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THE STRUCTURE OF PRODUCTION IN GREEK AGRICULTURE: ELASTICITIES OF SUBSTITUTION AND DERIVED FACTOR PRICE ELASTICITIES

By

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Abstract

The objective of this paper is to measure the own price, the cross price elasticities of derived input demand and the Allen-Uzawa elasticities of substitution among input pairs for the Greek agricultural sector. A restricted cost function is used to approximate agricultural technology and two quasi-fixed inputs are included, which are capital and a detrimental or 'non-productive' input, namely nitrate pollution. The system which consists of the translog cost function, factor share equations and a revenue share equation is estimated by the method of Seemingly Unrelated Regressions. Findings indicate that demand is price inelastic for the three variable inputs. Labour is found to be a substitute for land and for intermediate inputs. Land and intermediate inputs are complements. JEL Classifications: Q11, Q12.

Keywords: Restricted cost function, translog, derived factor demand price elasticity, agriculture, elasticity of substitution.

1. Introduction

The dual cost function expressed in a variety of flexible functional forms has often been applied to the agricultural and other industries in order to gain insights into the substitution possibilities between inputs (Binswanger, 1974; Ray, 1982; Velentzas *et al.,* 1992; Karagiannis *et al.,* 1996). In this context, the prevailing assumption is that all factors of production are in long run equilibrium. However, in certain circumstances, a partial static equilibrium cost function may be considered as more suitable. In this situation the firm is thought to be in equilibrium regarding a subset of variable inputs conditional on the observed levels of the remaining quasi-fixed inputs. That is, current production technology may be at short run equilibrium and firms can then be assumed to minimize variable production costs under the restriction imposed by the utilization levels of one or more quasi-fixed factors of production. This setting permits the measurement of variable factor elasticities while holding the levels of the quasi-fixed inputs constant (Kulatilaka, 1987).

Any inputs presumed to be in disequilibrium can be treated as quasi-fixed inputs as was shown by Brown and Christensen (1981) who estimated translog variable cost functions for the U.S. farm sector including self-employed labour as either a variable or quasi-fixed input in alternative runs of the model. Their results showed that substitution elasticities were quite different in the two cases and the inference was that the choice of a particular specification has important influence on estimated elasticities. Kulatilaka (1985) rejected the static equilibrium model for the U.S manufacturing sector in favour of a temporary equilibrium specification with capital being the factor that was quasi-fixed in the short run in the context of a translog variable cost function. Morrison (1988b) employed another specification for the U.S and Japanese manufacturing sectors, the Generalized Leontief restricted cost function, with capital being fixed in the short run or alternatively with both capital and labour as the quasi-fixed inputs. Mergos and Karagiannis (1997) applied a restricted cost function to the Greek agricultural sector in order to study the sources of productivity change for the period 1961-1993, in which land and capital are treated as quasi-fixed inputs since they were in market disequilibrium.

Reinhard and Thijssen (2000) refer to the inclusion of pollution as an input along with the conventional inputs, an idea initially applied by Pittman (1981) and later discussed in a theoretical review by Cropper and Oates (1992) who formalized the argument. Waste discharges seen in that way enter the objective function as another factor of production, the rationale being that the end result of any effort to reduce waste emissions is the diversion of some or all remaining inputs to abatement activities. This in turn means that less of these other inputs are now available for the production of output and less output will be produced just like with conventional inputs. Reinhard *et al.* (1999), adopted this approach, treated the nitrogen surplus in Dutch dairy farming as an environmentally detrimental input and consequently estimated environmental efficiency.

The objective of this paper is to examine the structure of production in Greek agriculture through the measurement of factor price elasticities of input demand and of elasticities of substitution between inputs. A restricted cost function is used to summarize production technology for the Greek agricultural sector and two quasi-fixed inputs are included, which are capital and a detrimental or 'non-productive' input, namely, nitrate pollution. The substitution possibilities among variable inputs are measured subject to the observed levels of capital utilization and nitrate pollution.

This paper is organized as follows. Section two includes the theoretical framework regarding the variable cost function and its properties, the translog specification and the factor share equations that are being estimated. The third section presents the estimated elasticities and the fourth one offers some concluding comments.

2. Theoretical framework and model specification

Production technology in agriculture can be described by a restricted or variable cost function that assumes fixity of certain inputs in the short run, in this case, the short run total cost function is as follows (Kulatilaka, 1985; Berndt and Fuss, 1986):

$$C\ (P, Q, Z, t) = G\ (P, Q, Z, t) + \sum_{k=1}^{m} r_k Z_k \tag{1}$$

where C represents the total cost of production, G the variable cost of production, P is the vector of variable input prices, Q the vector of outputs, Z denotes the levels of those inputs that are fixed or subject to some availability constraint and are termed quasi-fixed inputs, rk is the vector of shadow prices for the quasi-fixed inputs, m is the number of quasi-fixed inputs and t is the time trend. This characterization of technology implies that producers minimize variable production costs while choosing some stock level of the quasi-fixed inputs. An application of the Shephard's lemma which entails differentiation with respect to input prices, gives a set of cost- minimizing input demand functions:

$$X^* = h\ (P, Q, Z, t) \tag{2}$$

For the variable cost function to be well defined certain properties must be satisfied which translate to specific parameter restrictions. The necessary and sufficient conditions for cost- minimization require the variable cost function to be continuous in factor prices (P) and output (Q), monotonic and non- decreasing in P and Q and linearly homogeneous and concave in P (Chambers, 1988). The restricted cost function satisfies another property, that is short-run variable costs are non-increasing in constrained inputs: $-\frac{\partial G}{\partial Z_k} = r_k$ where r_k is the shadow price of the quasi-fixed input k.

Producers are assumed to minimize variable costs for given levels of certain fixed inputs. The agricultural sector is supposed to be in equilibrium with respect to a subset of variable inputs given the observed levels of the quasi-fixed inputs. In other words, the dual variable cost function expresses variable production costs as a function of output quantity, of variable input prices, of the quantity of quasi-fixed inputs and of technological progress. In this specification, there is no possibility of substitution between the quasi-fixed inputs and the variable inputs (Capalbo, 1988). The functional form that is chosen in this case is the translog (Brown and Christensen, 1981; Morrison, 1988a; Mergos and Karagiannis, 1997):

$$\ln G = \alpha_o + \alpha_q \ln Q + \sum_{i=1}^{n} \alpha_i \ln P_i + \sum_{i=1}^{n} \beta_i \ln Z_i + \frac{1}{2}\gamma_{qq}(\ln Q)^2 + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n}\gamma_{ij}\ln P_i \ln P_j +$$
$$+\frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n}\delta_{ij}\ln Z_i \ln Z_j + \sum_{i=1}^{n}\rho_{iq}\ln Q \ln P_i + \sum_{i=1}^{n}\sum_{j=1}^{n}\rho_{ij}\ln P_i \ln Z_j + \sum_{i=1}^{n}\pi_i \ln Q \ln Z_i + \tag{3}$$
$$+\varphi_t T_t + \frac{1}{2}\phi_{tt}T^2 + \phi_{tq}\ln Q T + \sum_{i=1}^{n}\varphi_{it}\ln P_i \cdot T + \sum_{i=1}^{n}\varphi_{zit}\ln Z_i T$$

where G is the variable production cost, Pi is the price of variable inputs, which are labour, intermediate inputs and land and the variable (Q) corresponds to total agricultural output, crop and livestock. Expenditure on labour includes family and hired labour and the intermediate inputs are fertilizers, pesticides, energy, lubricants, seeds, feeding stuff and other minor costs. Data were obtained from the Ministry of Agriculture, the National Statistical Service of Greece- National Accounts and Eurostat- Economic Accounts for Agriculture and Forestry. The two quasi-fixed inputs (Zi) are capital and nitrate pollution, which is modelled as a detrimental input, a "counter-productive" input. The growth rate of nitrogenous fertilizers used in agriculture is considered a satisfactory alternative to the growth rate in nitrate pollution and is taken as the detrimental quasi-fixed input. This conjecture relies on reported evidence that indicate rising nitrate levels in all the main rivers of Greece (Environmental Statistics, NSSG). Yearly averages of nitrates found in these surface waters were calculated and then regressed against the quantity of nitrogenous fertilizers (one-year lag) and time. The quantity of nitrates depends on the quantity of nitrogenous fertilizers used in the previous period and the growth rate of the forecasted nitrate variable was found to exceed the growth rate of nitrogenous fertilizers applied to agriculture. However, taking into account the cumulative nature of pollutants, the use of the growth rate of nitrogenous fertilizers as a proxy to the growth rate of nitrates may underestimate pollution.

By applying Shephard's lemma to (3) in its logarithmic form we obtain:

$$S_i = \frac{\partial \ln G}{\partial \ln P_i} = \alpha_i + \sum_{i=1}^{n} \rho_{iq} \ln Q + \sum_{j=1}^{n} \gamma_{ij} \ln P_j + \sum_{j=1}^{n} \rho_{ij} \ln Z_j + \varphi_{it} T \tag{4}$$

S_i is the cost share of variable input i, that is: $S_i = \frac{P_i X_i}{\Sigma_i P_i X_i}$ where p_i, is the price of input i and X_i is the quantity of that input. The revenue share is given by:

$$R = \frac{\partial \ln G}{\partial \ln Q} = \alpha_q + \gamma_{qq} \ln Q + \sum_{i=1}^{n} \rho_{iq} \ln P_i + \sum_{i=1}^{n} \pi_i \ln Z_i + \varphi_{tq} T \tag{5}$$

where R indicates the revenue share to variable costs. Hence, $R = \frac{P^* Q}{G}$, where P^* and Q correspond to the price and quantity of agricultural output respectively. From the translog we obtain,

$$M_i = \frac{\partial \ln G}{\partial \ln Z_i} = \beta_i + \sum_{i=1}^{n} \delta_{ij} Z_j + \sum_{i=1}^{n} \rho_{ij} \ln P_i + \sum_{i=1}^{n} \pi_i \ln Q + \varphi_{zit} T \tag{6}$$

where, $M_i = -\frac{W_i Z_i}{G}$. M_i is the shadow share of the quasi-fixed input in variable costs, W_i is the shadow price and Z_i is the quantity of the quasi-fixed input.

A number of restrictions should hold at the point of approximation in order for the restricted variable cost function to be well behaved. It should be non-decreasing in variable input prices P and output Q and non-increasing in the quantity of the quasi-fixed input Z_i. Hence, the factor shares and the revenue share must be positive ($S_i > 0$, $R > 0$) while the shadow share must be negative ($M_i < 0$). These in turn translate to $\beta_i < 0$, $\alpha_q > 0$ και $\alpha_i > 0$.

Linear homogeneity in input prices of (3) requires the following restrictions for the coefficients of the model:

$\Sigma\alpha_i=1$ and $\Sigma\gamma_{ji}=\Sigma\varrho_{iq}=\Sigma\varrho_{ij}=\Sigma\varphi_{it}=0.$

Additionally, symmetry is imposed on the parameters of input prices due to the symmetry of the Hessian matrix of the translog function:

$$\gamma_{ij} = \gamma_{ji}.$$

It should also be symmetric with respect to the quantity of the quasi-fixed input Z_i

$$\delta_{ij} = \delta_{ji}.$$

It should be concave in P which means that the corresponding Hessian matrix must be negative semi-definite and convex in Z which implies that Hessian matrix must be positive semi-definite.

One type of elasticities derived from the translog cost function is substitution elasticities and own price elasticities that explain the consequences of changes in the price of inputs, the volume of output and the quantity of the quasi-fixed inputs on derived input demand.

The elasticity of substitution specifies how a factor of production can be substituted by another given the level of output, information that is helpful in analyzing the effect of agricultural policy measures which alter relative input prices. More specifically, the Allen-Uzawa own partial elasticity of substitution which is an extension for the multi-factor case, is defined as the percentage change in the level of use of an input due to a percentage change in its price, given the price and quantity of other inputs and taking into account its relative share in production costs. The cross partial elasticity of substitution is defined as the percentage change in the level of use of an input due to a percentage change in the price of another input. The Allen-Uzawa partial elasticities of substitution can be derived from the short run translog cost function and are given by the following equations, (Binswanger, 1974; Morrison, 1988a):

$$\sigma_{ij} = \frac{\gamma_{ij}}{S_i S_j} + 1 \tag{7}$$

$$\sigma_{ii} = \frac{\gamma_{ii}}{S_i^2} - \frac{1}{S_i} + 1 \tag{8}$$

The own price elasticities of derived input demand are calculated by Mundlak (1968) and are as follows:

$$\varepsilon_{ii} = \frac{\gamma_{ii}}{S_i} + S_i - 1 \tag{9}$$

$$\varepsilon_{ij} = \frac{\gamma_{ij}}{S_i} + S_j \tag{10}$$

The γii and γij coefficients that are necessary for the calculation of substitution and own price elasticities are estimated in the following section.

3. Empirical Results

A restricted cost function is employed to represent production technology in Greek agriculture using aggregate data for the period 1969-1996. The system of equations which consists of the cost function (equation 3), three factor share equations (equation 4), and a revenue share equation (equation 5), is estimated with Seemingly Unrelated Regressions (SUR), as there are across equation restrictions (Zellner, 1962). The equations are correlated through their error terms because the relative share equations are produced as the solution to the problem of variable cost minimization. Hence, the optimal choice for producers regarding a specific input has a direct effect on the quantities of all other inputs and on variable production costs. SUR is the most suitable method in this case because it gives estimators with all the desirable properties (Oberhofer and Kmenta, 1974). In estimating the system, it is possible to remove any equation because of the adding-up property of the variable inputs cost shares. Iterative- SUR is the method employed, given that SUR is sensitive to which equation is excluded and in order to avoid singularity of the estimated variance-covariance matrix across equations (Capalbo, 1988; Velentzas *et al.,* 1992).

The output variable (Q) includes all agricultural produce, crop and livestock and the three variable inputs (P) are price indices for labor, intermediate inputs and land. The variable cost of production is defined as the sum of expenditures on labour, land and intermediate inputs. Expenditure on labour includes family and hired labour, intermediate inputs are fertilizers, pesticides, energy, lubricants, seeds, feedingstuff and other. One quasi-fixed input (Z) is capital and refers to buildings, construction, equipment and machinery. The other quasi-fixed input (Z) is nitrate pollution, which is modeled as a detrimental input. The growth rate of nitrogenous fertilizers is used to approximate the growth rate in nitrate pollution. Data were obtained from the Ministry of Agriculture, the National Statistical Service of Greece, from National Accounts and Eurostat- Economic Accounts for Agriculture and Forestry.

The estimation of the system of equations (3), (4) and (5) produced a set of coefficients which are presented in Table 1. The monotonicity and curvature conditions must be assessed at the point of approximation in order to satisfy the requirements for theoretical consistency (Antle and Capalbo, 1988). The model satisfies the necessary and sufficient conditions for monotonicity in prices since the estimated cost shares of the variable factors are greater than zero. At the point of approximation, the estimated variable cost function is non-decreasing in variable input prices and output quantity and non-increasing in quasi-fixed input levels. The values of the relevant coefficients are α_1=0,571 α_2=0,215 α_3=0,214 α_q=1,558 β_1= -0,216 and β_2= -0,474. Regarding the curvature conditions, the variable cost function is concave in terms of input prices since the principal minors of the Hessian matrix are H_{11}= -0,134, H_{22}= -0,21 and H_{33}= -0,41.

The values of the variable input demand price elasticities for the whole period and for a series of sub-periods are reported in Table 2. These elasticities are calculated yearly according to relationship (9), using the estimated coefficients γii from Table 1 and the yearly relative share of each input in variable costs. The derived input demand price elasticities have a negative sign for all sub-periods signifying downward sloping demand curves and take absolute values less than one indicating inelastic demand.

The average value of the price elasticity for all three factors appears to be quite small for the whole period especially for labour and intermediate inputs (-0.2 and -0.3 respectively). This may be due to the number of restrictions imposed on the system given that it reflects a state of temporary equilibrium. According to the Le Chatelier principle in the long run when all factors of production can freely adjust, demand is more elastic than in the short run when some remain constant. The fewer the restrictions imposed on the system the greater will be the response of a factor of production to changes in its price (Capalbo, 1988).

Labour has the most inelastic demand relative to other inputs, yet, labour's wage responsiveness increases slightly over the examined period. With respect to labour supply, economic immigrants are the main source of non-family labour in the Greek agricultural sector. Increasing social pressure in the past led inevitably to an arrangement regarding their legal status and, by and large, to their complete integration in the labour market. Consequently, these changes augmented to some extent labour costs. On the other hand, the rural population is turning continuously over the last decades to other parallel activities in the tertiary sector such as agro-tourism. The increasing availability of opportunities for alternative employment is associated with rising opportunity cost for family labour. These trends combined with labour's inelastic demand may lead to an increase in production costs and more so for output that is produced with labour-intensive methods.

Additionally, it is worth pointing out that labour cost for the production of organic goods has been found to be 10% to 20% higher relative to labour cost for conventionally produced output (Offermann and Nieberg, 1999). This should be taken into account if we are considering the option to turn to more extensive methods of production or rather to more sustainable farming systems. Nevertheless, this depends on the degree of substitutability of labour with other inputs. The elasticity of substitution between capital and labour in conventional intensive agriculture is rather large 1.24 for the period 1973-1989 (Veletzas *et al.,* 1992). However, it may be expected that this elasticity of substitution will be smaller in sustainable farming systems on account of labour's relative significance as a factor of production.

The own price-elasticity for intermediate inputs increases from -0.21 to -0.34 during the sub-periods but it should be interpreted with caution because it is an aggregate input. The own price-elasticity for land is –0.73 on average, which means that the demand for land is price inelastic.

The values of the cross price elasticities are given in Table 3. They are calculated yearly according to equation (10), using the estimated coefficients γij from Table 1 and the yearly relative share of each input in variable costs. The cross price elasticity between two factors of production i και j reflects the relative importance of each factor as can be seen from equation 10, where the share Sj of factor j is added (Binswanger, 1974). Hence the cross price elasticities between two factors of production can take different values.

From Table 3, it appears that the demand for intermediate inputs is more sensitive to variations in wages than the other way around with the respective cross-price elasticities being 0.36 and 0.13. The demand for land is more sensitive to variations in wages than the opposite given the value of the elasticities, (0.23 και 0.09 respectively).

The Allen-Uzawa partial elasticities of substitution are given in Table 4. They are calculated on a yearly basis according to equations (7) and (8) using the estimated coefficients γij from Table 1 and the yearly relative share of each input in variable costs. It should be noted that these are short run elasticities of substitution and Mundlak (1968) has developed the relationship between short and long run elasticities. The own - partial elasticities of substitution given in the first three columns have a negative sign for all periods, as expected, indicating downward sloping demand functions.

Labour exhibits low levels of substitutability with land and with intermediate inputs with the elasticities of substitution being 0.4 and 0.6 respectively. The substitution possibilities between labour and land are decreasing during the period 1969-1996 as can be seen in Graph 1. The direction taken by the Greek agricultural sector towards crop as opposed to livestock production during these decades, the outflow of labour from agriculture and the rising opportunity cost for land, have contributed to the decline of substitutability between land and labour (Velentzas *et al.,* 1992).

Taking into account that in this case nitrate pollution has been included as a detrimental input, the tendency of falling substitutability between land and labour is carried on further because of the indirect effect quasi-fixed inputs have on the substitution possibilities of variable factors. Pollution levels have been rising and this is associated with intensive production technology. So, for given levels of capital and pollution, in a situation of temporary equilibrium, the substitution possibilities between land and labour may be further reduced. This interpretation is also supported by the finding that the substitution possibilities between labour and intermediate inputs are increasing over the period 1969-1996 (Graph 2). This outcome is consistent with the continuing decline in labour's relative importance as a factor of agricultural production and with rising pollution which is the product of intensive farming.

On the other hand, intermediate inputs and land appear to be complementary factors of production over the entire period with substitution elasticity taking an average value of -0.4 (Table 4). The elasticity is falling during the latter sub-periods indicating very low complementarity (Graph 3). During the period under study there has been an increase in the use of intermediate inputs especially after 1981 and the country's accession in the EU, due to policy induced intensification of production, which was assisted by their low price elasticity of demand (-0,3). More intermediate inputs were applied per hectare on moderately rising land leading to the occurrence of various environmental problems including nitrate pollution. For given levels of capital use and pollution the degree of complementarity between land and intermediate inputs is falling. Ceteris paribus, in the face of rising pollution they may become substitutes and raising prices of intermediate inputs could lead to more use of land.

4. Concluding remarks

This paper presents a number of elasticities that characterize the structure of production in the Greek agricultural sector conditional on the stock of capital and on the level of nitrate pollution which are considered as quasi-fixed inputs and have an indirect influence on calculated elasticities. The interaction between the factors of production and the way they are transformed to output via implemented technology is useful information for policy purposes. The intensity of input use in the future is affected by whether inputs are substitutes or complements and to what extent.

The derived factor demand price elasticities indicate inelastic demand for all three factors, especially labour. This in conjunction with rising wages for farm workers and increasing opportunity cost for family labour may lead to higher production costs, something that might adversely affect the prospects of sustainable farming systems which are labour intensive. The estimation of cross price elasticities shows demand for intermediate inputs to be more responsive to variations in wages than the reverse, while demand for land is more sensitive to variations in wages.

The elasticity of substitution between the factors labour-land and labour-intermediate inputs is rather low. The substitution possibilities are decreasing for the first pair of inputs and increasing for the second pair during the whole period, findings that have been partially attributed to the indirect effect of rising pollution. The growing intensity in the use of intermediate inputs is one factor that has contributed to a series of environmental problems including nitrate pollution. Intermediate inputs and land are found to be complementary factors of production with the substitution elasticity falling throughout the whole period conditional on the levels of capital use and pollution.

APPENDIX

TABLE 1

Estimated Coefficients of the Restricted Cost Function[1]

Parameter	Value	t - statistic
α_o	0.049	1.13
α_q	1.558	15.18
α_1	0.571	37.45
α_2	0.215	31.00
α_3	0.214	
β_1	-0.216	-1.35
β_2	-0.474	-0.95
γ_{qq}	-0.667	-1.61
γ_{11}	0.120	4.60
γ_{12}	-0.045	-2.17
γ_{13}	-0.075	
γ_{22}	0.107	5.91
γ_{23}	-0.062	
γ_{33}	0.009	0.13
δ_{11}	-0.801	-1.22
δ_{12}	0.746	0.56
δ_{22}	-2.583	-1.06
ϱ_{1q}	0.486	10.23
ϱ_{2q}	-0.187	-5.88
ϱ_{3q}	-0.299	
ϱ_{11}	0.003	0.10
ϱ_{12}	-0.096	-1.30
ϱ_{21}	-0.007	-0.51
ϱ_{22}	-0.003	-0.08
ϱ_{31}	0.004	
ϱ_{32}	0.098	
π_1	0.073	0.35
π_2	0.400	0.81
φ_{1t}	-0.012	-6.65

[1] *The values of the parameters where no t-statistic is given have been determined by the imposed restrictions.*

Continues

φ_{2t}	0.010	11.27
φ_{3t}	0.002	
φ_{z1}	0.003	0.17
φ_{z2}	0.053	1.21
φ_{tq}	0.000	0.01
φ_{t}	-0.013	-1.63
φ_{tt}	0.001	1.00

TABLE 2

Derived Factor Demand Price Elasticities

Period	Elasticities		
	Labour (e_{LL})	**Intermediate Inputs (e_{II})**	**Land (e_{HH})**
1969-1979	-0.187	-0.212	-0.776
1980-1989	-0.217	-0.262	-0.743
1990-1996	-0.257	-0.340	-0.752
1969-1982	-0.189	-0.206	-0.717
1983-1996	-0.241	-0.317	-0.744
1969-1996	-0.217	-0.291	-0.731

TABLE 3

Cross Price Elasticities

Period	Labour-Inter.Input	Inter.Input – Labour	Land-Labour	Labour - Land	Inter. Input-Land	Land-Inter. Input
1969-1979	0.082	0.327	0.286	0.105	-0.176	-0.120
1980-1989	0.132	0.358	0.224	0.084	-0.082	-0.078
1990-1996	0.208	0.351	0.125	0.049	-0.017	-0.025
1969-1982	0.087	0.333	0.279	0.102	-0.166	-0.118
1983-1996	0.176	0.355	0.168	0.065	-0.040	-0.045
1969-1996	0.132	0.360	0.225	0.085	-0.079	-0.077

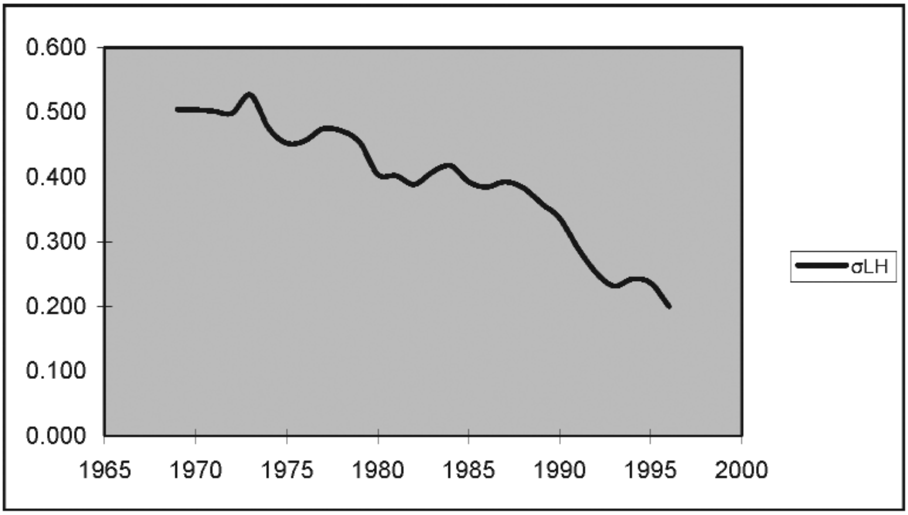
TABLE 4

Elasticities of Substitution

Period	Labour	Inter.Input	Land	Labour-Land	Labour-Inter. Input	Inter.Input-Land
1969-1979	-0.399	-1.195	-3.254	0.484	0.543	-0.786
1980-1989	-0.377	-1.252	-3.456	0.393	0.616	-0.384
1990-1996	-0.533	-1.138	-3.816	0.256	0.695	-0.057
1969-1982	-0.372	-1.181	-3.301	0.465	0.550	-0.747
1983-1996	-0.478	-1.222	-3.633	0.324	0.664	-0.174
1969-1996	-0.419	-1.332	-3.446	0.409	0.626	-0.367

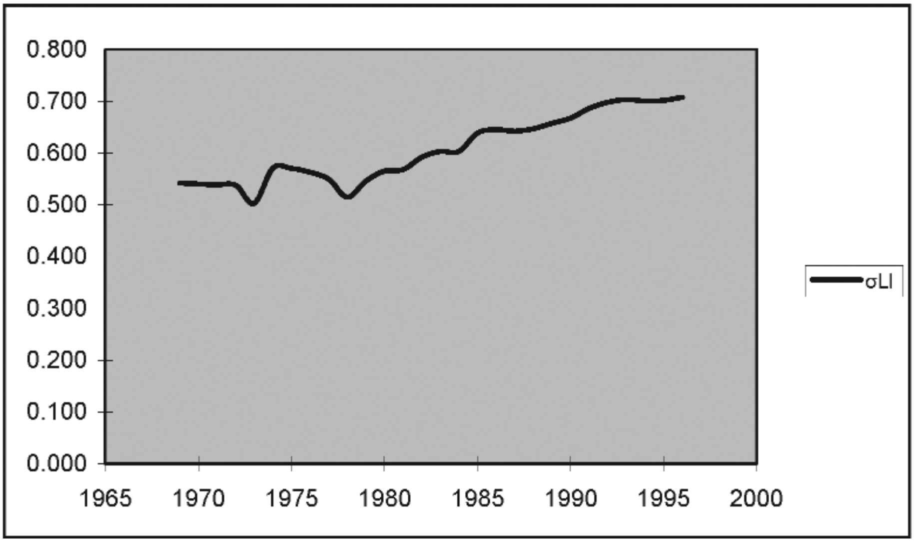
GRAPH 1

Elasticity of Substitution, Labour - Land



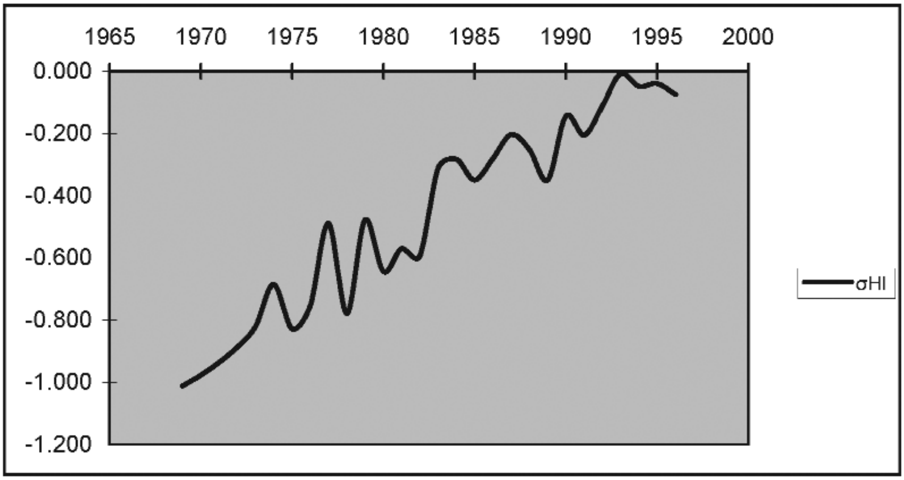
GRAPH 2

Elasticity of Substitution, Labour - Intermediate Inputs



GRAPH 3

Elasticity of Substitution, Land - Intermediate Inputs



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