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# SUBSTITUTION AND THE STRUCTURE OF THE LABOUR FORCE

by

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## ABSTRACT

The dominant methodology for projecting the structure of the labour force, the manpower requirements approach, is based on the assumption that there is no substitutability among the different types of labour. The purpose of the present paper is to estimate directly and quantitatively the effects of supply variables, using international cross-section data.

In Section 1, it is argued that the utilization of a given type of labour within a given sector is likely to depend at least partially on the supply of that type of labour within the economy as a whole. In Section II, the hypothesis is tested statistically. It performs well in the sense that half of the coefficients of the supply variable are significant at the 5% level, and all but one have the expected sign.

Results suggest that the manpower requirements approach gives a misleadingly rigid impression of the demand for labour and hence of the derived demands on the educational system. For a few occupations, the supply variable is relatively unimportant, and in such cases it is possible that the manpower requirements approach -- modified to take into account the productivity factor -- might perform satisfactorily. But for most occupations, the influence of the supply variable is sufficiently strong to invalidate the notion of "requirements."

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C R S Dougherty
January 1971

# SUBSTITUTION AND THE STRUCTURE OF THE LABOUR FORCE *

The dominant methodology for projecting the structure of the labour force, the manpower requirements approach, is firmly based upon the assumption that different kinds of labour may not be substituted for one another. In its more sophisticated versions attempts have been made at taking into account the influences of such factors as the level of output per worker on the structure of the labour force, but nonetheless the analysis has remained rigidly demand-orientated.

A growing number of studies have nevertheless noted the probable importance of substitution. Hollister (1964), in what was probably the first attempt at testing systematically the manpower requirements approach, discusses it extensively, but made no attempt at estimating directly the effects of the supply variables. Instead he observed the large proportions of the variances of the labour utilization coefficients unaccounted for by technological and scale variables and inferred that they were the result of substitution.[1] In the same manner the authors of the recent OECD study (1970)[2] are led to make indirect inferences about the extent of substitution. Among the purely theoretical papers that have treated the subject probably the best known is that of Blaug (1967).

The residual approach to the assessment of the effects of substitution is unsatisfactory in several obvious respects. In the first place, as Hollister acknowledges, there is no way of knowing what proportion of the unexplained variance in the labour coefficients should genuinely be ascribed to substitution

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* I am indebted to Zvi Griliches and George Psacharopoulos for valuable comments.

1 See especially pp. 136-8. The study remains a most incisive critique of the manpower requirements approach.

2 See Chapter V.

and what proportion is due to errors in the measurement of the data and to technological variables excluded from the analysis. Secondly, it is probable that part of the variance apparently accounted for by the technological variables should in fact be ascribed to the supply variables, since the former may be acting partially as proxies for the latter. Thirdly, even if one were able to measure accurately by an indirect method the variation in labour coefficients due to substitution, one would still have no knowledge of the mechanism responsible for it and would be little better off for either prediction or planning.

The purpose of this paper is to estimate directly and quantitatively the effects of supply variables, using international cross-section data. Section I sets out the theoretical framework. It is of tedious length but this is inevitable because the final model is a gross simplification of a complex structure of interacting relationships, and a detailed exposition is necessary for it to be possible to interpret the empirical results. These are presented in Section II. In conclusion Section III discusses the implications for planning.

## I The Theoretical Framework

In any attempt to unravel the supply and the demand effects operating simultaneously within an economic system it is necessary to formulate an equilibrium model of scope broad enough to include all the relevant functional relationships. Within any given country the problem of the utilization of labour can be viewed from two different angles : the determination of the composition of the labour force employed by a given industry, and the determination of the allocation of the total supply of a given type of labour between the different industries.

The first element of any model, explicitly or otherwise, of the structure of the labour force is the production function

$$(1) \qquad Y_i = Y_i ( K_i , L_{i1} , \ldots , L_{im})$$

where

$Y_i$ = output of industry i

$K_i$ = capital stock of industry i

$L_{ij}$ = employment of labour of type j in industry i

Generally the production function is written in the restricted form

$$(2) \qquad Y_i = Y_i ( K_i , L_i )$$

where

$$(3) \qquad L_i = L_i ( L_{i1} , \ldots , L_{im} )$$

Thus $L_i$ is an aggregate index of the labour employed in industry i .

The manpower requirements approach predicates that (3) takes the special form

$$(4) \qquad L_i = \min_j \left( \frac{L_{ij}}{a_{ij}} \right)$$

where the $a_{ij}$ are technological constants. It can be seen that, in the absence of unemployment, (4) determines the proportions of the different types of labour employed by industry i, $l_{ij}$ $(j=1,\ldots,m)$, since

$$(5) \qquad l_{ij} = \frac{L_{ij}}{\sum_k L_{ik}} = \frac{a_{ij}}{\sum_k a_{ik}}$$

In the original version of the manpower requirements approach, as outlined by Parnes (1962), the $a_{ij}$, and hence the $l_{ij}$, were assumed to be constant. In later variations of the methodology, for example Horowitz, Zymelman and

Herrnstadt (1966), and Layard and Saigal (1966), they were assumed to be functions of output per worker. In either case, providing that one makes the further assumption that there is no substitution between capital and labour, it is not necessary to complicate the model further by introducing supply functions for labour. The industry production function (2) becomes

$$(6) \qquad Y_i = \min \left( \frac{L_i}{\alpha_i}, \frac{k_i}{\beta_i} \right)$$

where $\alpha_i$ and $\beta_i$ are technologically determined parameters. Hence, providing that there is no unemployment,

$$(7) \qquad L_i = \alpha_i Y_i$$

and

$$(8) \qquad L_{ij} = l_{ij} \alpha_i Y_i$$

In order to compute the $L_{ij}$ one merely has to make a projection of $Y_i$ and to calculate estimates of $\alpha_i$ and the $l_{ij}$. In industries which have exhibited significant growth in labour productivity it is customary to take this into account by writing the parameter $\alpha_i$ as a function, for example a declining exponential function, of time.[3]

Having obtained the demand for a given kind of labour in each industry, one can obtain the aggregate demand for that kind of labour for the economy as a whole. If the aggregate supply of each kind of labour is not equal to its aggregate demand, the result must be either loss of output or unemployment or both. According to the manpower requirements approach, therefore, either careful planning or considerable luck is essential if full employment and maximal growth are to be achieved.

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3 In spite of the well-known finding of Kendrick (1961) that the rate of growth of labour productivity does not appear to be stable in most industries.

In order to reach this pessimistic conclusion three important assumptions had to be made and each of them has been challenged by empirical studies. To write the production function in the form (2) in the place of (1) it is necessary to assume that there is no relative complementarity between any particular type of labour and capital. A study by Griliches (1969) indicates that, for the United States, there exists relative complementarity between skilled labour and capital. In order to write (4) instead of (3) it has to be assumed that there is no scope for substitution between different kinds of labour. Doubts on this score are expressed in the works by Hollister, Layard and Saigal, Blaug and OECD cited above. In addition empirical studies by Bowles (1968) and the present writer (1971) report attempts at measuring directly the elasticity of substitution between different kinds of labour, and the estimates of such elasticities are invariably high, always above unity. Finally it should be recalled that in writing (6) in the place of (2) it is assumed that the elasticity of substitution between capital and labour is zero for each industry. The numerous empirical studies on this topic have in general concluded otherwise.[4]

If these three assumptions are not made then one must start again from the beginning with the production function (1). It appears inevitable that one must bring in the supply side explicitly and complete the model in order to obtain an equilibrium system for the labour market. If the latter were perfectly competitive one could expect that a given kind of labour would have the same wage, and therefore the same marginal productivity, in all industries. One would then obtain the following system of equations :

$$(1) \qquad Y_i = Y_i ( K_i , L_{i1} , \ldots , L_{im} ) \qquad (i=1,\ldots,n)$$

$$(9) \qquad w_j = \frac{\partial Y_i}{\partial L_{ij}} \qquad (i=1,\ldots,n ; \; j=1,\ldots,m)$$

$$(10) \qquad \sum_i L_{ij} = \overline{L}_j \qquad (j=1,\ldots,m)$$

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4 For a survey of some of these see Nerlove (1967).

where

$w_j$ = wage of labour of type j

$\bar{L}_j$ = total supply of labour of type j

Taking the $K_i$ and $\bar{L}_j$ as exogenous, there are (nm+n+m) equations in as many variables and they could be solved if the functions $Y_i$ were specified explicitly and possessed plausible first and second derivatives. However there exists no general agreement concerning the nature of the $Y_i$ and thus any attempt to specify them would be unduly ambitious. This of course entails abandoning any attempt to specify the $L_{ij}$ as functions of the $K_i$ and the $\bar{L}_j$. Nevertheless it does not rule out the less ambitious goal of estimating the effects of small changes in the $K_i$ and $\bar{L}_j$ on the values of the $L_{ij}$. Taking differentials of (9) and (10) one obtains

$$(11) \qquad \frac{dw_j}{d\bar{L}_s} = \sum_{p=1}^{n} \frac{\partial^2 Y_i}{\partial L_{ij}\partial L_{ip}} \cdot \frac{dL_{ip}}{d\bar{L}_s} \qquad (i=1,\ldots,n\,;\ j=1,\ldots,m)$$

$$(12) \qquad \sum_i \frac{dL_{ij}}{d\bar{L}_s} = 0 \qquad (j \neq s)$$

$$= 1 \qquad (j = s) \qquad (j=1,\ldots,m)$$

$$(13) \qquad \frac{dw_j}{dK_s} = \sum_{p=1}^{n} \frac{\partial^2 Y_i}{\partial L_{ij}\partial L_{ip}} \cdot \frac{dL_{ip}}{dK_s} + \frac{\partial^2 Y_i}{\partial L_{ij}\partial K_s}$$

$$(i=1,\ldots,n\,;\ j=1,\ldots,m)$$

$$(14) \qquad \sum_i \frac{dL_{ij}}{dK_s} = 0 \qquad (j=1,\ldots,m)$$

For any change in one of the $\bar{L}_s$ there are m(n+1) variables of the form $dL_{ij}/d\bar{L}_s$, $dw_j/d\bar{L}_s$ and as many equations. Similarly for any change in one of the $K_s$ there are m(n+1) variables of the form $dL_{ij}/dK_s$, $dw_j/dK_s$ and as many equations. The equations are linear and can be solved without difficulty providing that some method can be found for estimating their coefficients. In order to simplify the analysis it will be assumed that

$$(15) \qquad \frac{\partial^2 Y_i}{\partial L_{ij} \partial L_{ip}} = 0 \qquad (j = p) \qquad (i=1,\ldots,n)$$

i.e. that the effect of a change in the employment of one kind of labour on the marginal productivity of a different kind of labour within any given industry is so small that it may be ignored. Naturally this can be valid only as a first approximation and then it is satisfactory only if, as has been the contention of the two empirical studies cited above, the elasticity of substitution between different kinds of labour is high. Equation (11) now becomes

$$(16) \qquad \frac{dw_j}{d\bar{L}_s} = \frac{\partial^2 Y_i}{\partial L_{ij}^2} \cdot \frac{dL_{ij}}{d\bar{L}_s} = \frac{1}{h_{ij}} \cdot \frac{dL_{ij}}{d\bar{L}_s}$$

where $h_{ij}$ is the inverse of $\frac{\partial^2 Y_i}{\partial L_{ij}^2}$. Hence, using (12),

$$(17) \qquad \sum_i h_{ij} \cdot \frac{dw_j}{d\bar{L}_s} = 0 \qquad (j \neq s)$$

$$= 1 \qquad (j = s)$$

whence

$$(18) \qquad \frac{dw_j}{d\bar{L}_s} = 0 \qquad (j \neq s)$$

$$= \frac{1}{\sum_i h_{ij}} \qquad (j = s)$$

It then follows that

$$(19) \qquad \frac{dL_{ij}}{d\bar{L}_s} = 0 \qquad (j \neq s)$$

$$= b_{ij} \qquad (j = s)$$

where

$$b_{ij} = \frac{h_{ij}}{\sum_p h_{pj}}$$

A similar analysis can be used to derive the effects of a change in the capital stock of an industry. Using (15), (13) becomes

$$(20) \qquad \frac{dw_j}{dK_s} = \frac{\partial^2 Y_i}{\partial L_{ij}^2} \cdot \frac{dL_{ij}}{dK_s} + \frac{\partial^2 Y_i}{\partial L_{ij} \partial K_s}$$

$$= \frac{1}{h_{ij}} \cdot \frac{dL_{ij}}{dK_s} + \frac{\partial^2 Y_i}{\partial L_{ij} \partial K_s}$$

Hence, with (14), and remembering that $\frac{\partial^2 Y_i}{\partial L_{ij} \partial K_s}$ is equal to zero if i and s are different,

$$(21) \qquad \sum_i h_{ij} \frac{dw_j}{dK_s} - h_{sj} \frac{\partial^2 Y_s}{\partial L_{sj} \partial K_s} = 0$$

Thus

$$(22) \qquad \frac{dw_j}{dK_s} = b_{sj} \frac{\partial^2 Y_s}{\partial L_{sj} \partial K_s}$$

and

$$(23) \qquad \frac{dL_{ij}}{dK_s} = h_{ij} \, b_{sj} \frac{\partial^2 Y_s}{\partial L_{sj} \partial K_s} \qquad (i \neq s)$$

$$= h_{ij} \, (b_{sj} - 1) \frac{\partial^2 Y_s}{\partial L_{sj} \partial K_s} \qquad (i = s)$$

In (23) it can be seen that the employment of labour of type $j$ in industry $i$ is affected by changes in the capital stock in industry $s$ even if $i$ and $s$ are different. It may be argued that such influence is likely to be sufficiently small that it may be ignored, in which case (23) becomes

$$(24) \qquad \frac{dL_{ij}}{dK_i} = (b_{ij} - 1) \, g_{ij}$$

where

$$g_{ij} = h_{ij} \frac{\partial^2 Y_i}{\partial L_{ij} \partial K_i}$$

From (19) and (24) one can derive by integration

$$(25) \qquad L_{ij} = b_{ij} \bar{L}_j + (b_{ij} - 1) g_{ij} K_i + q_{ij}$$

where $q_{ij}$ is a constant.

Unfortunately it was not possible to obtain data on the capital stocks for the statistical analysis described in the next section. Two ways of dealing with this problem were tried. The first consisted of linearizing equation (1) to obtain an equation relating $Y_i$ to the $L_{ij}$ $(j=1,\ldots,m)$ and $K_i$, and then substituting for the $L_{ij}$ from (25) in order to obtain an expression for $Y_i$ in terms of the exogenous variables :

$$(26) \qquad Y_i = \sum_{j=1}^{m} r_{ij} \bar{L}_j + s_i K_i + \text{constant}$$

where $r_{ij}$ $(j=1,\ldots,m)$ and $s_i$ are constants. The residuals obtained when $Y_i$ was regressed against the $\bar{L}_j$ $(j=1,\ldots,m)$ thus produced estimates of the term $s_i K_i$, and these were used instead of direct estimates of $K_i$ in (25).

In the alternative procedure the $Y_i$ themselves were used as proxies for the $K_i$. This substitution is perhaps not as arbitrary as it may appear at first sight. It would be naive to believe that differences between countries in the use of different kinds of labour could be explained exclusively in terms of differences in their relative supplies and in the supply of capital. However since the supply of capital is likely to be highly correlated with some of the other factors not treated explicitly, it could be used as a general surrogate for non-labour sources of productivity. Effectively this would be tantamount to writing the production function (1) as a function of the different types of labour only, and then assigning to the supply of capital the role of a shift factor. According to this interpretation, the supply of capital would be playing the same role in the derived labour utilization

function (25), and it is not easy to make an a priori case for supposing that the level of output would be any less satisfactory. It is presumably for this reason that the statistical studies cited above have usually taken the level of output per worker to be the major determinant of variations in labour utilization coefficients.

## 11 Statistical Analysis

The data used in the statistical analysis were taken exclusively from the tables prepared by Horowitz, Zymelman and Herrnstadt (1966) from twenty-six censuses (nineteen countries) held between 1950 and 1962. From the information furnished by these tables it was possible to calculate the number of persons in each occupation in each industry for each census, and the value of the output of the industry in most cases. The occupations were grouped into 225 categories based on the International Standard Classification of Occupations, and the industries were disaggregated adhering closely to the International Standard Industrial Classification at the one and two digit levels.

The previous section developed the arguments for relating the utilization of a given type of labour within a given industry to the total supply of labour of that type within the economy as a whole and to either the capital stock of the industry, estimated by the residual method described above, or the level of output of the industry :

$$(27) \qquad l_{ij} = b_{ij}\,\bar{L}_j + c_{ij}\,\hat{K}_i + p_{ij} + u_{ij}$$

$$(28) \qquad l_{ij} = b_{ij}\,\bar{L}_j + d_{ij}\,Y_i + q_{ij} + v_{ij}$$

where $\hat{K}_i$ is the residual estimate of the capital stock in industry i , $c_{ij}$ is equal to the coefficient of $K_i$ in (25) multiplied by $s_i$ , and $d_{ij}$ , $p_{ij}$ and $q_{ij}$ are constants. $u_{ij}$ and $v_{ij}$ are the stochastic disturbance terms which account for deviations of the observed values of $l_{ij}$ from the values

which would be expected given the values of $\bar{L}_j$ and $\hat{K}_i$ or $Y_i$. In order to derive confidence intervals for the estimates of the coefficients of (27) and (28) obtained by using the least squares regression technique, it is necessary to postulate an a priori distribution for each of the disturbance terms, and it is customary to invoke the Central Limit Theorem to justify the assumption of the normal distribution in the absence of evidence to the contrary. Since (27) and (28) include intercept terms the means of the distributions can be taken to be zero. It remains to make some further assumption regarding the variances of the distributions, and the usual assumption, that of constancy over the observations, is unlikely to be satisfied. Indeed it is reasonable to suppose that they are highly correlated with the size of the labour force providing the observation. If this were the case, the heteroscedasticity could be removed by dividing the set of observations for each country by its total labour force :

$$(29) \qquad \frac{L_{ij}}{\bar{L}} = b_{ij}\frac{\bar{L}_j}{\bar{L}} + c_{ij}\frac{\hat{K}_i}{\bar{L}} + p'_{ij} + u'_{ij}$$

$$(30) \qquad \frac{L_{ij}}{\bar{L}} = b_{ij}\frac{\bar{L}_j}{\bar{L}} + d_{ij}\frac{Y_i}{\bar{L}} + q'_{ij} + v'_{ij}$$

where

$\bar{L} = \sum_j \bar{L}_j$ = total labour force

$p'_{ij} = p_{ij}/\bar{L}$

$q'_{ij} = q_{ij}/\bar{L}$

$u'_{ij} = u_{ij}/\bar{L}$

$v'_{ij} = v_{ij}/\bar{L}$

The disturbance terms $u'_{ij}$ and $v'_{ij}$ would then be normally distributed with zero means and constant variances.

Previous studies have favoured the use of the proportion of the labour force of a given industry in a given occupation as the dependent variable and the productivity per worker in that industry as an explanatory variable. For the purpose of comparison with them a third variation was tried :

$$(31) \qquad \frac{L_{ij}}{L_i} = b_{ij} \frac{\bar{L}_j}{\bar{L}} + d_{ij} \frac{Y_i}{L_i} + q''_{ij} + v''_{ij}$$

Equation (31) has an advantage over (30) in that the heteroscedasticity of $v_{ij}$ is more likely to be proportional to $L_i$ than to $\bar{L}$, and hence the former may be a more appropriate scaling factor. It might seem more consistent to have used it as the scaling factor for the supply variable as well, but this was resisted on the grounds that $\bar{L}_j / L_i$ has a less clear meaning than $\bar{L}_j / \bar{L}$. It should be noted that the $L_i$ are endogenous variables within the labour allocation model discussed in the previous section, and that therefore the interpretation of the coefficients of (31) is more complicated than that of the coefficients of (30).

The analysis upon which equations (29) - (31) are based offers little indication of the appropriate degree of aggregation of either the sectors or the occupations. Accordingly two levels of aggregation were used for both, and hence for each experiment four sets of results were obtained. The equations were fitted for nine major sectors (ISIC one digit) : (1) Agriculture, Forestry and Logging (2) Mining and Quarrying (3) Construction (4) Manufacturing (5) Transportation and Warehousing (6) Utilities (7) Trade (8) Finance, Insurance and Real Estate (9) Services ; and a selection of the minor (two digit) sectors within Manufacturing : (1) Food and Beverages (2) Tobacco and Tobacco Products (3) Textile Mill Products (4) Clothing and Other Fabricated Textiles (5) Furniture and Fixtures (6) Paper and Paper Products (7) Chemicals and Chemical Products (8) Petroleum and Coal Products (9) Machinery (excluding Electrical) (10) Transportation Equipment .

For each of these sectors the equations were fitted for twelve occupations : seven major occupations (1) Professionals (2) Technicians (3) Administrators and Managers (4) Clerical Workers (5) Sales Workers (6) Manual Workers (7) Service Workers ; and a selection of five minor occupations (1) Engineers (2) Natural Scientists (3) Secretaries, Stenographers and Typists (4) Foremen and Supervisors (5) Mechanics and Repairmen.[5]

Table 1 presents the results of some one-way analysis of variance experiments executed as a preamble to the regression analysis proper. The table gives for each occupation the proportion of the variance in its utilization accounted for by the classification by sector, for the group of major sectors and for the group of minor sectors. For the application of analysis of variance to the data it is necessary that the observations in each cell (here the employment of a given type of labour in a given sector in the different countries) be normally distributed. Since, as was observed earlier in this section, this requirement is unlikely to be satisfied by the raw data, the employment figures have to be scaled in the same way in which the dependent variables of equations (29) - (31) were scaled. Table 1 shows the results obtained using $\overline{L}$, total employment within the country, and $L_i$, employment within the sector providing the observation, as scaling factors.

The results were all significant at the 0.1% level, with the exception of those for foremen. It would be easy, but mistaken, to interpret them as supporting the manpower requirements approach. They indicate that the labour utilization functions are different for different sectors, not that labour utilization within any given sector is constant. For all of the major occupations, and for three of the five minor occupations, the major sector classification accounted for a higher proportion of the variance than the minor sector classification. This is scarcely surprising since the major sectors cover the whole economy exhaustively while the minor sectors comprise only part of the manufacturing sector and are therefore unlikely to exhibit as great a diversity in their occupational structure.

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5 For detailed ISCO definitions of the occupations see Horowitz, Zymelman and Herrnstadt op. cit. Appendix D.

## TABLE 1

**Proportion of the variance "explained" by the classification of employment within occupations (i) by major sector (ii) by a selection of minor sectors within manufacturing** [a]

| | major sectors | | minor sectors | |
|---|---|---|---|---|
| | scaling factor [a] | | scaling factor | |
| | $\bar{L}$ | $L_i$ | $\bar{L}$ | $L_i$ |
| **major occupations** | | | | |
| professionals | 0.88 | 0.84 | 0.39 | 0.65 |
| technicians | 0.88 | 0.84 | 0.33 | 0.48 |
| administrators | 0.59 | 0.67 | 0.53 | 0.18 |
| clerical workers | 0.78 | 0.87 | 0.55 | 0.54 |
| sales workers | 0.86 | 0.78 | 0.64 | 0.35 |
| manual workers | 0.77 | 0.92 | 0.54 | 0.67 |
| service workers | 0.82 | 0.87 | 0.30 | 0.14 |
| **minor occupations** | | | | |
| engineers | 0.52 | 0.60 | 0.36 | 0.55 |
| natural scientists | 0.47 | 0.20 | 0.51 | 0.61 |
| secretaries | 0.48 | 0.55 | 0.25 | 0.26 |
| foremen | 0.26 | 0.08 | 0.14 | 0.03 |
| mechanics | 0.56 | 0.39 | 0.48 | 0.54 |

[a] see the text for definitions of the major and minor sectors and for an explanation of the scaling factors.

The results for equation (29) for all the occupations and sectors are shown in Tables 2 - 7. Tables 2 - 4 give the coefficients of $\bar{L}_j / \bar{L}$, $K_i / \bar{L}$ and the intercept. An asterisk indicates that the coefficient is significantly different from zero at the 5% level, using a two-tailed t-test. It should be noted that for the labour supply coefficient, which may be expected a priori to be positive, the two-tailed test is severe and the weaker one-tailed test may be more appropriate. This is not so obvious, however, in the case of the capital variable.

From Table 2 it may be seen that 111 of the 228 labour supply coefficients are positive and significant at the 5% level using the two-tailed test. One is negative and significant. A further 24 are negative but not significant. The coefficient is significant most frequently for technicians, clerical workers, engineers, secretaries and foremen. It is seldom significant for administrators, manual workers, service workers and natural scientists. Among the sectors the variable performs best for manufacturing, utilities, trade, finance, services, chemicals and petroleum products, and worst for agriculture, tobacco and machinery.

Of the capital coefficients, shown in Table 3, 59 are significant at the 5% level. Of these all but 2 are positive. The frequency of significance is fairly uniform for the occupations, being highest for professionals, manual workers and foremen, and lowest for sales workers, service workers and mechanics, but it is very uneven among the sectors, being highest for mining, food products, tobacco and paper, and lowest for agriculture, construction, manufacturing, trade, finance, services, furniture, chemicals and petroleum products.

The intercept term in the equation appears to be almost redundant. It is significant only 30 times out of 228, and 11 of these are for the single occupation administrators.

Table 5 gives the value of the coefficient of determination for each equation. An asterisk indicates that the corresponding F-test is significant at the 1% level.

According to the analysis in Section 1, the coefficient of $\bar{L}_j / \bar{L}$ in equation (29), $b_{ij}$, is given by

$$b_{ij} = \frac{h_{ij}}{\sum_p h_{pj}} \qquad \text{where } h_{ij} = \text{inverse of } \frac{\partial^2 Y_i}{\partial L_{ij}^2}$$

Hence the labour supply coefficients represent the proportions in which an increment in the supply of a given type of labour would have to be distributed among the sectors for its marginal productivity to fall uniformly in each sector. Theoretically the sum of the coefficients for a given type of labour over the major sectors should be equal to unity.[6] It therefore provides a check on the consistency of the results. In fact the sums all lie between 0.8 and 1.2.[7]

The elasticities derived from the labour supply coefficients thus constitute measures of the relative ease with which the different sectors can absorb the type of labour in question.[8] In Table 6 it may be observed that

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6 One major sector, communications, was excluded from the regression analysis for lack of output data. The sum of the coefficients should therefore fall short of unity, but not by far since this sector generally employed less than 2% of the total labour force.

7 The significance of this check should not be exaggerated. For the estimates of the coefficients would necessarily have summed exactly to unity if the capital variable had not been included in the equation and if two other conditions had been fulfilled: (i) that all the major sectors had been included in the regression analysis (see footnote 6); and (ii) that the same set of countries had furnished the observations for the estimation of each equation. Since these conditions were in fact approximately satisfied, the sums of the supply coefficients could have diverged from unity only to the extent that the capital variable disturbed the equations.

It might have been possible to improve the efficiency of the estimation procedure by taking the equations together and using an Aitken estimator (see in particular Zellner (1962) and Powell (1969)). This was not attempted because it was doubtful whether the data were good enough to provide a satisfactory estimate of the joint variance-covariance matrix.

8 More precisely, the ease with which they can absorb a given proportional increase in the employment of that kind of labour. The coefficients themselves are measures of the ease with which the sectors can absorb a given absolute increase in the employment of the labour.

the elasticities for administrators are on the whole lower than unity, that those for technicians and sales workers are higher than unity, and that those for clerical workers, and in particular, secretaries, are approximately equal to unity. No tendency is dominant for the remaining occupations, nor for any sector across the occupations.

Since the estimates of the capital stocks were estimated as residuals, their sum for any given sector is necessarily equal to zero, and hence the elasticities corresponding to the coefficients in Table 3 are also necessarily equal to zero.

The results for equation (30) are similar to those for equation (29), and are shown in Tables 7 - 12. Fewer labour supply coefficients (Table 7) are significant at the 5% level (91 instead of 112). Only 7 coefficients are significant for equation (30) but not for equation (29). The numerical values of the coefficients are much the same as before.

The output variable (Table 8) is significant more frequently than the capital variable that it replaces (83 times instead of 59). Again the overlap between the sets of significant coefficients is high, since only 15 of the coefficients significant for equation (29) are not significant for equation (30). The orders of magnitude of the coefficients are generally the same as previously, and none of the significant coefficients changes sign.

The intercept term (Table 9) is again relatively unimportant, being significant only 29 times.

The overall fit is slightly improved. The value of the coefficient of determination (Table 10) is, on average, a tenth higher than for equation (29), and the corresponding F-test is significant at the 1% level 115 times instead of 92.

Tables 11 and 12 give the elasticities derived from the coefficients of $\bar{L}_j$ and $Y_i$. The former are much the same as those for equation (29). The latter, which yield measures of the sensitivity of the utilization of a given type of labour to the level of output, are in general lower than unity, implying that the demand for labour grows more slowly than output, even for the

more skilled occupations. Those for professionals tend to be highest, suggesting that the demand for professionals grows more rapidly than the demand for other occupations as output increases.

At the beginning of the section equation (31) was offered as an alternative formulation of the relationship between the utilization of a given kind of labour, its total supply and the level of output. This equation has $L_{ij} / L_i$ as the dependent variable and $Y_i / L_i$ as one of the independent variables. It should be emphasized that the coefficient of $Y_i / L_i$ does not have the same interpretation as that of $Y_i / \bar{L}$ in equation (30). In general the estimate of its value may be expected to be lower, since $L_i$ is positively correlated with $L_{ij}$. This effect is likely to be especially pronounced in the cases of those occupations which form substantial proportions of the labour force, for example manual workers. The economic explanation for the divergence of the coefficients lies in the fact that increases in the demand for a given kind of labour within a given sector can be split into two components : increases due to increases in the total employment within the sector, and increases due to changes in the level of productivity per worker. The latter generally causes the demand for more skilled workers to rise and for less skilled workers to fall, as productivity increases, if total employment is kept constant. The coefficient of $Y_i / L_i$ in equation (31) is an estimate of the second component only, while the coefficient of $Y_i / \bar{L}$ in equation (30) includes both, and is consequentially higher. It follows that the elasticities derived from the coefficients should be higher for equation (30) than for equation (31), and this can be verified by comparing Tables 12 and 14.

There is a somewhat similar effect on the coefficient of the supply variable, which is the same for both equations. Because the denominator of the dependent variable of equation (31) is correlated with the numerator, the response of the dependent variable to the supply variable is damped and hence the estimate of the elasticity is lower. Again, this is especially noticeable in the case of manual workers.

On the whole equation (31) performs about as well as equation (30). 98 of the supply coefficients are positive and significant at the 5% level ; one is negative and significant ; and 19 are negative but not significant. Substantially fewer (47 instead of 83) output coefficients are significantly

different from zero, but this was to be expected since they should in theory be lower. Far fewer are positive and significant, more (15 instead of 6) are negative and significant. For the most part the values of the coefficient of determination are lower than those for equation (30).

Before drawing conclusions from the statistical analysis the results of a further experiment will be presented. In none of the three major empirical studies cited above[9] was a supply variable included explicitly in the regressions testing the determinants of the occupational structure. In order to investigate the effects of its omission on their conclusions, the supply variable was dropped from equation (30) and the coefficients re-estimated.

$$(32) \qquad \frac{L_{ij}}{\bar{L}} = d_{ij}\frac{Y_i}{\bar{L}} + q'_{ij} + v'_{ij}$$

The elasticities derived from the estimates of the output variable are shown in Table 16 and the values of the coefficient of determination in Table 17. 107 of the 228 output coefficients are significant at the 5% level, as opposed to 83 for equation (30). Hence the number of coefficients which fail to remain significant upon the addition of the supply variable is not great. It may be noted that almost half of these correspond to one minor occupation, secretaries. The elasticities are as a rule higher than those for equation (30), indicating, as has already been suggested, that the output variable is partly acting as a proxy for the supply variable. The F-ratio measuring the goodness of fit is significant at the 1% level 72 times instead of 115 times for equation (30).

summary

The statistical analysis has investigated four variations of a relationship which seeks to explain the employment of 12 occupations in 19 sectors, requiring the fitting of nearly 1000 regression equations in all. It may be

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9 Hollister, Layard and Saigal, OECD

worthwhile to hazard a few general observations concerning these results.

First, of the three variations of the relationship which include supply as an explanatory variable, that which performs best statistically, in terms of goodness of fit, is that represented by equation (30). Equation (29), which is the most satisfactory from the point of view of the underlying theory, performs slightly less well, but this may be due to the fact that the capital variable had to be estimated as a residual, and hence the equation contains a double dose of random disturbance. Taking this into account, the equation might be considered to perform rather well. The other variation, represented by equation (31), is inferior both theoretically and statistically, and need not be considered further. The relationship represented by equation (32) has been included simply to evaluate the effect of omitting the supply variable.

In none of the equations (29) - (31) does the intercept term play more than a peripheral role. It is important for only two occupations, administrators and manual workers. For the other occupations it is seldom, or never, significant, no matter which of the equations is used. This implies that, except for the two occupations mentioned, the notion that labour utilization may be determined by fixed coefficients or fixed proportions is highly misleading. It does not even serve as a useful first approximation.

The regressions for the minor occupations display better fits than those for the major occupations. Among the former, only those for natural scientists do badly. However this particular result might have been anticipated, since the factors responsible for the employment of natural scientists are certainly more complex than those considered here. Among the major occupations, technicians and clerical workers have relatively good fits, and administrators, sales workers, manual workers and service workers, relatively poor ones. The overall impression is that the better defined is the economic role of the occupation, the better is the fit. This suggests that one of the more formidable problems in explaining the allocation of labour by occupation is the erratic economic relevance of the occupational classification itself.

On the whole the supply variable performs better than either the capital variable or the output variable, and it is the main factor behind variations among occupations in the goodness of fit, since the frequency of significance

of the other two variables is fairly uniform among the occupations.[10]

The elasticity of employment with respect to output appears to be systematically higher for those occupations requiring most education. The elasticity with respect to supply is high for technicians and sales workers, close to unity for clerical workers, and lower than unity for administrators. No particular pattern is discernible among the other occupations.

The supply variable performs equally well for the major and minor sectors, but both the capital and the output variables perform appreciably better for the latter. Neither the magnitude of the supply elasticity, nor that of the output elasticity, appear to bear any close relation to the sector of employment.

Finally, comparing equations (30) and (32), the inclusion of the supply variable causes a substantial improvement in the goodness of fit, as should be expected.

## III Conclusions

In Section I it was argued that the utilization of a given type of labour within a given sector was likely to depend, among other things on the supply of that type of labour within the economy as a whole. In Section II the hypothesis was tested statistically and it performed well in the sense that half of the coefficients of the supply variable were significant at the 5% level and all but one of them had the expected sign.

These results are hardly surprising since most of the previous studies on this topic have at least displayed awareness of the possibilities of substitution between different types of labour. They are consistent with those of the previous studies in as much as the level of output was found to be a

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10 An important exception is professionals in equation (30), where the output variable is significant for half the sectors and the supply variable not significant at all. It should, however, be noted that for professionals in equation (29) the supply variable is significant as often as the capital variable.

significant explanatory variable nearly as frequently as the supply variable when both were included in the regression equation. However it appeared that the output variable was to a certain extent capable of acting as a proxy for the supply variable, with the result that when the latter was omitted the coefficient of the output variable was biased upwards and was slightly more likely to be significant. Nevertheless the low level of interference between the two variables suggests that both are important separately.

The replacement of the output variable by a capital variable yielded results which were broadly similar.

One of the more striking results of the analysis was the infrequency with which the intercept term was significant. This finding suggests that the apparent rough constancy in the utilization of a given type of labour in a given sector, as a proportion of the total labour force of that sector, is due not so much to any technologically determined invariability but to the similarity of the occupational profiles of the countries providing the data.

If the analysis is correct, it follows that the manpower requirements approach gives a misleadingly rigid impression of the demand for labour, and hence of the derived demands on the educational system. For a few occupations, it is true, the supply variable was relatively unimportant, and in such cases it is possible that the manpower requirements approach, modified to take into account the productivity factor, might perform fairly satisfactorily. But for most occupations the influence of the supply variable was sufficiently strong to invalidate the notion of "requirements".

This of course does nothing to simplify the problem of planning the educational system. Instead of there being a unique and easily calculated efficient growth pattern, deviations from which inevitably leading to bottlenecks or to unemployment, there would exist an infinite family of such patterns whose extent would depend upon the scope for labour substitution. The extra degrees of freedom make it desirable to devise criteria for locating the optimal pattern. The definition of the optimal pattern is of course a complex and controversial issue and it has not been the purpose of this paper to discuss it.

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TABLE 2 : COEFFICIENTS OF THE SUPPLY VARIABLE IN EQUATION (29)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | -0.003 | 0.011 | 0.805* | 0.015 | -0.002 | 0.907* | -0.050 | -0.003 | 0.189 | 0.006* | 0.044 | 0.008 |
| MINING | 0.006 | 0.009* | 0.000 | 0.001 | 0.003 | 0.056 | 0.005 | 0.023* | 0.053* | 0.004* | 0.040* | 0.011 |
| CONSTRUCTION | 0.025 | 0.029 | -0.004 | 0.022* | 0.006 | 0.022 | -0.006 | 0.105* | 0.011 | 0.024* | 0.069* | 0.046* |
| MANUFACTURING | 0.111* | 0.136* | 0.026 | 0.222* | 0.138* | 0.113 | 0.100* | 0.616* | 0.117 | 0.222* | 0.455* | 0.646* |
| TRANSPORTATION | 0.003 | -0.071 | 0.067* | 0.074* | 0.019 | -0.021 | 0.002 | 0.025* | 0.000 | 0.032* | 0.095* | 0.035 |
| UTILITIES | 0.012* | 0.012* | -0.002 | 0.019* | 0.006* | -0.016 | 0.006 | 0.022* | 0.002 | 0.014* | 0.014* | 0.016* |
| TRADE | 0.054* | 0.024* | 0.136* | 0.154* | 0.807* | -0.048 | 0.094 | 0.033* | 0.025 | 0.125* | 0.144* | 0.188 |
| FINANCE | 0.023* | 0.004* | 0.005 | 0.145* | 0.164* | -0.004 | 0.015 | 0.003 | 0.001 | 0.142* | 0.076* | 0.006* |
| SERVICES | 0.681* | 0.705* | 0.006 | 0.334* | 0.014 | -0.024 | 0.972* | 0.117* | 0.613* | 0.359* | 0.067* | 0.087 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.054 | 0.074* | 0.053* | 0.046 | 0.118 | -0.216 | 0.097* | 0.047 | 0.229* | 0.104* | 0.322* | 0.131 |
| TOBACCO | -0.004 | 0.008 | 0.001 | -0.026* | -0.003 | 0.094* | 0.006 | 0.016 | 0.005 | 0.003 | 0.015* | 0.002 |
| TEXTILES | 0.014 | 0.036* | -0.008 | 0.039 | 0.032 | 0.546* | 0.014 | 0.077* | 0.031 | 0.047* | 0.146* | 0.068 |
| CLOTHING | 0.009 | 0.012* | 0.025 | 0.043* | 0.045* | -0.084 | -0.001 | 0.043* | 0.000 | 0.047* | 0.054 | 0.020 |
| FURNITURE | 0.006 | 0.005* | -0.002 | 0.022* | 0.017* | 0.097 | 0.005 | 0.044 | 0.000 | 0.023* | 0.079* | 0.026* |
| PAPER | 0.030 | 0.030* | 0.002 | 0.026 | 0.018* | -0.067 | 0.002 | 0.092* | 0.035 | 0.048* | 0.054* | 0.082* |
| CHEMICALS | 0.078* | 0.106* | 0.004 | 0.104* | 0.024 | 0.083 | 0.031 | 0.103* | 0.295 | 0.128* | 0.149* | 0.093* |
| PETROLEUM PRODUCTS | 0.068* | 0.032* | 0.013* | 0.011 | 0.000 | -0.025 | 0.001 | 0.021 | 0.171* | 0.040* | 0.048* | 0.052* |
| MACHINERY | 0.090 | 0.077 | -0.004 | 0.147 | 0.041* | 0.104 | 0.020 | 0.915* | 0.029 | 0.169* | 0.249* | 0.335 |
| TRANSPORT EQUIPMENT | 0.113 | 0.114 | 0.030 | 0.198* | 0.014 | -0.028 | 0.036* | 0.560* | 0.028 | 0.151* | 0.321* | 0.320 |

* indicates that the coefficient is significantly different from zero at the 5% level.

TABLE 3 : COEFFICIENTS OF THE CAPITAL VARIABLE IN EQUATION (29)[a]

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.65 | 1.04* | 2.96 | -1.51 | -0.34 | 41.79 | -7.94 | -0.01 | 0.40 | 0.02 | 2.26 | 0.19 |
| MINING | 3.98* | 1.46* | 2.33* | 5.75* | 0.53 | 89.36* | 2.38 | 1.95* | 0.96* | 1.04* | 1.15 | 4.85 |
| CONSTRUCTION | 1.27 | 4.47 | -2.06 | -2.16 | 0.13 | 37.48 | 2.64 | -0.31 | -0.12 | 0.83 | -4.10* | 1.16 |
| MANUFACTURING | 4.98* | 1.52 | 3.76 | 3.84 | 4.13 | 31.08 | -0.96 | 0.52 | 0.25 | 1.02 | 0.72 | -2.38 |
| TRANSPORTATION | 26.65 | 5.62 | -28.69* | 11.76 | -1.48 | 104.33* | 17.71 | 0.15 | 0.00 | 1.79* | 9.64 | -1.62 |
| UTILITIES | 3.06* | 0.40 | 2.32 | 1.68 | 0.63 | 3.85 | -3.79 | 0.68 | 0.08 | 1.81* | 3.87* | 4.10 |
| TRADE | 1.94 | -0.17 | 9.15 | 9.26 | -7.65 | 29.62* | 11.40 | 0.20 | -0.05 | 2.02 | -2.63 | 1.32 |
| FINANCE | 0.58 | -0.05 | 9.14 | 4.52 | 6.82 | 0.69 | 2.45 | 0.08 | -0.03 | 1.67 | -3.25 | 0.35 |
| SERVICES | -4.31 | 4.30 | -1.65 | -8.16 | -1.70 | 7.53 | -4.79 | -0.13 | -0.86 | -0.19 | 0.88 | 2.95 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 1.83* | 1.09* | 3.26 | 6.53 | 5.26* | 50.57 | 2.62 | 0.35 | 0.65* | 1.28 | 3.18* | 4.92* |
| TOBACCO | 4.08* | 1.59 | 5.13* | 8.79* | 1.73 | 143.25* | 9.70* | 2.83* | 0.01 | 0.61 | 1.36 | 6.41* |
| TEXTILES | 2.50 | 1.36 | -1.03 | 10.33 | 7.34* | 179.90 | 5.23 | 0.99 | 0.35* | 1.60 | 7.91* | 0.26 |
| CLOTHING | 0.79 | 0.51 | 4.83 | 6.90* | 2.26 | 152.17 | -1.52 | 0.24 | 0.00 | 1.89* | 10.92* | 3.16* |
| FURNITURE | 1.97 | 0.20 | 0.98 | 5.52 | -0.15 | 132.69 | 1.21 | 0.02 | 0.00 | -0.09 | 0.26 | -1.15 |
| PAPER | 4.33* | 2.55* | 3.32* | 10.70* | 1.14* | 81.88* | 3.17* | 2.34* | 0.28* | 1.96* | 3.27* | 2.56 |
| CHEMICALS | 2.94 | -0.71 | -0.92 | -0.76 | 0.86 | 7.18 | 0.46 | 2.32* | -0.09 | -0.57 | 1.49 | 2.22 |
| PETROLEUM PRODUCTS | 4.14 | 1.29 | 10.14* | 37.24 | 3.76 | 100.99 | 0.59 | 3.12 | 0.18 | 1.94 | 2.57 | 3.62 |
| MACHINERY | 10.65* | 2.64 | 8.88* | 18.41* | 0.89 | 122.82* | 2.86* | 2.02 | 0.43 | 3.08 | 1.17 | 32.57 |
| TRANSPORT EQUIPMENT | 5.05 | 2.71 | 1.70 | 5.76 | 1.19 | 120.37* | 0.33 | 4.88* | 0.04 | 0.01 | 6.57* | 32.41 |

[a] workers per million 1960 U.S. dollars

* coefficient significant at the 5% level

TABLE 4 : COEFFICIENTS OF THE INTERCEPT IN EQUATION (29)[a]

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.64 | -0.08 | -42.35* | -0.35 | 0.21 | -339.64* | 6.89 | 0.05 | -0.03 | 0.00 | 0.40 | 0.00 |
| MINING | 0.09 | -0.15 | 0.39* | 0.85 | -0.11 | -12.53 | -0.08 | 0.05 | -0.03 | 0.04 | -0.01 | 0.26 |
| CONSTRUCTION | 0.38 | -0.31 | 3.39* | 0.28 | -0.13 | 55.39* | 1.90 | 0.22 | -0.01 | 0.07 | 0.07 | -0.16 |
| MANUFACTURING | 1.27 | -0.88 | 8.30* | 0.31 | -0.66 | 162.94 | -2.69 | -0.94* | 0.29 | 0.50 | -0.08 | -0.87 |
| TRANSPORTATION | 3.16 | 5.70 | -5.73 | -0.73 | -0.67 | 49.90* | 2.70 | 0.10 | 0.00 | 0.13 | 0.37 | 0.85 |
| UTILITIES | 0.00 | -0.21* | 0.72* | 0.09 | -0.22 | 15.35* | -0.05 | 0.26* | 0.01 | 0.02 | 0.10 | 0.11 |
| TRADE | -0.77 | -0.26 | 14.45 | 0.62 | -2.45 | 50.25* | -2.10 | -0.02 | -0.01 | 0.35 | -0.40 | -0.95 |
| FINANCE | -0.56 | -0.09 | 2.10 | -3.03 | -5.39* | 3.17 | 0.10 | 0.02 | 0.00 | -0.19 | -0.39 | -0.06 |
| SERVICES | 0.62 | 3.91 | 12.58* | -4.08 | 1.23 | 33.43 | -17.87* | 0.61* | -0.24 | 0.19 | -0.12 | 0.56 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | -0.04 | -0.15 | 6.24 | 14.99 | 4.52 | 276.31* | -3.02 | 0.47 | 0.10 | 0.68 | 0.55 | 1.29 |
| TOBACCO | 0.38 | -0.20 | 0.71 | 4.87* | 0.57* | -32.48 | -0.08 | -0.02 | 0.00 | 0.14 | 0.07 | 0.32 |
| TEXTILES | 0.43 | -0.46 | 5.57* | 5.72 | -0.04 | -147.01 | 1.86 | 0.02 | 0.02 | 0.33 | 0.69 | 1.01 |
| CLOTHING | 0.02 | -0.12 | 2.15 | 1.74 | -0.51 | 183.39 | 3.77 | -0.17 | 0.00 | 0.24 | 1.02* | 0.18 |
| FURNITURE | 0.05 | -0.02 | 2.40* | 0.21 | -0.38 | -7.49 | -0.10 | -0.14 | 0.00 | -0.01 | -0.10 | -0.21* |
| PAPER | -0.16 | -0.40 | 1.66* | 2.20 | -0.19 | 76.92* | 1.32 | 0.04 | 0.04 | 0.10 | 0.37 | -0.23 |
| CHEMICALS | 0.54 | -1.08 | 3.89* | 0.98 | 1.97 | 5.46 | 0.27 | 1.11* | 0.74 | 0.24 | 0.06 | -0.07 |
| PETROLEUM PRODUCTS | -1.52 | -0.50 | -0.56 | 3.35 | 0.61 | 26.72 | 0.89 | 0.61 | 0.01 | -0.08 | 0.13 | -0.41 |
| MACHINERY | 1.31 | 0.21 | 7.36* | -1.35 | -0.70 | 43.57 | 0.25 | -2.69* | 0.06 | 0.11 | -0.01 | 6.28 |
| TRANSPORT EQUIPMENT | 0.32 | -1.04 | 1.96 | -5.00 | 0.68 | 158.35 | -0.11 | -0.47 | 0.05 | -0.17 | 0.08 | 32.75 |

[a] multiplied by 1000

* coefficient significant at the 5% level

TABLE 5 : R-SQUARED FOR EQUATION (29)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.03 | 0.27 | 0.79* | 0.06 | 0.08 | 0.38* | 0.12 | 0.04 | 0.17 | 0.41* | 0.13 | 0.07 |
| MINING | 0.59* | 0.39* | 0.31 | 0.19 | 0.12 | 0.27 | 0.26 | 0.47* | 0.42* | 0.61* | 0.47* | 0.15 |
| CONSTRUCTION | 0.10 | 0.22 | 0.02 | 0.28 | 0.13 | 0.05 | 0.01 | 0.30 | 0.26 | 0.64* | 0.54* | 0.33 |
| MANUFACTURING | 0.43* | 0.37* | 0.12 | 0.46* | 0.43* | 0.08 | 0.19 | 0.96* | 0.13 | 0.73* | 0.92* | 0.57* |
| TRANSPORTATION | 0.28 | 0.16 | 0.66* | 0.65* | 0.30 | 0.66* | 0.29 | 0.41 | 0.00 | 0.87* | 0.44 | 0.18 |
| UTILITIES | 0.42* | 0.65* | 0.19 | 0.39* | 0.20 | 0.09 | 0.11 | 0.36 | 0.03 | 0.78* | 0.60* | 0.32 |
| TRADE | 0.45* | 0.51* | 0.32 | 0.50* | 0.95* | 0.47* | 0.14 | 0.64* | 0.05 | 0.83* | 0.48* | 0.26 |
| FINANCE | 0.47 | 0.46 | 0.24 | 0.69* | 0.72* | 0.08 | 0.25 | 0.14 | 0.00 | 0.86* | 0.61* | 0.54* |
| SERVICES | 0.73* | 0.87* | 0.00 | 0.51* | 0.14 | 0.03 | 0.87* | 0.61* | 0.66* | 0.93* | 0.54* | 0.14 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.38 | 0.40* | 0.25 | 0.19 | 0.32 | 0.19 | 0.29 | 0.14 | 0.33 | 0.64* | 0.76* | 0.36 |
| TOBACCO | 0.50 | 0.15 | 0.59* | 0.59* | 0.15 | 0.69* | 0.50 | 0.47 | 0.11 | 0.16 | 0.44 | 0.38 |
| TEXTILES | 0.20 | 0.32 | 0.03 | 0.12 | 0.26 | 0.34 | 0.07 | 0.39* | 0.24 | 0.58* | 0.59* | 0.11 |
| CLOTHING | 0.17 | 0.31 | 0.21 | 0.47* | 0.45* | 0.16 | 0.02 | 0.34 | 0.00 | 0.74* | 0.77* | 0.58* |
| FURNITURE | 0.15 | 0.62* | 0.01 | 0.68* | 0.52 | 0.41 | 0.28 | 0.37 | 0.00 | 0.92* | 0.92* | 0.78* |
| PAPER | 0.63* | 0.59* | 0.50* | 0.72* | 0.42* | 0.60* | 0.29 | 0.45* | 0.61* | 0.91* | 0.67* | 0.36 |
| CHEMICALS | 0.42 | 0.53* | 0.03 | 0.26 | 0.05 | 0.13 | 0.05 | 0.55* | 0.09 | 0.71* | 0.87* | 0.62* |
| PETROLEUM PRODUCTS | 0.57 | 0.65 | 0.63 | 0.32 | 0.19 | 0.26 | 0.00 | 0.11 | 0.55 | 0.73* | 0.62 | 0.84* |
| MACHINERY | 0.26 | 0.13 | 0.27 | 0.37 | 0.27 | 0.43 | 0.30 | 0.84* | 0.19 | 0.52* | 0.73* | 0.27 |
| TRANSPORT EQUIPMENT | 0.34 | 0.24 | 0.21 | 0.72* | 0.05 | 0.45 | 0.33 | 0.64* | 0.05 | 0.93* | 0.91* | 0.13 |

* indicates that the corresponding F-ratio was significant at the 1% level.

TABLE 6 : SUPPLY VARIABLE ELASTICITIES IN EQUATION (29)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | -0.28 | 1.22 | 1.61* | 1.28 | -0.79 | 3.71* | -2.04 | -0.97 | 1.09 | 0.97* | 0.51 | 0.99 |
| MINING | 0.76 | 1.70* | -0.20 | 0.09 | 2.56 | 1.77 | 1.23 | 0.76* | 1.56* | 0.63* | 1.05* | 0.47 |
| CONSTRUCTION | 0.75 | 1.35 | -0.19 | 0.89* | 1.64 | 0.17 | -0.40 | 0.78* | 2.49 | 0.85* | 0.90* | 1.20* |
| MANUFACTURING | 0.80* | 1.18* | 0.30 | 0.99* | 1.08* | 0.26 | 1.44* | 1.25* | 0.43 | 0.88* | 1.02* | 1.07* |
| TRANSPORTATION | 0.05 | -1.32 | 2.40* | 1.09* | 2.06 | -0.25 | 0.07 | 0.71* | 0.00 | 0.82* | 0.72* | 0.49 |
| UTILITIES | 1.00* | 1.71* | -0.79 | 0.96* | 2.66* | -1.03 | 1.09 | 0.40* | 0.21 | 0.94* | 0.56* | 0.76* |
| TRADE | 1.45* | 1.35* | 0.57* | 0.97* | 1.05* | -0.95 | 1.35 | 1.10* | 1.36 | 0.86* | 1.41* | 1.37 |
| FINANCE | 2.04* | 1.96* | 0.25 | 1.24* | 2.09* | -2.55 | 0.93 | 0.54 | 0.37 | 1.08* | 1.99* | 2.04* |
| SERVICES | 0.98* | 0.88* | 0.07 | 1.12* | 0.41 | -0.55 | 1.24* | 0.58* | 1.25* | 0.97* | 1.22* | 0.77 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 1.02 | 1.13* | 0.54* | 0.26 | 0.61 | -0.66 | 1.52* | 0.44 | 0.81* | 0.73* | 0.84* | 0.69 |
| TOBACCO | -0.95 | 2.36 | 0.27 | -1.77* | -0.40 | 3.49* | 1.16 | 1.20 | 1.35 | 0.31 | 0.68* | 0.11 |
| TEXTILES | 0.60 | 1.43* | -0.26 | 0.43 | 1.02 | 2.13* | 0.41 | 0.97* | 0.73 | 0.69* | 0.67* | 0.59 |
| CLOTHING | 0.95 | 1.37* | 0.63 | 0.73* | 1.21* | -0.30 | -0.03 | 2.16* | 0.00 | 0.76* | 0.30 | 0.69 |
| FURNITURE | 0.83 | 1.13* | -0.15 | 0.92* | 1.44* | 1.18 | 1.30 | 1.63 | 0.00 | 1.04* | 1.20* | 1.76* |
| PAPER | 1.13 | 1.47* | 0.11 | 0.57 | 1.21* | -0.78 | 0.10 | 0.94* | 0.61 | 0.87* | 0.58* | 1.15* |
| CHEMICALS | 0.87* | 1.34* | 0.11 | 0.92* | 0.43 | 0.89 | 0.91 | 0.42* | 0.43 | 0.90* | 0.97* | 1.03* |
| PETROLEUM PRODUCTS | 2.00* | 1.74* | 1.47* | 0.28 | -0.04 | -0.92 | 0.05 | 0.22 | 0.95* | 1.13* | 0.77* | 1.59* |
| MACHINERY | 0.77 | 0.94 | -0.09 | 1.09 | 1.35* | 0.55 | 0.88 | 1.60* | 0.49 | 0.96* | 1.01* | 0.53 |
| TRANSPORT EQUIPMENT | 0.94 | 1.28 | 0.70 | 1.30* | 0.56 | -0.10 | 1.04* | 1.12* | 0.56 | 1.08* | 0.98* | 0.17 |

* indicates that the corresponding coefficient is significant at the 5% level.

TABLE 7 : COEFFICIENTS OF THE SUPPLY VARIABLE IN EQUATION (30)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | -0.004 | 0.006 | 0.814* | 0.016 | -0.001 | 0.935* | -0.055 | -0.004 | 0.183 | 0.006* | 0.046 | 0.009 |
| MINING | 0.004 | 0.007* | -0.001 | -0.001 | 0.003 | 0.099* | 0.003 | 0.025* | 0.047* | 0.003* | 0.039* | 0.007 |
| CONSTRUCTION | 0.030 | 0.032 | -0.005 | 0.029* | 0.006 | 0.067 | -0.006 | 0.104* | 0.015* | 0.029* | 0.066* | 0.049* |
| MANUFACTURING | 0.011 | 0.134* | 0.025 | 0.221* | 0.120* | 0.225 | 0.130* | 0.641* | 0.070 | 0.239* | 0.452* | 0.774* |
| TRANSPORTATION | -0.012 | -0.049 | 0.089* | 0.063* | 0.016* | 0.088 | -0.014 | 0.020* | 0.000 | 0.030* | 0.043 | 0.011 |
| UTILITIES | 0.007 | 0.012* | -0.002 | 0.019* | 0.007* | -0.006 | 0.006 | 0.021* | 0.000 | 0.015* | 0.015 | 0.010 |
| TRADE | 0.033 | 0.024* | 0.134* | 0.094* | 0.856* | 0.043 | 0.014 | 0.035* | 0.026 | 0.130* | 0.127* | 0.073 |
| FINANCE | 0.015 | 0.004* | 0.001 | 0.129* | 0.136* | -0.005 | 0.002 | 0.003 | 0.002 | 0.110* | 0.085* | 0.001 |
| SERVICES | 0.759* | 0.675* | 0.005 | 0.383* | 0.011 | 0.014 | 0.977* | 0.112* | 0.587* | 0.339* | 0.076* | 0.060 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.006 | 0.016 | 0.044 | 0.019 | 0.101 | 0.098 | 0.080 | 0.041 | 0.088 | 0.095* | 0.276* | 0.067 |
| TOBACCO | -0.007 | 0.009 | 0.000 | -0.021* | -0.002 | 0.109* | 0.005 | 0.009 | 0.005 | 0.004 | 0.016* | 0.000 |
| TEXTILES | 0.004 | 0.036* | -0.008 | 0.037 | 0.032 | 0.751* | 0.012 | 0.078* | 0.015 | 0.043* | 0.162* | 0.073 |
| CLOTHING | 0.001 | 0.008 | 0.027 | 0.032* | 0.041* | 0.180 | 0.001 | 0.041* | 0.000 | 0.035* | 0.008 | -0.004 |
| FURNITURE | -0.009 | 0.005* | -0.002 | 0.018* | 0.017* | 0.176* | 0.005 | 0.053* | 0.000 | 0.023* | 0.075* | 0.026* |
| PAPER | -0.017 | 0.016 | -0.002 | -0.003 | 0.016* | 0.144* | 0.000 | 0.077 | 0.010 | 0.027* | 0.052* | 0.070* |
| CHEMICALS | 0.016 | 0.098* | 0.002 | 0.111 | 0.000 | 0.140 | 0.043 | 0.082 | 0.154 | 0.115* | 0.146* | 0.105* |
| PETROLEUM PRODUCTS | -0.032 | 0.014 | 0.012 | -0.010 | 0.000 | -0.013 | 0.008 | -0.018 | 0.085 | 0.018* | 0.027 | 0.060* |
| MACHINERY | -0.081 | 0.061 | 0.001 | 0.061 | 0.026 | 0.408* | 0.006 | 0.943* | 0.017 | 0.118* | 0.232* | 0.184 |
| TRANSPORT EQUIPMENT | 0.016 | 0.102 | 0.029 | 0.173* | 0.005 | 0.142 | 0.039* | 0.384* | 0.018 | 0.147* | 0.375* | 1.065 |

* indicates that the coefficient is significantly different from zero at the 5% level.

TABLE 8 : COEFFICIENTS OF THE OUTPUT VARIABLE IN EQUATION (30)[a]

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.56 | 1.26* | -8.20 | -3.08 | -0.44* | 24.30 | -4.83 | -0.08 | 0.27 | -0.05 | 0.58 | -0.32 |
| MINING | 3.14* | 1.51* | 2.89* | 5.93* | -0.02 | 114.96* | 1.60 | 1.44* | 0.89* | 1.21* | 0.78 | 6.61* |
| CONSTRUCTION | -1.02 | -0.81 | 2.60 | -3.87 | -0.30 | 49.03 | 1.91 | -0.12 | -0.10* | -0.48 | -1.73 | -0.38 |
| MANUFACTURING | 3.45* | 0.14 | 3.50 | 0.05 | 1.86 | 18.21 | -2.21 | -0.10 | 0.26 | -0.10 | 0.77 | -5.42* |
| TRANSPORTATION | 10.28 | -9.90 | -16.70 | 8.78 | -4.07* | 80.18* | 8.74 | 0.66 | 0.00 | 1.01 | 6.13 | 3.69 |
| UTILITIES | 2.12 | -0.32 | 3.00* | 0.70 | -0.79 | 18.15 | -0.99 | 0.62 | 0.13 | 0.09 | 2.74* | 3.65* |
| TRADE | 2.00* | -0.03 | 4.20 | 11.74* | -9.60* | 30.48* | 14.85* | 0.01 | -0.01 | 0.46 | -0.03 | 5.60 |
| FINANCE | 1.07* | 0.03 | 9.55* | 4.72 | 5.81* | -0.13 | 3.05* | 0.10 | -0.01 | 3.93* | -2.78* | 0.50* |
| SERVICES | -4.60 | 2.49 | 4.04 | -5.41 | 0.40 | 9.42 | -5.51 | 0.40 | -0.14 | 0.81 | -0.12 | 3.83 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 1.55* | 0.93* | 3.88* | 5.96* | 2.05 | 45.82* | 1.38 | 0.23 | 0.49* | 0.86 | 2.71* | 4.03* |
| TOBACCO | 4.21* | 1.22 | 5.15* | 5.53 | 1.81 | 142.16* | 8.99* | 2.95* | 0.00 | 0.44 | 0.94 | 7.00* |
| TEXTILES | 1.39 | -0.02 | 0.11 | 0.56 | 0.07 | 156.64 | 1.49 | -0.29 | 0.36* | 1.00 | 4.58 | -0.83 |
| CLOTHING | 0.74 | 0.58* | 5.39 | 6.85* | 1.59 | 154.44* | -0.85 | -0.07 | 0.00 | 1.58* | 9.06* | 2.67* |
| FURNITURE | 2.30 | 0.08 | 6.52 | 5.41* | -0.33 | 118.93* | 0.32 | -0.66 | 0.00 | 0.08 | 1.12 | -0.28 |
| PAPER | 3.80* | 2.41* | 3.47* | 9.76* | 0.82* | 81.92* | 2.27* | 1.53* | 0.30* | 1.99* | 3.15* | 2.40* |
| CHEMICALS | 3.16* | 0.75 | 2.20* | -0.74 | 3.07* | 12.19 | -1.67 | 0.76 | 1.45* | 0.57 | 1.19* | 0.23 |
| PETROLEUM PRODUCTS | 7.44* | 1.86* | 1.20 | 5.35 | 0.45 | 5.92 | -1.64 | 2.17* | 0.54 | 1.93* | 1.74* | -0.21 |
| MACHINERY | 9.04* | 2.14 | 5.03* | 11.54* | 1.50* | 81.62* | 1.42 | 0.32 | 0.30* | 2.21 | 0.97 | 9.49 |
| TRANSPORT EQUIPMENT | 4.24* | 0.40 | 1.07 | 2.01 | 0.98 | 26.39 | -0.23 | 2.00 | 0.07 | 0.14 | 0.61 | -17.27 |

[a] workers per million 1960 U.S. dollars

* coefficient significant at the 5% level

TABLE 9 : COEFFICIENTS OF THE INTERCEPT IN EQUATION (30) [a]

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.52 | -0.31 | -41.00* | 0.45 | 0.33* | -361.63* | 8.91 | 0.08 | -0.11 | 0.02 | 0.20 | 0.08 |
| MINING | -0.04 | -0.19 | 0.23* | 0.67 | -0.11 | -42.41* | -0.04 | -0.06 | -0.09* | -0.02 | -0.06 | -0.11 |
| CONSTRUCTION | 0.33 | -0.29 | 2.17 | 0.25 | -0.09 | 23.16 | 1.60 | 0.25 | 0.00 | 0.09 | 0.41 | -0.15 |
| MANUFACTURING | 2.35 | -0.94 | 4.88 | 0.33 | -1.49 | 86.67 | -3.07 | -1.03* | 0.10 | 0.41 | -0.84 | 2.05 |
| TRANSPORTATION | 1.14 | 7.40* | -4.28 | -1.92 | 0.67 | -24.47 | 1.75 | 0.32 | 0.00 | -0.11 | -0.79 | 0.40 |
| UTILITIES | 0.10 | -0.21* | 0.45* | 0.11 | -0.23 | 9.37 | -0.01 | 0.22* | 0.01 | -0.02 | -0.11 | -0.02 |
| TRADE | -0.66 | -0.26 | 13.00 | 2.44 | -1.34 | -9.12 | -1.63 | -0.04 | -0.01 | 0.06 | -0.23 | -1.17 |
| FINANCE | -0.32 | -0.09 | 1.12 | -2.04 | -4.55* | 3.35 | 0.81 | 0.01 | 0.00 | -0.23 | -0.06 | -0.04 |
| SERVICES | -0.61 | 3.87 | 10.69* | -6.36 | 1.18 | 9.48 | -15.42 | 0.45* | -0.12 | 0.07 | -0.15 | -0.82 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.72 | -0.34 | 3.69 | 12.20 | 3.51 | 71.86 | -2.82 | 0.30 | -0.10 | 0.00 | -1.67* | -1.25 |
| TOBACCO | 0.15 | -0.35 | 0.09 | 3.89* | 0.40 | -52.02* | -0.76 | -0.22 | 0.00 | 0.09 | -0.01 | -0.23 |
| TEXTILES | 0.41 | -0.45 | 5.53* | 5.72 | -0.04 | -306.00* | 1.57 | 0.12 | -0.08 | 0.05 | -1.07 | 1.21 |
| CLOTHING | 0.11 | -0.18 | 0.01 | 0.49 | -0.85 | -5.34 | 3.84 | -0.13 | 0.00 | -0.14 | -1.86* | -0.31 |
| FURNITURE | 0.41 | -0.02 | 1.46 | 0.16 | -0.35 | -64.29 | -0.09 | -0.12 | 0.00 | -0.02 | -0.22* | -0.17 |
| PAPER | 0.90 | -0.53 | 1.15* | 2.62 | -0.30 | -53.42 | 0.80 | -0.29 | 0.00 | -0.16* | -0.53* | -0.67 |
| CHEMICALS | 1.98 | -1.09 | 3.02* | 0.45 | 1.98 | -29.29 | -0.05 | 0.92* | 0.33 | 0.19 | -0.48* | -0.46 |
| PETROLEUM PRODUCTS | 1.44 | -0.22 | -0.62 | 4.64 | 0.51 | 19.21 | 0.55 | 0.50* | 0.04 | -0.08 | -0.02 | -0.53 |
| MACHINERY | 4.53 | -0.31 | 3.94 | 2.19 | -0.52 | -153.43 | 0.73 | -3.09* | -0.08 | -0.24 | -0.41 | 4.36 |
| TRANSPORT EQUIPMENT | 1.62 | -1.09 | 1.40 | -3.85 | 0.49 | 53.22 | -0.22 | -0.57 | 0.01 | -0.21 | -0.10 | 30.56 |

[a] multiplied by 1000

* coefficient significant at the 5% level

TABLE 10 : R-SQUARED FOR EQUATION (30)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.03 | 0.43* | 0.80* | 0.12 | 0.19 | 0.37* | 0.09 | 0.08 | 0.17 | 0.42* | 0.09 | 0.09 |
| MINING | 0.51* | 0.44* | 0.61* | 0.26 | 0.10 | 0.43* | 0.20 | 0.40* | 0.46* | 0.76* | 0.46* | 0.34 |
| CONSTRUCTION | 0.10 | 0.13 | 0.16 | 0.34* | 0.14 | 0.10 | 0.01 | 0.30 | 0.29 | 0.62* | 0.47* | 0.32 |
| MANUFACTURING | 0.39* | 0.34 | 0.19 | 0.44* | 0.37* | 0.05 | 0.24 | 0.96* | 0.22 | 0.71* | 0.93* | 0.68* |
| TRANSPORTATION | 0.09 | 0.36 | 0.57 | 0.66* | 0.73* | 0.53 | 0.15 | 0.55 | 0.00 | 0.84* | 0.38 | 0.38 |
| UTILITIES | 0.38* | 0.65* | 0.37* | 0.38* | 0.22 | 0.15 | 0.08 | 0.37* | 0.12 | 0.72* | 0.66* | 0.39* |
| TRADE | 0.59* | 0.50* | 0.31 | 0.67* | 0.96* | 0.66* | 0.34 | 0.60* | 0.04 | 0.80* | 0.43* | 0.39 |
| FINANCE | 0.61* | 0.46 | 0.80* | 0.70* | 0.78* | 0.08 | 0.51* | 0.29 | 0.00 | 0.94* | 0.74* | 0.91* |
| SERVICES | 0.74* | 0.87* | 0.04 | 0.52* | 0.08 | 0.07 | 0.87* | 0.64* | 0.62* | 0.93* | 0.53* | 0.27 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.48* | 0.52* | 0.36 | 0.35 | 0.21 | 0.24 | 0.26 | 0.15 | 0.49* | 0.63* | 0.83* | 0.47* |
| TOBACCO | 0.64* | 0.13 | 0.69* | 0.46 | 0.19 | 0.80* | 0.52* | 0.56* | 0.11 | 0.14 | 0.42 | 0.56* |
| TEXTILES | 0.10 | 0.28 | 0.02 | 0.05 | 0.08 | 0.33 | 0.03 | 0.35* | 0.35* | 0.55* | 0.55* | 0.11 |
| CLOTHING | 0.19 | 0.41* | 0.29 | 0.63* | 0.43* | 0.24 | 0.01 | 0.33 | 0.00 | 0.69* | 0.79* | 0.59* |
| FURNITURE | 0.21 | 0.61* | 0.24 | 0.82* | 0.53 | 0.57 | 0.22 | 0.40 | 0.00 | 0.92* | 0.94* | 0.73* |
| PAPER | 0.60* | 0.71* | 0.80* | 0.83* | 0.37* | 0.71* | 0.22 | 0.34 | 0.82* | 0.95* | 0.81* | 0.39* |
| CHEMICALS | 0.74* | 0.55* | 0.33 | 0.26 | 0.40 | 0.19 | 0.11 | 0.38 | 0.54* | 0.72* | 0.92* | 0.55* |
| PETROLEUM PRODUCTS | 0.86* | 0.84* | 0.43 | 0.06 | 0.04 | 0.04 | 0.06 | 0.70* | 0.67* | 0.88* | 0.74* | 0.77* |
| MACHINERY | 0.44 | 0.17 | 0.27 | 0.39 | 0.44 | 0.48* | 0.22 | 0.84* | 0.28 | 0.53* | 0.74* | 0.10 |
| TRANSPORT EQUIPMENT | 0.51 | 0.19 | 0.22 | 0.67* | 0.11 | 0.04 | 0.34 | 0.55* | 0.15 | 0.93* | 0.78* | 0.12 |

* indicates that the corresponding F-ratio is significant at the 1% level.

TABLE 11 : SUPPLY VARIABLE ELASTICITIES IN EQUATION (30)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | -0.37 | 0.66 | 1.63* | 0.44 | -0.23 | 3.82* | -0.72 | -0.10 | 1.02 | 0.90* | 0.53 | 0.91 |
| MINING | 0.49 | 1.27* | -0.41 | -0.12 | 1.66 | 3.11* | 0.28 | 0.69* | 1.18* | 0.46* | 1.02* | 0.29 |
| CONSTRUCTION | 0.88 | 1.38 | -0.24 | 1.13* | 1.15 | 0.52 | -0.14 | 0.67* | 0.50* | 1.01* | 0.84* | 1.24* |
| MANUFACTURING | 0.08 | 1.10* | 0.28 | 0.96* | 0.83* | 0.52 | 0.75* | 1.11* | 0.19 | 0.94* | 0.97* | 1.26* |
| TRANSPORTATION | -0.14 | -0.79 | 3.07* | 0.89* | 0.82* | 1.06 | -0.20 | 0.22* | 0.00 | 0.77* | 0.31 | 0.15 |
| UTILITIES | 0.51 | 1.58* | -0.70 | 0.94* | 1.86* | -0.40 | 0.66 | 0.34* | 0.00 | 1.02* | 0.59 | 0.46 |
| TRADE | 0.87 | 1.21* | 0.56* | 0.54* | 1.09* | 0.78 | 0.16 | 0.43* | 0.72 | 0.89* | 1.10* | 0.52 |
| FINANCE | 1.00 | 1.27* | 0.05 | 1.09* | 1.50* | -2.03 | 0.12 | 0.17 | 0.30 | 0.84* | 1.63* | 0.22 |
| SERVICES | 1.09* | 0.81* | 0.05 | 1.26* | 0.18 | 0.32 | 1.23* | 0.17* | 0.97* | 0.90* | 0.94* | 0.52 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.11 | 0.54 | 0.45 | 0.11 | 0.53 | 0.30 | 1.26 | 0.38 | 0.31 | 0.66* | 0.72* | 0.35 |
| TOBACCO | -1.60 | 2.72 | -0.13 | -1.48* | -0.37 | 4.07* | 1.01 | 0.71 | 1.37 | 0.36 | 0.72* | 0.01 |
| TEXTILES | 0.16 | 1.43* | -0.26 | 0.41 | 1.01 | 2.93* | 0.34 | 0.98* | 0.36 | 0.62* | 0.74* | 0.63 |
| CLOTHING | 0.13 | 0.91 | 0.66 | 0.54* | 1.11* | 0.64 | 0.04 | 2.03* | 0.00 | 0.57* | 0.05 | -0.12 |
| FURNITURE | -1.35 | 1.08* | -0.12 | 0.67* | 1.46* | 2.13* | 1.14 | 1.96* | 0.00 | 1.02* | 1.13* | 1.74* |
| PAPER | -0.64 | 0.80 | -0.15 | -0.07 | 1.07* | 1.69* | 0.01 | 0.79 | 0.17 | 0.49* | 0.56* | 0.98* |
| CHEMICALS | 0.18 | 1.23* | 0.07 | 0.99 | 0.00 | 1.50 | 1.27 | 0.34 | 0.22 | 0.81* | 0.95* | 1.18* |
| PETROLEUM PRODUCTS | -0.94 | 0.78 | 1.32 | -0.23 | -0.04 | -0.47 | 0.76 | -0.19 | 0.48 | 0.51* | 0.42 | 1.82* |
| MACHINERY | -0.69 | 0.74 | 0.01 | 0.45 | 0.86 | 2.14* | 0.26 | 1.65* | 0.29 | 0.67* | 0.94* | 0.29 |
| TRANSPORT EQUIPMENT | 0.13 | 1.20 | 0.66 | 1.14* | 0.21 | 0.49 | 1.13* | 0.77* | 0.36 | 1.05* | 1.14* | 0.55 |

* indicates that the corresponding coefficient is significant at the 5% level.

## TABLE 12 : OUTPUT VARIABLE ELASTICITIES IN EQUATION (30)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.36 | 1.08* | -0.04 | -0.25 | -0.53* | 0.06 | -0.22 | -0.08 | 0.27 | -0.16 | 0.23 | -0.49 |
| MINING | 0.57* | 0.45* | 0.59* | 0.43* | -0.01 | 0.49* | 0.11 | 0.37* | 0.86* | 0.77* | 0.17 | 0.91* |
| CONSTRUCTION | -0.12 | -0.15 | 0.47 | -0.25 | -0.17 | 0.13 | 0.09 | -0.02 | -0.34* | -0.19 | -0.43 | -0.08 |
| MANUFACTURING | 0.55* | 0.03 | 0.30 | 0.00 | 0.22 | 0.08 | -0.15 | -0.02 | 0.39 | -0.05 | 0.18 | -0.44* |
| TRANSPORTATION | 0.64 | -0.96 | -1.10 | 0.29 | -0.84* | 0.55* | 0.38 | -0.21 | 0.00 | 0.37 | 1.23 | 0.57 |
| UTILITIES | 0.24 | -0.07 | 0.52* | 0.03 | -0.25 | 0.17 | -0.08 | 0.10 | 0.26 | 0.03 | 0.84* | 0.57* |
| TRADE | 0.49* | -0.01 | 0.05 | 0.25* | -0.08* | 0.46* | 0.85* | 0.01 | -0.08 | 0.08 | -0.01 | 0.90 |
| FINANCE | 0.24* | 0.03 | 0.53* | 0.06 | 0.16* | -0.02 | 0.32* | 0.11 | -0.15 | 0.26* | -0.80* | 0.88* |
| SERVICES | -0.07 | 0.04 | 0.14 | -0.10 | 0.06 | 0.23 | -0.04 | 0.04 | -0.06 | 0.07 | -0.08 | 0.79 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.60* | 0.74* | 0.28* | 0.29* | 0.17 | 0.27* | 0.23 | 0.27 | 0.88* | 0.34 | 0.76* | 0.95* |
| TOBACCO | 1.81* | 0.72 | 0.93* | 0.26 | 0.37 | 0.91* | 1.47* | 2.54* | 0.03 | 0.18 | 0.35 | 1.64* |
| TEXTILES | 0.45 | -0.01 | 0.01 | 0.02 | 0.01 | 0.42 | 0.16 | -0.18 | 1.63* | 0.33 | 0.77 | -0.12 |
| CLOTHING | 0.62 | 0.62* | 0.34 | 0.38* | 0.24 | 0.39* | -0.08 | -0.16 | 0.00 | 0.57* | 2.23* | 1.67* |
| FURNITURE | 1.02 | 0.06 | 0.42 | 0.27* | -0.05 | 0.38* | 0.13 | -0.41 | 0.00 | 0.03 | 0.31 | -0.14 |
| PAPER | 0.90* | 0.83* | 0.54* | 0.55* | 0.26* | 0.55* | 0.45* | 0.61* | 0.79* | 0.71* | 1.04* | 0.45* |
| CHEMICALS | 0.35* | 0.11 | 0.24* | -0.03 | 0.42* | 0.12 | -0.25 | 0.19 | 0.53* | 0.11 | 0.35* | 0.05 |
| PETROLEUM PRODUCTS | 0.98* | 0.55* | 0.20 | 0.23 | 0.16 | 0.09 | -0.35 | 0.55* | 0.40 | 0.62* | 0.61* | -0.06 |
| MACHINERY | 0.88* | 0.35 | 0.40* | 0.41* | 0.40* | 0.46* | 0.38 | 0.04 | 1.38* | 0.41 | 0.26 | 0.38 |
| TRANSPORT EQUIPMENT | 0.58* | 0.09 | 0.13 | 0.09 | 0.48 | 0.14 | -0.06 | 0.38 | 0.51 | 0.05 | 0.12 | -0.33 |

* indicates that the corresponding coefficient is significant at the 5% level.

TABLE 13 : SUPPLY VARIABLE ELASTICITIES IN EQUATION (31)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.52 | 0.04 | 0.82* | 1.41* | -0.69 | 1.84* | -0.53 | -0.10 | 1.16 | 1.07* | 0.62* | 1.63* |
| MINING | 1.05 | 1.77* | 0.24 | 0.41 | 1.23 | 0.11 | 0.23 | 0.85* | 0.97 | 0.64* | 0.93* | 0.75* |
| CONSTRUCTION | 0.46 | 1.01 | -0.17 | 0.91* | 1.41 | 0.04 | -0.16 | 0.53* | 0.41* | 1.10* | 0.69* | 0.95* |
| MANUFACTURING | 0.21 | 1.12* | 0.33 | 0.68* | 0.83* | 0.11 | 0.67* | 0.94* | 0.20 | 0.96* | 0.83* | 1.08* |
| TRANSPORTATION | 0.05 | -1.86* | 2.74* | 1.04* | 1.39* | 0.21 | 0.31 | 0.47* | 0.00 | 0.89* | -0.06 | 0.01 |
| UTILITIES | 0.00 | 1.24* | -0.40 | 0.49* | 2.27* | -0.21 | 0.25 | 0.59* | 0.02 | 0.85* | 0.95* | 0.29 |
| TRADE | 0.86 | 1.22* | 0.68* | 0.31 | 0.72* | 0.80 | 0.24 | 0.49* | 0.76 | 0.85* | 1.15* | 0.51 |
| FINANCE | 1.14 | 0.94 | 0.23 | 0.62* | 2.45* | -0.79 | 0.03 | 0.17 | 0.05 | 1.00* | 1.77* | 0.26 |
| SERVICES | 0.30 | 0.39* | 0.25 | 0.59* | 0.51* | 1.51 | 0.54* | 0.19* | 0.84* | 0.90* | 1.08* | 0.47 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.35 | 1.10* | 0.22 | 0.54* | 0.89* | -0.10 | 1.56* | 0.79* | 0.62* | 1.03* | 0.90* | 0.73* |
| TOBACCO | 1.47 | 1.55 | 0.02 | -0.11 | 0.45 | 0.13 | 1.92* | 2.26* | 1.02 | 1.17* | 0.52* | 0.87 |
| TEXTILES | 0.44 | 1.32* | 0.10 | 0.24 | 1.23* | 0.12 | 0.53 | 1.35* | 0.38 | 0.82* | 0.72* | 0.68 |
| CLOTHING | -0.07 | 0.52 | 0.82 | 0.61 | 1.61* | 0.03 | -0.15 | 2.47* | 0.00 | 1.25* | 0.45 | 0.61 |
| FURNITURE | -1.06 | 1.59* | -0.06 | 1.18* | 1.51* | 0.21 | 1.53 | 1.54 | 0.00 | 1.34* | 1.04* | 0.04 |
| PAPER | 0.46 | 1.32* | -0.10 | 0.42 | 1.32 | 0.11 | 0.74 | 0.75* | 0.09 | 1.01* | 0.96* | 1.18* |
| CHEMICALS | 0.25 | 1.17* | 0.15 | 0.41 | 0.00 | 0.53 | 1.60 | 0.44* | 0.22 | 0.88* | 1.12* | 1.18* |
| PETROLEUM PRODUCTS | -0.66 | 0.66 | -0.01 | 0.27 | 1.60 | 0.07 | 1.28 | 0.26 | 0.43 | 0.78* | 0.99* | 1.97* |
| MACHINERY | 0.07 | 1.29* | 0.26 | 0.42 | 0.06 | 0.27 | 1.15 | 0.98* | 0.41 | 1.07* | 0.61* | 1.01* |
| TRANSPORT EQUIPMENT | 0.14 | 1.23 | 0.66 | 0.79 | 0.90 | -0.09 | 0.73 | 0.86* | 0.46 | 0.94* | 0.93* | 0.58 |

* indicates that the corresponding coefficient is significant at the 5% level.

TABLE 14 : OUTPUT VARIABLE ELASTICITIES IN EQUATION (31)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.26 | 1.38* | 0.17* | -0.22 | -0.13 | -0.01 | -0.14 | -0.07 | -0.10 | -0.02 | 0.02 | -0.10 |
| MINING | 0.44* | 0.12 | 0.29 | -0.05 | -0.34 | -0.02 | -0.03 | 0.07 | 0.99* | 0.64* | 0.10 | 0.07 |
| CONSTRUCTION | -0.06 | -0.11 | 0.63* | -0.25 | -0.15 | -0.02 | 0.01 | -0.03 | -0.25* | -0.23 | -0.14 | 0.16 |
| MANUFACTURING | 0.42* | -0.01 | 0.22 | -0.04 | 0.14 | -0.03 | -0.17* | 0.04 | 0.38* | -0.07 | 0.39* | -0.44* |
| TRANSPORTATION | -0.26 | -1.63* | -0.95 | 0.10 | -1.01* | 0.15 | -0.12 | -0.41* | 0.00 | 0.07 | 2.31* | 0.92* |
| UTILITIES | 0.24 | 0.01 | 0.47* | -0.13 | -0.57 | -0.03 | -0.21 | -0.19 | 0.06 | 0.12 | 0.28 | 0.43 |
| TRADE | 0.23 | -0.24 | -0.27 | 0.15 | -0.27* | 0.36* | 0.45 | -0.07 | 0.05 | -0.11 | -0.21 | 0.84 |
| FINANCE | 0.07 | -0.19 | 0.24* | -0.19* | -0.27 | -0.14 | 0.10 | 0.01 | -0.26 | -0.11 | -1.25* | 0.84* |
| SERVICES | -0.04 | 0.11 | 0.07 | -0.09 | -0.07 | 0.08 | -0.07 | 0.03 | -0.06 | 0.02 | -0.15 | 0.50 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.32 | 0.15 | 0.24 | 0.05 | -0.20 | -0.06* | -0.05 | -0.13 | 0.41 | -0.20 | 0.42* | 0.37 |
| TOBACCO | -0.21 | -0.29 | 0.19 | -0.08 | 0.02 | 0.01 | -0.11 | -1.12* | 0.79 | -0.52* | 0.81* | 0.14 |
| TEXTILES | 0.27 | -0.13 | 0.14 | 0.14 | -0.13 | -0.01 | -0.14 | -0.48 | 1.12* | 0.15 | 0.62 | 0.08 |
| CLOTHING | 0.95 | 0.71* | 0.29 | 0.28 | -0.05 | -0.04 | -0.04 | -0.72 | 0.00 | -0.33 | 1.19* | 0.36 |
| FURNITURE | 0.93 | -0.09 | 0.34 | 0.13 | 0.18 | -0.04 | 0.06 | -0.24 | 0.00 | -0.37* | 0.43* | 1.26* |
| PAPER | 0.37 | 0.29 | 0.08 | 0.03 | -0.37 | -0.02 | -0.18 | 0.02 | 0.67* | -0.15 | 0.33 | -0.19 |
| CHEMICALS | 0.29* | 0.04 | 0.19 | 0.00 | 0.37* | -0.03 | -0.39 | 0.10 | 0.50* | -0.01 | 0.09 | -0.07 |
| PETROLEUM PRODUCTS | 0.80* | 0.50* | 0.30 | 0.01 | -0.44 | -0.08 | -0.70 | 0.33* | -0.07 | 0.13 | 0.07 | -0.33 |
| MACHINERY | 0.26 | -0.10 | 0.04 | -0.02 | 0.11 | 0.00 | -0.19 | -0.10 | 0.41 | -0.35 | 0.84* | -0.82* |
| TRANSPORT EQUIPMENT | 0.52* | 0.04 | -0.03 | 0.04 | 0.15 | -0.06 | -0.06 | 0.29 | 0.48 | 0.15 | 0.29* | -0.57* |

* indicates that the corresponding coefficient is significant at the 5% level.

TABLE 15 : R-SQUARED FOR EQUATION (31)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.04 | 0.82* | 0.47* | 0.16 | 0.07 | 0.46* | 0.08 | 0.05 | 0.15 | 0.34* | 0.16 | 0.19 |
| MINING | 0.47* | 0.39* | 0.08 | 0.06 | 0.17 | 0.16 | 0.08 | 0.51* | 0.45* | 0.64* | 0.66* | 0.26 |
| CONSTRUCTION | 0.03 | 0.10 | 0.28 | 0.31 | 0.15 | 0.13 | 0.01 | 0.25 | 0.33 | 0.72* | 0.33 | 0.36* |
| MANUFACTURING | 0.38* | 0.43* | 0.23 | 0.39* | 0.42* | 0.35 | 0.39* | 0.91* | 0.24 | 0.82* | 0.89* | 0.72* |
| TRANSPORTATION | 0.02 | 0.74* | 0.49 | 0.80* | 0.71 | 0.25 | 0.07 | 0.72* | 0.00 | 0.98* | 0.56 | 0.59 |
| UTILITIES | 0.12 | 0.37* | 0.31 | 0.21 | 0.24 | 0.03 | 0.10 | 0.65* | 0.01 | 0.71* | 0.83* | 0.18 |
| TRADE | 0.34 | 0.47* | 0.34 | 0.31 | 0.72* | 0.42 | 0.09 | 0.51* | 0.05 | 0.68* | 0.43 | 0.29 |
| FINANCE | 0.20 | 0.28 | 0.32 | 0.40 | 0.68* | 0.01 | 0.03 | 0.11 | 0.10 | 0.93* | 0.77* | 0.84* |
| SERVICES | 0.11 | 0.38 | 0.05 | 0.29 | 0.27 | 0.11 | 0.46* | 0.55* | 0.49* | 0.95* | 0.46* | 0.12 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.24 | 0.37 | 0.15 | 0.39* | 0.32 | 0.28 | 0.23 | 0.30 | 0.35 | 0.78* | 0.85* | 0.44* |
| TOBACCO | 0.11 | 0.15 | 0.20 | 0.03 | 0.07 | 0.02 | 0.32 | 0.59* | 0.27 | 0.66* | 0.67* | 0.31 |
| TEXTILES | 0.14 | 0.46* | 0.04 | 0.09 | 0.18 | 0.18 | 0.15 | 0.58* | 0.36* | 0.74* | 0.56* | 0.18 |
| CLOTHING | 0.25 | 0.31 | 0.21 | 0.44* | 0.40* | 0.19 | 0.01 | 0.46* | 0.00 | 0.81* | 0.63* | 0.29 |
| FURNITURE | 0.19 | 0.43 | 0.07 | 0.84* | 0.48 | 0.34 | 0.38 | 0.31 | 0.00 | 0.91* | 0.97* | 0.60* |
| PAPER | 0.29 | 0.58* | 0.02 | 0.13 | 0.15 | 0.12 | 0.07 | 0.30 | 0.28 | 0.92* | 0.66* | 0.37 |
| CHEMICALS | 0.72* | 0.57* | 0.25 | 0.14 | 0.28 | 0.46* | 0.22 | 0.33 | 0.48* | 0.75* | 0.84* | 0.65* |
| PETROLEUM PRODUCTS | 0.71* | 0.61* | 0.19 | 0.06 | 0.31 | 0.24 | 0.16 | 0.59 | 0.09 | 0.87* | 0.96* | 0.88* |
| MACHINERY | 0.12 | 0.29 | 0.10 | 0.09 | 0.02 | 0.14 | 0.13 | 0.90* | 0.05 | 0.63* | 0.62* | 0.30 |
| TRANSPORT EQUIPMENT | 0.51 | 0.23 | 0.23 | 0.28 | 0.07 | 0.34 | 0.09 | 0.65* | 0.16 | 0.93* | 0.91* | 0.34 |

* indicates that the corresponding F-ratio is significant at the 1% level.

TABLE 16 : OUTPUT VARIABLE ELASTICITIES IN EQUATION (32)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.33 | 1.23* | 0.27 | -0.74 | -1.24* | -0.18 | -0.54 | -0.83 | 0.62 | 0.05 | 0.42 | -0.47 |
| MINING | 0.59* | 0.60* | 0.60* | 0.43* | -0.06 | 0.34* | 0.43 | 0.41 | 1.01* | 0.92* | 0.51 | 0.95* |
| CONSTRUCTION | 0.08 | 0.22 | 0.47 | 0.00 | -0.11 | 0.07 | 0.24 | 0.25 | -1.24 | 0.58* | -0.06 | 0.33 |
| MANUFACTURING | 0.57* | 0.23 | 0.31 | 0.20 | 0.40 | 0.02 | -0.02 | 0.52 | 0.59* | 0.66* | 0.79 | 0.09 |
| TRANSPORTATION | 0.83 | -1.22* | 0.03 | 0.50 | -1.91* | 0.37* | 0.76 | -0.75 | 0.00 | 0.80* | 1.71* | 0.68* |
| UTILITIES | 0.41* | 0.24 | 0.58* | 0.22 | 0.08 | 0.21 | -0.04 | 0.21 | 0.60 | 0.87* | 1.23* | 0.73* |
| TRADE | 0.64* | 0.22 | 0.09 | 0.37* | 0.09 | 0.41* | 1.10* | 0.21 | 0.19 | 0.64* | 0.88 | 1.14* |
| FINANCE | 0.46* | 0.18 | 0.53* | 0.21* | 0.32* | 0.19 | 0.34* | 0.37 | -0.47 | 0.57* | -0.33 | 1.51* |
| SERVICES | 0.15 | 0.24* | 0.16 | 0.15 | 0.15 | 0.19 | -0.01 | 0.24 | 0.27 | 0.90* | 0.55 | 0.93* |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.62* | 0.82* | 0.33* | 0.29* | 0.22 | 0.24* | 0.38 | 0.24 | 0.90* | 0.69* | 1.16* | 1.03* |
| TOBACCO | 1.76* | 0.53 | 0.92* | 0.38 | 0.38 | 0.87* | 1.48* | 2.70* | 0.43 | 0.18 | 0.69 | 1.64* |
| TEXTILES | 0.50 | 0.32 | 0.01 | 0.14 | 0.05 | 0.02 | 0.22 | 0.01 | 1.73* | 1.01* | 1.35* | 0.13 |
| CLOTHING | 0.64* | 0.75* | 0.32 | 0.42* | 0.30 | 0.35* | -0.08 | -0.14 | 0.00 | 0.95* | 2.26* | 1.63* |
| FURNITURE | 0.63 | 0.32 | 0.43 | 0.39* | 0.00 | 0.17 | 0.33 | 0.61 | 0.00 | 0.46 | 0.95 | 0.81* |
| PAPER | 0.84* | 0.88* | 0.53* | 0.55* | 0.30* | 0.47* | 0.45* | 0.70* | 0.82* | 0.89* | 1.19* | 0.58* |
| CHEMICALS | 0.38* | 0.26 | 0.24* | 0.10 | 0.42* | -0.01 | -0.14 | 0.25* | 0.55* | 0.50* | 0.66* | 0.28 |
| PETROLEUM PRODUCTS | 0.74* | 0.76* | 0.36 | 0.19 | 0.16 | 0.15 | -0.21 | 0.52* | 0.60* | 0.92* | 0.91* | 0.66* |
| MACHINERY | 0.79* | 0.41 | 0.40* | 0.45* | 0.51* | 0.33* | 0.41 | 0.74* | 1.40* | 0.73* | 0.81* | 0.47 |
| TRANSPORT EQUIPMENT | 0.60* | 0.26 | 0.17 | 0.25* | 0.50 | 0.08 | 0.11 | 0.53* | 0.56 | 0.83* | 0.73 | -0.11 |

* indicates that the corresponding coefficient is significant at the 5% level.

TABLE 17 : R-SQUARED FOR EQUATION (32)

| major sectors | PROF | TECH | ADMIN | CLER | SALES | MANUAL | SERV | ENGIN | N.SCI | SECR | FORE | MECH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGRICULTURE | 0.03 | 0.39* | 0.06 | 0.07 | 0.17 | 0.03 | 0.02 | 0.03 | 0.06 | 0.00 | 0.02 | 0.02 |
| MINING | 0.48* | 0.26* | 0.58* | 0.25 | 0.00 | 0.20 | 0.15 | 0.15 | 0.28* | 0.70* | 0.08 | 0.33* |
| CONSTRUCTION | 0.01 | 0.01 | 0.15 | 0.00 | 0.00 | 0.04 | 0.00 | 0.03 | 0.05 | 0.16 | 0.00 | 0.03 |
| MANUFACTURING | 0.39* | 0.04 | 0.13 | 0.09 | 0.15 | 0.00 | 0.00 | 0.16 | 0.19 | 0.29* | 0.17 | 0.01 |
| TRANSPORTATION | 0.09 | 0.31 | 0.00 | 0.29 | 0.55* | 0.39 | 0.14 | 0.29 | 0.00 | 0.33 | 0.33 | 0.37 |
| UTILITIES | 0.33* | 0.07 | 0.28* | 0.12 | 0.00 | 0.14 | 0.00 | 0.10 | 0.12 | 0.43* | 0.42* | 0.33* |
| TRADE | 0.48* | 0.06 | 0.02 | 0.54* | 0.03 | 0.61* | 0.34* | 0.03 | 0.00 | 0.34* | 0.09 | 0.37* |
| FINANCE | 0.48* | 0.06 | 0.80* | 0.33 | 0.38 | 0.04 | 0.51* | 0.23 | 0.00 | 0.64* | 0.03 | 0.91* |
| SERVICES | 0.12 | 0.26 | 0.04 | 0.08 | 0.04 | 0.07 | 0.00 | 0.11 | 0.07 | 0.61* | 0.04 | 0.23 |
| **minor sectors** | | | | | | | | | | | | |
| FOOD & BEVERAGES | 0.48* | 0.49* | 0.23 | 0.35* | 0.10 | 0.24 | 0.13 | 0.06 | 0.47* | 0.42* | 0.52* | 0.45* |
| TOBACCO | 0.60* | 0.03 | 0.69* | 0.23 | 0.16 | 0.57* | 0.51* | 0.53* | 0.04 | 0.04 | 0.15 | 0.56* |
| TEXTILES | 0.10 | 0.03 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.34* | 0.34* | 0.21 | 0.00 |
| CLOTHING | 0.19 | 0.33* | 0.14 | 0.52* | 0.15 | 0.22 | 0.01 | 0.00 | 0.00 | 0.59* | 0.79* | 0.59* |
| FURNITURE | 0.17 | 0.16 | 0.24 | 0.56* | 0.00 | 0.10 | 0.09 | 0.08 | 0.00 | 0.19 | 0.24 | 0.37 |
| PAPER | 0.59* | 0.67* | 0.80* | 0.83* | 0.20 | 0.64* | 0.22 | 0.25 | 0.81* | 0.87* | 0.68* | 0.26 |
| CHEMICALS | 0.74* | 0.16 | 0.32 | 0.06 | 0.40* | 0.00 | 0.02 | 0.23 | 0.52* | 0.39* | 0.32 | 0.10 |
| PETROLEUM PRODUCTS | 0.83* | 0.78* | 0.15 | 0.06 | 0.04 | 0.03 | 0.04 | 0.67* | 0.61* | 0.81* | 0.65* | 0.44 |
| MACHINERY | 0.42* | 0.11 | 0.27 | 0.37* | 0.36* | 0.30 | 0.21 | 0.33 | 0.27 | 0.38* | 0.28 | 0.09 |
| TRANSPORT EQUIPMENT | 0.51* | 0.05 | 0.06 | 0.30 | 0.10 | 0.03 | 0.04 | 0.32 | 0.13 | 0.47* | 0.20 | 0.01 |

* indicates that the corresponding F-ratio is significant at the 1% level.