensen 1981; Antle and Aitah 1983; Moschini 1988; Fulginiti and Perrin 1990). The second approach recognizes the cost of adjustment for the quasi-fixed factors explicitly and model this cost into the statistical models (Berndt *et al.* 1981; LeBlanc and Hrubovcak 1986).

The problem with the first procedure is that the choice of the quasi-fixed factors is not based on any statistical procedure. That is, whether some seemingly quasi-fixed inputs are really so and thus, their short-run observed quantities differ from the long-run optimum levels are not statistically tested. Therefore, model specification error is still expected. Furthermore, the intertemporal behavior of producers seen in the time path of the adjustment of quasi-fixed inputs from short-run to long-run is not explained by this procedure (Berndt *et al.* 1981; Squires, 1987).

The second approach also bears some limitations. The internal adjustment costs are the only assumed cause of disequilibrium in this approach and they are modeled with a smooth, convex function. Squires (1987) and Brown and Christensen (1981) argue that the departures from long-run static equilibrium may arise from factors other than internal costs of adjustment such as institutional rigidities, regulatory restrictions on input mobility, and credit rationing. If such conditions prevail in the economy, dynamic misspecification of the model occurs.

The present study shows that a general dynamic model, similar to that originally developed by Anderson and Blundell (1982) and used by Nakamura (1985) and Friesen (1992), can be used as an alternative approach for correct model specification by testing the need for the presence of dynamic behavior. A distinctive feature of this model is that it can accommodate any dynamic behavior without imposing inappropriate dynamics on the data. Rather, it allows data to

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determine the form of dynamics. It is general enough to provide a basis for testing the validity of the long-run static model, as well as a number of dynamic models such as a long-run static model with first order autoregressive error terms and a partial adjustment model. Thus, it overcomes the foregoing model misspecification.

MATERIALS AND METHODS

The Structure of the General Dynamic Model

Let the following stochastic model represent a system of static input demands in the form of factor cost shares.

$$S_t = \varphi Z_t + \varepsilon_t \quad (1)$$

where S_t is an nxl vector of factor cost shares, Z_t is a mxl vector of independent variables with the first element a constant, ε_t is a nxl vector of random errors with zero mean and a matrix of variance-covariance, Ω, of order $n \times n$, and φ is a $n \times m$ matrix of constant coefficients. Further, let the assumption of instantaneous adjustment in equation (1) be replaced by the assumption that the above static model holds asymptotically in the sense that as changes in Z_t stabilize over time, the expected values of observed S_t stabilize to their optimal values produced by the static model (1). Under this assumption, a general dynamic model of the form stationary autoregressive multivariate order p (i.e., ARX(p,p)), can appropriately represent the data generation process of S_t over time (Nakamura 1985). Such a model corresponding to equation (1) takes the following specification:

$$S_t = \sum_{i=0}^{P} A_i Z_{t-i} + \sum_{i=1}^{P} B_i S_{t-i} + \eta_t \quad (2)$$

where $i = 0 \ldots$,p is the order of lag structure for the dependent variable, S_t , and independent variables, Z_t, A and B are the matrices of the constant parameters in the system, and η_t is an independent identically distributed random disturbance vector.

The model represented by (2) with order of p>l requires a large number of observations which may not be available in many situations. A tractable version of the above model for a relatively small sample size can be obtained by restricting the order of lag structure to one. That is,

$$S_t = A_0 Z_t + A_1 Z_{t-1} + B_1 S_{t-1} + \eta_t \quad (3)$$

where S_t is a nxl vector of factor cost shares, Z_t, Z_{t-1}, and S_{t-1} are nxl vectors of exogenous and predetermined variables, respectively. The subscript (t- 1) denotes a one period lag in the respective vectors. The error term, η_t has the same definition as in equation (2).

Different transformations of the general form presented by (2) and, hence, (3) result in various dynamic specifications. Hendry *et al.* (1984) listed nine different types of transformations. Furthermore, Wickens and Breusch (1988) highlight some types of these dynamic models which are more appropriate when interest is mainly on the long-run properties of a model. A transformation which can accommodate the above generation of dynamic behaviour, and which provides an appropriate framework for conducting the "general to specific" nested testing procedure for model specification is obtained by subtracting the term S_{t-1} from both sides of equation (3), subtracting and adding the term $A_0\, Z_{t-1}$ to the right hand side of the resulting expression, and doing some manipulations. The resulting expression is:

$$\Delta S_t = A_0 \Delta Z_t - (I - B_1) \left[S_{t-1} - (I - B_1)^{-1} (A_0 + A_1) Z_{t-1} \right] + \eta_t \quad (4)$$

where ΔS_t represents a vector of first differences of factor cost shares, ΔZ_t is a vector of first differences of regressors, excluding the constant term, Z_{t-1} is a vector of lagged values of all regressors, including the constant, I is a nxn identity matrix, and A_0, A_1, and B_1 are appropriately dimensioned coefficient matrices. A version of model (4) which incorporates a time variable, T, for the state of technology, and a dummy variable, D, to represent structural change into the long-run portion of the model can be written as:

$$S_t = (I-B_1)\gamma + A_0 \Delta Z_t + B_1 S_{t-1} + (I-B_1)\varphi Z_{t-1} + (I-B_1)\theta(T-1) + (I-B_1)\phi D + \eta_t \quad (5)$$

where φ denotes the coefficient of Z_{t-1} inside the bracket in (4) and represents the long-run effects[3] of independent variables, excluding the time, dummy, and constant term. θ, φ and y are vectors of nxl and denote, respectively, the coefficients of time and dummy variables, and constant term in the original matrix of long-run coefficients, φ. The long-run nature of φ follows from the definition of short-run and long-run effects of variables in this specification, where the short-run effects are defined as the partial derivatives of equation (3) with respect to Z_t. The long-run equilibrium is defined as a situation where there are no further changes in the Z_t and consequently in S_t. That is, $Z_t = Z_{t-1}$, and $S_t = S_{t-1}$. Incorporating these conditions into equation (3) and taking the derivative of the resultant equation with respect to Z_t, gives:

$$\partial S_t / \partial Z_t = (I-B_1)^{-1}(A_0 - A_1) = \varphi$$

which is the long-run effect shown in equation (5).

The general model (5) nests several simpler models. In one side, the static long run equilibrium model such as (1) can be tested, where the dynamic specification is ruled out. On the other side, the partial adjustment model and the long-run with autoregressive error terms model can be tested, where dynamics is incorporated in the model.

The partial adjustment model (see, for example, Hendry *et al.* 1984, and Wickens and Breusch 1988), one of the most widely used models in empirical work, can be obtained from the general dynamic model (5) by imposing a restriction, $A_0 = (I-B_1)\ \varphi$, on the parameters of this model. That is,

$$S_t = (I-B_1)\gamma + B_1 S_{t-1} + (I-B_1)\varphi Z_t + (I-B_1)\theta T + (I-B_1)\phi D + \eta_t \quad (6)$$

Further, the long-run static model in which the error terms, ε, are generated by the first order autoregressive process results when $A_0 = \varphi$ in (5):

$$S_t = (I-B_1)\gamma + \varphi Z_t - B_1\varphi Z_{t-1} + B_1 S_{t-1} + (I-B_1)\theta T + (I-B_1)\phi D + \eta_t \quad (7)$$

Estimating such a model, instead of estimating the static model and then correcting for the observed serial correlation, will avoid dynamic misspecification (Hendry and Mizon, 1978). Finally, the long-run static specification is generated if $B_1=0$ and $A_0 = \varphi$ in (5):

$$S_t = \gamma + \varphi Z_t + \theta T + \phi D + \eta_t \quad (8)$$

Model (8) is the limit of the general dynamic model where the need for any type of dynamics is ruled out.

Given the capability of the general dynamic model (5) to nest several widely used models in applied production technology studies, it can be considered as the most appropriate specification which avoids dynamic misspecification error. Moreover, when the model is formulated explicitly to incorporate very general structural specifications such as nonhomotheticity and nonneutrality of technical change, it avoids structural specification errors. This becomes clearer later in this paper when an empirical model based on the translog cost function is presented to study the production structure of the Iranian crop sector.

Empirical Model and Estimation Procedure

A system of share equations derived from a translog cost function, incorporating the technological and the structural change variables, takes the following specification:

$$S_{it}=\gamma_i+\sum_{j=1}^{n}\gamma_{ij}\ln P_{jt}+\gamma_{iq}\ln Q_t+ \gamma_{it}T+\gamma_{id}D+\gamma_{itd}DT+\varepsilon_{it} \quad i=1,.m \tag{9}$$

The empirical model corresponding to the first order dynamic specification (5) is obtained by replacing the general system of share equations (1) by the translog cost share system (9). That is,

$$S_t=(I-B_1)\gamma+A_0\Delta\ln P_t+\alpha\Delta\ln Q_t+B_1S_{t-1}+ (I-B_1)\varphi\ln P_{t-1}+(I-B_1)\theta(T-1)+ (I-B_1)\pi\ln Q_{t-1}+(I-B_1)\,\phi D+(I-B_1)\,\psi DT+\eta_t \tag{10}$$

where $\Delta\, lnP_t$ and lnP_{t-1} are, respectively, vectors of first differences and one period-lag prices of inputs. LnQ_t and lnQ_{t-1} are, respectively, the log of current and one period-lag output, and a is the last column of matrix A_0 related to the first difference of output variable, $ln\ Q_t \pi$ is the last column of the long-run matrix of coefficient, φ, associated with the lagged output variable, lnQ_{t-1}. The parameter ψ is an $n\times l$ vector of long-run coefficients associated with the time and dummy interaction variable. The parameters $\varphi,\psi.\pi,\theta$ and ϕ are the parameters of the share equation (10).

Before estimating equation (10), some modifications are needed. In equation (10) the cost shares of all inputs in period *(t-1)* enter into the i-th share equation. First, since there is no a *priori* reason that such a relation should exist and to save some degrees of freedom, the effects of all lagged shares in the i-th share equation are eliminated. This makes the matrix B diagonal with all diagonal elements being equal, as the elements of the vector of lagged shares must sum to unity. Second, the system of share equations (10) is singular because of the above adding up constraint. To generate a non-singular system, one of the equations has to be deleted from the joint estimation. According to Anderson and Blundell (1982) the system (10) is invariant to the equation deleted. A typical equation from (10) which incorporates four variable inputs; labor *(E)*, land *(L)*, capital *(K)*, and material *(M)*, after dropping one of the equation *(labor)* and making the matrix of B diagonal, takes the following specification:

$$S_t^k=(1-b_{kk})\gamma_k+a_{kk}\Delta\ln P_t^k+a_{kl}\Delta\ln P_t^l+ a_{km}\Delta\ln P_t^m+a_{kq}\Delta\ln Q_t+b_{kk}S_{t-1}^k+ (1-b_{kk})\varphi_{kk}\ln P_{t-1}^k+(1-b_{kk})\varphi_{kl}\ln P_{t-1}^l+ (1-b_{kk})\varphi_{km}\ln P_{t-1}^m+(1-b_{kk})\varphi_{ke}\ln P_{t-1}^e+ (1-b_{kk})\varphi_{kq}\ln Q_{t-1}+(1-b_{kk})\theta_k(T-1)+ (1-b_{kk})\phi_k D+(1-b_{kk})\psi_k DT+\eta_t \tag{11}$$

The Maximum Likelihood (ML) method of nonlinear estimation is used to estimate the system of dynamic share equations (11), as ML estimates are invariant to the dropped equation.

Data

The model described in the above section is applied to explain the production structure of the Iranian crop sector. The dependent variables in estimating the system of equation (10) are factor cost shares. The independent variables are indices of input prices, an index of output quantity, a time trend proxy, and a binary variable, the dummy variable.

The output variable is the value of the gross output of the Iranian crop sector in 1974 constant prices. The wage rate index of unskilled labor in the Iranian construction sector is taken as a close approximation to the agricultural wage rate. The material price index is an implicit price index derived by dividing the current price expenditure on materials used in crop production by the constant price expenditure on material input. The materials include fertilizer, chemicals, irrigation water, seeds, packing materials, and fuel. The dual to the perpetual inventory method provides the theoretical framework for measuring the price of capital services (input). Using the perpetual inventory

Table 1. Restrictions required to generate alternative dynamic structures from the general dynamic model.

Models	Restrictions
Partial Adjustment	$a_{ij}=(1-b_{ii})\varphi_{ij}, a_{iq}=(1-b_{ii})\varphi_{iq}$ $i, j=K, M, L, E.$
Static Model with AR(1) Error Terms	$a_{ij}=\varphi_{ij}, a_{iq}=\varphi_{iq}$
Static Model	$b_{ii}=0, a_{ij}=\varphi_{ij}, a_{iq}=\varphi_{iq}$

Table 2. Theoretical and structural restrictions.

Model	Restrictions
Homogeneity Condition	$\varphi_{ie}=-\varphi_{ik}-\varphi_{im}-\varphi_{il} \quad i=k,l,m,e$
Symmetry Condition	$\varphi_{ij}=\varphi_{ji}$
No Structural Change	$\phi_i=0, \psi_i=0$
Homothetic Structure	$\varphi_{iq}=0$
Neutrality of Technical Change	$\theta_i=0, \varphi_i=0$
Cobb-Douglas	$a_{ij}=0, a_{iq}=0$

method (Jorgenson 1974; Hall and Jorgenson 1967), the capital service price was calculated as the product of the acquisition price of capital assets and the sum of the current rate of return to capital and the average depreciation rate. The factor cost shares are calculated as the ratios of the individual input expenditure to the total cost of production. Finally, the price of the land input is a residual derived by subtracting the cost of labor, capital and materials from total value of crop output and then dividing through by crop hectares. The total cost of production is the sum of expenditures on the capital, land, material, and labor inputs. The factor cost shares are calculated as the ratios of the respective input expenditures to the total cost of production. The details of deriving data are in Salami (1996).

Statistical Tests of Model Specification

The general dynamic model (10) without symmetry and homogeneity restrictions on φ is considered as the maintained hypothesis. Then, two types of tests are conducted to specify the most appropriate model representing the production process in the Iranian crop sector. The first set of tests is performed to determine the most parsimonious specification consistent with the data. This is accomplished by imposing the set of restrictions provided in Table (1) on the parameters of the general dynamic specification (10). The resultant models including the partial adjustment, long-run static model with AR(1) error scheme and the translog (TL) static model are all nested in (10). Therefore, the Likelihood ratio test can be applied to test the validity of each restriction. The partial adjustment and the static model with AR(1) are non-nested hypotheses. Thus, if either of these two models is accepted, we proceed to test the more restrictive one.

The second set of tests is performed to specify the structural specification of the production technology and to evaluate whether the specified model produces estimates of the parameters of the translog cost function that are consistent with neoclassical production theory. In particular, the second series of tests are conducted to identify the homotheticity of the production technology, the neutrality of technical change, the presence of structural change, the symmetry of the φ matrix of coefficients, and homogeneity in input prices. These tests are accomplished by imposing the restrictions provided in Table 2. These restrictions generate

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Table 3. Tests of model specification in the absence of homogeneity and symmetry restrictions.

Model	Estimated Log-Likelihood	No. of Parameters	Estimated X^2	Critical $X^2_{a=1\%}$
1-General Dynamic	221.00	37		
2-Partial Adjustment	206.47	22	29.06 (1 vs 2)	30.57
3-Static with AR(1)	206.47	22	29.06 (1 vs 3)	30.57
4-Static	206.38	21	1.04 (3 vs 4)	6.63

a series of nested models, thus the procedure of nested hypothesis testing can be applied.

The two types of tests can not be performed independently because the results of the tests of the second group may depend on the maintained dynamic specification and vice versa. For this reason and to ensure that the results of the tests are not a function of the ordering of the tests, the following strategy is adopted. We start with the most general dynamic form (10) and examine the relative appropriateness of alternative dynamic and static specifications when none of the structural and theoretical restrictions mentioned already are imposed. The most adequate model is selected based on likelihood ratio tests. The symmetry and homogeneity restrictions, and the structural specifications are, then, tested in the context of this specification. In a second round, a reverse action is taken. That is, the adequacy of the alternative models are tested when the symmetry and homogeneity are maintained and the restrictions on the technology are imposed in each step.

RESULTS

Results of the model specification when none of the theoretical and technological restrictions of Table 2 were imposed can be read from the likelihood ratio test statistics presented in Table 3.

According to these statistics, the null hypotheses of the partial adjustment specification as well as the static model with AR(1) errors against the more general dynamic model can not be rejected. Moreover, the test of the simple long-run static model against the static model with AR(1) is in favor of the former specification. Therefore, the static long-run model is nominated as the most appropriate specification in the case of crop production in Iran.

Results of the tests of the theoretical and technological restrictions within the long-run model are reported in Table 4. The results show that the joint imposition of theoretical restrictions-linear homogeneity in input prices and the symmetry of cross price effects-on the parameters of the model can not be rejected. The likelihood ratio test results also indicate that the homotheticity of the production technology in the static model which satisfies the homogenous and symmetry restrictions can not be rejected (Row 2, Table 4). Furthermore, the test of structural change supports the presence of structural change after the Islamic Revolution of 1979. However, the null hypothesis of the neutrality of technological change with and without imposing homotheticity is rejected. Finally, the test of the Cobb-Douglas specification against the translog specification is strongly rejected (Table 4).

To insure that the results of the above tests were not a function of the ordering of the tests, a reverse action was taken in the second round. That is, the adequacy of the alternative models was tested when the theoretical and the technological restrictions were imposed each in the successive steps. The results of the likelihood ratio tests are reported in Tables 5 to 8. All results from likelihood ratio tests support the results obtained from the first round of the testing procedure. Therefore, the final conclusion from the two rounds of the tests is that the long-run static model derived from a non-

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Table 4. Tests of theoretical and structural specification in the general static translog cost model.

Null-Hypotheses	Maintained Hypothesis	Log-Likelihood[b]	DF	Estima-Ted X^2	Critical $X^2_{\alpha=1\%}$
1-Symmetry & Homogeneity	Unrestricted Static model[a]	200.32	6	12.12	16.81
2-Homotheticity	NH1[c]	197.38	3	5.88	11.34
3-Neutrality of technical change	NH2	181.08	3	32.6	11.34
4-Neutrality of technical change	NHl	94.04	3	12.56	11.34
5-No structural change	NHl	209.84	6	24.92	16.81
6-Cobb-Douglas specification	NH5	138.43	9	142.82	21.66

[a] Model 4 in Table 3.with log-likelihood value 206.38 and 21 parameters

[b] Log-likelihoods of the null-hypotheses

[c] Null-Hypothesis

homothetic translog specification technology which incorporates non-neutral technological change and allows for structural change is the most appropriate model to explain and represent the crop production process in Iran. Accordingly, this model is selected as the econometric model of the Iranian crop sector for further economic analysis. The above cross testing procedures will minimize the specification errors and hence, will increase the reliability of results derived from such a model.

Although our focus in this paper is on presenting the general dynamic model and its usefulness in specifying the correct econometric model in studying structure of agriculture, some of the results may need some explanation. The above sequential testing procedure supports the static specification as the most appropriate way of presenting the production behavior of crop production in Iran, and hence, rules out the need for a dynamic adjustment process in moving from one state of equilibrium to the next. This implies that the observed production technology operates at cost-minimization input levels where all inputs are fully adjusted to their long-run equilibrium levels within one production period. This may not be surprising for the following reasons. First, crop production in Iran is not a capital intensive process. The share of the capital input is 11% which is very small relative to the shares of labor (37%) and land (36%). Agricultural machinery and equipment constitute the largest components of the capital input and they can be rented or leased out in response to likely changes in economic conditions. This situation makes farmers flexible in adjusting the level of capital input, the most obvious quasifixed factor of production. Second, the existence of excess demand for agricultural products in Iran ensures a full utilization of any expansion in production capacity. Thus, farmers will try to increase production capacity over time, not just in response to a short-run change in economic environment. The latter most likely changes the combinations of the products which involves reallocation of the existing factors of production. This can not appropriately be reflected in the aggregate data used in this study. In addition, this condition makes the last year level of output, to the extent which this reflects the stock of inventory and affects the level of current year production, an insignificant factor in the dynamic model. Third, the technology of production is not changing frequently in Iran. Thus, the marginal gain from learning by doing is negligible so that the accumulated past year level of output, to the extent that reflects accumulated experiences and requires dynamic specification, may not be an important factor in the dynamic model. Fourth, in the current study the dynamics entered in the model are in the form of one year-lags in input prices and output level. This does not rule out the existence of dynamics in the form of longer lag-length. This

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Table 5.Tests of model specification in the presence of homogeneity and symmetry restrictions.

Model	Estimated Log-Likelihood	No. of Parameters	Estimated X^2	Critical $x^2_{\alpha=1\%}$
1-General Dynamic	211.32	31		
2-Partial Adjustment	200.64	16	21.36	30.57
3-Static with AR(1)	200.53	16	21.58	30.57
4-Static	200.32	15	0.42	6.63

Table 6.Tests of model specification in the presence of homotheticity of production structure.

Model	Estimated Log-Likelihood	No. of Parameters	Estimated x^2	Critical $X^2_{\alpha=1\%}$
1-General Dynamic	209.92	28		
2-Partial Adjustment	198.16	13	23.52 (1 vs 2)	30.57
3-Static with AR(1)	198.80	13	22.24 (1 vs 3)	30.57
4-Static	197.38	12	2.84 (3 vs 4)	6.63

Table 7. Tests of model specification in the presence of neutrality of technical change.

Model	Estimated Log-Likelihood	No. of Parameters	Estimated X^2	Critical $X^2_{\alpha=1\%}$
1-General Dynamic	203.59	25		
2-Partial Adjustment	181.91	10	43.36 (1 vs 2)	30.57
3-Static with AR(1)	187.34	10	32.50 (1 vs 3)	30.57
4-Static	181.08	9	12.52 (3 vs 4)	6.63

Table 8.Tests of model specification in the presence of structural change variables.

Model	Estimated Log-Likelihood	No. of Parameters	Estimated X^2	Critical $X^2_{\alpha=1\%}$
1-General Dynamic	221.47	34		
2-Partial Adjustment	210.62	19	21.70 (1 vs 2)	30.57
3-Static with AR(1)	211.27	19	20.40 (l vs 3)	30.57
4-Static	209.84	18	2.84 (3 vs 4)	6.63

was not considered here due to the limited number of observations.

DISCUSSION

In this paper it has been attempted to show the usefulness of the general dynamic model, originally developed by Anderson and Blundell (1982), in applied agricultural economics research. A good feature of the model is that it places no *a priori* structure on the dynamics, rather it allows testing several alternatives. The general dynamic model permits data to determine the most appropriate specification using classical testing procedures. Thus, it overcomes the problems with short-run specifications as well as the likely dynamic misspecification problem associated with "cost of adjustment" dynamic models. Further, it enables one to test the validity of the long-run model which is a frequently used assumption in modeling production structure in agriculture. By starting model estimation with the general dynamic model and doing the outlined testing procedure, one can be more confident in going on to estimate the parameters of produc-

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tion technology such as elasticities of substitutions and input price elasticities. This, in turn, might be of significant importance for policy purposes, as the magnitudes of these parameters will result in different policy implications.

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استفاده از الگوی اقتصادسنجی دینامیک گسترده در تعیین الگوی مناسب برای مطالعه ساختار تولید کشاورزی: مطالعه موردی تولیدات زراعی در ایران

چکیده

این مطالعه نقش الگوی دینامیک گسترده را در مطالعات کاربردی تکنولوژی تولید در بخش کشاورزی نشان می دهد. الگوی مذکور الگویی از نوع خودهمبستگی درجه اول چند متغیره می باشد که اولین بار توسط اندرسون و بلاندل توسعه و تکامل یافته است. این مدل به گونه ای کلی و گسترده است که قادر است چندین الگوی اقتصادسنجی ساده تر دینامیک و همچنین استاتیک را در خود جای دهد. از این رو الگوی مذکور بخوبی چارچوبی را برای انجام آزمونهای متعدد کلاسیک به منظور تعیین الگوی اقتصادسنجی کاربردی مناسب در تولید فراهم می نماید. در مطالعه حاضر مفید بودن این چارچوب اقتصادسنجی با بکارگیری آن درتعیین ساختار بخش زراعت ایران نشان داده شده است. نتایج مطالعه نشان می دهد که یک مدل استاتیک درازمدت که از فرم تابعی ترانسلوگ غیرهموتیک با تکنولوژی غیرخنثی بدست آمده باشد و دارای متغیر تغییر ساختاری برای نشان دادن تغییر ساختاری بعد از انقلاب اسلامی سال ۱۳۷۹ باشد، بخوبی می تواند ساختار تولید بخش زراعت ایران را تصویر نماید.

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