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# STUDIES IN THE STABILITY OF INPUT-OUTPUT RELATIONSHIPS.
## THE FORM OF INPUT-OUTPUT RELATIONSHIPS

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## Introduction[1)]

The following presentation of a statistical analysis of the form of input-output relationships in the Norwegian economy in the period 1949-1960 has been divided into three parts with altogether 26 chapters of varying lengths, two appendix tables and two textual appendices.

The analytical approach and the data are presented in part A, which contains a description of the analytic model (Ch. I), a presentation of the data (Ch. II) and a description of the processes which were applied to the data (Ch. III).

Part B gives a discussion of methodological problems in analysing and interpreting the results (Ch.s IV - IX).

The numerical results are given in part C, where the importance of a number of charasteristics for the relationships between inputs and outputs in the production sectors are studied (Ch.s X - XXV). An attempt to summarize the main findings is made in chapter XXVI.

Only summary tables have been reproduced in the text, whereas the detailed tables are entered in a separate section of Detailed tables (Tables D 1 - D 37) at the end of the text.

# PART A. PROBLEMS, DATA AND METHOD

## I. The analytic model

In this original presentation[2)] Leontief formulated his assumption about the relationship between inputs and outputs in production for an "industry" as a simple proportionality, which we may write:

(1) $$x_{ij} = b_{ij}x_j \qquad (i=1,2 \ldots n, \qquad j=1,2 \ldots n)$$

where

$x_j$ = quantity of output produced in industry (sector) j (measured e.g. in value at fixed prices)

$x_{ij}$= quantity of input produced by industry i and used in industry j for the production of $x_j$ (measured e.g. in the same way as $x_i$)

$b_{ij}$= a constant proportionality factor

n = the number of industries

Leontief himself has pointed out two principal advantages of this formulation:

1) The relationship is mathematically simple and may be handled without difficulties by simple computational equipment, even in a model with a large number of industries. It was Leontief's contention that a simplified form of the production function, which allowed for a realistic industrial breakdown of the macroeconomic production function might give a more realistic representation than the use of more complicated functional forms, which - at least at that time - would require a more aggregated industry specification in order to be handled by available computation techniques. It is still true that a simple mathematical form can more easily be handled computationally than a more complicated one.

2) The other advantage of the formulation (1), which Leontief emphasized, is the easiness of estimating the coefficients ($b_{ij}$): Just one set of observations of $x_j$ and $x_{ij}$ are necessary.

It is generally recognized that many slightly more complicated forms of the basic relationship retain much of these two advantages. In the more than thirty years since the Leontief model was first introduced, progress in computation techniques as well as in the availability of data, has made its

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1) I am indebted to several persons for advice and critical comments to earlier versions of this paper. They are in alphabetical order Arne Amundsen, Odd Aukrust, Jan M. Hoem, Vidar Ringstad and Odd Aalen. None of them are to blame for shortcomings and errors in the final result.

2) See for instance The Structure of the American Economy 1919-1939. Oxford University Press. New York 1951.

two principal advantages somewhat less important. On the other hand, planners' and research workers' desire for even more details have tended to counteract this effect. Irrespective of how much ease of computation and estimation may count, the decisive criterion for the acceptance of the Leontief theory must be its degree of realism.

In a previous paper I have discussed criteria for evaluating the stability of Leontief coefficients[1], and in another paper[2] I have discussed the effects on coefficient stability of aggregation and disaggreation in the sector specification, and also reported on the variability and the existence of trends in ordinary input-output coefficients computed on the basis of Norwegian national accounts figures over the 12 year period 1949-1960.

One possible cause of instability in the simple Leontief input-output coefficients might be that the relationships between inputs and outputs are of a more complex form. The subject of the present paper is an analysis of the Norwegian national accounts figures for the period 1949-1960 in order to test the form of the relationship between inputs and outputs. The forms which are tested are all special cases of the following more general function:

(2) $$x_{ij}(t) = (a_{ij} + c_{ij}t) + (b_{ij} + d_{ij}t)x_j(t) + u_{ij}(t)$$

where

$x_j(t)$ = volume of production in sector (industry) j in the year t

$x_{ij}(t)$ = quantity of input no. i used in production in sector j in the year t

$a_{ij}$, $b_{ij}$, $c_{ij}$ and $d_{ij}$ = structural constants

$u_{ij}(t)$ = an error term for the delivery from i to j in the year t

From this function and the ones we obtain by assuming one or more of its constants to be zero, we get the following alternatives (we use the non-zero constants in each form as superscripts to distinguish the alternatives, and we also have given each form a verbal identification bearing on the implied relationship between input and output):

(3) Proportional, no trend (The "pure"Leontief form):

$$x_{ij}(t) = b^b_{ij}x_j(t) + u^b_{ij}(t)$$

(4) Proportional trend (The Leontief form, with a smooth change in the coefficient over time):

$$x_{ij}(t) = (b^{bd}_{ij} + d^{bd}_{ij}t)\ x_j(t) + u^{bd}_{ij}(t)$$

(5) Linear, no trend:

$$x_{ij}(t) = a^{ab}_{ij} + b^{ab}_{ij}\ x_j(t) + u^{ab}_{ij}(t)$$

(6) Linear, trend (The "basic" form, (2), above)

$$x_{ij}(t) = (a_{ij} + c_{ij}t) + (b_{ij} + d_{ij}t)x_j(t) + u_{ij}(t)$$

(We write this form without superscripts)

(7) Independent (i.e. linearly independent), no trend

$$x_{ij}(t) = a^a_{ij} + u^a_{ij}(t)$$

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1) Per Sevaldson: Changes in Input-Output Coefficients in: Ed. T. Barna: Structural Interdependence and Economic Development, London 1963.
2) Per Sevaldson: The stability of input-output coefficients in: Ed.s A.P. Carter and A. Brody: Applications of Input-Output Analysis. Amsterdam, London 1970. Also as Artikler fra Statistisk Sentralbyrå (Articles from the Central Bureau of Statistics) No. 32, Oslo 1969.

(8) Independent, trend

$$x_{ij}(t) = a_{ij}^{ac} + c_{ij}^{ac}t + u_{ij}^{ac}(t)$$

In (4) we make no distinction between the cases where the coefficient $b_{ij}^{bd}$ is zero and those where it is different from zero, since the important features of (4) is that it has a proportionality term with a trend component and no systematic term which is independent of output. Correspondingly, in (6), we do not take into consideration whether one or both of $a_{ij}$ and $b_{ij}$ are zero or not, since the main features is the linear, non-proportional, form of the relationship between input and output, with trend components in both terms. In the same way, no distinction is made between cases of Zero and non-zero $a_{ij}^{ac}$ in (8). However, it does make a difference in the evaluation of the test results whether the coefficient $b_{ij}$ is positive or negative in the linear form. We must therefore subdivide the forms (5) and (6) into

| | | |
|---|---|---|
| (5a) | Linear, positive, no trend | ($b_{ij}^{ab} > 0$) |
| (5b) | Linear, negative, no trend | ($b_{ij}^{ab} < 0$) |
| (6a) | Linear, positive, trend | ($b_{ij} > 0$) |
| (6b) | Linear, negative, trend | ($b_{ij} < 0$) |

We have thus four basic forms: the proportional, (3) and (4), the linear, positive, (5a) and (6a), the linear, negative (5b) and (6b) and the independent, (7) and (8), each of them with or without trends in one or more of the coefficients. We have chosen to consider both the cases of proportionality and linear positive relationships between input and output as confirmations of the Leontief theory, and to consider the linear negative and the independent forms as refutations of this theory.

We do only take into account linear relationships between inputs and outputs, assuming that all forms of interdependence can be represented more or less approximately by these linear forms. We assume that the cases where non-linear dependencies take the effect of linear independence are so exeptional that we may ignore them.

Neither linearity instead of straight proportionality between input and output nor the existence of trends in the proportional or linear forms imply serious computational complications in the use of the model. But only the coefficients in the proportional form with no trend can be estimated on the basis of one set of observations alone. The coefficients of the linear form with no trend can be estimated on the basis of observations for two years. However, in order to provide significant estimates, the changes in production volumes between these years will in general have to be of a sufficiently large order. This they will normally not be for all production sectors, unless the years are relatively far apart. But in that case the problem of technological changes in the coefficients between the two years must be considered.

The estimation of trend coefficients obviously requires time series data, and the extrapolation of such trends raises problems of its own. As soon as data for more than one year are required, deflation problems must also be faced. Consequently, if the simple proportionality assumption for the coefficients has to be given up, the data requirements for input-output analysis will be a multiple of what it will be if this assumption can be maintained.

When the form of the relationships (if any) between inputs, outputs and time are given, the next question is how precise estimates of inputs can be made for given outputs and time. If they can lead to sufficiently precise estimates, all our alternative forms of the relationships are equally useful, provided we have the necessary data for estimation of their parameters. Even cases where inputs are independent of output represent no problem if sufficiently precise estimates for any given year can be made on the basis of the averages of observed magnitudes in previous years, or by extrapolation of trends through such observed magnitudes.

In ordinary input-output analysis the simple proportional form is assumed for all relationships between intermediate inputs and outputs in the production sectors. However, it is quite possible that the relationship between volumes of input and volumes of output may be closer for some types of inputs and outputs than for others, and also that the relationships may take on different forms for different types. If systematic differences can be established, they will give indications of how the simple Leontief model most profitably can be improved through further research into the structure of the production functions.

An important aspect of this study has consequently been to investigate wether any systematic differences could be discovered in the forms of the relationships between different types of inputs and outputs. Such differences could be related to characteristics of the input items themselves or to characteristics of the producing or receiving sectors.

## II. The data

The basic data for this investigation are provided by Norwegian input-output accounts in fixed 1955-prices for 89 production sectors for each of the years 1949-1960, althogether 12 years. The same data have also been utilized in several other investigations under the same research project[1].

This is not the place for a full description of the basic statistical data and the methods of prosessing of these data, which culminated in the series of input-output accounts in fixed prices[2].

However, it should be emphasized that the national accounts figures are the results of a rather extended system of processing of a body of primary statistical observations, which, even though it maintains high standards in regard to coverage and quality, is by far not comprehensive and consistent througout. Errors in reporting and mechanical as well as judgement errors in the various stages of processing may have affected all the elements in the input-output accounts. The precision in the data probably varies both with rows and colums in the input-output table. Due to scarcity of statistics it is probable that the greatest margins of error are to be found in the figures for inputs to and outputs from some of the service sectors. A particular problem is the question of consistency over time in the observations and their processing.

The expansion and general improvement of the Norwegian statistical system over the period must have had conciderable effects on the precision of the figures and may at the same time have impaired their comparability over time.

One particular source of variations in input-output proportions appears to be shifts in the designation of the production sector of origin for a given type of input.

The various types of error may have contributed to obscuring possibly stable relationships between inputs and outputs in the production sectors, but the estimation procedure may also have tended to introduce stable proportions where in reality there are none. The latter type of error may in particular have occurred at stages where human judgement comes into the process of estimation.

For each of the 89 production sectors we have for each year figures for gross production

1) See for instance: Per Sevaldson: "The Stability of Input-Output Coefficients" in "Applications of Input-Output Analysis" Eds. A.P. Carter and A. Brody. Amsterdam, London 1969. Also as "Artikler" No. 32 from the Central Bureau of Statistics of Norway.
- "Substitution and Complementarity Effects on Input-Output Ratios" Working Papers from the Central Bureau of Statistics of Norway, IO 69/14. Mimeographed, Oslo 1969.
- "Studies in the Stability of Input-Output Relationships. Effects of Aggregation and Changes in Coefficients on the Result of Input-Output Analysis" Working Papers from the Central Bureau of Statistics of Norway. IO 72/6. Mimeographed, Oslo 1972.

2) A relatively detailed description is given in "National Accounts 1865-1960", Central Bureau of Statistics, Oslo 1965.
See also Thomas Schiøts: "The use of Computers in the National Accounts of Norway". The Review of Income and Wealth, No. 4, Dec. 1966.
and
Erik Homb: Calculation of National Accounts at Constant Prices in Norway. Mimeographed note. Central Bureau of Statistics of Norway. Oslo 1967.

including intrasector deliveries (registered deliveries between establishments within the same production sector), intrasector inputs, inputs from each of the other production sectors and inputs from each og 62 "import sectors"[1] all in fixed 1955 purchasers' prices. As the difference between gross production and the sum of all inputs we also have value added at 1955-prices for each sector.

For each of the commodity producing sectors trade margins on its products was registered as an input from the sector Trade. By deducting the value of this input from the gross production value at purchasers' prices we obtained gross production value at producers' prices.

Since the size of trade margins were believed to depend on the use of the products, and since the distribution of the products of a sector over its various uses may vary from one year to the next, the sum of trade margins on total sector output was belived to be an unstable element in gross production at purchasers' prices, and consequently gross production at producers' prices was chosen as a measure of sector output.

Four of the production sectors are dummy sectors for the redistribution of unallocated items and 6 sectors had no inputs in the observation period, so that value added and gross production were identical. This left us with 79 sectors for which the relationships between inputs (at 1955-purchasers' prices) and gross production (at 1955 producers' prices) could be studied.

These sectors received inputs from 71 Norwegian production sectors and from 55 import sectors. Each import sector except one ("invisible imports") functions as a distributor of import goods corresponding to the products of one particular Norwegian sector. In addition there is for each of the 79 sectors an input item for value added.

The list of sectors is given in appendix tables I and II.

Our data for the 79 production sectors include about 1500 input items (including value added). However, some of these are very small and therefore subject to large relative changes due to arbitrary causes, like rounding and balancing adjustments. As a consequence all input items which were less than 2 per cent of gross production in the receiving sector in all years, and which were also less than 1 per cent of gross production in at least one year, are lumped together into one item ("small unspecified") for each sector. These input items, 75 in total, are not analysed in the same detail as the others.

There remaines then 477 specified input items, 79 gross value added items and the 75 small unspecified items.

Since the gross value added items are the difference between gross production and input sum for each sector, they are not entirely independent of the sepcified input items.

In the sequel we shall consider the 477 specified input items as a reference group, and compare the results for specific subgroups or combinations of input items with the results for this group.

Each of the 477 specified input items is charasterized by sector of origin and by receiving sector.

These items have been grouped according to wether the sector of origin was a Norwegian production sector or an import sector, and each of these two groups have been further subdivided in the following way:

When a receiving sector used inputs from both a Norwegian sector and the corresponding import sector, these inputs were classified as competitive, all other inputs were considered to be non-competitive. Accordingly we get a subsivision of specified inputs from Norwegian sectors into competitive and non-competitive and also a subdivision of sepcified inputs from import sectors into competitive and non-competitive. It should be noted that input deliveries from the same sector may be classified as competitive in some receiving sectors and non-competitive in others. Since the classification into competitive and non-competitive inputs was made on the basis of all the about 1500 input items, there is not one specified competitive imported input item for each specified competitive domestic input item or vice versa. (There are 86 cases where both domestic and corresponding imported inputs to a sector are large enough to be specified).

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1) Imported commodities grouped according to the assumed sector of production (in the country of production).

We get the following groups:

| | |
|---|---|
| Norwegian, competitive: | 161 input items |
| Norwegian, non-competitive: | 153 input items |
| Imports, competitive: | 137 input items |
| Imports, non-competitive: | 26 input items |
| Total specified | 477 input items |

On the basis of the specified and unspecified input items in each receiving sector we also formed the following aggregates:

The sum was formed of each item of Norwegian competitive input and the corresponding imports, competitive input when this sum was above 1 per cent of gross production in the receiving sector in all years or above 2 per cent in at least one year. This group of input items was calles "competitive inputs combined". There were 225 of these items.

The sum of all input items which were believed to contribute to the supply of energy in each receiving sector, were taken and termed "fuels combined". There were 53 of these items.

Inputs for which the sum of corresponding Norwegian and imported inputs in at least one year was above 10 per cent of gross production in the receiving sector were termed principal inputs. For each receiving sector the sum of each principal input (if any) and those inputs which were believed to be close substitutes for it was taken and these sums were termed "substitution groups". There were 53 such items.

For each sector the sum of all imports was taken. There were 68 "import sums".

Our data thus consists of input and corresponding output observations over the 12 year period 1949-1960 for the following 10 groups of inputs which we shall refer to as "basic groups".

| | |
|---|---|
| Norwegian, competitive: | 161 items |
| Norwegian, non-competitive: | 153 items |
| Imports, competitive: | 137 items |
| Imports, non-competitive: | 26 items |
| Competitive inputs combined: | 225 items |
| Fuels combined: | 53 items |
| Substitution groups: | 53 items |
| Import sums: | 68 items |
| Gross value added: | 79 items |
| Small unspecified: | 75 items |
| Total | 1 030 items |

Of these the four first groups will usually also be combined to the reference group of "all specified inputs". Since the Fuels combined items may be considered as special cases of substitution groups they have in som tables been merged with Substitution groups. And in some tables Imports, competitive and Imports, non-competitive are treated together as Imports. In this way it has been possible to obtain somewhat higher absolute frequencies than when all groups are treated separately.

It should be realized that all the other groups, except the group of value added items, are sums of items picked in various ways from the four groups of specified input items and from the group of small unspecified; and the value added items are related to the sum of all specified and unspecified items (as their complement in total production). As a consequence of this it does not make sense to combine all the 1 030 items into one large reference group. The various basic groups are kept apart throughout the analysis, with the exception already mentioned.

All or some of the basic groups may also be subdivided according to additional criteria, which make it possible to investigate if the outcome of the testing procedure varies between groups and subgroups. Such variations may give indications about the causes of differences in test results between individual input items.

In general the input items were classified according to characteristics of the input item itself, its sector of origin or the sector receiving it.

The characteristics of the input items, which are analysed are the following:

1) Characteristics of the input item itself:
   a) Basic group (i.e. Norwegian, competitive, etc.)
   b) Size of the input item i) in per cent of gross production in the receiving sector
      ii) in million kroner (at fixed 1955-prices)
      iii) in per cent and in million kroner simultaneously
   c) Type of input, i.e. whether the input was direct materials, auxiliary materials, packaging materials or services.
2) Charasteristics of the delivering sector:
   a) A full specification of all the individual sectors of origin
   b) Delivering sectors characterized by type as "extractive and service producing" or "commodity processing"
   c) Delivering sectors characterized by the number of specified deliveries.
3) Characteristics of the receiving sector:
   a) Type, i.e. "extractive and service", "commodity producing" or "unspecified".
   b) Size of average production value (in million 1955-kroner).
   c) Dispersion of production in relation to size of production.
   d) Existence or non-existence of a trend in production.
   e) Dispersion and trend combined.
   f) Number of specified input items.

## III. The computations

The variables were run through a computer program for least squares linear regressions. The program could handle up to 12 variables (dependent and independent) together, so that variables had to be grouped in twelves or smaller groups, each group including as the three first items the "independent" variables: $x_j(t)$, $t$ and $t \cdot x_j(t)$ respectively, and $x_{ij}(t)$ for eight i's as the remaining eight variables.

The program did not compute regressions without constant terms and did not compute any measure of serial correlation, like the Durbin-Watson statistic.

On the basis of an a priori assumption that all relationships between inputs and outputs are special cases of the form:

$$x_{ij}(t) = a_{ij} + b_{ij}x_j(t) + c_{ij}t + d_{ij}tx_j(t) + u_{ij}(t)$$

our problem was to test if some of the coefficients were zero.

By the program we could compute least squares estimates for the basic form

$$x_{ij}(t) = \alpha_{ij} + \beta_{ij}x_j(t) + \gamma_{ij}t + \delta_{ij}tx_j(t)$$

and the alternatives:

$$x_{ij}^{\alpha\beta}(t) = \alpha_{ij}^{\alpha\beta} + \beta_{ij}^{\alpha\beta}x_j(t)$$

$$x_{ij}^{\alpha\beta\delta}(t) = \alpha_{ij}^{\alpha\beta\delta} + \beta_{ij}^{\alpha\beta\delta}x_j(t) + \delta_{ij}^{\alpha\beta\delta}tx_j(t)$$

$$x_{ij}^{\alpha\beta\gamma}(t) = \alpha_{ij}^{\alpha\beta\gamma} + \beta_{ij}^{\alpha\beta\gamma}x_j(t) + \gamma_{ij}^{\alpha\beta\gamma}t$$

We wanted to use the results to test the hypotheses that some of the coefficients in the basic form are zero.

The results of such tests will depend on two types of choises:

a) the test criteria chosen and

b) the order in which the various tests are applied.

a. Test criteria

The test criteria were choosen so that, assuming the residual error to be normally distributed with zero mean, constant variance and no serial correlation, and ignoring the problems of applying a succession of test criteria, a hypothesis which is considered to confirm Leontief's theory runs a risk of being rejected in one out of 100 cases where it is correct ("the 1% level"), whereas a hypothesis which is considered to contradict Leontief's theory has a chance of being rejected in one of 20 cases where it is correct ("the 5% level"). Only hypotheses implying $b_{ij} = d_{ij} = 0$ were considered to contradict Leontief's theory in this connection. (We did not distinguish between positive and negative values of $b_{ij}$ in the testing procedure.)

b. The order of testing

The tests were applied in the following order:

(1) $a_{ij} = c_{ij} = d_{ij} = 0$ i.e. $x_{ij}(t) = b^{b}_{ij}x_j(t) + u^{b}_{ij}(t)$

If (1) was rejected at the 1% level, test

(2) $a_{ij} = c_{ij} = 0$ i.e. $x_{ij}(t) = b^{bd}_{ij}x_j(t) + d^{bd}_{ij}tx_j(t) + u^{bd}_{ij}(t)$

If (2) was rejected at the 1% level, test

(3) $b_{ij} = c_{ij} = d_{ij} = 0$ i.e. $x_{ij}(t) = a^{a}_{ij} + u^{a}_{ij}(t)$

If (3) was rejected at the 5% level, test

(4) $c_{ij} = d_{ij} = 0$ i.e. $x_{ij}(t) = a^{ab}_{ij} + b^{ab}_{ij}x_j(t) + u^{ab}_{ij}(t)$

If (4) was rejected at the 1% level, test

(5) $b_{ij} = d_{ij} = 0$ i.e. $x_{ij}(t) = a^{ac}_{ij} + c^{ac}_{ij}t + u^{ac}_{ij}(t)$

If (5) was rejected at the 5% level we accepted

$$x_{ij}(t) = a_{ij} + b_{ij}x_j(t) + c_{ij}t + d_{ij}tx_j(t) + u_{ij}(t)$$

It sholud be emphasized that both the test criteria and the order of testing are biased in the direction of favouring the Leontief theory. We wanted to find out whether the data indicated a need for modifications in our chosen basic hypothesis, not to use the data to choose a best fit. The order of testing, in particular, was important for the outcome. Had we chosen to start with testing the hypothesis (3) $b_{ij} = c_{ij} = d_{ij} = 0$ instead of (1) $a_{ij} = c_{ij} = d_{ij} = 0$, the results would have been different. Trying this reversed testing order, it turned out that we would have been led to reject the Leontief theory (e.i. put $b_{ij} = d_{ij} = 0$) in about 1/3 of all the cases instead of in only 1 per cent, as we will with the chosen ordering of the tests. (Compare tables 1a and 1b, 2a and 2b).

Table 1a. Forms of the regressions of inputs on outputs for basic categories of inputs. Numbers of input items.

| Form of regression | Norwegian, competitive | Norwegian, non-competitive | Imports, competitive | Imports, non-competitive | All specified inputs | Competitive inputs combined | Fuels combined | Substitution groups | Import sums | Gross value added | Small unspecified |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Proportional, no trend ....... | 107 | 87 | 96 | 16 | 306 | 147 | 33 | 30 | 45 | 48 | 51 |
| Proportional, trend .......... | 43 | 49 | 32 | 9 | 133 | 67 | 13 | 19 | 16 | 20 | 17 |
| Proportional, total .......... | 150 | 136 | 128 | 25 | 439 | 214 | 46 | 49 | 61 | 68 | 68 |
| | | | | | | | | | | | |
| Linear, positive, no trend ... | 3 | 3 | 3 | - | 9 | 1 | 1 | 1 | 2 | 5 | 2 |
| Linear, positive, trend ...... | 1 | 2 | 2 | 1 | 6 | 1 | 1 | 1 | 3 | 3 | - |
| Linear, positive, total ...... | 4 | 5 | 5 | 1 | 15 | 2 | 2 | 2 | 5 | 8 | 2 |
| | | | | | | | | | | | |
| Linear, negative, no trend ... | 3 | 3 | 1 | - | 7 | 1 | 3 | - | - | 1 | 1 |
| Linear, negative, trend ...... | 3 | 5 | 3 | - | 11 | 6 | 1 | 1 | 1 | 1 | 1 |
| Linear, negative, total ...... | 6 | 8 | 4 | - | 18 | 7 | 4 | 1 | 1 | 2 | 2 |
| | | | | | | | | | | | |
| Independent, no trend ........ | - | 1 | - | - | 1 | - | 1 | - | - | - | 2 |
| Independent, trend ........... | 1 | 3 | - | - | 4 | 2 | - | 1 | 1 | 1 | 1 |
| Indenpendent, total .......... | 1 | 4 | - | - | 5 | 2 | 1 | 1 | 1 | 1 | 3 |
| | | | | | | | | | | | |
| Total ...................... | 161 | 153 | 137 | 26 | 477 | 225 | 53 | 53 | 68 | 79 | 75 |

Table 1b. Forms of the regressions of inputs on outputs for basic categories of inputs. Numbers of input items. Changed order of testing.

| Form of regression | Norwegian, competitive | Norwegian, non-competitive | Imports, competitive | Imports, non-competitive | All specified inputs | Competitive inputs combined | Fuels combined | Substitution groups | Import sums | Gross value added | Small unspecified |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Proportional, no trend ...... | 49 | 61 | 38 | 11 | 159 | 86 | 21 | 28 | 27 | 42 | 35 |
| Proportional, trend ......... | 35 | 36 | 30 | 8 | 109 | 55 | 8 | 17 | 15 | 19 | 15 |
| Proportional, total ......... | 84 | 97 | 68 | 19 | 268 | 141 | 29 | 45 | 42 | 61 | 50 |
| | | | | | | | | | | | |
| Linear, no trend ............ | 6 | 6 | 4 | - | 16 | 2 | 4 | 1 | 2 | 6 | 3 |
| Linear, trend ............... | 4 | 7 | 5 | 1 | 17 | 7 | 2 | 2 | 4 | 4 | 1 |
| Linear, total ............... | 10 | 13 | 9 | 1 | 33 | 9 | 6 | 3 | 6 | 10 | 4 |
| | | | | | | | | | | | |
| Independent, no trend ....... | 66 | 40 | 60 | 6 | 172 | 73 | 18 | 4 | 19 | 7 | 20 |
| Independent, trend .......... | 1 | 3 | - | - | 4 | 2 | - | 1 | 1 | 1 | 1 |
| Independent, total .......... | 67 | 43 | 60 | 6 | 176 | 75 | 18 | 5 | 20 | 8 | 21 |
| | | | | | | | | | | | |
| Total ...................... | 161 | 153 | 137 | 26 | 477 | 225 | 53 | 53 | 68 | 79 | 75 |

Table 2a. Forms of the regressions of inputs on outputs for basic categories of inputs. Percentage distributions.

| Form of regression | Norwegian, competitive | Norwegian, non-competitive | Imports, competitive | Imports, non-competitive | All specified inputs | Competitive inputs combined | Fuels, combined | Substitution groups | Import sums | Gross value added | Small unspecified |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Proportional, no trend ....... | 66.5 | 56.9 | 70.1 | 61.6 | 64.2 | 65.3 | 62.3 | 56.6 | 66.2 | 60.8 | 68.0 |
| Proportional, trend .......... | 26.7 | 32.0 | 23.4 | 34.6 | 27.9 | 29.8 | 24.5 | 35.8 | 23.5 | 25.3 | 22.7 |
| Proportional, total .......... | 93.2 | 88.9 | 93.5 | 96.2 | 92.1 | 95.1 | 86.8 | 92.4 | 89.7 | 86.1 | 90.7 |
| Linear, positive, no trend ... | 1.9 | 2.0 | 2.2 | - | 1.9 | 0.5 | 1.9 | 1.9 | 2.9 | 6.3 | 2.7 |
| Linear, positive, trend ...... | 0.6 | 1.3 | 1.4 | 3.8 | 1.2 | 0.4 | 1.9 | 1.9 | 4.4 | 3.8 | - |
| Linear, positive, total ...... | 2.5 | 3.3 | 3.6 | 3.8 | 3.1 | 0.9 | 3.8 | 3.8 | 7.3 | 10.1 | 2.7 |
| Linear, negative, no trend ... | 1.8 | 1.9 | 0.7 | - | 1.5 | 0.4 | 5.6 | - | - | 1.3 | 1.3 |
| Linear, negative, trend ...... | 1.9 | 3.3 | 2.2 | - | 2.3 | 2.7 | 1.9 | 1.9 | 1.5 | 1.2 | 1.3 |
| Linear, negative, total ...... | 3.7 | 5.2 | 2.9 | - | 3.8 | 3.1 | 7.5 | 1.9 | 1.5 | 2.5 | 2.6 |
| Independent, no trend ........ | - | 0.6 | - | - | 0.2 | - | 1.9 | - | - | - | 2.7 |
| Independent, trend ........... | 0.6 | 2.0 | - | - | 0.8 | 0.9 | - | 1.9 | 1.5 | 1.3 | 1.3 |
| Independent, total ........... | 0.6 | 2.6 | - | - | 1.0 | 0.9 | 1.9 | 1.9 | 1.5 | 1.3 | 4.0 |
| Total ........................ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Of these: without trend ...... | 70.2 | 61.4 | 73.0 | 61.6 | 67.7 | 66.2 | 71.7 | 58.5 | 69.1 | 68.4 | 74.7 |
| with trend ......... | 29.8 | 38.6 | 27.0 | 38.4 | 32.3 | 33.8 | 28.3 | 41.5 | 30.9 | 31.6 | 25.3 |

Table 2b. Forms of the regressions of inputs on outputs for basic categories of inputs. Percentage distributions. Changed order of testing.

| Form of regression | Norwegian, competitive | Norwegian, non-competitive | Imports, competitive | Imports, non-competitive | All specified inputs | Competitive inputs combined | Fuels combined | Substitution groups | Import sums | Gross value added | Small unspecified |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Proportional, no trend ....... | 30.5 | 39.9 | 27.7 | 42.3 | 33.4 | 38.2 | 39.7 | 52.8 | 39.8 | 53.2 | 46.7 |
| Proportional, trend .......... | 21.7 | 23.5 | 21.9 | 30.8 | 22.8 | 24.5 | 15.1 | 32.1 | 22.0 | 24.0 | 20.0 |
| Proportional, total .......... | 52.2 | 63.4 | 49.6 | 73.1 | 56.2 | 62.7 | 54.8 | 84.9 | 61.8 | 77.2 | 66.7 |
| Linear, no trend ............. | 3.7 | 3.9 | 2.9 | - | 3.3 | 0.9 | 7.5 | 1.9 | 5.9 | 7.6 | 4.0 |
| Linear, trend ................ | 2.5 | 4.6 | 3.7 | 3.8 | 3.6 | 3.1 | 3.8 | 3.8 | 2.9 | 5.0 | 1.3 |
| Linear, total ................ | 6.2 | 8.5 | 6.6 | 3.8 | 6.9 | 4.0 | 11.3 | 5.7 | 8.8 | 12.6 | 5.3 |
| Independent, no trend ........ | 41.0 | 26.1 | 43.8 | 23.1 | 36.1 | 32.4 | 33.9 | 7.5 | 27.9 | 8.9 | 26.6 |
| Independent, trend ........... | 0.6 | 2.0 | - | - | 0.8 | 0.9 | - | 1.9 | 1.5 | 1.3 | 1.4 |
| Independent, total ........... | 41.6 | 28.1 | 43.8 | 23.1 | 36.9 | 33.3 | 33.9 | 9.4 | 29.4 | 10.2 | 28.0 |
| Total ........................ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.o | 100.0 |

## PART B. METHODOLOGICAL PROBLEMS

Two aspects of the present investigation raise methodilogical problems to which there are no easy standard solutions. One set of problems relate to the multiple testing procedure used in sifting our data through a process of successive tests. The other relate to the fact that we are interested not in a few individual regression studies, but in a statistical population of such studies. The latter aspect means that we face a problem of statistical analysis of the results of statistical analysis. The results of our computations and groupings of the data are in a way straightforward, and may be studied in part C of this publication. However, for a full understanding and interpretation of the general implications of our results, it is necessary to understand and appreciate the strengths as well as the limitations and biases implied by our methods.

The chapters of the present part, (Ch. IV to IX) are the author's somewhat pedestrian efforts to work his way through the various problems of interpreting and assessing the power of the methods employed. There did not seem to be more readily available standard methods at hand. Those who find these chapters too cumbersome or boring, may still be interested in the numerical results in part C.

### IV. The test

The tests that we used are based on methods for testing composite hypotheses in regression models.[1)]

We have an "unrestricted" model

A $$y_t = a_1x_{1t} + a_2x_{2t} + \ldots\ldots + a_nx_{nt} + u_t$$

and a "restricted" model

B $$y_t = a_1x_{1t} + a_2x_{2t} + \ldots\ldots + a_{n-k}x_{n-k,t} + u_t$$

i.e. $a_{n-k+1} = a_{n-k+2} = \ldots\ldots = a_n = 0$

$x_{it}$ = independent variable no. i in period t, measured from its average
$i = 1,2,\ldots,n;\ k<n;\ t=1,2,\ldots,T$

$y_t$ = dependent variable, in period t, measured from its average.

$u_t$ = residual terms

$\Sigma_t\ \hat{u}_t^2$ = least squares estimate of $\Sigma_t\ u_t^2$ according to A

$\Sigma_t\ \hat{\hat{u}}_t^2$ = least squares estimate of $\Sigma_t\ u_t^2$ according to B

Then, if the "restricted" model, B, is correct, and if $u_t$ is normally distributed around zero, with a finite variance and no serial correlation, independent of $x_{it}$ the statistic

$$F_{k,T-n-1} = \frac{\Sigma_t\ \hat{\hat{u}}_t^2 - \Sigma_t\ \hat{u}_t^2}{\Sigma_t\ \hat{u}_t^2} \cdot \frac{T-n-1}{k}$$

will be distributed according to the F-distribution, with k and T-n-1 degrees of freedom.

Substituting the multiple correlation coefficients, R and R' calculated on the basis of the unrestricted and the restricted models respectively we obtain:

$$F_{k,T-n-1} = \frac{(1-R'^2) - (1-R^2)}{1-R^2} \cdot \frac{T-n-1}{k} = \frac{R^2 - R'^2}{1-R^2}\ \frac{T-n-1}{k}$$

---

1) See e.g. J. Johnston "Econometric Methods", New York 1960.

The variables in the models above are measured from their means, and the model equations have no constant terms. When it is of interest also to test the constant, the variables may be measured from the origin (zero) and the constant may be included in (one or both of) the model equations. The constant term, $a_o$, is just like all the other parameters and can be tested (or not tested) jointly with other parameters. No special treatment is required.

The steps in the testing program are described in detail in Appendix A.

## V. Discussion of the testing procedure

Our test program has no test for serial correlation in the variables and this is a rather serious short-coming with this type of data.

We must also consider the implication of applying our test criteria successively, as a set of grids, through which the cases are sifted. We are concerned with the probability of rejecting a hypothesis when it is correct ("errors of the first kind") and the probability of not rejecting a hypothesis when it is wrong ("errors of the second kind").

In going from one hypothesis to the next we in some cases go from a more comprehensive, e.g. a=c=d=0, to a less comprehensive, e.g. a=c=0, in the sense that the latter hypothesis is always true if the former is true, but the latter may also be true if the former is wrong. In other cases we do not have these simple relationships between the hypotheses. Let us first consider the step from one hypothesis (A) to a less comprehensive (B) in the above sense: e.g. from a=c=d=0 to a=c=0. This test is performed by computing the test statistic, $F_{3.8}$, which is such that when the more comprehensive hypothesis, (A), is correct, and under the adopted assumptions, the probability that the computed F-statistic shall have a value above a given limit, ($F_{3.8} = 7.59$), is 0.01 and when the hypothesis is wrong the probability that the computed F-statistic shall have a value above this limit is "as great as possible". The more comprehensive hypothesis is then rejected for those cases where the computed F-statistic is above the given limit.

For those cases for which the more comprehensive hypothesis is rejected, the less comprehensive hypothesis, (B), is tested. A new test statistic, $F_{2.8}$, is now computed, which is such that if the less comprehensive hypothesis, (B), is correct, and under the adopted assumptions, the probability is 0.01 that $F_{2.8}$ will have a value above a given limit, ($F_{2.8} = 8.65$), and when the hypothesis is wrong, the probability that this test statistic shall have a value above this limit is "as great as possible".

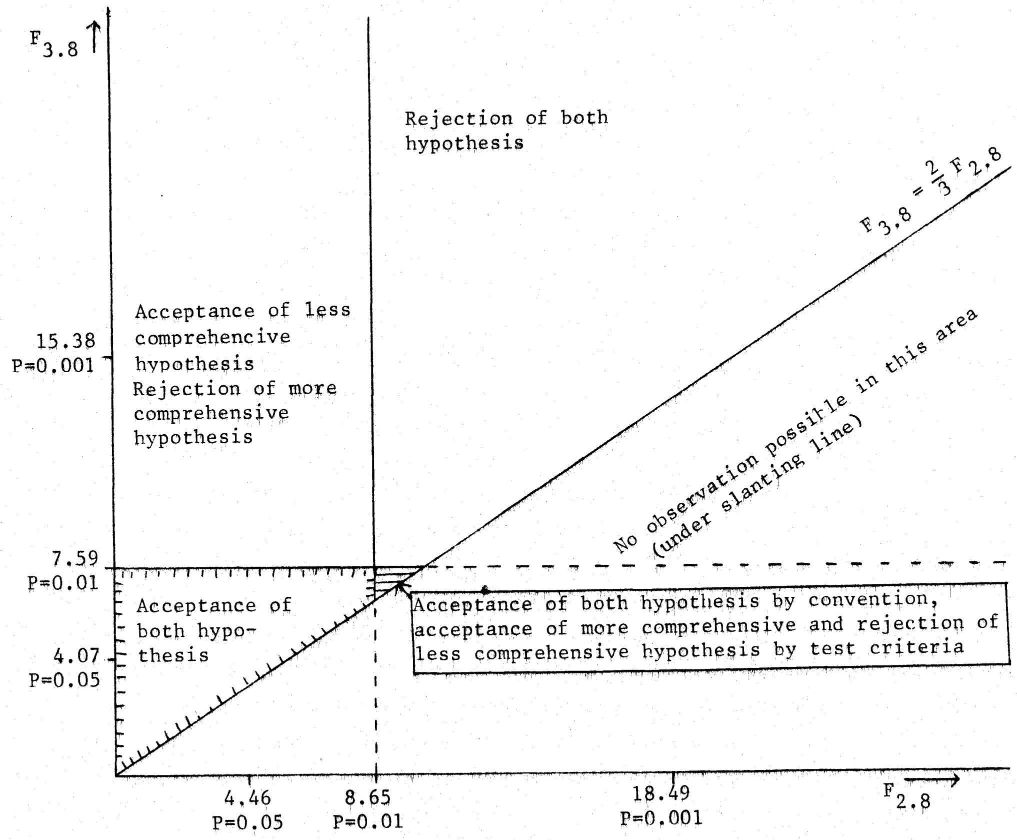
It can be shown that the value of the former test statistic ($F_{3.8}$) must be equal to or above two thirds of the value of the latter for a given observation and that equality is not excluded. (See Appendix B). However, the critical values of the former are up to 90 per cent of the corresponding value of the latter for given probability levels. This implies that we could obtain values of the F-statistics which led us to accept (not reject) the more comprehensive hypothesis, (A), but to reject the less comprehensive one, (B). This, of course, is a peculiarity of the test, and we will in the following maintain the more logical conclusion, that if the more comprehensive hypothesis is not rejected, we assume eo ipso that the less comprehensive hypothesis has also not been rejected.

The consequence of this use of the test will be:

a) The probability of rejecting the more comprehensive hypothesis when it is correct is 0.01.
b) The probability of accepting the more comprehensive hypothesis when it is wrong is as small as possible, given a).
c) The probability of rejection both hypotheses when at least the less comprehensive is correct is somewhat less than 0.01.
d) The probability of accepting the less comprehensive hypothesis when both are wrong, is as small as possible, given the probability level under c), but not necessarily quite as small as it might have been had the probability level under c) been 0.01.

The situation may be illustrated by the following diagram:

Diagram 1. Relations between values of the test statistics $F_{3.8}$ and $F_{2.8}$ and the decision rules adopted for acceptance and rejection of the more and less comprehensive hypothesis.[1)]




1) P = probability of obtaining corresponding F-value when hypothesis is correct.

For some tests we do not apply the same probability level for the more comprehensive as for the less comprehensive hypotheses. We use a test by which the more comprehensive hypothesis (under given conditions) would be rejected in 5 per cent of the cases when it is correct, but the less comprehensive hypothesis is tested by a procedure which would lead to rejection in only one per cent of the cases if it is correct. In this case the critical value of the test statistic for the more comprehensive hypothesis ($F_{3.8}$) is less than half the critical value of the test statistic for the less comprehensive hypothesis, ($F_{2.8}$), and the latter will never be rejected if the former is accepted.

When the hypotheses are not related in this simple way, the situation is more complicated, also in the interpretation of test results:

Let us consider two hypotheses A and B. (e.g. A: $a_{ij} = c_{ij} = 0$) and B: $b_{ij} = d_{ij} = 0$ in our basic form. (We assume our hypotheses to be mutually exclusive, so that not both can be valid simultaneously, but they may both be invalid.) For each of them we compute and apply a test statistic in the usual way, with a level of 0.01. The values which can be obtained for these test statistics may be conceptually related, e.g. so that one will always be in excess of or smaller than a certain fraction of the other, or so that the possible differences between their values are limited. In our reasoning we will to some extent abstract form any such dependencies.

Suppose that hypothesis A is correct and B is wrong, and that we apply the test statistic for A first. For in the average 1 out of 100 cases we will still reject hypothesis A.

Wether we now accept or reject B for the cases where A has been rejected is not very important, since both the conclusions: "A is wrong and B is right" and "A and B are both wrong" are erroneous. There is a 1 per cent chance that our test procedure will lead us to an erroneous conclusion. If we assume that the probability of accepting B when A is correct is $P_B^A$ and independent of the test statistic for A[1], then the probability of rejecting A and accepting B will be 0.01 $P_B^A$ and the probability of rejecting both A and B will be 0.01 $(1 - P_B^A)$.

Now suppose A is wrong and B is right. It is now an unknown probability that our test criterion for A will lead us to accept A. We know about this probability that it is as small as possible, under the condition that the same test criterion shall only lead us to reject A in 1 out of 100 cases when it is correct. We term this probability $P_A^B$. If we apply the test criterion for B, irrespective of the outcome in regard to A, we will accept B for 99 out of 100 cases and reject it for 1.

What are now the probabilities that we will:

1) accept A
2) reject A and accept B
3) reject both A and B?

if we follow our procedure of first testing A, and testing B only for those cases where A is rejected. We may set up the following diagram for a complete testing scheme and the probabilities for the possible outcomes:

| Probability | | Conclusion | | Probability |
|---|---|---|---|---|
| $P_A^B$ ............. | a) | Accept A and accept B | | } 99/100 (a + d) |
| | b) | Accept A and reject B | } ...... 1/100 (b + c) | |
| | c) | Reject A and reject B | | |
| $P_d^B$ ............. | d) | Reject A and accept B | | |

($P_A^B$ covers a) and b).)

Here a) + b) with the probability $P_A^B$ corresponds to conclusion 1) in our testing procedure. c) with an unknown probability corresponds to conclusion 3) and d) with the unknown probability $P_d^B$ corresponds to conclusion 2) in the testing procedure. Thus the probability that we shall arrive at the correct conclusion, d, is $P_d^B$, and we kvow that $1 - P_A^B \geq P_d^B \geq 1 - P_A^B - 0.01$. If the test statistic for B is entirely independent of the outcome for A, $P_d^B = 0.99\ (1 - P_A^B)$ and the probability of arriving at an erroneous conclusion will be $(1 - P_d^B) = 0.01 + 0.99\ P_A^B$. If the test statistics are not independent, the two last expressions must be replaced by expressions in $P_A^B$ which must be between limits which are only .01 apart, and thus, wether the test statistics are dependent or independent the probability of arriving at a correct conclusion will primarily depend on the size of $P_A^B$. $P_A^B$ may be expected to be great when hypothesis A is "not far from being correct" (coefficients near zero). Furthermore, there may be dependencies between the test statistics, in such a way that $P_A^B$ is large, i.e. the probabilities for errors of the second kind for hypothesis A is large, when B is correct.

Now let us suppose that both A and B are wrong and let us term the correct hypothesis C. With the appropriate notation our scheme will now be:

| Probability | | | | Probability |
|---|---|---|---|---|
| $P_A^C$ ............. | b) | Accept A and reject B | | |
| | a) | Accept A and accept B | } ...... | $P_B^C$ |
| $P_d^C$ | d) | Reject A and accept B | | |
| $P_c^C$ | c) | Reject A and reject B (i.e. accept C) | | |

($P_A^C$ covers b) and a); $P_B^C$ covers a) and d).)

The probability of arriving at the correct conclusion, c, is $P_c^C$, but now we have

$$\text{Min. } (1 - P_B^C,\ 1 - P_A^C) \geq P_c^C \geq \max\ (1 - P_A^C - P_B^C,\ 0)$$

1) This assumption of independence is perhaps not very realistic, but it is also not very important for the following reasoning and conclusions.

where min (a,b) means the smallest of a and b, and max (a, b) means the largest of a and b.

If the two test statistics are entirely independent

$$P_c^C = (1-P_A^C)(1-P_B^C)$$

When there is dependency between the test statistics for A and B, $P_c^C$ may approach one of the boundaries. In this case we could write $P_c^C = (1-p_A^C)(1-P_B^{C*})$, where $P_B^{C*}$ is the probability of obtaining both a test statistic for A which leads to rejection of A and a test statistic for B which leads to acceptance for B, when C is correct. We may have $P_B^{C*} \neq P_B^C$, but if $P_B^C$ is small $P_B^{C*}$ must be close to $P_B^C$ and if $P_A^C$ is large, $P_c^C$ will be small irrespective of the size of $P_B^{C*}$. Thus we may still maintain that the size of $P_c^C$ is decisively depending on $P_A^C$ and $P_B^C$.
As an illustration we have:

if $P_A^C = P_B^C = 0.25$, $P_c^C = 0.56$ under independency, and generally $0.75 \geq P_c^C \geq 0.50$
if $P_A^C = P_B^C = 0.5$, $P_c^C = 0.25$ under independency, and generally $0.50 \geq P_c^C$
if $P_A^C = P_B^C = 0.75$, $P_c^C = 0.06$ under independency, and generally $0.25 \geq P_c^C$

The probability that we in this case erroneously shall accept hypothesis A is $P_A^C$, that we shall accept B (after having rejected A) is $P_d^C$, which assuming independency between the tests will be

$$P_d^C = (1-P_A^C) \cdot P_B^C < P_B^C \qquad \text{and generally} \qquad P_d^C \leq P_B^C$$

Thus, if $P_A^C$ and $P_B^C$ are equal, our testing procedure is partial in favour of erroneously classifying cases as confirmation of hypothesis A rather than of B, when both hypothesis A and B are wrong. The chances of identifying the cases where both A and B are wrong, may become rather slim, if $P_A^C$ and $P_B^C$ are of some magnitude.

If we add still another hypothesis, D, to our link of testing, our chances of identifying cases where all the three hypotheses, A, B and C are wrong and D right will be even smaller. If the third hypothesis is C, with probability for error of the second kind - when D is right and both A, B and C are wrong - $P_C^D$, then our probability of identifying a case where hypothesis D is right and the others wrong, $P^D$, must satisfy:

$$\min(1-P_A^D,\ 1-P_B^D,\ 1-P_C^D) \geq P^D \geq \mathrm{MAX}\ (1-P_A^D - P_B^D - P_C^D,\ 0)$$

and in the case of independency between the test statistics:

$$P^D = (1-P_A^D)(1-P_B^D)(1-P_C^D)$$

and when there is dependency, $P^D$ may approach one of the boundaries. This result would now give:

if $P_A^D = P_B^D = P_C^D = 0.25$, $P^D = 0.422$ under independency, and generally
$0.75 \geq P^D \geq 0.25$
if $P_A^D = P_B^D = P_C^D = 0.50$, $P^D = 0.125$ under independency, and generally $0.50 \geq P^D$
if $P_A^D = P_B^D = P_C^D = 0.75$, $P^D = 0.016$ under independency, and generally $0.25 \geq P^D$

For the tests in our study we may stipulate:
Hypothesis

A: $a_{ij} = c_{ij} = d_{ij} = 0$, test level 0.01

B: $a_{ij} = c_{ij} = 0$ , test level 0.01

C: $b_{ij} = c_{ij} = d_{ij} = 0$, test level 0.05

D: $c_{ij} = d_{ij} = 0$ , test level 0.01

E: $b_{ij} = d_{ij} = 0$ , test level 0.05

F: A, B, C, D and E are all wrong,
where B and D are correct if A is correct
and D and E are correct if C is correct.

We denote by
$P_A^B$, $P_A^C$, $P_B^C$ etc. the probability of accepting A when B is correct and not A, of accepting A when C is correct, of accepting B when C is correct, etc. $\beta^A$, $\beta^B$ $\beta^C$ etc. the probability of accepting A and rejecting B, when A is correct, of accepting A and rejecting B when B is correct, of accepting A and rejecting B when C is correct etc. (In our case $\beta^A$ will also be the probability of rejecting A and accepting B when A is correct.)

Apart from the relationships between A, B and D and between C and D and E we abstract from any dependencies between the tests in so far as they are not decisive for the probabilities $P_A^B$, $P_A^C$, $P_B^C$ etc.

Table A. Specification of probabilities[1)]

| | when A is correct | when B is correct | when C is correct |
|---|---|---|---|
| Probability of: | | | |
| Accepting A .................. | 0.99 | $P_A^B$ | $P_A^C$ |
| Rejecting A and accepting B .. | $\beta^A$ | $0.99-P_A^B+\beta^B$ | $P_B^C-P_A^C+\beta^C$ |
| Rejecting A and B and accepting C .................. | $(0.01-\beta^A)P_C^A$ | $(0.01-\beta^B)P_C^B$ | $0.95(1-P_B^C-\beta^C)$ |
| Rejecting A, B and C and accepting D .................. | $(0.01-\beta^A)(P_D^A-P_C^A)$ | $(0.01-\beta^B)(P_D^B-P_C^B)$ | $0.04(1-P_B^C-\beta^C)$ |
| Rejecting A,B,C and D and accepting E .................. | $(0.01-\beta^A)(1-P_D^A)P_E^A$ | $(0.01-\beta^B)(1-P_D^B)P_E^B$ | $0.01(1-P_B^C-\beta^C)P_E^C$ |
| Rejecting A,B,C,D and E and accepting F .................. | $(0.01-\beta^A)(1-P_D^A)(1-P_E^A)$ | $(0.01-\beta^B)(1-P_D^B)(1-P_E^B)$ | $0.01(1-P_B^C-\beta^C)(1-P_E^C)$ |

| | when D is correct | when E is correct | when F is correct |
|---|---|---|---|
| Probability of: | | | |
| Accepting A .................. | $P_A^D$ | $P_A^E$ | $P_A^F$ |
| Rejecting A and accepting B .. | $P_B^D-P_A^D+\beta^D$ | $P_B^E-P_A^E+\beta^E$ | $P_B^F-P_A^F+\beta^F$ |
| Rejecting A and B and accepting C .................. | $(1-P_B^D-\beta^D)P_C^D$ | $(1-P_B^E-\beta^E)P_C^E$ | $(1-P_B^F-\beta^F)P_C^F$ |
| Rejecting A, B and C and accepting D .................. | $(1-P_B^D-\beta^D)(0.99-P_C^D)$ | $(1-P_B^E-\beta^E)(P_D^E-P_C^E)$ | $(1-P_B^F-\beta^F)(P_D^F-P_C^F)$ |
| Rejecting A,B,C and D and accepting E .................. | $0.01(1-P_B^D-\beta^D)P_E^D$ | $0.95(1-P_B^E-\beta^E)(1-P_D^E)$ | $(1-P_B^F-\beta^F)(1-P_D^F)P_E^F$ |
| Rejecting A,B,C,D and E and accepting F .................. | $0.01(1-P_B^D-\beta^E)(1-P_E^D)$ | $0.05(1-P_B^E-\beta^E)(1-P_D^E)$ | $(1-P_B^F-\beta^F)(1-P_D^F)(1-P_E^F)$ |

1) For explanations, see the text.

In table A we have to some extend abstracted even from the known relationships between A and D and between C and E. However, our main concern is with the probabilities of obtaining the correct test results, that is with the probabilities on the main diagonal in table A. If these probabilities are below the desired levels of .99 for tests A, B and D and .95 for C and E, our next concern is: which hypotheses "get" the extra probabilities for being accepted when they are wrong? Obviously the conclusions, which in this sense will "steal" probability from the correct conclusions in table A will be the probabilities above the main diagonal. Under our hypotheses the sum of the probabilities below the item in the main diagonal in a column of table A cannot exceed .01 and .05 respectively for the two test levels applied. In the table we have allowed for the dependency between the test statistics for A and B and between those for C and D. We have also allowed the possibility of accepting an erroneous hypothesis ($P_A^B$, $P_A^C$, etc.) to depend on which hypothesis is correct. We have, however, not allowed the probability of obtaining a value of the test statistic which implies acceptance for a subsequent test to depend on the value of the test statistics for earlier tests in the testing sequence. As we have indicated earlier, this may influence the results of exact computations, but is not serious as long as we are only interested in identifying the main influences which act on our results. Here we can in any case not obtain numerical estimates for the probabilities which are specified in table A.

We may reasonably assume the β-probabilities to be quite small (Cfr. Diagram 1.). Consequently it is the P-probabilities which occur on and above the main diagonal in table A which will be decisive for the distortions in our results.

Since we are testing here hypothesis that certain sets of coefficients are zero, the probability of not rejecting a given hypothesis when it is correct, must also be the limit towards which the probability of accepting a hypothesis when it is not correct moves as the non-zero coefficients in the set move towards zero. This implies that we generally have a greater chance of rejecting a hypothesis when it is "very wrong" than when it is "slightly wrong". But it also implies that the upper limits for $P_A^B$, $P_A^C$, ....., $P_B^C$, $P_B^D$, ....., $P_D^E$, $P_D^F$ are 0.99 and for $P_C^D$, $P_C^E$, $P_C^F$, $P_E^F$ are 0.95. Thus even with moderate sizes of the non-zero coefficients, there will be a strong tendency in our test procedure to obtain an overrepresentation of confirmation of the hypothesis which come early in the succession of tests. Even when the coefficients are large enough to make $P_B^F$, $P_D^F$ and $P_E^F$ all equal to 0.3, the probability of correctly classifying a case as confirmation of F, is by table A lower than 0.343, i.e. about the same as the joint probability of classifying it as confirmation of either A or B ($0.3+\beta^F$).

## VI. Testing for a group of observations

We apply our test procedure to several groups of data, and if these can be regarded as independent observations, we should expect to obtain certain distributions of results, depending upon the relative numbers of cases for which each of the alternative hypotheses is correct, and on the "degrees of incorrestness" of the hypotheses which are not correct in each case. Thus if hypothesis A were correct for all cases, we should expect to obtain confirmation of this hypothesis for 99 per cent of all cases, and rejection for 1 per cent. We now have: If hypothesis A is correct for all cases, the probability of acceptance of hypothesis A is 0.99 and of rejection is 0.01, and we can check if the outcomes for a given group of observations are consistent with this "second order" hypothesis or not, by applying a binomial distribution.

In nearly the same way we may control the second order hypothesis: "A or B is correct for all cases". Here the probability of rejection, if the hypotheses is correct is 0.01 minus some small β. In order to perform the test we must be willing to make assumptions about this β.

Thus, it may be possible to perform these two tests for groups of observations. Already when we go to the next step, considering the second order hypothesis: "A, B or C is correct for all cases" we face even more serious difficulties.

If we assume the (unknown) ratio of cases for which A is correct to be $r_A$, the one for which B is correct but not A to be $r_B$ and the one for which C is correct but not A or B to be $r_C = 1-r_A-r_B$, we have from table A the probability of accepting A, B or C when A, B or C is correct for all cases:

$$P^{ABC}_{ABC} = (0.99 + \beta^A + (0.01 - \beta^A)P^A_C)\ r_A + (0.99 + \beta^B + (0.01 - \beta^B)P^B_C)\ r_B$$
$$+ (0.95 + 0.05\ (P^C_B + \beta^C))\ r_C$$
$$= 0.99 + (\beta^A + (0.01 - \beta^A)P^A_C)\ r_A + (\beta^B + (0.01 - \beta^B)P^B_C)\ r_B$$
$$+ (-0.04 + 0.05\ (P^C_B + \beta^C))\ r_C$$

Here we know:

$$0 \le P^A_C \le P^C_C = 0{,}95,\ 0 \le P^B_C \le P^C_C = 0{,}95,\ 0 \le P^C_B \le P^B_B = 0{,}99$$

$$0 \le r_A \le 1,\ 0 \le r_B \le 1,\ 0 \le r_C \le 1,$$

$\beta^A$, $\beta^B$ and $\beta^C$ non-negative and small.

(At least $\beta^A \le 0.01$ and $\beta^B \le 0.01$)

We have consequently:

$$0.95 + 0.05\ \beta^C \le P^{ABC}_{ABC} \le 0.9995 + 0.05 \max\ (\beta^A,\ \beta^B,\ \beta^C)$$

and we may make tests under alternative assumptions about $P^{ABC}_{ABC}$. If our conclusions turn out to be independent of these assumptions, the tests can help us, in the opposite case they cannot.

The next step now would be to test if A, B, C or D is correct. Again, using the table, we obtain the probability of accepting A, B, C or D if A, B, C or D is correct.

$$P^{A,B,C,D}_{A,B,C,D} = (0.99 + \beta^A + (0.01 - \beta^A)\ P^A_C + (0.01 - \beta^A)(P^A_D - P^A_C))r_A$$
$$+ (0.99 + \beta^B + (0.01 - \beta^B)P^B_C + (0.01 - \beta^B)(P^B_D - P^B_C))r_B$$
$$+ (P^C_B + \beta^C + 0.99\ (1-P^C_B - \beta^C))r_C$$
$$+ (P^D_B + \beta^D + 0.99\ (1-P^D_B - \beta^D))r_D$$
$$= 0.99 + (\beta^A + (0.01 - \beta^A)\ P^A_D)\ r_A$$
$$+ (\beta^B + (0.01 - \beta^B)\ P^B_D)\ r_B$$
$$+ 0.01\ (P^C_B + \beta^C)\ r_C$$
$$+ 0.01\ (P^D_B + \beta^D)\ r_D$$

Here:

$$0 \le P^A_D \le P^D_D = 0.99,\ 0 \le P^B_D \le P^D_D = 0.99,\ 0 \le P^C_B \le P^B_B = 0.99,\ 0 \le P^D_B \le P^B_B = 0.99$$

$$0 \le r_A \le 1,\ 0 \le r_B \le 1,\ 0 \le r_C \le 1,\ 0 \le r_D \le 1,$$

$$r_A + r_B + r_C + r_D = 1$$

$\beta^A$, $\beta^B$, $\beta^C$, $\beta^D$ are all non-negative and small. (At least $\beta^A \le 0.01$, $\beta^B \le 0.01$).

$$0.99 \le P^{A,B,C,D}_{A,B,C,D} \le 0.9999 + 0.01 \cdot \max\ (\beta^A,\ \beta^B,\ \beta^C,\ \beta^D)$$

Again we may make tests under alternative assumptions.

We can go one step further and consider the nearly all-inclusice hypothesis: A or B or C or D or E is correct for all cases. The probability of accepting this hypothesis for a random case when it is correct should be:

$$P^{A,B,C,D,E}_{A,B,C,D,E} = (1-(0.01-\beta^A)(1-P^A_D)(1-P^A_E))r_A$$
$$+ (1-(0.01-\beta^B)(1-P^B_D)(1-P^B_E))r_B$$
$$+ (1-0.01(1-P^C_B-\beta^C)(1-P^C_E))r_C$$
$$+ (1-0.01(1-P^D_B-\beta^D)(1-P^D_E))r_D$$
$$+ (1-0.05(1-P^E_B-\beta^E)(1-P^E_D))r_E$$
$$= 0.99 + (\beta^A+(0.01-\beta^A)(P^A_D+P^A_E-P^A_D\ P^A_E))r_A$$
$$+(\beta^B+(0.01-\beta^B)(P^B_D+P^B_E-P^B_D\ P^B_E))r_B$$
$$+ 0.01\ (P^C_E+(P^C_B+\beta^C)(1-P^C_E))r_C$$
$$+ 0.01\ (P^D_E+(P^D_B+\beta^D)(1-P^D_E))r_D$$
$$+ (-0.04 + 0.05\ (P^E_D+(P^E_B+\beta^E)(1-P^E_D)))r_E$$

Here

$0 \le P^A_D \le P^D_D = 0.99,\ 0 \le P^A_E \le P^E_E = 0.95,\ 0 \le P^B_D \le P^D_D = 0.99,\ 0 \le P^B_E \le P^E_E = 0.95$

$0 \le P^C_B \le P^B_B = 0.99,\ 0 \le P^C_E \le P^E_E = 0.95,\ 0 \le P^D_B \le P^B_B = 0.99,\ 0 \le P^D_E \le P^E_E = 0.95,$

$0 \le P^E_B \le P^B_B = 0.99,\ 0 \le P^E_D \le P^D_D = 0.99$

$0 \le r_A \le 1,\ 0 \le r_B \le 1,\ 0 \le r_C \le 1,\ 0 \le r_D \le 1,\ 0 \le r_E \le 1$

$\beta^A$, $\beta^B$, $\beta^C$, $\beta^D$ and $\beta^E$ are all non-negative and small

$$0.95 + 0.05\ \beta^E \le P^{A,B,C,D,E}_{A,B,C,D,E} \le 0.999995 + 0.0005\cdot\max\ (\beta^A, \beta^B, \beta^C, \beta^D, \beta^E)$$

In the extreme case of a $P^{A,B,C,D,E}_{A,B,C,D,E} = 0.9999$, we will expect only 1 rejection in 10 000 cases.

The standard deviation in the binomial distribution will be $0.01.\ \sqrt{n}$ , where n is the number of cases in the group. 4 rejections in 10 000 will here be sufficient to reject the theory that all cases belong to A,B,C,D or E.

At the other extreme we will expect 5 rejections out of 100 cases. Even if all cases do belong to A,B,C,D or E, and the standard deviation on this expected value is $0.218\sqrt{n}$, so even 10 or 11 rejections out of 100 cases need not make us reject the hypothesis of A,B,C,D or E.

Our proposed use of the data is more demanding than just to ascertain the number of alternative hypotheses which may be applicable to our data groups. We want to estimate the fractions of the observations to which each separate hypothesis (A,B, etc.) is applicable. Again using our previous notation and table A, we obtain for the expected values of our estimations of the various fractions:

$$E(r_A) = 0.99\ r_A + P^B_A r_B + P^C_A r_C + P^D_A r_D + P^E_A r_E + P^F_A r_F$$
$$E(r_B) = \beta^A r_A + (0.99 - P^B_A + \beta^B)r_B + (P^C_B - P^C_A + \beta^C)r_C + (P^D_B - P^D_A + \beta^D)r_D$$
$$+ (P^E_B - P^E_A + \beta^E)r_E + (P^F_B - P^F_A + \beta^F)r_F$$

$$E(r_C) = (0.01 - \beta^A)\ P^A_C r_A + (0.01 - \beta^B)\ P^B_C r_B + 0.95\ (1-P^C_B - \beta^C)r_C + (1-P^D_B - \beta^D)P^D_C r_D$$
$$+ (1- P^E_B - \beta^E)\ P^E_C r_E + (I-P^F_B - \beta^F)P^F_C r_F$$

and corresponding for the other fractions. We cannot make precice statements about the distortions in our estimates, but it is easy to see, that, in general, the smaller the probabilities of accepting the various hypotheses, when they are not correct, and the greater the proportion of cases belonging to the earlier hypotheses in the succession of the testing procedure, the closer we may expect to come to estimating the true proportions. As already mentioned we must expect to overestimate the early proportions and to underestimate the late ones in the succession of tests.

Three more observations are pertinent: 1) even if we should obtain a grouping of the cases, which gives correct estimates of the fractions for which each hypothesis is correct, and, of course, even more when we do not get the correct fractions, individual cases will be erroneously classified. Thus, if there is e.g. an observable characteristic, which (unknown to us) occurs for all cases where hypothesis C is correct and for no cases where hypothesis C is not correct, this characteristic must be expected to occur in our observations also for cases grouped as not belonging to the class for which hypothesis C is correct; and among the cases for which C has not been rejected, some will be without the typical characteristic. As a consequence we may fail to discover the association between the given characteristic and the cases where hypothesis C is correct. 2) The elements on the main diagonal in table A may under quite wide assumptions be expected to dominate over other elements on each line, so that an increase in an actual fraction, $r_A$, $r_B$, $r_C$, $r_D$, $r_E$ or $r_F$ will normally lead to an increase in the expected estimate of the corresponding fraction, even under the restriction that the sum of fractions must be unity. 3) The estimates of the fractions $r_A$, $r_B$ etc. may be expected to be closer to the correct figures, the more the non-zero coefficients "contribute" to the explanation of the variations in input.

## VII. A numerial example

It is tempting to present a numerical example, based on purely hypothetical values. As alternative 1 we assume that the probability of accepting a hypothesis that three coefficients are zero, when one of them is not zero is 0.25, when two are not zero it is 0.20 and when none is zero it is 0.15. Further, let us assume that the probability of accepting a hypothesis that two coefficients are zero when only one of them is zero is 0.30 and when none of them is zero, is 0.20.

We then get:

$$P_B^C = P_B^D = P_D^B = P_D^E = P_E^A = P_E^D = 0.30^{1)}$$
$$P_A^B = P_A^C = P_A^D = P_C^A = P_C^D = P_C^E = 0.25$$
$$P_A^E = P_B^E = P_B^F = P_C^B = P_D^F = P_E^B = P_E^F = 0.20$$
$$P_A^F = P_C^F = 0.15$$

As alternative 2 we assume that all these probabilities are 0.05 higher than in alternative 1. We must also have for both alternatives

$$P_D^A = P_D^C = P_E^C = 0.99.$$

We will finally assume that for both alternatives

$$\beta^A = 0.002,\ \beta^B = 0.003,\ \beta^C = \beta^D = \beta^E = \beta^F = 0.004$$

Now for given sets of $r_A$, $r_B$, $r_C$, $r_D$, $r_E$ and $r_F$ we can find the corresponding estimates $\hat{r}_A$, $\hat{r}_B$, $\hat{r}_C$, $\hat{r}_D$, $\hat{r}_E$, and $\hat{r}_F$ which we would expect to obtain.

The values for some choosen fractions are given in table B.

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1) $P_B^C$ is the probability of accepting B when C is correct etc.

Table B. Examples of actual fractions and expected observations of fractions with given probabilities of errors of the second kind.[1)]

| Cases corresponding to hypothesis | Example 1 | | | Example 2 | | | Example 3 | | | Example 4 | | | Example 5 | | | Observed distribution[2)] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | r | $E(\hat{r})$ Alt.1 | $E(\hat{r})$ Alt.2 | r | $E(\hat{r})$ Alt.1 | $E(\hat{r})$ Alt.2 | r | $E(\hat{r})$ Alt.1 | $E(\hat{r})$ Alt.2 | r | $E(\hat{r})$ Alt.1 | $E(\hat{r})$ Alt.2 | r | $E(\hat{r})$ Alt.1 | $E(\hat{r})$ Alt.2 | |
| A: $a_{ij}=c_{ij}=d_{ij}=0$ | .17 | .350 | .392 | .33 | .479 | .513 | .50 | .609 | .634 | .50 | .618 | .643 | .53 | .640 | .664 | .64 |
| B: $a_{ij}=c_{ij}=0$ | .16 | .147 | .139 | .17 | .149 | .140 | .17 | .141 | .132 | .39 | .297 | .277 | .36 | .275 | .257 | .28 |
| A or B | .33 | .497 | .531 | .50 | .628 | .653 | .67 | .750 | .766 | .89 | .915 | .920 | .89 | .915 | .921 | .92 |
| C: $b_{ij}=c_{ij}=d_{ij}=0$ | .17 | .195 | .199 | .20 | .183 | .181 | .10 | .106 | .107 | .02 | .029 | .031 | .03 | .034 | .035 | .03 |
| D: $c_{ij}=d_{ij}=0$ | .16 | .102 | .089 | .10 | .067 | .059 | .08 | .053 | .047 | .07 | .041 | .035 | .06 | .036 | .031 | .04 |
| E: $b_{ij}=d_{ij}=0$ | .17 | .113 | .104 | .10 | .067 | .062 | .08 | .052 | .048 | .00 | .003 | .004 | .00 | .003 | .003 | .00 |
| F. Other | .17 | .093 | .077 | .10 | .055 | .045 | .07 | .039 | .032 | .02 | .012 | .010 | .02 | .012 | .010 | .01 |
| Total | 1.00 | 1.000 | 1.000 | 1.00 | 1.000 | 1.000 | 1.00 | 1.000 | 1.000 | 1.00 | 1.000 | 1.000 | 1.00 | 1.000 | 1.000 | 1.00 |

1) See the text for explanations. r = the assumed fractions of cases for which each hypothesis is correct. (Thus, in example 1 hypothesis A is assumed to be correct for 17 per cent of all cases). $E(\hat{r})$ = the expected results of our testing procedures. (Thus, in example 1, under the assumptions of alternative 1, the expected fraction of acceptance of hypothesis A is 35 per cent of all cases.)
2) Result of the testing procedure for 477 specified input items, Compare table 2 a col. 5.

Example 5 in the table has been choosen so as to make the expected estimates for alternative 1 as close as possible to the actual distribution which resulted from application of our testing procedure to the data, and example 4 has been choosen so as to obtain the same result for alternative 2. Since the choice of hypotheses in the examples are quite arbitrary, not too much importance should be accorded to the apparent correspondence which has been achieved for both alternatives, and which for both examples indicate considerable errors in the distribution of cases on the results A and B, but fairly small errors when these two result groups are combined. We could get an equally good fit if we raised the probabilities $P_B^C$, etc. with still 0.05. In this case our observed distribution would correspond to an actual distribution with .46 for A, and .42 for B, that is .88 for A and B combined. With probabilities as high as the double of the values assumed in alternative 1 our observed distribution would correspond to a $r_A$-value of .30, an $r_B$ of .54 and $r_A + r_B = .84$.

## VIII. The importance of coefficient size

When we have a set of statistical data which we assume to be a random sample from a universe charasterized by certain structural parameters, and when we want to test a hypothesis about the values of one or more of these structural parameters, we try to translate the basic hypothesis into a hypothesis about the distribution of a test statistic, computed from the data. The point is that it must be possible to indicate a range, let us call it the critical range, of values for the test statistic, within which it is a high probability to obtain an observation, when the hypothesis about the structural parameters is correct, but where the probability of an observation is distinctly less, if the basic hypothesis is wrong. The test is better the smaller the probability of getting an observation in the chosen critical range, if the hypothesis is wrong, for a given probability of getting an observation in the same critical range when the hypothesis is correct.

The probability of getting an observation of the test statistic in the critical range when the hypothesis is wrong, the probability of an "error of the second kind" will, however, in general depend on "how wrong" the hypothesis is. If, for instance, a parameter, which according to the hypothesis is zero, is not exactly zero but only slightly different from zero, then the probability of obtaining an observation of the test statistic within the critical range may be nearly as high as it would have been if the zero hypothesis had been correct.

If we have just one set of data, we can compute only one value for the test statistic. We then choose in advance a critical range, e.g. such that the probability of an observation within the range is high, say 95 or 99 per cent if the hypothesis is correct, and "as low as possible" if the hypothesis is not correct. We must be content to reject the basic hypothesis (with a given, small, probability of committing an error) if the test statistic falls outside the critical range, and not to reject the hypothesis (with an unknown probability of committing an error) if the test statistic falls within the critical range. The probability of committing an error in the latter case will be smaller "the greater the error would be" i.e. the more the correct parameter value deviates from the hypothesis. In the present study this would be the case if we were looking at the parameters for one single input item at the time.

The situation will be somewhat different if we have several sets of statistical data, e.g. the sets of time series for all our input items, each set assumed to be a random sample from a universe characterized by its own structural parameters, (but where the only differences between the universes are in the values of corresponding parameters.)

If we now want to test hypotheses about the parameters of these universes, we might construct test statistics, which would have identical probability distributions for correct hypotheses about different universes. Furthermore, the nature of the hypotheses may be such that it is of interest to know if they are correct for all the universes e.g. if certain regression coefficients are zero for all input items. The way to perform such a test would be to consider the distribution of the computed test statistic, e.g. the values obtained for $F_{3.8}$, for the various data sets, and to compare this "realized distribution" with the hypothetical distribution which would obtain if the hypotheses were correct for all the universes. If it cannot be rejected that the observed distribution has been generated from the hypothetical distribution, our hypotheses are not rejected and may thus be assumed to apply to the entire group, even if some of the observations give values of the test statistic that taken by themselves would have led to rejection for these individual observations. In the opposite case, several possibilities are open:

1) Our hypotheses are still correct, but we have been "unlucky" and have obtained a set of observations with very low probability.
2) Our hypothesis about the probability distribution of the test statistic is wrong.
3) Our hypotheses about the parameters are not correct for all observations.

Let us take up this last possibility for further study. It may now be of interest how the "true" parameter values are distributed about the hypothetical values originally assumed. What can our observed distribution tell about this?

We would like to know:

Does the fact that we must reject a hypothesis that the hypotheses are valid for all cases in the group indicate that it is invalid for every single case?

and if so,

does the observed distribution of the test statistic give any indication about how the true values of the underlying parameter are located in relation to the tested hypothetical values?

or

does the fact that we must reject the conclusion that the hypotheses about the parameters are valid for all cases in the group indicate that it may be valid for some and invalid for others,

and if so,

does the observed distribution of the test statistic give any indication about the relative frequency of cases for which the hypothesis is correct, and about the value of the underlying parameter for those cases where the hypothesis is not correct.

It appears, that without further information about our data we cannot distinguish between a situation where the hypothesis is wrong for all cases and one where it is correct for a given proportion of cases and wrong for the rest.

Our general position is that we take the fraction of cases for which a given hypothesis has been rejected as an indication of the fraction of cases for which it is not valid. We even assume that a given hypothesis is invalid for each individual input item for which it is rejected by our tests, and valid for those items for which it is not rejected, and we look at characteristics of the individual items in order to find explanations of why the various hypotheses do apply or not apply.

## IX. Evaluation of differences

In addition to obtaining indications regarding the relative frequencies of the various forms of relationships between inputs and outputs in our data, we want to investigate if there are differences between the various classes into which the data may be grouped. Such differences may give the clues to identification of the causes of the different forms of dependency or independency.

We will then be faced with the problem of evaluation of apparent differences in distributions of test results. In our discussion of the testing procedure and of the testing for a group of observations, we have looked upon the test results for a given group of observation sets as a function of the distribution cf the parameters of the complete regression equation about zero in a hypothetical universe, from which we assume our observations to be drawn. The distribution of the parameters in the universe will then determine the probability for each of the possible outcomes of our testing procedure.

We may then compare the testing results for different groups of observations and decide whether or not they are consistent with a hypothesis that they have all been drawn from universes with the same probabilities for the various results. We will use the relative frequencies of the various testing results for the reference group of 477 specified inputs as estimates of the hypothetical probabilities and may then apply a simple $X^2$-test to judge the deviations for groups of observations.

Unfortunately, the relative frequencies of some of the testing results are so low, that we shall have to distinguish only result classes which are more or less aggregated, for instance the following three: "Proportional, no trend", "Proportional, trend" and "Other", where "Other" is the aggregate of all testing results characterized as linear or independent. If we now compute the $X^2$ values for the groups in table 1a with these three result classes, we obtain the following $X^2$ values.

| Group | $X^2$ |
|---|---|
| Norwegian, competitive | .43 |
| Norwegian, non-competitive | 4.19 |
| Imports, competitive | 2.03 |
| Imports, competitive and non-competitive | .93 |
| Competitive inputs combined | 2.93 |
| Fuels combined and substitution groups | 1.37 |
| Import sums | .99 |
| Gross value added | 3.83 |
| Small unspecified | 1.09 |

Now the $X^2$-distribution gives a value of the $X^2$ of above 5.99 in 5 per cent of all cases. Thus, none of the basic groups deviate significantly from the reference group according to the $X^2$-test for the three classes of results at the 95 per cent level. We note that the $X^2$-test sets rather wide margins of variation: In a group of 100 cases the expected distribution based on the reference group is 64, 28, 8, but distributions such as 53, 36, 11; 75, 20, 5; 62, 35, 3 or 66, 21, 13 are not rejected as incompatible with basic probabilities of .64, .28 and .08 at the 95 per cent test level.

An alternative way of testing the groups for compatibility in the distribution of results would be to consider only one class of results against "all others". We might for instance consider the deviation between the expected and the actual number for the test result Proportional, no trend. With given probability for this outcome (0.6415) we should expect a binomial distribution in which we may compute the standard deviation ($\sigma = \sqrt{n.0.6415.0.3585}$). Assuming then that the binominal distribution may be approximated by a normal distribution we may find the probability of a deviation of the observed magnitude from the expected number in the class proportional, no trend. But (as one might perhaps have expected) the limits set by this type of testing are not very different from those set by the $X^2$-test for each group result, and the implications of using the test simultaneously to several classes of results are not clear.

One should, of course, be careful in trying to infer anything from differences which may easily be the results of statistical randomness. However, sometimes there may be a consistent pattern in the results, or the observed differences may be in conformity with a priori hypotheses, and one may still be justified in considering such results as one piece of evidence.

We have not computed the $X^2$ for all the groupings considered in the following, i.a. because the number of cases in many groups are quite small. But we have tried to keep in mind, that only when the differences between groups are quite dramatic, may we feel relatively sure that they are not just due to randomness.

## PART C. RESULTS

### X. The principal results

In the following analysis we will concentrate on the group of 477 specified input items. This group will be considered as a reference group.

For the group of 477 specified input items our test procedure gives the following results:

Table 3. Results of testing procedure for 477 specified input items

| Hypothesis | Not rejected for: Number | Number Cumulative | Per cent | Per cent Cumulative |
|---|---|---|---|---|
| A) Proportional, no trend (a=c=d=0) ............ | 306 | 306 | 64.2 | 64.2 |
| B) Proportional, trend (a=c=0) ................ | 133 | 439 | 27.9 | 92.1 |
| C) Independent, no trend (b=c=d=0) ............ | 1 | 440 | 0.2 | 92.3 |
| D) Linear, no trend (c=d=0) positive (b > 0) ... | 9 | 449 | 1.9 | 94.2 |
| negative (b < 0) | 7 | 456 | 1.5 | 95.7 |
| E) Independent, trend (b=d=0) ................. | 4 | 460 | 0.8 | 96.5 |
| F) Linear, trend, positive (b > 0) ............ | 6 | 466 | 1.2 | 97.7 |
| negative (b < 0) ............ | 11 | 477 | 2.3 | 100.0 |
| Total .................................... | 477 | | 100.0 | |

It is evidently very unlikely that all cases belong to the class where hypothesis A is correct. It is somewhat less unlikely that either A or B is correct for all cases. If this were the case, the expected number of items for which either A or B would not be rejected is $477 \cdot 0.99 = 472.23$ and its standard deviation is $\sqrt{0.99.0.01 \cdot 477} = 2.1733$. Our result, 439, thus deviates from its expected value by

$\frac{472.23 - 439}{2.173} = 15.3$ times its standard deviation and we must reject a hypothesis that A or B is correct for all items.

The outstanding result of our analysis is the high percentage of cases classified as showing a direct proportionality between inputs and outputs, with or without a trend in the proportionality coefficient. 439 or 92 per cent of the reference group of 477 specified input items fall in this class, and the percentages are on the same level for all categories of inputs. Fuels combined and Gross value added come out with the lowest percentages, namely 87 and 86 per cent respectively (Tables 1a and 2a).

We should, however, also recall that up to 49 per cent of the items classified as proportional might nearly as well have been classified as independent of output (tables 1b, and 2b). Furthermore, since a great percentage of the sectors (70 to 80 per cent) had trends in output, there is at least a possibility that input items which are linearly, but not proportionally dependent on output, have been classified as proportional with a trend[1].

The interpretation of the results concerning the effects of alternative ordering of the tests must be: We cannot by our test criteria, for the cases that were differently classed by the alternative ordering of the tests and under our adopted assumptions, reject the hypothesis that inputs are proportional to outputs. But we can neither reject the hypothesis that inputs are independent of outputs. Since the former alternative corresponds to our a priori theory, we have chosen to conclude that this theory has not been rejected.

As one might expect, the inputs for which the ordering of the tests is important are predominantly relatively small inputs into sectors with a limited range of variation in the production volume. (Se tables 4, 5 and 6 and D1, D2 and D3).

From table 4 (and D1) we see that the ordering of the tests is important for about 40 per cent of the items of less than 10 million kroner in average size, but only for less than a quarter of those between 10 and 100 million kroner. For the big items of more than 100 million kroner on the average, the ordering of the tests is important for less than one in ten of the items. When we look at the group of items formed by combining corresponding competitive items, this tendency is somewhat strengthened compared to the group of all specified inputs.

Table 4. Equivalence in the forms of the regressions of inputs on outputs. Classification by size in kroner of the input items. All specified inputs and competitive inputs combined. Percentage distributions

| Form of regression | Average size of input item in million 1955-kroner | | | | |
|---|---|---|---|---|---|
| | 0-<br>10.0 | 10.1-<br>50.0 | 50.1-<br>100.0 | 100.1<br>and<br>above | Total |
| All specified inputs | | | | | |
| Proportional or independent, no trend ...... | 38.8 | 23.0 | 24.1 | 5.4 | 30.8 |
| Other proportional, no trend .............. | 25.7 | 45.9 | 34.5 | 43.2 | 33.3 |
| Other forms .............................. | 35.5 | 31.1 | 41.4 | 51.4 | 35.9 |
| Total .................................... | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Number of items .......................... | 276 | 135 | 29 | 37 | 477 |
| Competitive inputs combined | | | | | |
| Proportional or independent, no trend ...... | 43.0 | 16.0 | 25.0 | 9.1 | 27.1 |
| Other proportional, no trend .............. | 31.2 | 44.0 | 29.2 | 51.5 | 38.2 |
| Other forms .............................. | 25.8 | 40.0 | 45.8 | 39.4 | 34.7 |
| Total .................................... | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Number of items .......................... | 93 | 75 | 24 | 33 | 225 |

As a measure of dispersion of production in the receiving sector we have used the standard deviation of production measured in 1955-kroner, divided by average production in 1955-kroner. It is

1) This could happen if the input function were

$$y(t) = a+bx(t)+u(t)$$

and if output followed a strict trend, e.g.

$$x(t) = \frac{m}{k-t} ,$$

where y(t) is input, x(t) is output, t is time, a,b,m and k are constants and u(t) is a disturbance term. We will now have:

$$y(t) = (\frac{a}{x(t)} + b)\ x(t) + u(t) = (\frac{a}{m}\ k + b)\ x(t) - \frac{a}{m}\ t\ x(t) + u(t)$$

By statistical accident we might then get the best fit for this last equation, even if there was an error term also in the trend function for x(t). A positive trend in x(t) would give a negative trend in the proportionality coefficient.

clear from table 5 (and D2) that the indeterminacy between proportionality and independence decreases as the dispersion in production in the receiving sector increases. The tendency is somewhat more pronounced when we consider the competitive inputs combined, thou when we look at all specified items.

Table 5. Equivalence in the forms of the regressions of inputs on outputs. Classification by relative dispersion of production in receiving sectors. All specified inputs and competitive inputs combined. Percentage distributions

| | Standard deviation of production in receiving sectors divided by average production | | | |
|---|---|---|---|---|
| | 0–0.14 | 0.15–0.24 | 0.25 and over | Total |
| All specified inputs | | | | |
| Proportional or independent, no trend .......... | 34.0 | 30.6 | 18.7 | 30.8 |
| Other proportional, no trend .................. | 27.3 | 41.4 | 37.5 | 33.3 |
| Other forms .................................. | 38.7 | 28.0 | 43.8 | 35.9 |
| Total ........................................ | 100.0 | 100.0 | 100.0 | 100.0 |
| Number of items .............................. | 256 | 157 | 64 | 477 |
| Competitive inputs combined | | | | |
| Proportional or independent, no trend .......... | 34.3 | 23.7 | 15.0 | 27.1 |
| Other proportional, no trend .................. | 26.7 | 48.7 | 47.5 | 38.2 |
| Other forms .................................. | 39.0 | 27.6 | 37.5 | 34.7 |
| Total ........................................ | 100.0 | 100.0 | 100.0 | 100.0 |
| Number of items .............................. | 105 | 80 | 40 | 225 |

When input items are classified simultaneously by relative dispersion of production in receiving sectors and the size of the input-output coefficient, as in table 6 (and D3), we find that small dispersion and small coefficients tend to give a larger proportion of indeterminate cases between proportionality and independence, and large dispersion and large coefficients result in a smaller proportion of indeterminate cases, and each of the factors seems to have an independent effect.

Table 6. Equivalence in the forms of the regressions of inputs on outputs. Classification by relative dispersion of production in receiving sectors and coefficient size. All specified inputs and competitive inputs combined. Percentage distributions

| | Standard deviation of production in receiving sectors in per cent of average production | | | | |
|---|---|---|---|---|---|
| | 0-14 | | 15 and over | | Total |
| | Coefficient size | | | | |
| | 0–0.05 | Over 0.05 | 0–0.05 | Over 0.05 | |
| All specified inputs | | | | | |
| Proportional or independent, no trend .......... | 37.7 | 24.6 | 31.6 | 16.7 | 30.8 |
| Other proportional, no trend .................. | 23.5 | 37.0 | 36.8 | 48.5 | 33.3 |
| Other forms .................................. | 38.8 | 38.4 | 31.6 | 34.8 | 35.9 |
| Total ........................................ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Number of items .............................. | 183 | 73 | 155 | 66 | 477 |
| Competitive inputs combined | | | | | |
| Proportional or independent, no trend .......... | 48.3 | 17.0 | 26.3 | 11.4 | 27.1 |
| Other proportional, no trend .................. | 17.2 | 38.3 | 47.4 | 50.0 | 38.2 |
| Other forms .................................. | 34.5 | 44.7 | 26.3 | 38.6 | 34.7 |
| Total ........................................ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Number of items .............................. | 58 | 47 | 76 | 44 | 225 |

From this evidence it seems reasonable to draw the following conclusion with regard to the "indeterminate" cases: Whereas there may well be a tendency to proportionality between these inputs and outputs, or at least to a positive correlation, this tendency is disturbed by other impulses, and these other impulses render the correlation between inputs and outputs rather weak. Such disturbing impulses are particularly influential when there is little variation in the explanatory variable, output, and when the input item is small, either in absolute value or in relation to the value of output. This is, of course, just another aspect of the fact that, although the proportionality assumption turns out to be acceptable for a great majority of cases according to the present study, the proportionality coefficients appeared to be subject to very substantial variations over time according to our study of coefficient stability, and the variability was found to be relatively greatest for small inputs.[1)]

On the basis of general production theory we would expect positive, and for some inputs even zero, but not negative correlation between inputs and outputs. The number of cases of positive, linear but non-proportional correlation in our test results is 15 items or 3 per cent for the reference group. The percentage is only 0.9 for Competitive inputs combined and as high as 7 for import sums and 10 for Gross value added. (Table 2a). Adding the proportional and linear positive cases we get as much as 95.2 per cent of the cases in the reference group and lower percentages only for Fuels combined (90.6), Norwegian, non-competitive (92.2) and Small unspecified (92.7). (None of these percentages deviate by as much as two times the standard deviation from an expected value of 95.2 in a binomial distribution.) Thus, there is no doubt that input volumes are in general positively correlated with output, and in the majority of cases a direct proportionality seems to be indicated by our data.

The class of input items characterized as independent of outputs is very small, containing only 5 items or 1 per cent of the reference group, 3 items or 4 per cent of the category of Small unspecified and 6 items scattered over the other categories, giving percentages between 1 and 2. (We must, however, again remember that a large number of the items classified as proportional with outputs might nearly equally well have been classified as independent. (Tables 1b and 2b)).

Only 18 items, or 3.8 per cent of the category of 477 specified inputs fall in the class linear with a negative coefficient for output. The percentages for the other categories vary from 1.5 for Import sums to 7.5 for Fuels combined. (None of these values appear to be significantly different from 3.8 per cent.)

A negative correlation between input and output is in contrast to what we would a priori expect, and it calls for some further analysis: First, there is a certain chance that our estimation methods and test criteria will give negative correlation, even if the true correlation is positive or zero. As already pointed out (See chapter I, Introduction) when there is a trend in the regression coefficient, we do not distinguish between the cases where the constant term is zero and those where it is different from zero. Thus some of our negative estimates of (the constant term in) the regression coefficient may not be significantly different from zero.

1) Compare Sevaldson op.cit. 1970.

Further, even if the true value of a regression coefficient is positive or zero, we must expect to get negative estimates in a certain percentage of all cases, but the frequency of negative regression coefficients in our results appears to be too great to be caused only by regular random disturbances.[1)]

In our data we can imagine that the following five systematic causes have been at work, giving the effect of negative correlation with output for specific input items:

a) When there is a trend in output, the trend factor in the fitted regression may "steal" the effect of output on input. This will be particularly liable to occur if input purchases are (erroneously) reported in stead of uses, and if purchases are only gradually adjusted to changes in production levels. (See chapter XV for evidence of this effect).

b) A gradual change in the input structure (e.g. change from one type of input to another) may be accompanied by a trend in output, or a relatively constant level of output.

c) Fluctuations in output may be accompanied by price fluctuations for inputs, which cause substitution effects.

d) Fluctuations in the output of a sector may be accompanied by fluctuations in product mix.

e) There may be statistical errors in the primary data or in their processing, e.g. in the deflation to constant price figures.

## XI. Time trends

There may be many causes for gradual changes over time in the functional relations between inputs and outputs, particularly when the relationships are estimated in such simple forms as here.

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1) If we denote by $\hat{b}$ our estimate of the regression coefficient and with $s_b$ its estimated standard deviation, and if we assume that the disturbances in our regression equations are independent, normally distributed stochastic variables with expectation zero and equal variance, we can make the following tabulations:

| If the true value of the regression coefficient, b, is | We should expect[1)] the following percentages of cases for which $\hat{b}$ is less than: | | | | |
|---|---|---|---|---|---|
| | 0 | $-s_b$ | $-2s_b$ | $-3s_b$ | $-6s_b$ |
| $+3s_b$ | 0.7- 0.9 | 0.1- 0.2 | - | - | - |
| $+2s_b$ | 3.7- 4.0 | 0.7- 0.9 | 0.1- 0.2 | - | - |
| $+s_b$ | 17.0-17.3 | 3.7- 4.0 | 0.7- 0.9 | 0.1-0.2 | - |
| 0 | 50.0 | 17.0-17.3 | 3.7- 4.0 | 0.7-0.9 | - |

1) **Based on the t distribution of $\frac{\hat{b}-d}{s_b}$ . The percentages depend a little on the number of parameters in the regression equation.**

| Basic groups | Of our input items the following percentages of cases were classified as linearly dependent on output with values of $\hat{b}$ less than | | | | |
|---|---|---|---|---|---|
| | 0 | $-\hat{s}_b$ | $-2\hat{s}_b$ | $-3\hat{s}_b$ | $-6\hat{s}_b$ |
| All specified inputs ................. | 4.6 | 3.6 | 3.5 | 1.9 | 0.2 |
| Competitive inputs combined .......... | 3.6 | 3.6 | 2.2 | 1.8 | 0.4 |
| Substitution groups and fuels ........ | 5.7 | 3.8 | 1.9 | 0.9 | 0.9 |
| Import sums .......................... | 2.9 | 3.0 | 1.5 | 1.5 | - |
| Gross value added .................... | 2.5 | 2.5 | 2.5 | 1.3 | - |

When we look at the first and perhaps the second column of these tabulations, we can easily imagine that the results of our tests could be the results of statistical disturbances in a universe with true coefficients ranging from zero and upwards. But the 3 last columns indicate that other causes for negative correlation must be at play as well. We will go a little deeper into that later on.

Changes in technology as well as in product mix will usually affect an industry gradually.[1] In particular, we will expect this to be the case, when the volume of production follows a smooth trend; whereas abrupt changes in the output volume might also be expected to give occasion to spurts or stops in the innovation process due to accompanying changes in the rate at which new equipment is installed. However, the majority of our sectors had a relatively smooth production rise over the period studied.

Also, when there is a continuing trend in production, adjustments to the change in output volume may display a smoother trend for inputs than for outputs if changes in the stock of goods in process absorb minor deviations from trend in output, or if purchases are reported for inputs instead of use.

When there is a trend in output, a linear relationship between input and output may be represented by a proportional relationship with a trend in the proportionality coefficient, and conversely, a proportional relationship with a trend in the proportionality factor may be represented by a linear relationship without trend.[2]

Finally, when there is a smooth trend in output, the trend factor may absorb the effect of non-linearity in the input-output relationship.[3]

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1) See for instance Per Sevaldson: Changes in Input-Output Coefficients. Chapter 16 in Structural interdependence and Economic Development. Ed. Tibor Barna, London and New York 1963.

2) If we have a relationship

$$y(t) = a + bx(t) + u(t)$$

between input y(t), and output x(t), with a and b constants and u(t) a residual term and if output follows a trend

$$x(t) = F(t)$$

with F some function of t, we also have

$$y(t) = \left(\frac{a}{F(t)} + b\right) x(t) + u(t)$$

and we may find a closely fitting regression

$$y(t) = (\alpha t + \beta)\, x(t) + e(t)$$

Correspondingly, if the last expression is the correct one, it may happen that $\alpha t\, x(t) = \alpha t \cdot F(t)$ turns out to be approximately constant and that the linear relationship with no trend gives the best fit to data.

3) We see this readily if we assume the true form of the input function to be:

$$y(t) = a + bx(t) + f(x(t))^2 + u(t)$$

and output to follow a linear trend:

$$x(t) = k + mt + v(t)$$

where y(t) is input, x(t) is output, t is time, a,b,f,k and m are constants and u(t) and v(t) are disturbance terms. We may then write:

$$y(t) = a + \alpha bx(t) + (1-\alpha)b(k+mt+v(t)) + f(k+mt+v(t))x(t) + u(t)$$

$$= (a+(1-\alpha)bk) + (\alpha b+fk)x(t) + fmtx(t) + (1-\alpha)bmt + (fx(t)v(t) + (1-\alpha)bv(t) + u(t))$$

where $\alpha$ is an arbitrary constant.
Estimating now the least squares regression of y(t) on x(t), t and tx(t), we will obtain some sort of estimates of the composite terms in this last expression and the structural terms are not identifiable in this way.

70 to 80 per cent of the input items are in sectors with a trend in output over the observation period. (Tables 7, D4 and D5). The percentages are about the same for those inputs which have a trend

Tabel 7. Forms of the regressions of inputs on outputs and trend characteristics of output in receiving sectors. Reference group of all specified inputs. Percentage distribution

| Form of regression | Trend character of receiving sector | | |
|---|---|---|---|
| | No trend | Moderate trend | Clear trend |
| Proportional, no trend | 64.3 | 74.4 | 62.9 |
| " , trend | 27.4 | 18.6 | 29.1 |
| " , total | 91.7 | 93.0 | 92.0 |
| Linear positive, no trend | 1.2 | 4.6 | 1.7 |
| " " , trend | 1.2 | 2.3 | 1.1 |
| " " , total | 2.4 | 7.0 | 2.8 |
| Confirmation, total | 94.1 | 100.0 | 94.8 |
| Linear negative, no trend | 1.2 | - | 1.7 |
| " " , trend | 2.3 | - | 2.6 |
| " " , total | 3.5 | - | 4.3 |
| Independent, no trend | - | - | 0.3 |
| " , trend | 2.4 | - | 0.6 |
| " , total | 2.4 | - | 0.9 |
| Rejection, total | 5.9 | - | 5.2 |
| Total, per cent | 100.0 | 100.0 | 100.0 |
| " number of items | 84 | 43 | 350 |
| in per cent of total | 17.6 | 9.0 | 73.4 |
| All forms: | | | |
| No trend | 66.7 | 79.1 | 66.6 |
| Trend | 33.3 | 20.9 | 33.4 |

factor in the input-output relationship according to our results. Or, seen the other way, the percentages falling in the classes of input-output relationships with trends seem to be about the same for inputs into sectors with as for inputs into sectors without trends in output. This should indicate that trends in output are not a dominating cause of trend effect in our relationships. (See also chapter XXIII Dispersion and Trends in output in receiving sectors).

For roughly one third of the input items, 154 or 32.2 per cent for the reference group, the preferred class of input-output relationship contained a trend factor (Tables 1a and 2a). The percentages for all categories were about the same, except for Small unspecified, where it was as low as 25.4 per cent and Imports competitive with 27.0 per cent. Norwegian, non-competitive had 38.6 per cent, and Imports, non competitive had 38.4. Among these percentages none deviate as much as two times the standard deviation if 32.2 per cent is taken as the correct value of the probability of this class of results. Among the input items classified as proportional to outputs, about 1/3 had a trend in the proportionality coefficient, 30.3 per cent for the reference group, a high of 38.8 per cent for Substitution groups and a low of 25 per cent for Imports, competitive and Small unspecified (Tables 1a and 2a). Of these, the figure of 38.8 is 2.1 times the standard deviation above 30.3, and thus just significantly different at the 5 per cent level.

In the study on coefficient stability[1] it was found that about one third of the coefficients showed a trend in their development over time, but it could not be excluced that the trend effect could for some inputs be an effect of the existence of a linear, rather than the assumed proportional

1) Sevaldson, op.cit. 1970.

relationship between input and an output following a time trend. In the present study, where linear relationships are admitted, the probability for such spurious results should be somewhat reduced, but we still find a trend factor in about 1/3 of the relationships. Thus, the existence of a considerable trend element in input-output relationships must be considered to be established.

When we analyse the effects of the size of the input items, (see chapter XIV) we find that large input items (in kroner) are more often subject to trends than small, so that the effects of time trends on input-output relationships are even more important than what is suggested by the average of about one third of all coefficients showing trends.

## XII. Correspondence with coefficient test

Our results concerning trends in the input-output relationships should be compared with our results concerning significant regression coefficients between input coefficients and time, estimated on the basis of the same data.[1] The relationships between the trend characteristics of the input-output relationships and the trend characteristics of the input-output coefficients should be expected to be as displayed by table C.

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1) Sevaldson, op.cit. 1970.

Table C. Correspondence between linear form of input-output relationship and trend character of input-output coefficient

| If $x_{ij}(t)$ is as below | then $\frac{x_{ij}(t)}{x_j(t)}$ is when $x_j(t) = \bar{x}_j + v_j(t)$ | when $x_j(t) = x_j^o + f_j t + v_j(t)$ | Conclusion for coefficient $\frac{x_{ij}}{x_j}(t)$ 1) |
|---|---|---|---|
| $b_{ij}x_j(t)+u_{ij}(t)$ | $b_{ij} + \frac{u_{ij}(t)}{\bar{x}_j+v_j(t)}$ | | No trend |
| | | $b_{ij} + \frac{u_{ij}(t)}{x_j^o+f_j t+v_j(t)}$ | Tendency to trend(?) |
| $(b_{ij}+d_{ij}t)x_j(t)+u_{ij}(t)$ | $b_{ij} + d_{ij}t+ \frac{u_{ij}(t)}{\bar{x}_j+v_j(t)}$ | | Trend |
| | | $b_{ij} + d_{ij}t + \frac{u_{ij}(t)}{x_j^o+f_j t+v_j(t)}$ | Trend |
| $a_{ij}+b_{ij}x_j(t)+u_{ij}(t)$ | $b_{ij} + \frac{a_{ij}}{\bar{x}_j+v_j(t)} + \frac{u_{ij}(t)}{\bar{x}_j+v_j(t)}$ | | No trend |
| | | $b_{ij}+ \frac{a_{ij}}{x_j^o+f_j t+v_j(t)} + \frac{u_{ij}(t)}{x_j^o+f_j t+v_j(t)}$ | Trend |
| $a_{ij}+c_{ij}t +$ $(b_{ij}+d_{ij}t)x_j(t)+u_{ij}(t)$ | $b_{ij}+ \frac{a_{ij}}{\bar{x}_j+v_j(t)} + d_{ij}t +$ $+ \frac{c_{ij}}{\bar{x}_j+v_j(t)} t + \frac{u_{ij}(t)}{\bar{x}_j+v_j(t)}$ | | Trend |
| | | $b_{ij}+d_{ij}t + \frac{a_{ij}+c_{ij}t}{x_j^o+f_j t+v_j(t)} +$ $\frac{u_{ij}(t)}{x_j^o+f_j t+v_j(t)}$ | Trend(?) |
| $a_{ij}+ u_{ij}(t)$ | $\frac{a_{ij}}{\bar{x}_j+v_j(t)} + \frac{u_{ij}(t)}{\bar{x}_j+v_j(t)}$ | | No trend |
| | | $\frac{a_{ij}}{x_j^o+f_j t+v_j(t)} + \frac{u_{ij}(t)}{x_j^o+f_j t+v_j(t)}$ | Trend |
| $a_{ij}+c_{ij}t+u_{ij}(t)$ | $\frac{a_{ij}}{\bar{x}_j+v_j(t)} + \frac{c_{ij}}{\bar{x}_j+v_j(t)} t$ $+ \frac{u_{ij}(t)}{\bar{x}_j+v_j(t)}$ | | Trend |
| | | $\frac{a_{ij}+c_{ij}t}{x_j^o+f_j t+v_j(t)} + \frac{u_{ij}(t)}{x_j^o+f_j t+v_j(t)}$ | Trend(??) |

1) In all cases the residual items, $u_{ij}(t)$ and $v_j(t)$, may take on special values, which will give inconsistent conclusions when the coefficients are tested directly. In two cases (indicated by question marks) special values of the constants may make our conclusions about an expected trend in the input output coefficients invalid.

We have combined the results of the two testing procedures, (table D6), but in studying the results we must remember that the two testing procedures are not directly comparable: On the one hand, when testing the relationship between inputs and outputs, we base our conclusions on the squares of the absolute discrepancies between the data and the fitted regression curves; on the other hand, when testing the input-output-coefficients for the existence of trends, we base our conclusions on the squares of the discrepancies between data and fitted curves when both are expressed as percentages of output.

There is fairly good correspondence between the two test results for most categories of inputs. In table 8, (cfr. D7) we have grouped the results according to consistency in the two tests. The

Table 8. Comparisons between form of regression of input on output and trend character of input-output coefficient. Consistent and inconsistent results. All specified inputs. Percentage distribution

| Form of regression | Comparison of results | | | | |
|---|---|---|---|---|---|
| | Consistent | Moderately incosis-tent | Incon-sistent | Total | Number of items |
| Proportional or independent, no trend | | | | | |
| No trend in output ............. | 78.8 | 12.1 | 9.1 | 100.0 | 33 |
| Moderate trend in output ........ | 73.9 | 17.4 | 8.7 | 100.0 | 23 |
| Clear trend in output ........... | 61.5 | 19.8 | 18.7 | 100.0 | 91 |
| Other porportional, no trend | | | | | |
| No trend in output ............. | 42.9 | 19.0 | 38.1 | 100.0 | 21 |
| Trend in output ................ | 50.7 | 23.2 | 26.1 | 100.0 | 138 |
| Proportional, trend ................ | 95.5 | - | 4.5 | 100.0 | 133 |
| All other forms .................... | 65.8 | 2.6 | 31.6 | 100.0 | 38 |
| Total .............................. | 62.1 | 31.8 | 6.1 | 100.0 | 477 |

existence of a "moderate" trend in the input-output coefficient, when the preferred linear form implies no trend, we have interpreted as "moderately inconsistent" results. The existence of a "moderate" trend in the coefficient when the linear form implies a trend, we have interpreted as consistent results.

For the form "Proportional, no trend", with a trend in output the tendency to trend in the input-output coefficient is only due to the divisor of the residual term, and we must expect that this tendency can very easily disappear in the data. For this reason we have classified the cases of no trend in the coefficient here as only moderately inconsistent with the expected tendency to a trend. For the same reason we should not be worried by the relatively low percentages of "consistent" results for this group.

In order to see what significance the uncertainty in the results for some of the items characterised as "Proportional, no trend" may have for the consistency in results from the two testing procedures, we have split this group into "Proportional or independent, no trend" and "Other proportional, no trend" in table 8 (and D8). It turns out that there are fewer input-output coefficients with a trend among the items classified as "Proportional or independent, no trend" than among the rest, both when there is no trend in output and when there is such a trend. This may have to do with small size and relatively large variability in the items which constitute the group "Proportional or independent, no trend".

In spite of all the reasons why we should not expect complete consistency between the results of our two testing procedures, the relatively low percentages of entirely consistent results (around 60 per cent) probably ought to warn us that our results are to a considerable degree influenced by random disturbances.

## XIII. Substitution between special input categories

When we consider the inputs classified in the basic groups group by group, we find only small differences in the test results. This is brought out by all our tables.

Between some of the groups there are, however, special connections: If we take the input items classified as "Norwegian, competitive" and to each of these add the corresponding imports, we obtain items in the group "Competitive inputs combined" and when we to the inputs classified as "Imports, competitive" add the corresponding Norwegian inputs we also obtain items in the group "Competitive inputs combined". If we add to the specified main inputs all inputs classified as substitutes, we obtain the "Substitution groups". When a specified main input is competitive, Norwegian or imported, we may first form the combined competitive input, and to this add the remaining substitutes to arrive at the "Substitution groups". How do these "aggregations" affect our test results when we make the comparisons item by item?

If there are relatively simple substitution effects between domestically produced and imported competitive inputs, and between main inputs and their assumed substitutes, we would expect to find closer relationships between competitive inputs combined and output than between either of the corresponding Norwegian, competitive or imports, competitive inputs and output. We would further expect closer relationships between substitution group inputs and outputs than between competitive inputs combined or either of the separate Norwegian or imported main input items and output. Our testing procedure is not a very good basis for evaluation of the "closeness" of relationships. However, we might perhaps interpret a higher percentage of proportional inputs and a lower percentage of independent and negatively correlated inputs for the more aggregate items, as indications that the results for the disaggregated items to some extent were influenced by the effects of simple substitution between the components of the aggregation.

We have matched each specified competitive input with the corresponding combined input item. (Table D9). The marginal distribution are compared in table 9. This comparison does not substantially

Table 9. Forms of the regressions of inputs on outputs for Norwegian, competitive, Imports, competitive and corresponding items of Competitive inputs combined. Percentage distributions

| Form og regression | Norwegian competitive | Imports, competitive | Competitive inputs combined: Items matching Norwegian, competitive | Competitive inputs combined: Items matching Imports, competitive | Competitive inputs combined: All items 1) |
|---|---|---|---|---|---|
| Proportional, no trend | 66.5 | 70.1 | 60.9 | 60.7 | 65.3 |
| Proportional, trend | 26.7 | 23.4 | 35.4 | 32.1 | 29.8 |
| Proportional, total | 93.2 | 93.5 | 96.3 | 92.8 | 95.1 |
| Linear, positive, no trend | 1.9 | 2.2 | 0.6 | 0.7 | 0.5 |
| Linear, positive, trend | 0.6 | 1.4 | - | 0.7 | 0.4 |
| Linear, positive, total | 2.5 | 3.6 | 0.6 | 1.4 | 0.9 |
| Confirmation, total | 95.7 | 97.1 | 96.9 | 94.2 | 96.0 |
| Linear, negative, no trend | 1.8 | 0.7 | 0.6 | 0.7 | 0.4 |
| Linear, negative, trend | 1.9 | 2.2 | 1.2 | 3.6 | 2.7 |
| Linear, negative, total | 3.7 | 2.9 | 1.8 | 4.3 | 3.1 |
| Independent, no trend | - | - | - | - | - |
| Independent, trend | 0.6 | - | 1.3 | 1.5 | 0.9 |
| Independent, total | 0.6 | - | 1.3 | 1.5 | 0.9 |
| Rejection, total | 4.3 | 2.9 | 3.1 | 5.8 | 4.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Number of items | 161 | 137 | 161 | 137 | 225 |

1) From table 2a.

alter the impression given by table 2a: There is no definite improvement in the results in favour of the Leontief hypothesis when we consider the combined inputs instead of the specified competitive inputs separately.

As a matter of fact (see table D9) there is a quite close correspondence between results for the specified items and the matching combined items. For 121, or 75 per cent, of the 161 specified Norwegian, competitive input items the test results were not changed when the corresponding combined items were considered. For 97 or 71 per cent og the 137 specified import, competitive items the results were not changed. If we distinguish only between "confirmation" and "rejection" of the hypothesis of positive correlation, we obtain, of course an even better correspondence, namely for 151 or 94 per cent of the specified Norwegian, competitive items and for 131 or 96 per cent of the import, competitive items.

The general conclusion must be that the combination of presumably competitive Norwegian and corresponding imported input items do not appear to affect the performance of our tests, and thus there is no evidence of direct substitution between Norwegian and corresponding imported inputs in our data. (Compare also: Per Sevaldson: Substitution and complementarity effects on input-output ratios Mimeographed working paper from the Central Bureau of Statistics of Norway IO 69/14, Oslo 1969).

In table 10 (and D10) the specified input items characterized as "main inputs" have been

Table 10. Forms of the regressions of inputs on outputs for specified main inputs and corresponding substitution groups. Percentage distributions

| Form of regression | Main specified inputs | Correspon-ding sub-stitution groups |
|---|---|---|
| Proportional, no trend | 58.8 | 54.9 |
| Proportional, trend | 37.2 | 37.2 |
| Proportional, total | 96.0 | 92.1 |
| Linear positive, no trend | - | 2.0 |
| Linear positive, trend | 2.0 | 2.0 |
| Linear positive, total | 2.0 | 4.0 |
| Confirmation, total | 98.0 | 96.1 |
| Linear negative, no trend | 2.0 | - |
| Linear negative, trend | - | 2.0 |
| Linear negative, total | 2.0 | 2.0 |
| Independent, no trend | - | - |
| Independent, trend | - | 1.9 |
| Independent, total | - | 1.9 |
| Rejection, total | 2.0 | 3.9 |
| Total | 100.0 | 100.0 |
| Number of items | 51 | 51 |

matched against the corresponding "substitution groups", i.e. the same input items augmented by their close substitutes. The marginal distributions are even here quite similar.

The correspondence of the test results is not quite as good for these categories of inputs as for the specified competitive inputs compared with competitive inputs combined. Only 29 or 57 per cent of the 51 cases give identical test results for specified main inputs and corresponding substitution groups. There is, however, only one case where the test results gave "rejection" for the specified main input and "confirmation" for the substitution group, and only 2 cases where the test results gave "confirmation" for the specified main inputs and "rejection" for the corresponding substitution groups. For the remaining 48 cases, i.e. 94 per cent, the test results gave "confirmation" both for the specified main inputs and for the corresponding substitution groups.

For the main inputs which are competitive, we have also matched the results for the combined Norwegian and imported inputs with the corresponding complete substitution groups (table 11 and D11).

Table 11. Forms of the regressions of inputs on outputs for main competitive inputs combined and corresponding substitution groups. Percentage distributions

| Forms of regression | Main competitive inputs combined | Corresponding substitution groups |
|---|---|---|
| Proportional, no trend ..................... | 46.7 | 51.2 |
| Proportional, trend ........................ | 46.7 | 40.0 |
| Proportional, total ........................ | 93.4 | 91.2 |
| Linear positive, trend ..................... | 2.2 | 2.2 |
| Linear positive, no trend .................. | - | 2.2 |
| Linear positive, total ..................... | 2.2 | 4.4 |
| Confirmation, total ........................ | 95.6 | 95.6 |
| Linear negative, no trend .................. | - | - |
| Linear negative, trend ..................... | 2.2 | 2.2 |
| Linear negative, total ..................... | 2.2 | 2.2 |
| Independent, no trend ...................... | - | - |
| Independent, trend ......................... | 2.2 | 2.2 |
| Independent, total ......................... | 2.2 | 2.2 |
| Rejection, total ........................... | 4.4 | 4.4 |
| Total ...................................... | 100.0 | 100.0 |
| Number og items ............................ | 45 | 45 |

But this grouping does not materially change the picture. There is a somewhat better correspondence between the results here than in the preceding table (33 or 73 per cent of the 45 cases give the same test results) but this is probably due to the fact that by going from the specified single main input to the combined Norwegian and imported, we obtain inputs that are much closer to the total substitution group inputs.

We must again conclude that the effects of direct substitution between technically similar inputs do not seem to play an important role for the outcome of our tests.

## XIV. Size of the input item

We have shown earlier (ch. X) that the indeterminancy between proportionality and independence of input in relation to output resulting from alternative test orderings is particularly marked for small input items. And this effect was attributed to a relatively stronger influence of random disturbances on small than on larger inputs. It is important to know whether there are other differences in our test results when inputs are grouped according to some criteria of size.

The greater the arbitrary dispersion in the figures for a given input item in relation to the systematic changes, the smaller will be the power of our testing procedure to distinguish between the alternative forms of relationships to output. Since we believe, both that arbitrary statistical errors are in general relatively greater for small than for big input items and that enterprises are less alert in adjusting the inputs of small than of big items to variations in product level, we would expect greater relative arbitrary errors in the small input items. Accordingly, if there was an important reduction in the proportion of acceptance of the proportionality hypothesis for the benefit of, say, the linear positive hypothesis with increasing size of the input items, we might conclude that the high proportion of acceptance of the proportionality hypothesis in our data was to some extent due to the lack of precision, particularly in our data for small inputs, and that more precise data would have given a higher percentage of acceptance for linear (non-proportional) relationships. Such a result would also indicate that more was to be lost by ignoring the linear forms and basing input-output analysis on the simple proportionality hypothesis than would appear from our aggregate data, since the importance for the outcome of computations is greater for the large inputs than for the small ones.

The size of an input item may be assessed in various ways. Here we have used classifications by absolute size in 1955-kroner, by coefficient size (i.e. as a fraction of output value in the receiving sector) and by a combination of these two criteria.

In the analysis of coefficient stability[1)] it was found that the coefficient size seemed to have the strongest influence on variation (about the average coefficient or about the coefficient trend). As appears from table 12 (and D12) the coefficient size alone appears to have little influence on the

Table 12. Forms of the regressions of inputs on outputs classified by the size of the coefficients. All specified inputs. Percentage distributions

| Form of regression | Average size of coefficients 0-0.02 | 0.02-0.05 | 0.05-0.10 | 0.10-0.25 | 0.25 and over | Total | Number of items |
|---|---|---|---|---|---|---|---|
| Proportional, no trend .............. | 69.2 | 59.0 | 68.5 | 54.6 | 64.0 | 64.2 | 306 |
| Proportional, trend ................ | 24.8 | 30.8 | 24.3 | 34.1 | 32.0 | 27.9 | 133 |
| Proportional, total ................ | 94.0 | 89.8 | 92.8 | 88.7 | 96.0 | 92.1 | 439 |
| Linear positive, no trend ........... | 1.7 | 1.9 | 1.4 | 4.5 | - | 1.9 | 9 |
| Linear positive, trend ............. | 0.5 | 1.9 | 2.9 | 2.3 | 4.0 | 1.2 | 8 |
| Linear positive, total ............. | 2.2 | 3.8 | 4.3 | 6.8 | 4.0 | 3.1 | 17 |
| Confirmation, total ................ | 96.2 | 93.6 | 97.1 | 95.5 | 100.0 | 95.2 | 456 |
| Linear negative, no trend ........... | 1.6 | 1.3 | 2.9 | - | - | 1.5 | 7 |
| Linear negative, trend ............. | 1.7 | 3.2 | - | 2.2 | - | 2.3 | 9 |
| Linear negative, total ............. | 3.3 | 4.5 | 2.9 | 2.2 | - | 3.8 | 16 |
| Independent, no trend .............. | 0.5 | - | - | - | - | 0.2 | 1 |
| Independent, trend ................. | - | 1.9 | - | 2.3 | - | 0.8 | 4 |
| Independent, total ................. | 0.5 | 1.9 | - | 2.3 | - | 1.0 | 5 |
| Rejection, total ................... | 3.8 | 6.4 | 2.9 | 4.5 | - | 4.8 | 21 |
| Total .............................. | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 477 |
| Number of items .................... | 182 | 156 | 70 | 44 | 25 | 477 | |

regression form, (except for the category of competitive inputs combined, for which it appears that the inputs corresponding to small coefficients are influenced by trend in fewer cases than those corresponding to bigger coefficients (see table D12). The difference between this category and the average for all specified inputs is particularly marked for inputs corresponding to average coefficients of less than 2 per cent of the output value but nevertheless this difference is not big enough to be statistically significant by the tests we can apply).

If we consider the size distribution in absolute (1955-) kroner, in table 13 (and D13) there

1) See Sevaldson Op.cit. 1970.

Tabell 13. Forms of the regressions of inputs on outputs, classified by average size in kroner of the input item. All specified inputs. Percentage distribution

| Form of regression | Average size of input in million, 1955-kroner 0-10.0 | 10.1-50.0 | 50.1-100.0 | 100.1-250.0 | 250.1 and over | Total | Number of items |
|---|---|---|---|---|---|---|---|
| Proportional, no trend ........... | 64.5 | 68.8 | 58.6 | 45.5 | 53.4 | 64.2 | 306 |
| Proportional, trend ............. | 27.9 | 23.0 | 31.1 | 40.9 | 46.6 | 27.9 | 133 |
| Proportional, total ............. | 92.4 | 91.8 | 89.7 | 86.4 | 100.0 | 92.1 | 439 |
| Linear positive, no trend ....... | 1.4 | 2.2 | - | 9.1 | - | 1.9 | 9 |
| Linear positive, trend .......... | 1.1 | 0.8 | 3.4 | 4.5 | - | 1.2 | 6 |
| Linear positive, total ........... | 2.5 | 3.0 | 3.4 | 13.6 | - | 3.1 | 15 |
| Confirmation, total ............. | 94.9 | 94.8 | 93.1 | 100.0 | 100.0 | 95.2 | 454 |
| Linear negative, no trend ........ | 1.8 | 1.5 | - | - | - | 1.5 | 7 |
| Linear negative, trend ........... | 2.2 | 2.2 | 6.9 | - | - | 2.3 | 11 |
| Linear negative, total ........... | 4.0 | 3.7 | 6.9 | - | - | 3.8 | 18 |
| Independent, no trend ............ | 0.4 | - | - | - | - | 0.2 | 1 |
| Independent, trend ............... | 0.7 | 1.5 | - | - | - | 0.8 | 4 |
| Independent, total ............... | 1.1 | 1.5 | - | - | - | 1.0 | 5 |
| Rejection, total ................. | 5.1 | 5.2 | 6.9 | - | - | 4.8 | 23 |
| Total ........................... | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 477 |
| Number of items .................. | 276 | 135 | 29 | 22 | 15 | 477 | |

appears a tendency towards a larger percentage of linear negative and independent items for the inputs up to 100 million kroner, and a compensating tendency towards a larger proportion of linear (not proportional) relationships for larger inputs. The aggregate percentage of proportional cases appears to be insensitive to this size classification, (possibly with an exception for the very large inputs of more than 250 million kroner), but the percentage of items with a trend in the proportionality coefficient shows a tendency to increase with size, from 26 per cent of all cases for inputs of 50 million kroner and less and up to 47 per cent, or nearly half of the 15 inputs of more than 250 million kroner, when we consider the group of all specified inputs (cfr. table 13).

A simultaneous classification of inputs by size in kroner and in per cent of outputs (see table 14 and D14) indicates a combined effect of these two size criteria, but still with the size in kroner

Table 14. Forms of the regressions of inputs on outputs, classified by average size in 1955-kroner of the input item and average size of coefficient. All specified inputs. Percentage distribution

| Input, million kroner | 0-50.0 | of these 0-10.0 | of these rest | 0-50.0 | over 50.0 | over 50.0 | Total |
|---|---|---|---|---|---|---|---|
| Average coefficient % | 0-10.0 | 0-2.0 | rest | over 10.0 | 0-10.0 | over 10.0 | |
| **Form of regression** | | | | | | | |
| Proportional, no trend ................ | 66.4 | 69.7 | 63.9 | 60.0 | 46.4 | 57.9 | 64.2 |
| Proportional, trend ................... | 26.0 | 24.3 | 27.3 | 30.0 | 42.8 | 34.2 | 27.9 |
| Proportional, total ................... | 92.4 | 94.0 | 91.2 | 90.0 | 89.2 | 92.1 | 92.1 |
| Linear positive, no trend ............. | 1.6 | 1.2 | 1.8 | 3.4 | 3.6 | 2.6 | 1.9 |
| Linear positive, trend ................ | 1.0 | 0.6 | 1.4 | - | - | 5.3 | 1.2 |
| Linear positive, total ................ | 2.6 | 1.8 | 3.2 | 3.4 | 3.6 | 7.9 | 3.1 |
| Confirmation, total ................... | 95.0 | 95.8 | 94.4 | 93.4 | 92.8 | 100.0 | 95.2 |
| Linear negative, no trend ............. | 1.8 | 1.8 | 1.9 | - | - | - | 1.5 |
| Linear negative, trend ................ | 2.1 | 1.8 | 2.3 | 3.3 | 7.2 | - | 2.3 |
| Linear negative, total ................ | 3.9 | 3.6 | 4.2 | 3.3 | 7.2 | - | 3.8 |
| Independent, no trend ................. | 0.3 | 0.6 | - | - | - | - | 0.2 |
| Independent, trend .................... | 0.8 | - | 1.4 | 3.3 | - | - | 0.8 |
| Independent, total .................... | 1.1 | 0.6 | 1.4 | 3.3 | - | - | 1.0 |
| Rejection, total ...................... | 5.0 | 4.2 | 5.6 | 6.6 | 7.2 | - | 4.8 |
| Total ................................. | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Number og items ....................... | 381 | 165 | 216 | 30 | 28 | 38 | 477 |

as the dominating criterion: For the group of inputs which are 50 million kroner and less in average size those which are the smallest, both in kroner and as coefficients have a larger percentage of proportional cases, and among the proportional cases a larger percentage without trend, than the rest. Otherwise there are no clear differences within this group. The group of inputs above 50 million kroner in average size show no influence of coefficient size on the percentage of proportional cases, but has a larger group of proportional items with a trend for the coefficients which are 10 per cent and less than for those above 10 per cent. There is a greater percentage of linear negative and independent cases for the small coefficients and a correspondingly greater percentage of linear positive cases for the big coefficients in this group.

The conclusion of our analysis of input size must be that input size in kroner rather than in per cent of output appears to be the decisive criterion, further, that the fraction of input items for which alternative assumptions about non-proportional, linear relationships with output give significantly better fit than proportionality is low for all size groups, whereas the fraction of input items which show independence of or negative correlation with output decrease with increasing size of input. The latter observation may be taken as confirmation of a suspicion that negative correlation and independence mainly are the effects of statistical inaccuracy. We also find that the larger coefficients are subject to trend changes to a larger extent than the smaller ones, and we may take this as an indication that entrepreneurs are more alert to technical changes affecting large than small inputs, but it may also be an effect of the better statistical precision in the reporting of large inputs. However, differences are not large enough to indicate that our general results are strongly influenced by characteristics of the size distribution of inputs.

## XV. Linearly dependent inputs

Less than 1 in 10 of our input items came out of the testing procedure as linearly dependent on outputs, and they were more or less evenly divided between dependency with negative and possitive regression coefficients. For these items the size of the constant term is quite important. For this reason we have made the constant term in the regression equation, estimated without trends, the subject of further study. (Tables 15 and D15). The items with a negative regression coefficient will have a

Table 15. Distribution of constant terms in per cent of average value og input for input depending linearly on outputs. All specified inputs. Numbers of input items

| Constant term in per cent of average input | Input size in million kroner | | Total |
|---|---|---|---|
| | 0-10.0 | over 10.0 | |
| 200 and over | 5 | 1 | 6 |
| 100 - 199.9 | 2 | 1 | 3 |
| 100 and over | 7 | 2 | 9 |
| 25 - 99.9 | 6 | 3 | 9 |
| -24.9 - 24.9 | 2 | 3 | 5 |
| -74.9 - -25 | 1 | 3 | 4 |
| -75 and less | 3 | 3 | 6 |
| Less than 100 | 12 | 12 | 24 |
| Total | 19 | 14 | 33 |

constant term exceeding 100 per cent of the average value of the item itself. In these studies of the constant terms we have ignored any trends in the linear relationships. It turns out then that some of the items which were classified by our testing procedure as linearly dependent on output with a negative regression coefficient change to a positive regression coefficient when trends are ignored. Thus there were 33 items in the group of all specified inputs classified as linearly dependent on outputs and of these 18 were found to have a negative regression coefficient (cfr. table 1a.) When trends are ignored, only 9 of the same 33 input items are found to be negatively correlated with output. Among the 33 linearly dependent input items 14 were above 10 million kroner in average size, and among these 14 there were 6 with a negative regression coefficient. However, when trends are ignored, only 2 of these items over 10 million kroner were negatively correlated with inputs (table D13). Less than half of the linearly dependent inputs had a positive constant term, indicating a predominant tendency for these items to increase more than proportionately with increasing output.

The majority of constant terms are quite moderate in size, between -75 and +100 per cent of the average of the item itself. We have not made a study of the elasticities of these inputs with regard to output.

## XVI. Input types

It has been generally assumed that the hypothesis of proportionality between inputs and outputs is more suitable for inputs of direct materials than for service inputs or for inputs of auxiliary materials. This assumption has influenced the sector specification details and the interpretation of results in many input-output studies.

In order to find out if our data would support this assumption the input items were classified by types in the following categories:

- Direct materials
- Auxiliary materials
- Service inputs
- Packaging materials

The classification was done for each item on the basis of an evaluation of delivering and receiving sector, but without investigation of the types of goods included in the deliveries (tables 16, D16 and 17).

Table 16. Forms of the regressions of inputs on outputs. Classification by input types. All specified inputs. Percentage distribution

| Form of regression | Input type | | | |
|---|---|---|---|---|
| | Direct materials | Auxiliary materials | Services | Packaging materials |
| Proportional, no trend | 68.5 | 59.4 | 53.9 | 75.0 |
| Proportional, trend | 25.2 | 35.8 | 27.7 | 16.7 |
| Proportional, total | 93.7 | 95.2 | 81.6 | 91.7 |
| Linear positive, no trend | 2.0 | 1.6 | 2.6 | - |
| Linear positive, trend | 0.8 | 0.8 | 2.7 | 4.1 |
| Linear positive, total | 2.8 | 2.4 | 5.3 | 4.1 |
| Confirmation, total | 96.5 | 97.6 | 86.9 | 95.8 |
| Linear negative, no trend | 1.2 | 0.8 | 2.6 | 4.2 |
| Linear negative, trend | 1.9 | 0.8 | 6.6 | - |
| Linear negative, total | 3.1 | 1.6 | 9.2 | 4.2 |
| Independent, no trend | - | - | 1.3 | - |
| Independent, trend | 0.4 | 0.8 | 2.6 | - |
| Independent, total | 0.4 | 0.8 | 3.9 | - |
| Rejection, total | 3.5 | 2.4 | 13.1 | 4.2 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |
| Number of items | 254 | 123 | 76 | 24 |

Classified in this way our data indicate a difference between inputs of services on the one hand and inputs of the three other categories on the other hand. The three classes of materials inputs came out with about 97 per cent items with positive correlation with output, whereas the percentage for service inputs was only 87 (tables16, D16 and D17). Correspondingly, the three classes of materials inputs came out with proportionality for 92-95 per cent of the items, against 82 per cent for service inputs.

Thus, we have a clear confirmation of the assumption stated initially, but it is a question if the difference is big enough to warrant differential treatment of services from other inputs.

For auxiliary materials the distribution between proportional, no trend and proportional, trend, seems to deviate from the others, in favour of the latter class (i.e. proportional, trend). This may be a reflection of improved (or deteriorated) reporting of such items in the basic statistics over the period.

## XVII. Characteristics of the delivering sector

The difference between service inputs and materials input in their relationships to output in the receiving sectors may suggest that there are also other differences related to the types of input items. Such differences might have to do with characteristics of the sectors producing the input items. In grouping the inputs by domestic or foreign origin we have already taken into account one characteristic of the producing sectors, and since services and materials are produced in different types of sectors, also the classification of inputs by type has a relationship to the character of producing sectors.

We may now go further and ask if there are particular sectors or particular types of sectors, the products of which are related to outputs in consuming sectors in ways which differ from the general pattern. A listing of input items grouped according to sector of origin for specified Norwegian inputs, specified imported inputs and for competitive inputs combined, is given in Appendix, table I. The sectors have been ordered according to the percentages of their specified deliveries which are in agreement with the Leontief theory. The sectors are identified by their names and their numbers in a consecutive numbering used in this study, as well as by a digit indicating their types as either: 0, extractive - and service sectors or 1, commodity processing sectors. For Norwegian sectors the average production in the period 1949-1960 in constant 1955-prices is also given. A separate listing of sectors with one or more deliveries not positively correlated with output in receiving sectors is given in table D18.

With some 5 per cent of all inputs not positively correlated with output, and a total of around 8 per cent not proportional to output according to table 2a, the distribution of the items which are not positively correlated and of the non-proportional items on delivering sectors might apparently well be random, since there is no spectacular agglomeration of such items on particular sectors. The few sectors which have more than one not positively correlated or non proportional items also have relatively high total numbers of deliveries (see table D18).

When we look at the producing sectors for the reference group of 477 specified input items the sectors 61 Real estate and 82 Unspecified services with each 4 not positively correlated and respectively 5 and 6 non-proportional items alltogether are the only ones with more than 2 items of the former type and more than of 3 of the latter. In both sectors the measurement and registration of output is rather problematic.

An effort at a more systematic grouping of all delivering sectors has been made in table 17 (and D19, D20 and D21). The grouping adopted in the reproduced table into Extractive and service

Table 17. Characteristics of delivering sectors. Distribution of delivering sectors according to results for specified deliveries and type of delivering sector. All specified deliveries and competitive inputs combined. Percentage distribution

| Type of deliveries<br>Results | Type of delivering sector: Extractive and service | Commodity processing | Unspecified | Total | Number of sectors |
|---|---|---|---|---|---|
| **Specified deliveries form Norwegian sectors:** | | | | | |
| Sectors for which all specified deliveries are positively correlated with output in receiving sectors .......................... | 76.2 | 94.1 | 50.0 | 84.7 | 50 |
| Of these: All proportional with output .. | 71.4 | 79.4 | 50.0 | 74.6 | 44 |
| Total number of sectors .................. | 21 | 34 | 4 | 59 | 59 |
| **Specified deliveries from import sectors** | | | | | |
| Sectors for which all specified deliveries are positively correlated with output in receiving sectors .......................... | 85.7 | 92.9 | .. | 90.5 | 38 |
| Of these: All proportional with output .. | 78.6 | 85.7 | .. | 83.3 | 35 |
| Total number of sectors .................. | 14 | 28 | .. | 42 | 42 |
| **Competitive inputs combined** | | | | | |
| From sectors for which all combined deliveries are positively correlated with output in receiving sectors .............. | 88.8 | 87.9 | .. | 88.1 | 37 |
| Of these: All proportional with output .. | 88.8 | 81.8 | .. | 83.3 | 27 |
| Total number of sectors .................. | 9 | 33 | .. | 42 | 42 |

producing, commodity processing, and "unspecified" sectors brought out the greatest differences. An experimental distribution between service producing and commodity producing sectors gave less pronounced differences.

Thus, we find confirmation that inputs originating from commodity processing sectors show a closer relationship to outputs in consuming sectors than inputs from service producing sectors. However, it is surprising that inputs originating from extractive sectors should fall in with those from service producing sectors in this grouping. However, some of the Norwegian extractive sectors are of a somewhat special nature, i.a. because of the substitutability between their products and imports. If we consider the competitive inputs combined, where all but one of the extractive and service producing sectors are extractive, we do not find any difference between this group and the commodity producing group (tables 17 and D21).

## XVII. Number of deliveries

One way of characterizing a production sector is by the number of sectors to which it delivers its product as input. The general idea would be that the principal raw materials through their successive stages of processing follow only a limited number of routs, and consequently that the sectors mainly occupied in this type of processing will have few recepients for their deliveries for further processing. On the other hand, production sectors procuring auxillary materials and services to the major production sectors will in general have products which are used in many processes, and consequently have many recipients for their intermediate deliveries. It is a priori possible that there will tend to be a closer quantitative relationship between principal inputs and output, than between aucillary inputs and output.

A grouping of the sectors by number of deliveries has been made in table 18 (and in D22, D23 and D24). There appears to be a definite tendency for the percentage of deliveries which are not

Table 18. Characteristics of delivering sectors. Distribution of delivering sectors according to results for specified deliveries and number of specified deliveries. All specified deliveries and competitive inputs combined. Percentage distribution

| | Number of specified deliveries | | | | Number of sectors |
|---|---|---|---|---|---|
| | 1 | 2-4 | Over 4 | Total | |
| Specified deliveries from Norwegian sectors | | | | | |
| Sectors for which all specified deliveries are positively correlated with output in receiving sectors | 84.5 | 100.0 | 61.1 | 84.7 | 50 |
| Of these: All proportional with output | 84.5 | 85.7 | 50.0 | 74.6 | 44 |
| Total number of sectors | 13 | 28 | 18 | 59 | 59 |
| Specified deliveries from import sectors | | | | | |
| Sectors for which all specified deliveries are positively correlated with output in receiving sectors | 100.0 | 90.0 | 75.0 | 90.5 | 38 |
| Of these: All proportional with output | 100.0 | 80.0 | 58.4 | 83.3 | 35 |
| Total number of sectors | 20 | 10 | 12 | 42 | 42 |
| Competitive inputs combined | | | | | |
| From sectors for which all combined deliveries are positively correlated with output in receiving sectors | 100.0 | 95.5 | 69.2 | 88.1 | 37 |
| Of these: All proportional with output | 100.0 | 90.9 | 61.5 | 83.3 | 35 |
| Total number of sectors | 7 | 22 | 13 | 42 | 42 |

positively correlated with output in the receiving sector to increase as the number of specified deliveries increases and for the percentage of proportional inputs to decline with increasing number of deliveries. We get the same general picture in table 19, where results for the individual input items

Table 19. Forms of the regressions of inputs on outputs. Classification by number of specified inputs from delivering sectors. All specified inputs. Percentage distribution

| Form of regression | Number of specified inputs from sector of origin | | |
|---|---|---|---|
| | 1-3 | 4-9 | 10 and over |
| Proportional, no trend | 68.4 | 59.5 | 65.3 |
| Proportional, trend | 25.7 | 34.4 | 24.4 |
| Proportional, total | 94.1 | 93.9 | 89.7 |
| Linear positive, total | 3.9 | 2.4 | 3.7 |
| Confirmation, total | 98.0 | 96.3 | 93.4 |
| Linear negative, total | 1.0 | 3.7 | 4.7 |
| Independent, total | 1.0 | - | 1.9 |
| Rejection, total | 2.0 | 3.7 | 6.6 |
| Total | 100.0 | 100.0 | 100.0 |
| Number of input items | 101 | 163 | 213 |

have been grouped. The figures thus give some support to the suggested hypothesis.

Of the 13 Norwegian sectors with only one specified delivery, there were five cases where this delivery was intra-sector. The following three deliveries were classified as Proportional, no trend: From Margarine to Bakeries, from Transport, not elsewhere classified to Trade, and from Consultants to Publishing. The following two were classified as Proportional, trend: From Whaling to Oil refineries and from Communications to Commercial banks. Classified as Linear, negative, trend was the delivery from Hunting to Other food and as Independent, trend from Ocean transportation to Whaling. Of the 20 import sectors with only one specified delivery there were 11 where the delivery was to the corresponding Norwegian sector. The following 6 deliveries were classified as Proportional, no trend:

From Fisheries to Leather, from Whaling to Oil refineries, from Cordage to Leather, from Paper to Paper products, from Paper products to Laundry etc., from Herring oil to Oil refineries. The following three were classified as Proportional, trend: From Grain mills to Bakeries, from Pulp to Paper and from Rubber products to Shoe factories.

## XIX. Characteriatics of the receiving sector

So far we have examined the results for groups of input items characterized by the inputs themselves, irrespective of the character of the sectors into which they are inputs.

Obviously, we would also expect the characteristics of the receiving sectors to have some influence on the behaviour of their inputs in relation to changes in output. In order to study this, we have also grouped the inputs according to various characteristics of the receiving sectors.

In Appendix table II we have listed all the 79 sectors in the study, identified by the sector code used and by abbreviated sector names, indicating the major activities included in each sector. Various characteristics of the sectors, as average production in millions of (1955-)kroner, number of input items specified in the study and total number sepcified in the basic accounts are also given, as well as the figures on the test results for the specified inputs.

The sector code gives the following information:

Digits 1 and 2: consecutive numbering of the sectors from 01 to 79.

Digit 3: used for computational purposes.

Digit 4: Sector type: 0 = extractive and service sectors,
1. commodity processing sectors.

Digit 5: Size of production:

| Code | Average production value in million (1955-)kroner |
|---|---|
| 0 | 0 - 30.8 |
| 1 | 30.9 - 99.9 |
| 2 | 100.0 - 499.9 |
| 3 | 500.0 - 999.9 |
| 4 | 1000.0 and over |

Digit 6: Dispersion in production:

| Code | Coefficient of variation |
|---|---|
| 0 | 0 - 9 |
| 1 | 10 - 14 |
| 2 | 15 - 19 |
| 3 | 20 - 24 |
| 4 | 25 - 30 |
| 5 | 31 and over |

Digit 7: Trend in sector production:

| Code | Coefficient of correlation with time | |
|---|---|---|
| 0 | 0 - 0.575 | (95% level) |
| 1 | 0.576 - 0.707 | (99% level) |
| 2 | 0.708 - 0.85 | |
| 3 | 0.86 - 0.90 | |
| 4 | 0.91 - 0.95 | |
| 5 | 0.96 - 1.00 | |

In table 20 we have listed all the sectors with a fifth or more of the specified input items

Table 20. Sectors with one fifth or more of input items not proportional to output

| No. | Sector | Sector type[1)] | Number of specified inputs | Of these non-proportional | Of these not positively correlated |
|---|---|---|---|---|---|
| 05 | Whaling .................................... | 0 | 4 | 2 | 2 |
| 03 | Hunting etc. ............................... | 0 | 2 | 1 | 1 |
| 61 | Real estate ................................ | 0 | 2 | 1 | 1 |
| 67 | Tramways ................................... | 0 | 3 | 1 | 1 |
| 04 | Fisheries etc. ............................. | 0 | 3 | 1 | 1 |
| 56 | Central bank ............................... | 0 | 3 | 1 | 1 |
| 59 | Life insurance ............................. | 0 | 3 | 1 | 1 |
| 68 | Transport n.e.c. ........................... | 0 | 3 | 1 | 1 |
| 54 | Gas supply ................................. | 1 | 4 | 1 | 1 |
| 78 | Hotels etc. ................................ | 0 | 4 | 1 | 1 |
| 38 | Herring oil ................................ | 1 | 5 | 2 | 1 |
| 07 | Metal mining ............................... | 0 | 5 | 1 | 1 |
| 18 | Spirits .................................... | 1 | 5 | 1 | 1 |
| 65 | Post services .............................. | 0 | 5 | 1 | 1 |
| 79 | Laundry etc. ............................... | 0 | 6 | 2 | - |
| 10 | Dairies .................................... | 1 | 3 | 1 | - |
| 63 | Ocean transport ............................ | 0 | 3 | 1 | - |
| 09 | Slaughtering ............................... | 1 | 4 | 1 | - |
| 39 | Vegetable oil .............................. | 1 | 5 | 1 | - |

1) 0 = Extractive and service sectors (13)
1 = Commodity processing sectors (6)

classified as non-proportional to output. These are all sectors with a small number of specified input items. With few exceptions they are sectors where a quantitative measurement of the product presents conceptual difficulties, where the quantity measure of production is related to utilisation while a major part of operation costs are related to capacity (Transportation) or where indirect taxes or subsidies are of great importance (Spirits, Dairies).

We also note that more than two thirds of these sectors have been classified as extractive and service sectors.

## XX. Type of receiving sector

The classification into "Extractive and service sectors" and "Commodity processing sectors" is based on an a priori hypothesis that the simple types of relationships between inputs and outputs which we are testing here would be better adapted to the latter than to the former group: In both extractive and service sectors the intermediate inputs are typically of an ancillary nature and quite often not directly related to the volume of output for technical reasons. In the commodity processing sectors, on the other hand, inputs will to a large extent be "direct materials", and thus for technical reasons directly related to the volume of output.

Grouping our results according to this classification (table 21 and tables D25 and D26) brings

Table 21. Characteristics of receiving sectors. Forms of the regressions of inputs on output. Classification by type of receiving sector. All specified inputs. Percentage distributions

| Form of regression | Type of sector | |
|---|---|---|
| | Extractive and service | Commodity processing |
| Proportional, no trend | 51.7 | 69.7 |
| Proportional, trend | 36.7 | 23.9 |
| Proportional, total | 88.4 | 93.6 |
| Linear positive, no trend | 2.0 | 1.8 |
| Linear positive, trend | 0.7 | 1.5 |
| Linear positive, total | 2.7 | 3.3 |
| Confirmation, total | 91.1 | 96.9 |
| Linear negative, no trend | 2.1 | 1.2 |
| Linear negative, trend | 4.1 | 1.6 |
| Linear negative, total | 6.2 | 2.8 |
| Independent, trend | 0.7 | - |
| Independent, no trend | 2.0 | 0.3 |
| Independent, total | 2.7 | 0.3 |
| Rejection, total | 8.9 | 3.1 |
| Total | 100.0 | 100.0 |
| Number of items | 147 | 330 |

out quite consistently a difference in the expected direction. As with all our results, the difference is perhaps not dramatic, but it is consistently present in nearly all the basic groups of inputs (cfr. tables D25 and D26): The percentages of items in the class "proportional, total" is higher in commodity processing sectors than in extractive and service sectors for all categories of inputs except Imports, non competitive, which has only 13 items in each of the two classes, and Gross value added, where the difference is very small.

When we consider the percentages falling in the class "proportional, no trend", we again find a quite consistent difference to the effect that the percentages are also here higher for commodity processing sectors than for extractive and service sectors, with exceptions again for the category Imports, non competitive, and for Substitution groups. Still, the differences are not very big. But here they are big enough to be significant: For all specified inputs the proportion of Proportional, no trend is 51.7 for Extractive and service sectors. This is a deviation of 3.2 times the standard deviation in a binomial distribution with the probability 64.2 per cent (the result for all specified inputs) for this outcome and 147 items. Similarly, the percentage for commodity processing sectors is 69.7 and 2.1 times the standard deviation away from 64.2.

Correspondingly, the class proportional, trend has the higher percentages in extractive and service sectors for all categories except Imports, non-competitive and Substitution groups. The differences between the two types of sectors in respect of the distribution on the classes without and with trend seem to be somewhat more marked than the differences in respect of the total percentages in the class proportional.

The proportion of inputs in the classes Linear with negative regression coefficient for output and Independent are higher for extractive and service sectors for all categories except Norwegian, competitive and Gross value added.

The observed differences indicate that the Leontief model is slightly better adapted to the commodity processing sectors than to the extractive and service sectors, but the difference is not very great. The difference between the two types of sectors stands out more clearly, when we group the sectors in stead of the individual input items. For each sector we have computed the percentage of the specified coefficients which falls into each of the 8 classes of results. We have then grouped the sectors according to the following scheme:

1. Sectors with 70 per cent or more of their specified input items falling in the result class Proportional, no trend.

2. Sectors with at least 50 per cent of the specified input items falling in the result class Proportional, no trend, and the rest in the result class Proportional, trend.

3. Sectors with all specified input items falling in the result classes Proportional, no trend and Proportional, trend.

4. Sectors with all specified input items falling in classes with what we have considered significant positive correlation between input and output, i.e. in the classes Proportional and linear positive.

The three latter classes are cumulative.

The results of this grouping of the sectors for the two types of sectors are given in table 22.

Table 22. Characteristics of receiving sectors. Distribution of sectors according to results for specified input items and type of sector

| | Type of receiving sector | | | |
|---|---|---|---|---|
| | Extractive and service sectors | Commodity processing sectors | Extractive and service sectors | Commodity processing sectors |
| | Number of sectors | | Percentage distribution | |
| 70 per cent or more of specified input items in the class Proportional, no trend | 12 | 28 | 33.3 | 67.7 |
| All specified input items in the classes Proportional, majority without trend .... | 15 | 25 | 41.7 | 59.5 |
| All specified input items in the classes Proportional .......................... | 22 | 27 | 61.2 | 64.3 |
| All specified input items in classes with significant positive correlation between input and output ...................... | 24 | 33 | 66.7 | 78.5 |
| All sectors with sepcified items ........ | 36 | 42 | 100.0 | 100.0 |

The difference between the two types are particularly striking as regards the proportion of sectors with 70 per cent or more of input items falling in the class Proportional, no trend. Only one third of the extractive and service sectors against two thirds of the commodity processing sectors answer this description.

The above result is partly in contrast to the results obtained from an analysis of the inputs in coefficient form (comp. The Stability of Input-output Coefficients). In that analysis we found that "Surprisingly, the coefficients appear to be more stable in the extractive and service sectors than in the commodity processing sectors ....". However, we also found that "There is possibly an indication of a greater proportion of no trend coefficients for inputs in manufacturing", i.e. in commodity processing sectors.

The fact that we found greater dispersion about average and trends for input coefficients in commodity processing sectors than in extractive and service sectors in the earlier study is not necessarily inconsistent with our present result of greater percentages classified as proportional and as positively correlated with output in commodity processing sectors than in extractive and service sectors. One possible explanation might have been differences in size distribution of the input items, but the difference persists for all the size groups (see table D27).

We must conclude that there are differences in the expected direction between the sector types in regard to the percentages of cases where inputs are best explained by proportionality or positive linear dependency on output, but that there are differences in the closeness of the relationships, which go in the opposite direction.

## XXI. Size of receiving sectors

The average value of production in our sectors in the observation period varied from 13 million kroner (State banks) to 5 700 million kroner (Trade, all in 1955-prices). There are 6 sectors with average production less than 50 million 1955-kroner and 5 with an average of over 1 000 million kroner; these five range from 1 700 to 5 700 million kroner in average. Are there systematic differences between the sectors associated with output size in the way inputs are adjusted to changes in output? Conceivably, statistical errors might be relatively more important for input and output measurements in small than in large sectors. When data are grouped according to the size of production in receiving sectors, at least the specified items give a considerably higher percentage of cases with no positive correlation between inputs and outputs for sectors with less than 100 million kroner in average production than in larger sectors (table 23). This result for the specified inputs is also brought out when we group the sectors instead of the individual input items (table 24).

Table 23. Forms of the regressions of inputs on output, classified by size in 1955-kroner of the average production value of receiving sectors. All specified inputs. Percentage distribution

| | Average production values. Million (1955-)kroner | | | |
|---|---|---|---|---|
| | 0-<br>99.9 | 100.0-<br>499.9 | 500.0<br>999.9 | 1716<br>and<br>over |
| Proportional, no trend | 66.2 | 64.8 | 66.3 | 48.6 |
| Proportional, trend | 22.1 | 29.6 | 23.4 | 40.0 |
| Proportional, total | 88.3 | 94.4 | 89.7 | 88.6 |
| Linear positive, total | 1.4 | 2.3 | 5.6 | 8.6 |
| Confirmation, total | 89.7 | 96.7 | 95.3 | 97.2 |
| Linear negative, total | 5.9 | 2.6 | 4.7 | 2.8 |
| Independent, total | 4.4 | 0.7 | - | - |
| Rejection, total | 10.3 | 3.3 | 4.7 | 2.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |
| Number og items | 68 | 267 | 107 | 35 |

Table 24. Characteristics of receiving sectors. Distribution of sectors according to results for specified input items and size of average production in million 1955-kroner. Percentage distribution

| | Average production in million 1955-kroner | | |
|---|---|---|---|
| | 0-<br>99.9 | 100-<br>499.9 | 500<br>and<br>over |
| 70 per cent and more of specified input items in the class Proportional, no trend | 38.5 | 51.3 | 57.7 |
| All specified input items in the classes Proportional, majority without trend | 38.5 | 56.4 | 50.0 |
| All specified input items in the classes Proportional | 46.1 | 71.8 | 57.7 |
| All specified input items in classes with signigicant positive correlation between input and output | 53.8 | 79.5 | 73.0 |
| Number of sectors | 13 | 39 | 26 |

We seem thus to be able to discern a tendency to a somewhat less pronounced conformity to the Leontief model for the inputs in the smallest sectors. Usually, the small sectors have been specified because their character sets them off from others, so that there are no natural combinations into which to intergrate them. An effort at an a priori identification of "special sectors", where we would expect irregular input behaviour gave a larger proportion of such special sectors among the small sectors than among the middle sized ones. This "test" is, of course, highly subjective.

## XXII. Dispersion of production in receiving sectors

Generally, the dependency of quantities of input on volume of output in a sector should be expected to be more precisely estimated, the wider the dispersion in output is in the data, provided that production technique and quality of output remain unchanged. However, extreme changes in the volume of output are probably often accompanied by or directly caused by important changes in production techniques and - or product composition.

As a measure of relative dispersion in output we used standard deviation about average production in the sector in per cent of average production. When the results for individual input items are grouped according to this measure of dispersion of production in receiving sectors (tables 25 and D31 and D32) there appears to be a tendency for a greater percentage of the input items to fall in the class proportional, no trend, with increasing dispersion of production in the receiving sector, up to the group of dispersions above 25 per cent of average production, where there is again a fall in the percentage in this class of results. We might draw the conclusion from this evidence that the frequency of trends in the proportionality coefficients may be slightly overstated in our results, due to the effects of statistical disturbances. No other systematic differences appear to be associated with the relative distribution of production in receiving sectors.

A generally similar picture emerges when we study the distribution of sectors instead of the distribution of individual input items (tables 26 and D33).

Table 25. Forms of the regressions of inputs on outputs. Classification by the relative dispersion of production in receiving sectors. All specified inputs. Percentage distribution

| Form of regression | Standard deviation in per cent of average production value | | | | |
|---|---|---|---|---|---|
| | 0-9 | 10-14 | 15-19 | 20-24 | 25 and over |
| Proportional, no trend .................. | 55.5 | 63.6 | 68.5 | 73.8 | 56.3 |
| Proportional, trend ..................... | 37.5 | 28.3 | 24.1 | 19.4 | 32.8 |
| Proportional, total ..................... | 93.0 | 91.9 | 92.6 | 93.2 | 89.1 |
| Linear positive ......................... | 4.2 | 1.6 | 1.9 | 3.9 | 6.2 |
| Confirmation, total ..................... | 97.2 | 93.5 | 94.5 | 97.1 | 95.3 |
| Linear negative ......................... | - | 4.9 | 5.5 | 2.9 | 4.7 |
| Independent ............................. | 2.8 | 1.6 | - | - | - |
| Rejection, total ........................ | 2.8 | 6.5 | 5.5 | 2.9 | 4.7 |
| Total ................................... | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Number of items ......................... | 72 | 184 | 54 | 103 | 64 |

Table 26. Characteristics of receiving sectors. Distribution of sectors according to results for specified input items and dispersion in production. Percentages of numbers of sectors

| Sectors with: | Standard deviation in per cent of average production value | | | | |
|---|---|---|---|---|---|
| | 0-9 | 10-14 | 15-19 | 20-24 | 25 and over |
| 70 per cent or more of specified input items in class Proportional, no trend .... | 35.7 | 46.8 | 50.0 | 75.0 | 62.5 |
| All specified input items in the classes Proportional, majority without trend ..... | 42.8 | 50.0 | 58.3 | 50.0 | 62.5 |
| All specified input items in the classes Proportional .......................... | 71.4 | 59.4 | 66.7 | 50.0 | 75.0 |
| All specified input items in classes with significant positive correlation between input and output ........................ | 85.7 | 65.7 | 75.0 | 75.0 | 75.0 |
| Number of sectors ...................... | 14 | 32 | 12 | 12 | 8 |

## XXIII. Dispersion and trend in output in receiving sector

As was pointed out in the discussion of possible effect of time trends in output in receiving sectors (chapter XI), such trends may distort the results of our study in several ways. In particular there might be a confusion between proportional relationships with a trend and linear relationships without trend. When we grouped the results according to the existence or non-exixtence of trends in output in receiving sectors, not much light was thrown on this problem. However, when we also take into consideration the dispersion of output in receiving sectors, we may perhaps draw some conclusions. (See tables 27 and D34 and D35): For the inputs into sectors with large dispersion in output and where this dispersion is not mainly the effect of a strong trend, the percentage of cases classified as proportional with a trend in the proportionality factor is considerably lower, and the percentage of linear cases (without trend) is correspondingly higher than for inputs into other sectors. This might indicate that our results, tend to exaggerate the frequency of proportional relationships with trend, at the expences of the frequency of linear relationships. This conslusion

Table 27. Forms of regressions of inputs on outputs. Classification by dispersion and trend characteristics of output in receiving sectors. All specified inputs. Percentage distribution

| Form of regression | Standard deviation in per cent of average production value | | | | |
|---|---|---|---|---|---|
| | 0-9 | 10-14 | | 15 and over | |
| | All receiving sectors[1] | No clear trend in output in receiving sectors[1] | Clear trend in output in receiving sectors[1] | No clear trend in output in receiving sectors[1] | Clear trend in output in receiving sectors[1] |
| Proportional, no trend ...... | 55.5 | 68.2 | 61.0 | 68.4 | 67.3 |
| Proportional, trend ......... | 37.5 | 25.8 | 29.7 | 10.5 | 25.7 |
| Proportional, total ......... | 93.0 | 94.0 | 90.7 | 78.9 | 93.0 |
| Linear positive, total ...... | 4.2 | 1.5 | 1.7 | 15.8 | 3.0 |
| Confirmation, total ......... | 97.2 | 95.5 | 92.4 | 94.7 | 96.0 |
| Linear negative, total ...... | - | 3.0 | 5.9 | 5.3 | 4.0 |
| Independent, total .......... | 2.8 | 1.5 | 1.7 | - | - |
| Rejection, total ............ | 2.8 | 4.5 | 7.6 | 5.3 | 4.0 |
| Total ....................... | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Of these without trend .... | 58.3 | 68.2 | 64.4 | 89.5 | 70.8 |
| Number of input items ....... | 72 | 66 | 118 | 19 | 202 |

1) Sectors with a correlation coefficient between output and time above. 707 are classified as having a clear trend in output.

would be supported by the fact that the result Proportional, trend comes early in our testing procedure (compare chapter V) whereas the linear relationships are much later. The testing procedure must consequently be expected to be biased in favour of the proportional, trend result. On the other hand, the fact that there are only 19 input items into only two sectors in the class of inputs into sectors with large dispersion and no clear trend in output makes the basis for a strong conclusion somewhat shaky.

Since we have established that inputs and outputs do not change proportionately over time in about one third of all cases, and since the extrapolation of time trends seems to be a somewhat hazardous project for logical reasons, it may be that some further experimenting with linear input output relationships is more warranted than appears from our results at first sight.

## XXIV. Number of input items

The idea that the nature of input-output relationships may depend on the number of input items in a sector may seem a little far fetched, but conceivably there might be a difference between sectors engaged in an assembly type of production, putting together parts made up of materials from a great variety of sources on the one hand, and sectors processing one or a small number of main raw materials with little materials added on the other. However, service sectors, with generally few input items would also influence the picture.

The number of specified input items and the total number of input items for each sector is given in Appendix table II, together with the test results for each sector. When the sectors are grouped according to number of specified input items (table 28) or according to total number of input items (table 29) it appears that the sectors with the smallest numbers of input items have relatively fewer results in the class Proportional, no trend and fewer in the classes with positive correlation with output alltogether than sectors with greater numbers of inputs. We have thus an indication that the hypothesis about a better fit for the assembly type sectors is correct. (See also tables D36 and D37)

Table 28. Forms of the regressions of inputs on output. Classification by number of specified input items in receiving sector. All specified inputs. Percentage distribution

| Form of regression | Number of specified input items in receiving sector | | |
|---|---|---|---|
| | 1-6 | 7-9 | 10 and over |
| Proportional, no trend | 56.0 | 77.7 | 60.9 |
| Proportional, trend | 31.9 | 19.5 | 31.4 |
| Proportional, total | 87.9 | 97.2 | 92.3 |
| Linear positive, total | 3.9 | 0.7 | 4.5 |
| Confirmation, total | 91.8 | 97.9 | 96.8 |
| Linear negative, total | 5.5 | 2.1 | 3.2 |
| Independent, total | 2.7 | - | - |
| Rejection, total | 8.2 | 2.1 | 3.2 |
| Total | 100.0 | 100.0 | 100.0 |
| Number of input items | 182 | 139 | 156 |

Table 29. Forms of the regressions of inputs on output. Classification by total number of input items in receiving sector. All specified inputs. Percentage distribution

| Form of regression | Total number of inputs items in receiving sector | | |
|---|---|---|---|
| | 3-9 | 10-24 | 25 and over |
| Proportional, no trend .................. | 53.5 | 70.0 | 50.8 |
| Proportional, trend ..................... | 32.6 | 24.8 | 36.2 |
| Proportional, total ..................... | 86.1 | 94.8 | 87.0 |
| Linear positive, total .................. | 1.1 | 2.4 | 8.7 |
| Confirmation, total ..................... | 87.2 | 97.2 | 95.7 |
| Linear negative, total .................. | 8.1 | 2.5 | 4.3 |
| Independent, total ...................... | 4.7 | 0.3 | - |
| Rejection, total ........................ | 12.8 | 2.8 | 4.3 |
| Total ................................... | 100.0 | 100.0 | 100.0 |
| Number og specified input items .......... | 86 | 323 | 69 |

## XXV. Summary of findings

It was found in earlier studies[1)] that there are considerable variations from year to year in the input-output proportions and that part of these variations could be accounted for by linear trends in the coefficients, but that much variation also remained about the trend lines. It was also found that the instability in coefficients led to considerable errors in forecasts of intermediate deliveries when these forecasts were based on an observed set of input-output coefficients or on averages of such coefficients. In the present study we wanted to test if the simple hypothesis of linear, nonproportional relationships between inputs and outputs, or of independency would offer better alternatives to the hypothesis of proportionality. We also wanted to investigate if there are specific types of inputs or specific types of sectors, which differ from the rest in respect of input-output relationships. Since an interindustry model of production is bases on assumptions about input-output relationships for up to thousands of input items, it would be of great practical importance if the mass of input items could be subdivided into groups where the hypothesis of proportionality worked quite well, and others where it did not turn out so well, so that the search for alternative hypotheses could be intensified for the latter groups.

As the preceding account of our results show, the alternatives did not prevail over the proportionality assumption in the majority of cases. With the reservation that our testing procedure was biased in favour of the proportionality assumption, this assumption was rejected for only about 1 out of 10 cases (8 per cent for the reference group). With this low over all percentage of rejections it is perhaps not so surpricing that we were not able to discover groups of inputs or production sectors which stood clearly out from the rest in regard to relationships between inputs and outputs. Roughly 3 in 100 (3 per cent for the reference group) of the input items studied appeared to be linearly, nonproportionally, dependent on output with a positive regression coefficient and 1 in 20 (4.8 per cent for the reference group) showed a negatively inclined linear dependency or independence between input and output.

In all the forms of relationships between inputs and outputs selected by our testing procedure about one third were forms with a trend factor (32.2 per cent for the reference group). This is clearly less than the percentage of input-output coefficients with a trend (42 to 58 per cent for the reference group) found in the earlier study of coefficient stability[2)], and there is no good correspondende between the results of the present and the former study in this respect. A certain possibility for trade-offs between non-proportional linear forms and proportionality with a trend in our test results, together with different minimization procedures must account for this difference.

1) Sevaldson, Op.cit.1970 and Sevaldson, Op.cit. 1972.
2) Sevaldson, Op.cit. 1970.

Nearly two thirds (64 per cent for the reference group) of all items were classified as proportional with output and without trend.

In respect to the various categories describing origin, competitiveness and aggregation levels into which the input items were grouped, the general impression is that there are no very marked differences between the groups as regards test results. It is particularly remarkable that the formation of more aggregate input units through the combination of "similar" items, like corresponding domestic and imported inputs, inputs characterised as "substitution groups" or "fuels combined" do not tend to alter the relative frequencies of the various outcomes of the testing procedure. We must take this as an indication that the increase in coefficient stability achieved by aggregating the input-output matrix[1)] is primarily an effect of statistical and not of systematic causes.

The size of the input-output coefficient did not appear to influence the results of the testing procedure. This is remarkable but it is not inconsistent with the finding in the study of coefficient stability[2)], that the larger coefficients were more stable over time than the small ones. Measured in absolute size, i.e. in 1955-kroner, the larger inputs showed more evidence of trends in the relationships with output, and somewhat fewer instances of independence or negative correlation with output, than the small and medium-sized inputs. The general conclusion is that there are not marked differences in the input-output relationships between inputs of different sizes.

A closer study of the input items which were classified as linearly and non-proportionately related to output, showed that the constant terms were not large for the majority of items. Negative regression coefficients between input and output were found more often for small than for large input items, and when trends were ignored, half of the negative regression coefficients were changed to positive, and the changes were particularly frequent for the larger input items.

When inputs were classified by type into a) direct and b) auxiliary materials, c) services and d) packing materials, a clear difference was found between service inputs and the three types of materials input in respect of results. The results indicated a tendency to stronger positive correlation between inputs and outputs for the materials inputs than for service inputs, which is in agreement with commonly held beliefs, but the differences are hardly sufficiently important to warrant a differential treatment of services and materials in input-output analysis.

The difference between services and materials is to some extent found again when we group inputs by type of delivering sector into deliveries from extractive and service sectors as compared to deliveries from commodity processing sectors, where there is a tendency to differences in the same direction.

Inputs coming from sectors which deliver their products to many different sectors seemed to be somewhat less closely tied to the production levels in receiving sectors than inputs coming from sectors with fewer "customers". It is assumed that sectors with deliveries to many users typically produce ancillary inputs, whereas sectors with few recepients for their products deliver principal materials.

When the test results are grouped according to whether the receiving sectors are commodity processing or extractive and service producing, the commodity processing sectors showed the highest share of proportional outputs, both in total and in the class proportional, without trend. These sectors also had the lowest percentages of inputs classified as independent of, or negatively related to outputs. But again the difference was not so big as one might have expected on the basis of customary arguments for a more ready acceptance of the Leontief model for processing sectors.

Very small sectors, which are in many respects "problematic" shoved a tendency to give more uncertain results, and smaller fractions of proportional inputs than the rest.

Dispersion in output in the receiving sector, which should be expected to improve the presicion in our tests appeared to reduce the frequency of trends in the proportionality coefficient and increase the frequency of non-proportional, linear dependencies.

1) Sevaldson, op.cit. 1972.
2) Sevaldson, op.cit. 1970.

An analysis of the results classified according to number of input items in receiving sectors provides a mild support for a hypothesis that "assembly type" sectors, with many inputs are in better conformity with the hypothesis of input-output analysis than "processing" sectors and service sectors with few input items.

To sum up, our analysis appears to indicate that:

- the assumption about a positive relationship between inputs and output in production sectors is correct for 19 out of 20 cases.
- the observed instability in input-output ratios is not much helped by the introduction of linear, non-proportional relationships.
- a considerable part of the variation over time in input-output ratios is captured by the introduction of trends in input-output relationships.
- there are small differences between the groups into which input items have been classified in this study in respect to results of the testing procedure applied. To the extent that there are differences they coinside with apriori expectations, but they are hardly big enough to warrant differential approaches to the problem of relationships between inputs and outputs.

As explanations for the variability in input-output ratios we are then left with possibilities such as:

- the relationships are of a more complicated mathematical form than linearity.
- there are other variables than output which systematically influence the volumes of inputs.
- the statistical precision in our data is insufficient, due to reporting or measurement problems.
- there are arbitrary variations in the input-output ratios in the production processes.

PART D. DETAILED TABLES

Table D1. Equivalence in the forms of the regressions of inputs on outputs for basic categories of inputs. Classification by average size in kroner of the input items

| Basic category<br>Form of regression | Average size of input item in million 1955-kroner | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 - 10.0 | 10.1- 50.0 | 50.1- 100.0 | 100.1- 250.0 | 250.1 + | Total | 0 - 10.0 | 0 - 50.0 | 0 - 100.0 | 100.1 + | 250.1 + | Total |
| | Number of input items | | | | | | Percentage distribution | | | | | |
| Norwegian competitive | | | | | | | | | | | | |
| Proportional or independent, no trend | 43 | 11 | 4 | - | - | 58 | 74.2 | 93.2 | 100.0 | - | - | 100.0 |
| Other proportional, no trend | 19 | 17 | 3 | 5 | 5 | 49 | 38.8 | 73.5 | 79.6 | 20.4 | 10.2 | 100.0 |
| Other forms | 23 | 15 | 6 | 5 | 5 | 54 | 42.6 | 70.4 | 81.5 | 18.5 | 9.2 | 100.0 |
| Norwegian, non-competitive | | | | | | | | | | | | |
| Proportional or independent, no trend | 19 | 6 | 1 | - | - | 26 | 73.1 | 96.2 | 100.0 | - | - | 100.0 |
| Other proportional, no trend | 37 | 20 | 1 | 1 | 2 | 61 | 60.7 | 93.5 | 95.1 | 4.9 | 3.3 | 100.0 |
| Other forms | 52 | 10 | 1 | 3 | - | 66 | 78.8 | 94.0 | 95.5 | 4.5 | - | 100.0 |
| Imports | | | | | | | | | | | | |
| Proportional or independent, no trend | 45 | 14 | 2 | 1 | 1 | 63 | 71.5 | 93.7 | 96.8 | 3.2 | 1.6 | 100.0 |
| Other proportional, no trend | 15 | 25 | 6 | 3 | - | 49 | 30.6 | 81.7 | 93.9 | 6.1 | - | 100.0 |
| Other forms | 23 | 17 | 5 | 4 | 2 | 51 | 45.1 | 78.5 | 88.2 | 11.8 | 3.9 | 100.0 |
| All specified inputs | | | | | | | | | | | | |
| Proportional or independent, no trend | 107 | 31 | 7 | 1 | 1 | 147 | 72.8 | 93.8 | 98.6 | 1.4 | 0.7 | 100.0 |
| Other proportional, no trend | 71 | 62 | 10 | 9 | 7 | 159 | 44.7 | 83.6 | 89.9 | 10.1 | 4.1 | 100.0 |
| Other forms | 98 | 42 | 12 | 12 | 7 | 171 | 57.3 | 81.8 | 88.9 | 11.1 | 4.1 | 100.0 |
| Competitive inputs combined | | | | | | | | | | | | |
| Proportional or independent, no trend | 40 | 12 | 6 | 2 | 1 | 61 | 65.6 | 85.3 | 95.1 | 4.9 | 1.6 | 100.0 |
| Other proportional, no trend | 29 | 33 | 7 | 9 | 8 | 86 | 33.7 | 72.1 | 80.3 | 19.7 | 9.3 | 100.0 |
| Other forms | 24 | 30 | 11 | 8 | 5 | 78 | 30.8 | 69.3 | 83.3 | 16.7 | 6.4 | 100.0 |
| Fuels combined | | | | | | | | | | | | |
| Proportional or independent, no trend | 10 | 2 | - | - | - | 12 | 83.3 | 100.0 | 100.0 | - | - | 100.0 |
| Other proportional, no trend | 14 | 7 | - | - | - | 21 | 66.7 | 100.0 | 100.0 | - | - | 100.0 |
| Other forms | 15 | 5 | - | - | - | 20 | 75.0 | 100.0 | 100.0 | - | - | 100.0 |
| Substitution groups | | | | | | | | | | | | |
| Proportional or independent, no trend | - | 2 | - | - | - | 2 | - | 100.0 | 100.0 | - | - | 100.0 |
| Other proportional, no trend | - | 4 | 7 | 4 | 13 | 28 | - | 14.3 | 39.3 | 60.7 | 46.4 | 100.0 |
| Other forms | 3 | 8 | 2 | 5 | 5 | 23 | 13.0 | 47.8 | 56.5 | 43.5 | 21.7 | 100.0 |
| Import sums | | | | | | | | | | | | |
| Proportional or independent, no trend | 5 | 10 | 2 | 1 | - | 18 | 27.8 | 83.3 | 94.5 | 5.5 | - | 100.0 |
| Other proportional, no trend | 5 | 9 | 5 | 6 | 2 | 27 | 18.5 | 51.9 | 70.4 | 29.6 | 7.4 | 100.0 |
| Other forms | 6 | 6 | 3 | 5 | 3 | 23 | 26.1 | 52.2 | 65.3 | 34.0 | 13.0 | 100.0 |
| Gross value added | | | | | | | | | | | | |
| Proportional or independent, no trend | - | 2 | 1 | 2 | 1 | 6 | - | 33.3 | 50.0 | 50.0 | 33.3 | 100.0 |
| Other independent, no trend. | 2 | 4 | 7 | 19 | 10 | 42 | 4.8 | 14.3 | 31.0 | 69.0 | 23.8 | 100.0 |
| Other forms | 1 | 7 | 5 | 10 | 8 | 31 | 3.2 | 25.8 | 42.0 | 58.0 | 25.8 | 100.0 |

Table D2. Equivalence in the forms of the regressions of inputs on outputs for basic categories of inputs. Classification by relative dispersion of production in receiving sectors

| Basic category<br>Form of regression | Standard deviation divided by average production in receiving sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 - 0.09 | 0.10- 0.14 | 0.15- 0.19 | 0.20- 0.24 | 0.25 + | Total | 0 - 0.09 | 0 - 0.14 | 0 - 0.19 | 0 - 0.24 | 0.25 + | Total |
| | Number of input items | | | | | | Percentage distribution | | | | | |
| Norwegian, competitive | | | | | | | | | | | | |
| Proportional or independent, no trend ................ | 10 | 25 | 5 | 13 | 5 | 58 | 17.2 | 60.3 | 68.9 | 91.3 | 8.7 | 100.0 |
| Other proportional, no trend | 7 | 12 | 4 | 16 | 10 | 49 | 14.3 | 38.8 | 47.0 | 79.6 | 20.4 | 100.0 |
| Other forms ............... | 8 | 20 | 5 | 9 | 12 | 54 | 14.8 | 51.8 | 61.0 | 77.7 | 22.3 | 100.0 |
| Norwegian, non-competitive | | | | | | | | | | | | |
| Proportional or independent, no trend ................ | 4 | 17 | 2 | 3 | - | 26 | 15.4 | 80.8 | 88.5 | 100.0 | - | 100.0 |
| Other proportional, no trend | 6 | 26 | 14 | 10 | 5 | 61 | 9.8 | 52.4 | 75.3 | 91.7 | 8.3 | 100.0 |
| Other forms ............... | 15 | 29 | 8 | 7 | 7 | 66 | 22.7 | 66.7 | 78.8 | 89.4 | 10.6 | 100.0 |
| Imports | | | | | | | | | | | | |
| Proportional or independent, no trend ................ | 9 | 22 | 8 | 17 | 7 | 63 | 14.3 | 49.2 | 61.9 | 88.9 | 11.1 | 100.0 |
| Other proportional, no trend | 4 | 15 | 4 | 17 | 9 | 49 | 8.2 | 38.8 | 47.0 | 81.7 | 18.3 | 100.0 |
| Other forms ............... | 9 | 18 | 4 | 11 | 9 | 51 | 17.6 | 53.0 | 60.8 | 82.4 | 17.6 | 100.0 |
| All specified inputs | | | | | | | | | | | | |
| Proportional or independent, no trend ................ | 23 | 64 | 15 | 33 | 12 | 147 | 15.7 | 59.2 | 69.4 | 91.8 | 8.2 | 100.0 |
| Other proportional, no trend | 17 | 53 | 22 | 43 | 24 | 159 | 10.7 | 44.1 | 57.9 | 84.9 | 15.1 | 100.0 |
| Other forms ............... | 32 | 67 | 17 | 27 | 28 | 171 | 18.7 | 57.9 | 67.8 | 83.6 | 16.4 | 100.0 |
| Competitive inputs combined | | | | | | | | | | | | |
| Proportional or independent, no trend ................ | 15 | 21 | 8 | 11 | 6 | 61 | 24.6 | 59.1 | 72.2 | 90.2 | 9.8 | 100.0 |
| Other proportional, no trend | 8 | 20 | 11 | 28 | 19 | 86 | 9.3 | 32.6 | 45.4 | 78.0 | 22.0 | 100.0 |
| Other forms ............... | 10 | 31 | 4 | 18 | 15 | 78 | 12.8 | 52.6 | 57.7 | 80.8 | 19.2 | 100.0 |
| Fuels combined | | | | | | | | | | | | |
| Proportional or independent, no trend ................ | 2 | 7 | - | 2 | 1 | 12 | 16.7 | 75.0 | 75.0 | 91.7 | 8.3 | 100.0 |
| Other proportional, no trend | 3 | 3 | 5 | 5 | 5 | 21 | 14.3 | 28.6 | 52.4 | 76.2 | 23.8 | 100.0 |
| Other forms ............... | 5 | 9 | 1 | 4 | 1 | 20 | 25.0 | 70.0 | 75.0 | 95.0 | 5.0 | 100.0 |
| Substitution groups | | | | | | | | | | | | |
| Proportional or independent, no trend ................ | 1 | 1 | - | - | - | 2 | 50.0 | 100.0 | 100.0 | 100.0 | - | 100.0 |
| Other proportional, no trend | 4 | 12 | 3 | 7 | 2 | 28 | 14.3 | 57.1 | 67.8 | 92.8 | 7.2 | 100.0 |
| Other forms ............... | 2 | 12 | 1 | 6 | 2 | 23 | 8.7 | 60.9 | 65.2 | 91.3 | 8.7 | 100.0 |
| Import sums | | | | | | | | | | | | |
| Proportional or independent, no trend ................ | 4 | 10 | 2 | 1 | 1 | 18 | 22.2 | 77.7 | 88.8 | 94.4 | 5.6 | 100.0 |
| Other proportional, no trend | 7 | 7 | 4 | 7 | 2 | 27 | 25.9 | 51.8 | 66.6 | 92.5 | 7.5 | 100.0 |
| Other forms ............... | 2 | 11 | 1 | 4 | 5 | 23 | 8.7 | 56.5 | 60.8 | 78.2 | 21.8 | 100.0 |
| Gross value added | | | | | | | | | | | | |
| Proportional or independent, no trend ................ | 3 | 3 | - | - | - | 6 | 50.0 | 100.0 | 100.0 | 100.0 | - | 100.0 |
| Other proportional, no trend | 7 | 12 | 11 | 8 | 4 | 42 | 16.6 | 45.2 | 71.4 | 90.4 | 9.6 | 100.0 |
| Other forms ............... | 4 | 17 | 1 | 5 | 4 | 31 | 12.9 | 67.8 | 71.0 | 87.1 | 12.9 | 100.0 |

Table D3. Equivalence in the forms of the regressions of inputs on outputs for basic categories of inputs. Classification by relative dispersion of production in receiving sectors and coefficient size

| Basic category / Form of regression | Standard deviation in per cent of average production for receiving sectors | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 - 14 | | 15 and over | | | 0 - 14 | | 15 and over | | |
| | Coefficient size | | | | | | | | | |
| | 0 - 0.05 | Over 0.05 | 0 - 0.05 | Over 0.05 | Total | 0 - 0.05 | Over 0.05 | 0 - 0.05 | Over 0.05 | Total |
| | Number of input items | | | | | Percentage distribution | | | | |
| **All specified inputs** | | | | | | | | | | |
| Proportional or independent, no trend ................ | 69 | 18 | 49 | 11 | 147 | 47.0 | 12.2 | 33.3 | 7.5 | 100.0 |
| Other proportional, no trend | 43 | 27 | 57 | 32 | 159 | 27.0 | 17.0 | 35.9 | 20.1 | 100.0 |
| Other forms ............... | 71 | 28 | 49 | 23 | 171 | 41.5 | 16.4 | 28.6 | 13.5 | 100.0 |
| **Competitive inputs combined** | | | | | | | | | | |
| Proportional or independent, no trend ................ | 28 | 8 | 20 | 5 | 61 | 45.9 | 13.1 | 32.8 | 8.2 | 100.0 |
| Other proportional, no trend | 10 | 18 | 36 | 22 | 86 | 11.6 | 20.9 | 41.9 | 25.6 | 100.0 |
| Other forms ............... | 20 | 21 | 20 | 17 | 78 | 25.6 | 26.9 | 25.7 | 21.8 | 100.0 |
| **Substitution groups and fuels** | | | | | | | | | | |
| Proportional or independent, no trend ................ | 10 | 1 | 3 | - | 14 | 71.5 | 7.1 | 21.4 | - | 100.0 |
| Other proportional, no trend | 7 | 15 | 11 | 16 | 49 | 14.3 | 30.6 | 22.4 | 32.7 | 100.0 |
| Other forms ............... | 15 | 13 | 8 | 7 | 43 | 34.9 | 30.2 | 18.6 | 16.3 | 100.0 |
| **Import sums** | | | | | | | | | | |
| Proportional or independent, no trend ................ | 7 | 7 | 3 | 1 | 18 | 38.9 | 38.9 | 16.7 | 5.5 | 100.0 |
| Other proportional, no trend | 4 | 10 | 1 | 12 | 27 | 14.8 | 37.0 | 3.7 | 44.5 | 100.0 |
| Other forms ............... | 5 | 8 | 1 | 9 | 23 | 21.8 | 34.8 | 4.2 | 39.2 | 100.0 |
| **Gross value added** | | | | | | | | | | |
| Proportional or independent, no trend ................ | - | 6 | - | - | 6 | - | 100.0 | - | - | 100.0 |
| Other proportional, no trend | - | 19 | - | 23 | 42 | - | 45,2 | - | 54.8 | 100.0 |
| Other forms ............... | - | 21 | - | 10 | 31 | - | 67.7 | - | 32.3 | 100.0 |

Table D4. Forms of the regression of inputs on outputs for basic categories of inputs classified according to trend characteristics of output in receiving sectors. Numbers of input items

| Basic category / Trend character of receiving sector | Form of regression: Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | Number | Percentage |
| **Norwegian, competitive** | | | | | | | | | | | | | | |
| No trend ..... | 21 | 8 | 29 | - | - | - | 1 | 1 | 2 | - | 1 | 1 | 32 | 19.9 |
| Moderate trend | 15 | 1 | 16 | - | - | - | - | - | - | - | - | - | 16 | 9.9 |
| Clear trend .. | 71 | 34 | 105 | 3 | 1 | 4 | 2 | 2 | 4 | - | - | - | 113 | 70.2 |
| **Norwegian, non competitive** | | | | | | | | | | | | | | |
| No trend ..... | 11 | 9 | 20 | 1 | 1 | 2 | - | - | - | - | 1 | 1 | 23 | 15.0 |
| Moderate trend | 7 | 1 | 8 | - | - | - | - | - | - | - | - | - | 8 | 5.2 |
| Clear trend .. | 69 | 39 | 108 | 2 | 1 | 3 | 3 | 5 | 8 | 1 | 2 | 3 | 122 | 79.8 |
| **Imports** | | | | | | | | | | | | | | |
| No trend ..... | 22 | 6 | 28 | - | - | - | - | 1 | 1 | - | - | - | 29 | 17.8 |
| Moderate trend | 10 | 6 | 16 | 2 | 1 | 3 | - | - | - | - | - | - | 19 | 11.7 |
| Clear trend .. | 80 | 29 | 109 | 1 | 2 | 3 | 1 | 2 | 3 | - | - | - | 115 | 70.5 |
| **All specified inputs** | | | | | | | | | | | | | | |
| No trend ..... | 54 | 23 | 77 | 1 | 1 | 2 | 1 | 2 | 3 | - | 2 | 2 | 84 | 17.6 |
| Moderate trend | 32 | 8 | 40 | 2 | 1 | 3 | - | - | - | - | - | - | 43 | 9.0 |
| Clear trend .. | 220 | 102 | 322 | 6 | 4 | 10 | 6 | 9 | 15 | 1 | 2 | 3 | 350 | 73.4 |
| **Competitive inputs combined** | | | | | | | | | | | | | | |
| No trend ..... | 27 | 13 | 40 | - | - | - | - | 2 | 2 | - | - | - | 42 | 18.7 |
| Moderate trend | 13 | 7 | 20 | - | - | - | - | 1 | 1 | - | 2 | 2 | 23 | 10.2 |
| Clear trend .. | 107 | 47 | 154 | 1 | 1 | 2 | 1 | 3 | 4 | - | - | - | 160 | 71.1 |
| **Substitution groups and fuels** | | | | | | | | | | | | | | |
| No trend ..... | 14 | 5 | 19 | - | - | - | 2 | - | 2 | 1 | - | 1 | 22 | 20.8 |
| Moderate trend | 3 | 6 | 9 | 1 | - | 1 | - | - | - | - | 1 | 1 | 11 | 10.4 |
| Clear trend .. | 46 | 21 | 67 | 1 | 2 | 3 | 1 | 2 | 3 | - | - | - | 73 | 68.8 |
| **Import sums** | | | | | | | | | | | | | | |
| No trend ..... | 10 | - | 10 | 1 | - | 1 | - | - | - | - | 1 | 1 | 12 | 17.6 |
| Moderate trend | 4 | 1 | 5 | - | - | - | - | - | - | - | - | - | 5 | 7.4 |
| Clear trend .. | 31 | 15 | 46 | 1 | 3 | 4 | - | 1 | 1 | - | - | - | 51 | 75.0 |
| **Gross value added** | | | | | | | | | | | | | | |
| No trend ..... | 8 | 2 | 10 | 2 | 1 | 3 | - | - | - | - | - | - | 13 | 16.5 |
| Moderate trend | 3 | 1 | 4 | - | - | - | - | 1 | 1 | - | - | - | 5 | 6.3 |
| Clear trend .. | 37 | 17 | 54 | 3 | 2 | 5 | 1 | - | 1 | - | 1 | 1 | 61 | 77.2 |

Table D5. Forms of the regressions of inputs on outputs for basic categories of inputs classified according to trend characteristics of output in receiving sectors. Percentage distribution

| Basic category<br>Trend character of receiving sector | Form of regression | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | |
| | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | |
| **Norwegian, competitive** | | | | | | | | | | | | | |
| No trend ............ | 65.6 | 25.0 | 90.6 | - | - | - | 3.2 | 3.1 | 6.3 | - | 3.1 | 3.1 | 100.0 |
| Moderate trend ....... | 93.7 | 6.3 | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 |
| Clear trend .......... | 62.8 | 30.1 | 92.9 | 2.6 | 0.9 | 3.5 | 1.8 | 1.8 | 3.6 | - | - | - | 100.0 |
| **Norwegian, non-competitive** | | | | | | | | | | | | | |
| No trend ............ | 47.8 | 39.1 | 86.9 | 4.4 | 4.3 | 8.7 | - | - | - | - | 4.4 | 4.4 | 100.0 |
| Moderate trend ....... | 87.5 | 12.5 | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 |
| Clear trend .......... | 56.5 | 32.0 | 88.5 | 1.6 | 0.8 | 2.4 | 2.5 | 4.1 | 6.6 | 0.8 | 1.7 | 2.5 | 100.0 |
| **Imports** | | | | | | | | | | | | | |
| No trend ............ | 75.9 | 20.7 | 96.6 | - | - | - | - | 3.4 | 3.4 | - | - | - | 100.0 |
| Moderate trend ....... | 52.6 | 31.6 | 84.2 | 10.5 | 5.3 | 15.8 | - | - | - | - | - | - | 100.0 |
| Clear trend .......... | 69.6 | 25.2 | 94.8 | 0.9 | 1.7 | 2.6 | 0.9 | 1.7 | 2.6 | - | - | - | 100.0 |
| **All specified inputs** | | | | | | | | | | | | | |
| No trend ............ | 64.3 | 27.4 | 91.7 | 1.2 | 1.2 | 2.4 | 1.2 | 2.3 | 3.5 | - | 2.4 | 2.4 | 100.0 |
| Moderate trend ....... | 74.4 | 18.6 | 93.0 | 4.7 | 2.3 | 7.0 | - | - | - | - | - | - | 100.0 |
| Clear trend .......... | 62.9 | 29.1 | 92.0 | 1.7 | 1.1 | 2.8 | 1.7 | 2.6 | 4.3 | 0.3 | 0.6 | 0.9 | 100.0 |
| **Competitive inputs combined** | | | | | | | | | | | | | |
| No trend ............ | 64.3 | 30.9 | 95.2 | - | - | - | - | 4.8 | 4.8 | - | - | - | 100.0 |
| Moderate trend ....... | 56.5 | 30.5 | 87.0 | - | - | - | - | 4.3 | 4.3 | - | 8.7 | 8.7 | 100.0 |
| Clear trend .......... | 66.8 | 29.4 | 96.2 | 0.7 | 0.6 | 1.3 | 0.6 | 1.9 | 2.5 | - | - | - | 100.0 |
| **Substitution groups and fuels** | | | | | | | | | | | | | |
| No trend ............ | 63.6 | 22.7 | 86.4 | - | - | - | 9.1 | - | 9.1 | 4.5 | - | 4.5 | 100.0 |
| Moderate trend ....... | 27.3 | 54.5 | 81.8 | 9.1 | - | 9.1 | - | - | - | - | 9.1 | 9.1 | 100.0 |
| Clear trend .......... | 63.0 | 28.8 | 91.8 | 1.4 | 2.7 | 4.1 | 1.4 | 2.7 | 4.1 | - | - | - | 100.0 |
| **Import sums** | | | | | | | | | | | | | |
| No trend ............ | 83.4 | - | 83.4 | 8.3 | - | 8.3 | - | - | - | - | 8.3 | 8.3 | 100.0 |
| Moderate trend ....... | 80.0 | 20.0 | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 |
| Clear trend .......... | 60.8 | 29.4 | 90.2 | 2.0 | 5.9 | 7.9 | - | 1.9 | 1.9 | - | - | - | 100.0 |
| **Gross value added** | | | | | | | | | | | | | |
| No trend ............ | 61.5 | 15.4 | 76.9 | 15.4 | 7.7 | 23.1 | - | - | - | - | - | - | 100.0 |
| Moderate trend ....... | 60.0 | 20.0 | 80.0 | - | - | - | - | 20.0 | 20.0 | - | - | - | 100.0 |
| Clear trend .......... | 60.6 | 27.9 | 88.5 | 4.9 | 3.3 | 8.2 | 1.7 | - | 1.7 | - | 1.6 | 1.6 | 100.0 |

Table D6. Comparison between form of regression of input on output and trend character of input-output coefficient

| Basic category<br>Form of regression | None | Mode-rate | Clear | Total | None | Mode-rate | Clear | Total |
|---|---|---|---|---|---|---|---|---|
| | Number of input items | | | | Percentage distribution | | | |
| **All specified inputs** | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output .............. | 35 | 8 | 11 | 54 | 64.8 | 14.8 | 20.4 | 100.0 |
| Moderate trend in output ........ | 20 | 5 | 7 | 32 | 62.5 | 15.6 | 21.9 | 100.0 |
| Clear trend in output ........... | 123 | 49 | 48 | 220 | 55.9 | 22.3 | 21.8 | 100.0 |
| Proportional, trend ............... | 6 | 8 | 119 | 133 | 4.5 | 6.0 | 89.5 | 100.0 |
| Linear, no trend | | | | | | | | |
| No trend in output .............. | 2 | - | - | 2 | 100.0 | - | - | 100.0 |
| Moderate trend in output ........ | 1 | 1 | - | 2 | 50.0 | 50.0 | - | 100.0 |
| Clear trend in output ........... | 2 | 2 | 8 | 12 | 16.7 | 16.7 | 66.6 | 100.0 |
| Linear trend | | | | | | | | |
| No trend in output .............. | - | - | 3 | 3 | - | - | 100.0 | 100.0 |
| Moderate trend in output ........ | 1 | - | - | 1 | 100.0 | - | - | 100.0 |
| Clear trend in output ........... | 7 | 4 | 2 | 13 | 53.8 | 30.8 | 15.4 | 100.0 |
| Independent, no trend | | | | | | | | |
| Clear trend in output ........... | - | - | 1 | 1 | - | - | 100.0 | 100.0 |
| Independent, trend | | | | | | | | |
| No trend in output .............. | 1 | - | 1 | 2 | 50.0 | - | 50.0 | 100.0 |
| Clear trend in output ........... | 1 | - | 1 | 2 | 50.0 | - | 50.0 | 100.0 |
| Total ............................ | 199 | 77 | 201 | 477 | 41.7 | 16.1 | 42.2 | 100.0 |
| **Competitive inputs combined** | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output .............. | 16 | 6 | 5 | 27 | 59.3 | 22.2 | 18.5 | 100.0 |
| Moderate trend in output ........ | 9 | 1 | 3 | 13 | 69.2 | 7.7 | 23.1 | 100.0 |
| Clear trend in output ........... | 60 | 22 | 25 | 107 | 56.1 | 20.5 | 23.4 | 100.0 |
| Proportional, trend ............... | - | 3 | 64 | 67 | - | 4.5 | 95.5 | 100.0 |
| Linear, no trend | | | | | | | | |
| Clear trend in output ........... | - | - | 2 | 2 | - | - | 100.0 | 100.0 |
| Linear, trend | | | | | | | | |
| No trend in output .............. | - | 1 | 1 | 2 | - | 50.0 | 50.0 | 100.0 |
| Moderate trend in output ........ | 1 | - | - | 1 | 100.0 | - | - | 100.0 |
| Clear trend in output ........... | 1 | 1 | 2 | 4 | 25.0 | 25.0 | 50.0 | 100.0 |
| Independent, trend | | | | | | | | |
| Moderate trend in output ........ | - | - | 2 | 2 | - | - | 100.0 | 100.0 |
| Total ............................ | 87 | 34 | 104 | 225 | 38.7 | 15.1 | 46.2 | 100.0 |
| **Substitution groups and fuels** | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output .............. | 7 | 1 | 6 | 14 | 50.0 | 7.1 | 42.9 | 100.0 |
| Moderate trend in output ........ | 3 | - | - | 3 | 100.0 | - | - | 100.0 |
| Clear trend in output ........... | 29 | 10 | 7 | 46 | 63.1 | 21.7 | 15.2 | 100.0 |
| Proportional, trend ............... | 3 | 1 | 28 | 32 | 9.4 | 3.1 | 87.5 | 100.0 |
| Linear, no trend | | | | | | | | |
| No trend in output .............. | 1 | 1 | - | 2 | 50.0 | 50.0 | - | 100.0 |
| Moderate trend in output ........ | 1 | - | - | 1 | 100.0 | - | - | 100.0 |
| Clear trend in output ........... | 1 | - | 1 | 2 | 50.0 | - | 50.0 | 100.0 |
| Linear, trend | | | | | | | | |
| Clear trend in output ........... | 2 | - | 2 | 4 | 50.0 | - | 50.0 | 100.0 |
| Independent, no trend | | | | | | | | |
| No trend in output .............. | 1 | - | - | 1 | 100.0 | - | - | 100.0 |
| Independent, trend | | | | | | | | |
| Moderate trend in output ........ | - | - | 1 | 1 | - | - | 100.0 | 100.0 |
| Total ............................ | 48 | 13 | 45 | 106 | 45.3 | 12.3 | 42.4 | 100.0 |

Table D6 (cont.). Comparison between form of regression of input on output and trend character of input-output coefficient

| Basic category<br>Form of regression | Trend in input-output coefficient | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | None | Moderate | Clear | Total | None | Moderate | Clear | Total |
| | Number of input items | | | | Percentage distribution | | | |
| Import sums | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output ............. | 6 | 2 | 2 | 10 | 60.0 | 20.0 | 20.0 | 100.0 |
| Moderate trend in output ........ | 4 | - | - | 4 | 100.0 | - | - | 100.0 |
| Clear trend in output ........... | 20 | 4 | 7 | 31 | 64.5 | 12.9 | 22.6 | 100.0 |
| Proportional, trend ............... | 3 | 3 | 10 | 16 | 18.8 | 18.8 | 62.4 | 100.0 |
| Linear, no trend | | | | | | | | |
| No trend in output ............. | 1 | - | - | 1 | 100.0 | - | - | 100.0 |
| Clear trend in output ........... | - | - | 1 | 1 | - | - | 100.0 | 100.0 |
| Linear, trend | | | | | | | | |
| Clear trend in output ........... | - | 1 | 3 | 4 | - | 25.0 | 75.0 | 100.0 |
| Independent, trend | | | | | | | | |
| No trend in output ............. | - | 1 | - | 1 | - | 100.0 | - | 100.0 |
| Total ............................ | 34 | 11 | 23 | 68 | 50.0 | 16.2 | 33.8 | 100.0 |
| Gross value, added | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output ............. | 7 | - | 1 | 8 | 87.5 | - | 12.5 | 100.0 |
| Moderate trend in output ........ | 3 | - | - | 3 | 100.0 | - | - | 100.0 |
| Clear trend in output ........... | 20 | 12 | 5 | 37 | 54.1 | 32.4 | 13.5 | 100.0 |
| Proportional, trend ............... | 3 | 2 | 15 | 20 | 15.0 | 10.0 | 75.0 | 100.0 |
| Linear, no trend | | | | | | | | |
| No trend in output ............. | 2 | - | - | 2 | 100.0 | - | - | 100.0 |
| Clear trend in output ........... | - | 1 | 3 | 4 | - | 25.0 | 75.0 | 100.0 |
| Linear, trend | | | | | | | | |
| No trend in output ............. | - | - | 1 | 1 | - | - | 100.0 | 100.0 |
| Moderate trend in output ........ | 1 | - | - | 1 | 100.0 | - | - | 100.0 |
| Clear trend in output ........... | - | 1 | 1 | 2 | - | 50.0 | 50.0 | 100.0 |
| Independent, trend | | | | | | | | |
| Clear trend in output ........... | - | - | 1 | 1 | - | - | 100.0 | 100.0 |
| Total ............................ | 36 | 16 | 27 | 79 | 45.6 | 20.2 | 34.2 | 100.0 |
| Small unspecified | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output ............. | 2 | 3 | 2 | 7 | 28.6 | 42.8 | 28.6 | 100.0 |
| Moderate trend in output ........ | 1 | 1 | 1 | 3 | 33.3 | 33.3 | 33.4 | 100.0 |
| Clear trend in output ........... | 26 | 10 | 5 | 41 | 63.4 | 24.4 | 12.2 | 100.0 |
| Proportional, trend ............... | 2 | 3 | 12 | 17 | 11.8 | 17.7 | 70.5 | 100.0 |
| Linear, no trend | | | | | | | | |
| Clear trend in output ........... | 1 | - | 2 | 3 | 33.3 | - | 66.7 | 100.0 |
| Linear, trend | | | | | | | | |
| Clear trend in output ........... | 1 | - | - | 1 | 100.0 | - | - | 100.0 |
| Independent, no trend | | | | | | | | |
| Clear trend in output ........... | 1 | - | 1 | 2 | 50.0 | - | 50.0 | 100.0 |
| Independent, trend | | | | | | | | |
| Moderate trend in output ........ | - | - | 1 | 1 | - | - | 100.0 | 100.0 |
| Total ............................ | 34 | 17 | 24 | 75 | 45.3 | 22.7 | 32.0 | 100.0 |

Table D7. Comparison between form of regression of input on output and trend character of input-output coefficient. Consistent and inconsistent results

| Basic category<br>Form of regression | Comparability of test results<br>Consistent | Moderately inconsistent | Inconsistent | Total | Consistent | Moderately inconsistent | Inconsistent | Total |
|---|---|---|---|---|---|---|---|---|
| | Number of items | | | | Percentage distribution | | | |
| **All specified inputs** | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output ............ | 35 | 8 | 11 | 54 | 64.8 | 14.8 | 20.4 | 100.0 |
| Trend in output ............... | 109 | 143 | - | 252 | 43.2 | 56.8 | - | 100.0 |
| Proportional, trend ............. | 127 | - | 6 | 133 | 95.5 | - | 4.5 | 100.0 |
| All other forms .................. | 25 | 1 | 12 | 38 | 65.8 | 2.6 | 31.6 | 100.0 |
| Total .......... | 296 | 152 | 29 | 477 | 62.1 | 31.8 | 6.1 | 100.0 |
| **Competitive inputs combined** | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output ............ | 16 | 6 | 5 | 27 | 59.3 | 22.2 | 18.5 | 100.0 |
| Trend in output ............... | 51 | 69 | - | 120 | 42.5 | 57.5 | - | 100.0 |
| Proportional, trend ............. | 67 | - | - | 67 | 100.0 | - | - | 100.0 |
| All other forms .................. | 9 | - | 2 | 11 | 81.8 | - | 18.2 | 100.0 |
| Total .......... | 143 | 75 | 7 | 225 | 63.6 | 33.3 | 3.1 | 100.0 |
| **Substitution groups and fuels** | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output ............ | 7 | 1 | 6 | 14 | 50.0 | 7.1 | 42.9 | 100.0 |
| Trend in output ............... | 17 | 32 | - | 49 | 34.7 | 65.3 | - | 100.0 |
| Proportional, trend ............. | 29 | - | 3 | 32 | 90.6 | - | 9.4 | 100.0 |
| All other forms .................. | 6 | 2 | 3 | 11 | 54.5 | 18.2 | 27.3 | 100.0 |
| Total .......... | 59 | 35 | 12 | 106 | 55.7 | 33.0 | 11.3 | 100.0 |
| **Import sums** | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output ............ | 6 | 2 | 2 | 10 | 60.0 | 20.0 | 20.0 | 100.0 |
| Trend in output ............... | 11 | 24 | - | 35 | 31.4 | 68.6 | - | 100.0 |
| Proportional, trend ............. | 13 | - | 3 | 16 | 81.3 | - | 18.7 | 100.0 |
| All other forms .................. | 7 | - | - | 7 | 100.0 | - | - | 100.0 |
| Total .......... | 37 | 26 | 5 | 68 | 54.4 | 38.3 | 7.3 | 100.0 |
| **Gross value added** | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output ............ | 7 | - | 1 | 8 | 87.5 | - | 12.5 | 100.0 |
| Trend in output ............... | 17 | 23 | - | 40 | 42.5 | 57.5 | - | 100.0 |
| Proportional, trend ............. | 17 | - | 3 | 20 | 85.0 | - | 15.0 | 100.0 |
| All other forms .................. | 11 | - | - | 11 | 100.0 | - | - | 100.0 |
| Total .......... | 52 | 23 | 4 | 79 | 65.8 | 29.1 | 5.1 | 100.0 |
| **Small unspecified** | | | | | | | | |
| Proportional, no trend | | | | | | | | |
| No trend in output ............ | 2 | 3 | 2 | 7 | 28.6 | 42.8 | 28.6 | 100.0 |
| Trend in output ............... | 17 | 27 | - | 44 | 38.6 | 61.4 | - | 100.0 |
| Proportional, trend ............. | 15 | - | 2 | 17 | 88.2 | - | 11.8 | 100.0 |
| All other forms .................. | 4 | - | 3 | 7 | 57.2 | - | 42.8 | 100.0 |
| Total .......... | 38 | 30 | 7 | 75 | 50.7 | 40.0 | 9.3 | 100.0 |

Table D8. Comparison between form of regression of input on output and trend character of input-output coefficient. Further breakdowns of proportional items

| Basic category<br>Form of regression | Trend in input-output coefficient | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | None | Moderate | Clear | Total | None | Moderate | Clear | Total |
| | Number of input items | | | | Percentage distribution | | | |
| **All specified inputs** | | | | | | | | |
| Proportional or independent, no trend | | | | | | | | |
| No trend in output ............... | 26 | 4 | 3 | 33 | 78.8 | 12.1 | 9.1 | 100.0 |
| Moderate trend in output ......... | 17 | 4 | 2 | 23 | 73.9 | 17.4 | 8.7 | 100.0 |
| Clear trend in output ............ | 56 | 18 | 17 | 91 | 61.5 | 19.8 | 18.7 | 100.0 |
| Other proportional, no trend | | | | | | | | |
| No trend in output ............... | 9 | 4 | 8 | 21 | 42.9 | 19.0 | 38.1 | 100.0 |
| Moderate trend in output ......... | 3 | 1 | 5 | 9 | 33.3 | 11.1 | 55.6 | 100.0 |
| Clear trend in output ............ | 67 | 31 | 31 | 129 | 52.0 | 24.0 | 24.0 | 100.0 |
| **Competitive inputs combined** | | | | | | | | |
| Proportional or independent, no trend | | | | | | | | |
| No trend in output ............... | 9 | 3 | 1 | 13 | 69.2 | 23.1 | 7.7 | 100.0 |
| Moderate trend in output ......... | 7 | 1 | 1 | 9 | 77.8 | 11.1 | 11.1 | 100.0 |
| Clear trend in output ............ | 23 | 7 | 9 | 39 | 59.0 | 17.9 | 23.1 | 100.0 |
| Other proportional, no trend | | | | | | | | |
| No trend in output ............... | 7 | 3 | 4 | 14 | 50.0 | 21.4 | 28.6 | 100.0 |
| Moderate trend in output ......... | 2 | - | 2 | 4 | 50.0 | - | 50.0 | 100.0 |
| Clear trend in output ............ | 37 | 15 | 16 | 68 | 54.4 | 22.1 | 23.5 | 100.0 |

Table D9. Correspondence between results for specified competitive inputs and corresponding combined competitive inputs

| Classification of specified inputs | Classification of combined inputs | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Proportional | | Linear positive | | Confirmation | Linear negative | | Independent | | Rejection | Total |
| | No trend | Trend | No trend | Trend | Total | No trend | Trend | No trend | Trend | Total | |
| **Norwegian competitive** | | | | | | | | | | | |
| Proportional, no trend ....... | 87 | 18 | - | - | 105 | - | - | - | 2 | 2 | 107 |
| Proportional, trend .......... | 7 | 33 | 1 | - | 41 | 1 | 1 | - | - | 2 | 43 |
| Linear, positive, no trend ... | 1 | 2 | - | - | 3 | - | - | - | - | - | 3 |
| Linear, positive, trend ...... | 1 | - | - | - | 1 | - | - | - | - | - | 1 |
| Confirmation, total .......... | 96 | 53 | 1 | - | 150 | 1 | 1 | - | 2 | 4 | 154 |
| Linear, negative, no trend ... | 2 | 1 | - | - | 3 | - | - | - | - | - | 3 |
| Linear, negative, trend ...... | - | 2 | - | - | 2 | - | 1 | - | - | 1 | 3 |
| Independent, no trend ........ | - | - | - | - | - | - | - | - | - | - | - |
| Independent, trend ........... | - | 1 | - | - | 1 | - | - | - | - | - | 1 |
| Rejection, total ............. | 2 | 4 | - | - | 6 | - | 1 | - | - | 1 | 7 |
| Total ........................ | 98 | 57 | 1 | - | 156 | 1 | 2 | - | 2 | 5 | 161 |
| Items on the main diagonal ... | . | . | . | . | . | . | . | . | . | . | 121 |
| **Imports, competitive** | | | | | | | | | | | |
| Proportional, no trend ....... | 73 | 21 | - | - | 94 | - | - | - | 2 | 2 | 96 |
| Proportional, trend .......... | 10 | 21 | - | - | 31 | - | 1 | - | - | 1 | 32 |
| Linear, positive, no trend ... | - | 1 | - | - | 1 | - | 2 | - | - | 2 | 3 |
| Linear, positive, trend ...... | - | - | 1 | 1 | 2 | - | - | - | - | - | 2 |
| Confirmation, total .......... | 83 | 43 | 1 | 1 | 128 | - | 3 | - | 2 | 5 | 133 |
| Linear, negative, no trend ... | - | 1 | - | - | 1 | - | - | - | - | - | 1 |
| Linear, negative, trend ...... | - | - | - | - | - | 1 | 2 | - | - | 3 | 3 |
| Independent, no trend ........ | - | - | - | - | - | - | - | - | - | - | - |
| Independent, trend ........... | - | - | - | - | - | - | - | - | - | - | - |
| Rejection, total ............. | - | 1 | - | - | 1 | 1 | 2 | - | - | 3 | 4 |
| Total ........................ | 83 | 44 | 1 | 1 | 129 | 1 | 5 | - | 2 | 8 | 137 |
| Items on the main diagonal ... | . | . | . | . | . | . | . | . | . | . | 97 |

Table D10. Correspondende between results for specified main inputs and corresponding substitution groups[1)]

| Classification of specified main inputs | Classification of substitution groups: Proportional | | Linear positive | | Confirmation | Linear negative | | Independent | | Rejection | Total | Per cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No trend | Trend | No trend | Trend | Total | No trend | Trend | No trend | Trend | Total | | |
| Proportional, no trend ... | 20 | 8 | 1 | - | 29 | - | - | - | 1 | 1 | 30 | 58.8 |
| Proportional, trend ...... | 8 | 9 | - | 1 | 18 | - | 1 | - | - | 1 | 19 | 37.2 |
| Linear, positive, no trend | - | - | - | - | - | - | - | - | - | - | - | - |
| Linear, positive, trend .. | - | 1 | - | - | 1 | - | - | - | - | - | 1 | 2.0 |
| Confirmation, total ...... | 28 | 18 | 1 | 1 | 48 | - | 1 | - | 1 | 2 | 50 | 98.0 |
| Linear, negative, no trend | - | 1 | - | - | 1 | - | - | - | - | - | 1 | 2.0 |
| Linear, negative, trend .. | - | - | - | - | - | - | - | - | - | - | - | - |
| Independent, no trend .... | - | - | - | - | - | - | - | - | - | - | - | - |
| Independent, trend ....... | - | - | - | - | - | - | - | - | - | - | - | - |
| Rejection, total ......... | - | 1 | - | - | 1 | - | - | - | - | - | 1 | 2.0 |
| Total .................... | 28 | 19 | 1 | 1 | 49 | - | 1 | - | 1 | 2 | 51 | . |
| Per cent ................ | 54.9 | 37.2 | 2.0 | 2.0 | 96.1 | - | 2.0 | - | 1.9 | 3.9 | . | 100.0 |

1) Two substitution groups in "Proportional, no trend" are missing from this distribution.

Table D11. Correspondence between results for main competitive inputs combined and corresponding substitution groups

| Classification of main competitive inputs combined | Classification of substitution groups: Proportional | | Linear positive | | Confirmation | Linear negative | | Independent | | Rejection | Total | Per cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No trend | Trend | No trend | Trend | Total | No trend | Trend | No trend | Trend | Total | | |
| Proportional, no trend ... | 17 | 3 | 1 | - | 21 | - | - | - | - | - | 21 | 46.7 |
| Proportional, trend ...... | 6 | 14 | - | 1 | 21 | - | - | - | - | - | 21 | 46.7 |
| Linear, positive, no trend | - | 1 | - | - | 1 | - | - | - | - | - | 1 | 2.2 |
| Linear, positive, trend .. | - | - | - | - | - | - | - | - | - | - | - | - |
| Confirmation, total ...... | 23 | 18 | 1 | 1 | 43 | - | - | - | - | - | 43 | 95.6 |
| Linear, negative, no trend | - | - | - | - | - | - | - | - | - | - | - | - |
| Linear, negative, trend .. | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 2.2 |
| Independent, no trend .... | - | - | - | - | - | - | - | - | - | - | - | - |
| Independent, trend ....... | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 2.2 |
| Rejection, total ......... | - | - | - | - | - | - | 1 | - | 1 | 2 | 2 | 4.4 |
| Total .................... | 23 | 18 | 1 | 1 | 43 | - | 1 | - | 1 | 2 | 45 | . |
| Per cent ................ | 51.2 | 40.0 | 2.2 | 2.2 | 95.6 | - | 2.2 | - | 2.2 | 4.4 | . | 100.0 |

Table D12. Forms of regressions of inputs on outputs for basic categories of inputs, classified by average size of the coefficients

| Basic category<br>Form of regression | Average size of coefficients | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 - 0.02 | 0.02- 0.05 | 0.05- 0.10 | 0.10- 0.25 | 0.25+ | Total | 0 - 0.02 | 0.02- 0.05 | 0.05- 0.10 | 0.10- 0.25 | 0.25+ | Total |
| | Number of input items | | | | | | Percentage distribution | | | | | |
| Norwegian, competitive | | | | | | | | | | | | |
| Proportional ......... | 51 | 47 | 23 | 16 | 13 | 150 | 92.7 | 88.7 | 100.0 | 94.1 | 100.0 | 93.2 |
| Linear, positive...... | 1 | 2 | - | 1 | - | 4 | 1.8 | 3.8 | - | 5.9 | - | 2.5 |
| Linear, negative ..... | 3 | 3 | - | - | - | 6 | 5.5 | 5.6 | - | - | - | 3.7 |
| Independent .......... | - | 1 | - | - | - | 1 | - | 1.9 | - | - | - | 0.6 |
| Total ................ | 55 | 53 | 23 | 17 | 13 | 161 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Norwegian, non-competitive | | | | | | | | | | | | |
| Proportional ......... | 61 | 45 | 21 | 7 | 2 | 136 | 95.3 | 81.8 | 91.3 | 77.8 | 100.0 | 88.9 |
| Linear, positive ..... | 1 | 4 | - | - | - | 5 | 1.6 | 7.3 | - | - | - | 3.3 |
| Linear, negative ..... | 1 | 4 | 2 | 1 | - | 8 | 1.5 | 7.3 | 8.7 | 11.1 | - | 5.2 |
| Independent .......... | 1 | 2 | - | 1 | - | 4 | 1.6 | 3.6 | - | 11.1 | - | 2.6 |
| Total ................ | 64 | 55 | 23 | 9 | 2 | 153 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Imports, competitive | | | | | | | | | | | | |
| Proportional ......... | 50 | 39 | 20 | 12 | 7 | 128 | 92.6 | 100.0 | 87.0 | 85.7 | 100.0 | 93.5 |
| Linear, positive ..... | 2 | - | 1 | 2 | - | 5 | 3.7 | - | 4.3 | 14.3 | - | 3.6 |
| Linear, negative ..... | 2 | - | 2 | - | - | 4 | 3.7 | - | 8.7 | - | - | 2.9 |
| Independent .......... | - | - | - | - | - | - | - | - | - | - | - | - |
| Total ................ | 54 | 39 | 23 | 14 | 7 | 137 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Imports, non-competitive | | | | | | | | | | | | |
| Proportional ......... | 9 | 9 | 1 | 4 | 2 | 25 | 100.0 | 100.0 | 100.0 | 100.0 | 66.7 | 96.2 |
| Linear, positive ..... | - | - | - | - | 1 | 1 | - | - | - | - | 33.3 | 3.8 |
| Linear, negative ..... | - | - | - | - | - | - | - | - | - | - | - | - |
| Independent .......... | - | - | - | - | - | - | - | - | - | - | - | - |
| Total ................ | 9 | 9 | 1 | 4 | 3 | 26 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| All specified inputs | | | | | | | | | | | | |
| Proportional, no trend | 126 | 92 | 48 | 24 | 16 | 306 | 69.2 | 59.0 | 68.5 | 54.6 | 64.0 | 64.2 |
| Proportional, trend .. | 45 | 48 | 17 | 15 | 8 | 133 | 24.8 | 30.8 | 24.3 | 34.1 | 32.0 | 27.9 |
| Proportional, total .. | 171 | 140 | 65 | 39 | 24 | 439 | 94.0 | 89.8 | 92.8 | 88.7 | 96.0 | 92.1 |
| Linear, positive, no trend ............. | 3 | 3 | 1 | 2 | - | 9 | 1.7 | 1.9 | 1.4 | 4.5 | - | 1.9 |
| Linear, positive, trend | 1 | 3 | - | 1 | 1 | 6 | 0.5 | 1.9 | - | 2.3 | 4.0 | 1.2 |
| Linear, positive, total | 4 | 6 | 1 | 3 | 1 | 15 | 2.2 | 3.8 | 1.4 | 6.8 | 4.0 | 3.1 |
| Linear, negative, no trend ............. | 3 | 2 | 2 | - | - | 7 | 1.6 | 1.3 | 2.9 | - | - | 1.5 |
| Linear, negative, trend | 3 | 5 | 2 | 1 | - | 11 | 1.7 | 3.2 | 2.9 | 2.2 | - | 2.3 |
| Linear, negative, total | 6 | 7 | 4 | 1 | - | 18 | 3.3 | 4.5 | 5.8 | 2.2 | - | 3.8 |
| Independent, no trend | 1 | - | - | - | - | 1 | 0.5 | - | - | - | - | 0.2 |
| Independent, trend ... | - | 3 | - | 1 | - | 4 | - | 1.9 | - | 2.3 | - | 0.8 |
| Independent, total ... | 1 | 3 | - | 1 | - | 5 | 0.5 | 1.9 | - | 2.3 | - | 1.0 |
| Total ................ | 182 | 156 | 70 | 44 | 25 | 477 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Competitive inputs combined | | | | | | | | | | | | |
| Proportional, no trend | 45 | 49 | 23 | 17 | 13 | 147 | 78.9 | 63.7 | 63.9 | 53.2 | 56.5 | 65.3 |
| Proportional, trend .. | 9 | 24 | 12 | 12 | 10 | 67 | 15.8 | 31.1 | 33.3 | 37.5 | 43.5 | 29.8 |
| Proportional, total .. | 54 | 73 | 35 | 29 | 23 | 214 | 94.7 | 94.8 | 97.2 | 90.7 | 100.0 | 95.1 |
| Linear, positive, no trend ............. | - | - | - | 1 | - | 1 | - | - | - | 3.1 | - | 0.5 |
| Linear, positive, trend | 1 | - | - | - | - | 1 | 1.8 | - | - | - | - | 0.4 |
| Linear, positive, total | 1 | - | - | 1 | - | 2 | 1.8 | - | - | 3.1 | - | 0.9 |
| Linear, negative, no trend ............. | - | 1 | - | - | - | 1 | - | 1.3 | - | - | - | 0.4 |
| Linear, negative, trend | 1 | 3 | 1 | 1 | - | 6 | 1.7 | 3.9 | 2.8 | 3.1 | - | 2.7 |
| Linear, negative, total | 1 | 4 | 1 | 1 | - | 7 | 1.7 | 5.2 | 2.8 | 3.1 | - | 3.1 |
| Independent, no trend . | - | - | - | - | - | - | - | - | - | - | - | - |
| Independent, trend .... | 1 | - | - | 1 | - | 2 | 1.8 | - | - | 3.1 | - | 0.9 |
| Independent, total .... | 1 | - | - | 1 | - | 2 | 1.8 | - | - | 3.1 | - | 0.9 |
| Total ................ | 57 | 77 | 36 | 32 | 23 | 225 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D12 (cont.). Forms of regressions of inputs on outputs for basic categories of inputs, classified by average size of the coefficients

| Basic category / Form of regression | Average size of coefficients: Number of input items 0 - 0.02 | 0.02- 0.05 | 0.05- 0.10 | 0.10- 0.25 | 0.25+ | Total | Percentage distribution 0 - 0.02 | 0.02- 0.05 | 0.05- 0.10 | 0.10- 0.25 | 0.25+ | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fuels combined | | | | | | | | | | | | |
| Proportional ........ | 31 | 9 | 3 | 2 | 1 | 46 | 81.6 | 100.0 | 100.0 | 100.0 | 100.0 | 86.8 |
| Linear, positive .... | 2 | - | - | - | - | 2 | 5.3 | - | - | - | - | 3.8 |
| Linear, negative .... | 4 | - | - | - | - | 4 | 10.5 | - | - | - | - | 7.5 |
| Independent ......... | 1 | - | - | - | - | 1 | 2.6 | - | - | - | - | 1.9 |
| Total ............. | 38 | 9 | 3 | 2 | 1 | 53 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Substitution groups | | | | | | | | | | | | |
| Proportional ........ | 3 | 3 | 4 | 11 | 28 | 49 | 100.0 | 75.0 | 100.0 | 91.7 | 93.3 | 92.4 |
| Linear, positive .... | - | - | - | - | 2 | 2 | - | - | - | - | 6.7 | 3.8 |
| Linear, negative .... | - | 1 | - | - | - | 1 | - | 25.0 | - | - | - | 1.9 |
| Independent ......... | - | - | - | 1 | - | 1 | - | - | - | 8.3 | - | 1.9 |
| Total ............. | 3 | 4 | 4 | 12 | 30 | 53 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Import sums | | | | | | | | | | | | |
| Proportional ........ | 7 | 11 | 5 | 23 | 15 | 61 | 87.5 | 84.6 | 83.3 | 88.5 | 100.0 | 89.7 |
| Linear, positive .... | 1 | 1 | 1 | 2 | - | 5 | 12.5 | 7.7 | 16.7 | 7.7 | - | 7.3 |
| Linear, negative .... | - | 1 | - | - | - | 1 | - | 7.7 | - | - | - | 1.5 |
| Independent ......... | - | - | - | 1 | - | 1 | - | - | - | 3.8 | - | 1.5 |
| Total ............. | 8 | 13 | 6 | 26 | 15 | 68 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| | Average size of coefficients 0.05- 0.10 | 0.10- 0.25 | 0.25- 0.50 | 0.50+ | Total | 0.05- 0.10 | 0.10- 0.25 | 0.25- 0.50 | 0.50+ | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Gross value added | | | | | | | | | | |
| Proportional ........ | 1 | 5 | 25 | 37 | 68 | 50.0 | 83.3 | 92.6 | 84.1 | 86.1 |
| Linear, positive .... | 1 | - | 1 | 6 | 8 | 50.0 | - | 3.7 | 13.6 | 10.1 |
| Linear, negative .... | - | 1 | 1 | - | 2 | - | 16.7 | 3.7 | - | 2.5 |
| Independent ......... | - | - | - | 1 | 1 | - | - | - | 2.3 | 1.3 |
| Total ............. | 2 | 6 | 27 | 44 | 79 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D13. Forms of regressions of inputs on outputs for basic categories of inputs, classified by average size in kroner of the input items

| Basic category / Form of regression | Average size of input item in millions 1955-kroner | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 - 10.0 | 10.1- 50.0 | 50.1- 100.0 | 100.1- 250.0 | 250.1 + | Total | 0 - 10.0 | 10.1- 50.0 | 50.1- 100.0 | 100.1- 250.0 | 250.1 + | Total |
| | Number of input items | | | | | | Percentage distribution | | | | | |
| **Norwegian, competitive** | | | | | | | | | | | | |
| Proportional ......... | 79 | 40 | 12 | 9 | 10 | 150 | 92.9 | 93.0 | 92.3 | 90.0 | 100.0 | 93.2 |
| Linear, positive ..... | 1 | 2 | - | 1 | - | 4 | 1.2 | 4.7 | - | 10.0 | - | 2.5 |
| Linear, negative ..... | 4 | 1 | 1 | - | - | 6 | 4.7 | 2.3 | 7.7 | - | - | 3.7 |
| Independent .......... | 1 | - | - | - | - | 1 | 1.2 | - | - | - | - | 0.6 |
| Total ............... | 85 | 43 | 13 | 10 | 10 | 161 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| **Norwegian, non-competitive** | | | | | | | | | | | | |
| Proportional ......... | 98 | 30 | 3 | 3 | 2 | 136 | 90.7 | 83.3 | 100.0 | 75.0 | 100.0 | 88.9 |
| Linear, positive ..... | 3 | 1 | - | 1 | - | 5 | 2.8 | 2.8 | - | 25.0 | - | 3.3 |
| Linear, negative ..... | 5 | 3 | - | - | - | 8 | 4.6 | 8.3 | - | - | - | 5.2 |
| Independent .......... | 2 | 2 | - | - | - | 4 | 1.9 | 5.6 | - | - | - | 2.6 |
| Total ............... | 108 | 36 | 3 | 4 | 2 | 153 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| **Imports, competitive** | | | | | | | | | | | | |
| Proportional ......... | 63 | 48 | 8 | 7 | 2 | 128 | 92.7 | 96.0 | 80.0 | 100.0 | 100.0 | 93.5 |
| Linear, positive ..... | 3 | 1 | 1 | - | - | 5 | 4.4 | 2.0 | 10.0 | - | - | 3.6 |
| Linear, negative ..... | 2 | 1 | 1 | - | - | 4 | 2.9 | 2.0 | 10.0 | - | - | 2.9 |
| Independent .......... | - | - | - | - | - | - | - | - | - | - | - | - |
| Total ............... | 68 | 50 | 10 | 7 | 2 | 137 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| **Imports, non-competitive** | | | | | | | | | | | | |
| Proportional ......... | 15 | 6 | 3 | - | 1 | 25 | 100.0 | 100.0 | 100.0 | - | 100.0 | 96.2 |
| Linear, positive ..... | - | - | - | 1 | - | 1 | - | - | - | 100.0 | - | 3.8 |
| Linear, negative ..... | - | - | - | - | - | - | - | - | - | - | - | - |
| Independent .......... | - | - | - | - | - | - | - | - | - | - | - | - |
| Total ............... | 15 | 6 | 3 | 1 | 1 | 26 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| **All specified inputs** | | | | | | | | | | | | |
| Proportional, no trend | 178 | 93 | 17 | 10 | 8 | 306 | 64.5 | 68.8 | 58.6 | 45.5 | 53.4 | 64.2 |
| Proportional, trend .. | 77 | 31 | 9 | 9 | 7 | 133 | 27.9 | 23.0 | 31.1 | 40.9 | 46.6 | 27.9 |
| Proportional, total .. | 255 | 124 | 26 | 19 | 15 | 439 | 92.4 | 91.8 | 89.7 | 86.4 | 100.0 | 92.1 |
| Linear, positive, no trend ............. | 4 | 3 | - | 2 | - | 9 | 1.4 | 2.2 | - | 9.1 | - | 1.9 |
| Linear, positive, trend ............. | 3 | 1 | 1 | 1 | - | 6 | 1.1 | 0.8 | 3.4 | 4.5 | - | 1.2 |
| Linear, positive, total ............. | 7 | 4 | 1 | 3 | - | 15 | 2.5 | 3.0 | 3.4 | 13.6 | - | 3.1 |
| Linear, negative, no trend ............. | 5 | 2 | - | - | - | 7 | 1.8 | 1.5 | - | - | - | 1.5 |
| Linear, negative, trend ............. | 6 | 3 | 2 | - | - | 11 | 2.2 | 2.2 | 6.9 | - | - | 2.3 |
| Linear, negative, total ............. | 11 | 5 | 2 | - | - | 18 | 4.0 | 3.7 | 6.9 | - | - | 3.8 |
| Independent, no trend. | 1 | - | - | - | - | 1 | 0.4 | - | - | - | - | 0.2 |
| Independent, trend ... | 2 | 2 | - | - | - | 4 | 0.7 | 1.5 | - | - | - | 0.8 |
| Independent, total ... | 3 | 2 | - | - | - | 5 | 1.1 | 1.5 | - | - | - | 1.0 |
| Total ............... | 276 | 135 | 29 | 22 | 15 | 477 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D13 (cont.). Forms of regressions of inputs on outputs for basic categories of inputs, classified by average size in kroner of the input item

| Basic category<br>Form of regression | Average size of input item in millions 1955-kroner<br>0 - 10.0 | 10.1- 50.0 | 50.1- 100.0 | 100.1- 250.0 | 250.1 + | Total | 0 - 10.0 | 10.1- 50.0 | 50.1- 100.0 | 100.1- 250.0 | 250.1 + | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of input items | | | | | | Percentage distribution | | | | | |
| Competitive inputs combined | | | | | | | | | | | | |
| Proportional, no trend | 69 | 45 | 13 | 11 | 9 | 147 | 74.2 | 60.0 | 54.1 | 57.9 | 64.3 | 65.3 |
| Proportional, trend .. | 19 | 27 | 10 | 6 | 5 | 67 | 20.4 | 36.0 | 41.7 | 31.6 | 35.7 | 29.8 |
| Proportional, total .. | 88 | 72 | 23 | 17 | 14 | 214 | 94.6 | 96.0 | 95.8 | 89.5 | 100.0 | 95.1 |
| Linear, positive, no trend | - | - | - | 1 | - | 1 | - | - | - | 5.3 | - | 0.5 |
| Linear, positive, trend | 1 | - | - | - | - | 1 | 1.1 | - | - | - | - | 0.4 |
| Linear, positive, total | 1 | - | - | 1 | - | 2 | 1.1 | - | - | 5.3 | - | 0.9 |
| Linear, negative, no trend ............. | - | 1 | - | - | - | 1 | - | 1.3 | - | - | - | 0.4 |
| Linear, negative, trend ............. | 3 | 1 | 1 | 1 | - | 6 | 3.2 | 1.4 | 4.2 | 5.2 | - | 2.7 |
| Linear, negative, total ............. | 3 | 2 | 1 | 1 | - | 7 | 3.2 | 2.7 | 4.2 | 5.2 | - | 3.1 |
| Independent, no trend. | - | - | - | - | - | - | - | - | - | - | - | - |
| Independent, trend ... | 1 | 1 | - | - | - | 2 | 1.1 | 1.3 | - | - | - | 0.9 |
| Independent, total ... | 1 | 1 | - | - | - | 2 | 1.1 | 1.3 | - | - | - | 0.9 |
| Total ............... | 93 | 75 | 24 | 19 | 14 | 225 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Fuels combined | | | | | | | | | | | | |
| Proportional ......... | 33 | 13 | - | - | - | 46 | 84.6 | 92.9 | - | - | - | 86.8 |
| Linear, positive ..... | 2 | - | - | - | - | 2 | 5.1 | - | - | - | - | 3.8 |
| Linear, negative ..... | 3 | 1 | - | - | - | 4 | 7.7 | 7.1 | - | - | - | 7.5 |
| Independent .......... | 1 | - | - | - | - | 1 | 2.6 | - | - | - | - | 1.9 |
| Total ............... | 39 | 14 | - | - | - | 53 | 100.0 | 100.0 | - | - | - | 100.0 |
| Substitution groups | | | | | | | | | | | | |
| Proportional ......... | 2 | 13 | 9 | 7 | 18 | 49 | 66.7 | 92.9 | 100.0 | 77.8 | 100.0 | 92.4 |
| Linear, positive ..... | 1 | - | - | 1 | - | 2 | 33.3 | - | - | 11.1 | - | 3.8 |
| Linear, negative ..... | - | - | - | 1 | - | 1 | - | - | - | 11.1 | - | 1.9 |
| Independent .......... | - | 1 | - | - | - | 1 | - | 7.1 | - | - | - | 1.9 |
| Total ............... | 3 | 14 | 9 | 9 | 18 | 53 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Import sums | | | | | | | | | | | | |
| Proportional ......... | 14 | 24 | 8 | 11 | 4 | 61 | 87.5 | 96.0 | 80.0 | 91.7 | 80.0 | 89.7 |
| Linear, positive ..... | 2 | 1 | 1 | - | 1 | 5 | 12.5 | 4.0 | 10.0 | - | 20.0 | 7.3 |
| Linear, negative ..... | - | - | - | 1 | - | 1 | - | - | - | 8.3 | - | 1.5 |
| Independent .......... | - | - | 1 | - | - | 1 | - | - | 10.0 | - | - | 1.5 |
| Total ............... | 16 | 25 | 10 | 12 | 5 | 68 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Gross value added | | | | | | | | | | | | |
| Proportional ......... | 2 | 9 | 12 | 29 | 16 | 68 | 66.7 | 69.2 | 92.3 | 93.5 | 84.2 | 86.1 |
| Linear, positive ..... | - | 2 | 1 | 2 | 3 | 8 | - | 15.4 | 7.7 | 6.5 | 15.8 | 10.1 |
| Linear, negative ..... | 1 | 1 | - | - | - | 2 | 33.3 | 7.7 | - | - | - | 2.5 |
| Independent .......... | - | 1 | - | - | - | 1 | - | 7.7 | - | - | - | 1.3 |
| Total ............... | 3 | 13 | 13 | 31 | 19 | 79 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D14. Forms of regressions of inputs on outputs for basic categories of inputs classified by average size of coefficient and average size in 1955-kroner of the input item

| Average coefficient, % | 0 - 2.0 | 0 - 10.0 / 2.0- 10.0 | Over 10.0 | 0 - 10.0 | Over 10.0 | Total | 0 - 2.0 | 0 - 10.0 / 2.0- 10.0 | Over 10.0 | 0 - 10.0 | Over 10.0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Input, million kroner | 0 - 10.0 | 10.1- 50.0 / 0 - 50.0 | 0 - 50.0 | Over 50.0 | Over 50.0 | | 0 - 10.0 | 10.1- 50.0 / 0 - 50.0 | 0 - 50.0 | Over 50.0 | Over 50.0 | |
| | Number of input items | | | | | | Percentage distribution | | | | | |
| **Basic category** | | | | | | | | | | | | |
| Form of regression | | | | | | | | | | | | |
| **Norwegian, competitive** | | | | | | | | | | | | |
| Proportional ......... | 46 | 64 | 9 | 11 | 20 | 150 | 92.0 | 92.8 | 100.0 | 91.7 | 95.2 | 93.2 |
| Linear, positive ..... | 1 | 2 | - | - | 1 | 4 | 2.0 | 2.9 | - | - | 4.8 | 2.5 |
| Linear, negative ..... | 3 | 2 | - | 1 | - | 6 | 6.0 | 2.9 | - | 8.3 | - | 3.7 |
| Independent .......... | - | 1 | - | - | - | 1 | - | 1.4 | - | - | - | 0.6 |
| Total ................ | 50 | 69 | 9 | 12 | 21 | 161 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| **Norwegian, non-competitive** | | | | | | | | | | | | |
| Proportional ......... | 56 | 65 | 7 | 6 | 2 | 136 | 96.6 | 84.4 | 77.8 | 85.7 | 100.0 | 88.9 |
| Linear, positive ..... | - | 4 | - | 1 | - | 5 | - | 5.2 | - | 14.3 | - | 3.3 |
| Linear, negative ..... | 1 | 6 | 1 | - | - | 8 | 1.7 | 7.8 | 11.1 | - | - | 5.2 |
| Independent .......... | 1 | 2 | 1 | - | - | 4 | 1.7 | 2.6 | 11.1 | - | - | 2.6 |
| Total ................ | 58 | 77 | 9 | 7 | 2 | 153 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| **Imports, competitive** | | | | | | | | | | | | |
| Proportional ......... | 45 | 58 | 8 | 7 | 10 | 128 | 91.8 | 96.6 | 88.9 | 87.5 | 90.9 | 93.5 |
| Linear, positive ..... | 2 | 1 | 1 | - | 1 | 5 | 4.1 | 1.7 | 11.1 | - | 9.1 | 3.6 |
| Linear, negative ..... | 2 | 1 | - | 1 | - | 4 | 4.1 | 1.7 | - | 12.5 | - | 2.9 |
| Independent .......... | - | - | - | - | - | - | - | - | - | - | - | - |
| Total ................ | 49 | 60 | 9 | 8 | 11 | 137 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| **Imports, non-competitive** | | | | | | | | | | | | |
| Proportional ......... | 8 | 10 | 3 | 1 | 3 | 25 | 100.0 | 100.0 | 100.0 | 100.0 | 75.0 | 96.2 |
| Linear, positive ..... | - | - | - | - | 1 | 1 | - | - | - | - | 25.0 | 3.8 |
| Linear, negative ..... | - | - | - | - | - | - | - | - | - | - | - | - |
| Independent .......... | - | - | - | - | - | - | - | - | - | - | - | - |
| Total ................ | 8 | 10 | 3 | 1 | 4 | 26 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| **All specified inputs** | | | | | | | | | | | | |
| Proportional, no trend | 115 | 138 | 18 | 13 | 22 | 306 | 69.7 | 63.9 | 60.0 | 46.4 | 57.9 | 64.2 |
| Proportional, trend .. | 40 | 59 | 9 | 12 | 13 | 133 | 24.3 | 27.3 | 30.0 | 42.8 | 34.2 | 27.9 |
| Proportional, total .. | 155 | 197 | 27 | 25 | 35 | 439 | 94.0 | 91.2 | 90.0 | 89.2 | 92.1 | 92.1 |
| Linear, positive, no trend .............. | 2 | 4 | 1 | 1 | 1 | 9 | 1.2 | 1.8 | 3.4 | 3.6 | 2.6 | 1.9 |
| Linear, positive, trend .............. | 1 | 3 | - | - | 2 | 6 | 0.6 | 1.4 | - | - | 5.3 | 1.2 |
| Linear, positive, total .............. | 3 | 7 | 1 | 1 | 3 | 15 | 1.8 | 3.2 | 3.4 | 3.6 | 7.9 | 3.1 |
| Linear, negative, no trend .............. | 3 | 4 | - | - | - | 7 | 1.8 | 1.9 | - | - | - | 1.5 |
| Linear, negative, trend .............. | 3 | 5 | 1 | 2 | - | 11 | 1.8 | 2.3 | 3.3 | 7.2 | - | 2.3 |
| Linear, negative, total .............. | 6 | 9 | 1 | 2 | - | 18 | 3.6 | 4.2 | 3.3 | 7.2 | - | 3.8 |
| Independent, no trend. | 1 | - | - | - | - | 1 | 0.6 | - | - | - | - | 0.2 |
| Independent, trend ... | - | 3 | 1 | - | - | 4 | - | 1.4 | 3.3 | - | - | 0.8 |
| Independnet, total ... | 1 | 3 | 1 | - | - | 5 | 0.6 | 1.4 | 3.3 | - | - | 1.0 |
| Total ................ | 165 | 216 | 30 | 28 | 38 | 477 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D14 (cont.). Forms of regressions of inputs on outputs for basic categories of inputs classified by average size of coefficient and average size in 1955-kroner of the input item

| Average coefficient, % | 0 - 2.0 | 0 - 10.0 | 2.0- 10.0 | Over 10.0 | 0 - 10.0 | Over 10.0 | Total | 0 - 2.0 | 0 - 10.0 | 2.0- 10.0 | Over 10.0 | 0 - 10.0 | Over 10.0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Input, million kroner | 0 - 10.0 | 10.1- 50.0 | 0 - 50.0 | 0 - 50.0 | Over 50.0 | Over 50.0 | | 0 - 10.0 | 10.1- 50.0 | 0 - 50.0 | 0 - 50.0 | Over 50.0 | Over 50.0 | |
| | Number of input items | | | | | | | Percentage distribution | | | | | | |
| Basic category | | | | | | | | | | | | | | |
| Form of regression | | | | | | | | | | | | | | |
| Competitive inputs combined | | | | | | | | | | | | | | |
| Proportional, no trend | 37 | 70 | | 7 | 11 | 22 | 147 | 80.5 | 65.5 | | 46.7 | 61.1 | 56.4 | 65.3 |
| Proportional, trend .. | 6 | 33 | | 7 | 6 | 15 | 67 | 13.0 | 30.8 | | 46.6 | 33.3 | 38.5 | 29.8 |
| Proportional, total .. | 43 | 103 | | 14 | 17 | 37 | 214 | 93.5 | 96.3 | | 93.3 | 94.4 | 94.9 | 95.1 |
| Linear, positive, no trend ............. | - | - | | - | - | 1 | 1 | - | - | | - | - | 2.6 | 0.5 |
| Linear, positive, trend ............. | 1 | - | | - | - | - | 1 | 2.2 | - | | - | - | - | 0.4 |
| Linear, positive, total ............. | 1 | - | | - | - | 1 | 2 | 2.2 | - | | - | - | 2.6 | 0.9 |
| Linear, negative, no trend ............. | - | 1 | | - | - | - | 1 | - | 0.9 | | - | - | - | 0.4 |
| Linear, negative, trend ............. | 1 | 3 | | - | 1 | 1 | 6 | 2.1 | 2.8 | | - | 5.6 | 2.5 | 2.7 |
| Linear, negative, total ............. | 1 | 4 | | - | 1 | 1 | 7 | 2.1 | 3.7 | | - | 5.6 | 2.5 | 3.1 |
| Independent, no trend. | - | - | | - | - | - | - | - | - | | - | - | - | - |
| Independent, trend ... | 1 | - | | 1 | - | - | 2 | 2.2 | - | | 6.7 | - | - | 0.9 |
| Independent, total ... | 1 | - | | 1 | - | - | 2 | 2.2 | - | | 6.7 | - | - | 0.9 |
| Total ............... | 46 | 107 | | 15 | 18 | 39 | 225 | 100.0 | 100.0 | | 100.0 | 100.0 | 100.0 | 100.0 |
| Fuels combined | | | | | | | | | | | | | | |
| Proportional ......... | 28 | 15 | | 3 | - | - | 46 | 82.4 | 93.7 | | 100.0 | - | - | 86.8 |
| Linear, positive ..... | 2 | - | | - | - | - | 2 | 5.9 | - | | - | - | - | 3.8 |
| Linear, negative ..... | 3 | 1 | | - | - | - | 4 | 8.8 | 6.3 | | - | - | - | 7.5 |
| Independent .......... | 1 | - | | - | - | - | 1 | 2.9 | - | | - | - | - | 1.9 |
| Total ............... | 34 | 16 | | 3 | - | - | 53 | 100.0 | 100.0 | | 100.0 | - | - | 100.0 |
| Substitution groups | | | | | | | | | | | | | | |
| Proportional ......... | - | 6 | | 9 | 4 | 30 | 49 | - | 100.0 | | 81.8 | 80.0 | 96.8 | 92.4 |
| Linear, positive ..... | - | - | | 1 | - | 1 | 2 | - | - | | 9.1 | - | 3.2 | 3.8 |
| Linear, negative ..... | - | - | | - | 1 | - | 1 | - | - | | - | 20.0 | - | 1.9 |
| Independent .......... | - | - | | 1 | - | - | 1 | - | - | | 9.1 | - | - | 1.9 |
| Total ............... | - | 6 | | 11 | 5 | 31 | 53 | - | 100.0 | | 100.0 | 100.0 | 100.0 | 100.0 |
| Import sums | | | | | | | | | | | | | | |
| Proportional ......... | 7 | 16 | | 15 | 1 | 22 | 61 | 87.5 | 88.9 | | 100.0 | 50.0 | 88.0 | 89.7 |
| Linear, positive ..... | 1 | 2 | | - | - | 2 | 5 | 12.5 | 11.1 | | - | - | 8.0 | 7.3 |
| Linear, negative ..... | - | - | | - | 1 | - | 1 | - | - | | - | 50.0 | - | 1.5 |
| Independent .......... | - | - | | - | - | 1 | 1 | - | - | | - | - | 4.0 | 1.5 |
| Total ............... | 8 | 18 | | 15 | 2 | 25 | 68 | 100.0 | 100.0 | | 100.0 | 100.0 | 100.0 | 100.0 |
| Gross value added | | | | | | | | | | | | | | |
| Proportional ......... | - | 1 | | 10 | - | 57 | 68 | - | 50.0 | | 71.5 | - | 90.5 | 86.1 |
| Linear, positive ..... | - | 1 | | 1 | - | 6 | 8 | - | 50.0 | | 7.1 | - | 9.5 | 10.1 |
| Linear, negative ..... | - | - | | 2 | - | - | 2 | - | - | | 14.3 | - | - | 2.5 |
| Independent .......... | - | - | | 1 | - | - | 1 | - | - | | 7.1 | - | - | 1.3 |
| Total ............... | - | 2 | | 14 | - | 63 | 79 | - | 100.0 | | 100.0 | - | 100.0 | 100.0 |

Table D15. Distribution of constant terms[1)] in per cent of average value of input for input items depending linearly on outputs. Numbers of input items

| Constant term in per cent of average input \ Input category / Input size Mill. kroner | All specified items | | | | Competitive inputs combined | | | Substitution groups and fuels | | | Import sums | | | Gross value added | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 - 10.0 | 10.1-50.1 | 50.1 and over | Total | 0 - 10.0 | 10.1 and over | Total | 0 - 10.0 | 10.1 and over | Total | 0 - 10.0 | 10.1 and over | Total | 0 - 50.0 | 50.1 and over | Total |
| 1000 and over . | 2 | - | - | 2 | 1 | - | 1 | - | - | - | - | - | - | - | - | - |
| 500 - 999.9 .. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 200 - 499.9 .. | 3 | 1 | - | 4 | - | - | - | 1 | - | 1 | - | - | - | 1 | - | 1 |
| 125 - 199.9 .. | 2 | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | - | - | - | - |
| 100 - 124.9 .. | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| 100 and over . | 7 | 2 | - | 9 | 1 | 1 | 2 | 3 | - | 3 | - | - | - | 1 | - | 1 |
| 75 - 99.9. | 2 | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| 25 - 74.9. | 3 | 1 | 3 | 7 | 1 | 1 | 2 | 1 | - | 1 | - | 3 | 3 | - | - | - |
| -24.9 - 24.9. | 2 | 3 | - | 5 | - | 1 | 1 | 1 | - | 1 | - | - | - | 1 | 4 | 5 |
| -74.9 - -25 .. | 1 | - | 3 | 4 | - | 1 | 1 | - | 1 | 1 | - | - | - | 1 | 2 | 3 |
| -124.9 - -75 .. | - | 1 | - | 1 | - | 1 | 1 | - | 2 | 2 | 1 | 1 | 2 | - | - | - |
| -199.9 - -125 .. | 1 | 2 | - | 3 | 1 | - | 1 | 1 | - | 1 | 1 | - | 1 | - | - | - |
| -499.9 - -200 .. | 1 | - | - | 1 | 1 | - | 1 | - | - | - | - | - | - | 1 | - | 1 |
| -999.9 - -500 .. | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Less than 100. | 11 | 7 | 6 | 24 | 3 | 4 | 7 | 3 | 3 | 6 | 2 | 4 | 6 | 3 | 6 | 9 |
| T o t a l .... | 18 | 9 | 6 | 33 | 4 | 5 | 9 | 6 | 3 | 9 | 2 | 4 | 6 | 4 | 6 | 10 |

1) Constant terms estimated in linear regressions of inputs on outputs, ignoring possible trends. Input items for which the constant term in the regression function differs significantly from zero according to the test criteria employed.

Table D16. Forms of the regressions of inputs on outputs for basic categories of inputs, classified by input types. Number of input items

| Basic category / Input type | Form of regression: Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | |
| Norwegian, competitive | | | | | | | | | | | | | |
| Direct materials ......... | 86 | 34 | 120 | 2 | - | 2 | 2 | 3 | 5 | - | 1 | 1 | 128 |
| Auxiliary materials ...... | 12 | 6 | 18 | 1 | - | 1 | - | - | - | - | - | - | 19 |
| Packaging materials ...... | 9 | 3 | 12 | - | 1 | 1 | 1 | - | 1 | - | - | - | 14 |
| Norwegian, non-competitive | | | | | | | | | | | | | |
| Direct materials ......... | 13 | 6 | 19 | 1 | - | 1 | - | - | - | - | - | - | 20 |
| Auxiliary materials ...... | 32 | 23 | 55 | - | - | - | 1 | - | 1 | - | 1 | 1 | 57 |
| Service inputs ........... | 33 | 19 | 52 | 2 | 2 | 4 | 2 | 5 | 7 | 1 | 2 | 3 | 66 |
| Packaging materials ...... | 9 | 1 | 10 | - | - | - | - | - | - | - | - | - | 10 |
| Imports | | | | | | | | | | | | | |
| Direct materials ......... | 75 | 24 | 99 | 2 | 2 | 4 | 1 | 2 | 3 | - | - | - | 106 |
| Auxiliary materials ...... | 29 | 15 | 44 | 1 | 1 | 2 | - | 1 | 1 | - | - | - | 47 |
| Service inputs ........... | 8 | 2 | 10 | - | - | - | - | - | - | - | - | - | 10 |
| All specified inputs | | | | | | | | | | | | | |
| Direct materials ......... | 174 | 64 | 238 | 5 | 2 | 7 | 3 | 5 | 8 | - | 1 | 1 | 254 |
| Auxiliary materials ...... | 73 | 44 | 117 | 2 | 1 | 3 | 1 | 1 | 2 | - | 1 | 1 | 123 |
| Service inputs ........... | 41 | 21 | 62 | 2 | 2 | 4 | 2 | 5 | 7 | 1 | 2 | 3 | 76 |
| Packaging materials ...... | 18 | 4 | 22 | - | 1 | 1 | 1 | - | 1 | - | - | - | 24 |
| Competitive inputs combined | | | | | | | | | | | | | |
| Direct materials ......... | 101 | 48 | 149 | 1 | - | 1 | 1 | 3 | 4 | - | 1 | 1 | 155 |
| Auxiliary materials ...... | 33 | 15 | 48 | - | 1 | 1 | - | 3 | 3 | - | 1 | 1 | 53 |
| Packaging materials ...... | 13 | 4 | 17 | - | - | - | - | - | - | - | - | - | 17 |
| Substitution groups | | | | | | | | | | | | | |
| Direct materials ......... | 25 | 18 | 43 | 1 | 1 | 2 | - | - | - | - | 1 | 1 | 46 |
| Auxiliary materials ...... | 2 | 1 | 3 | - | - | - | - | 1 | 1 | - | - | - | 4 |
| Service inputs ........... | 3 | - | 3 | - | - | - | - | - | - | - | - | - | 3 |
| Fuels combined .......... | 33 | 13 | 46 | 1 | 1 | 2 | 3 | 1 | 4 | 1 | - | 1 | 53 |

Table D17. Forms of the regressions of inputs on outputs for basic categories of inputs, classified by input types. Percentage distributions

| Basic category / Input type | Form of regression: Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | |
| **Norwegian, competitive** | | | | | | | | | | | | | |
| Direct materials ..... | 67.2 | 26.5 | 93.7 | 1.6 | - | 1.6 | 1.6 | 2.3 | 3.9 | - | 0.8 | 0.8 | 100.0 |
| Auxiliary materials .. | 63.1 | 31.6 | 94.7 | 5.3 | - | 5.3 | - | - | - | - | - | - | 100.0 |
| Packaging materials .. | 64.3 | 21.4 | 85.7 | - | 7.2 | 7.2 | 7.1 | - | 7.1 | - | - | - | 100.0 |
| **Norwegian, non-competitive** | | | | | | | | | | | | | |
| Direct materials ..... | 65.0 | 30.0 | 95.0 | 5.0 | - | 5.0 | - | - | - | - | - | - | 100.0 |
| Auxiliary materials .. | 56.1 | 40.4 | 96.5 | - | - | - | 1.8 | - | 1.8 | - | 1.7 | 1.7 | 100.0 |
| Service inputs ....... | 50.0 | 28.8 | 78.8 | 3.0 | 3.1 | 6.1 | 3.0 | 7.6 | 10.6 | 1.5 | 3.0 | 4.5 | 100.0 |
| Packaging materials .. | 90.0 | 10.0 | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 |
| **Imports** | | | | | | | | | | | | | |
| Direct materials ..... | 70.7 | 22.7 | 93.4 | 1.9 | 1.9 | 3.8 | 0.9 | 1.9 | 2.8 | - | - | - | 100.0 |
| Auxiliary materials .. | 61.7 | 31.9 | 93.6 | 2.1 | 2.2 | 4.3 | - | 2.1 | 2.1 | - | - | - | 100.0 |
| Service inputs ....... | 80.0 | 20.0 | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 |
| **All specified inputs** | | | | | | | | | | | | | |
| Direct materials ..... | 68.5 | 25.2 | 93.7 | 2.0 | 0.8 | 2.8 | 1.2 | 1.9 | 3.1 | - | 0.4 | 0.4 | 100.0 |
| Auxiliary materials .. | 59.4 | 35.8 | 95.2 | 1.6 | 0.8 | 2.4 | 0.8 | 0.8 | 1.6 | - | 0.8 | 0.8 | 100.0 |
| Service inputs ....... | 53.9 | 27.7 | 81.6 | 2.6 | 2.7 | 5.3 | 2.6 | 6.6 | 9.2 | 1.3 | 2.6 | 3.9 | 100.0 |
| Packaging materials .. | 75.0 | 16.7 | 91.7 | - | 4.1 | 4.1 | 4.2 | - | 4.2 | - | - | - | 100.0 |
| **Competitive inputs combined** | | | | | | | | | | | | | |
| Direct materials ..... | 65.2 | 31.0 | 96.2 | 0.6 | - | 0.6 | 0.6 | 2.0 | 2.6 | - | 0.6 | 0.6 | 100.0 |
| Auxiliary materials .. | 62.2 | 28.3 | 90.5 | - | 1.9 | 1.9 | - | 5.7 | 5.7 | - | 1.9 | 1.9 | 100.0 |
| Packaging materials .. | 76.5 | 23.5 | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 |
| **Substitution groups** | | | | | | | | | | | | | |
| Direct materials ..... | 54.4 | 39.1 | 93.5 | 2.2 | 2.1 | 4.3 | - | - | - | - | 2.2 | 2.2 | 100.0 |
| Auxiliary materials .. | 50.0 | 25.0 | 75.0 | - | - | - | - | 25.0 | 25.0 | - | - | - | 100.0 |
| Service inputs ....... | 100.0 | - | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 |
| **Fuels combined** ....... | 62.3 | 24.5 | 86.8 | 1.9 | 1.9 | 3.8 | 5.6 | 1.9 | 7.5 | 1.9 | - | 1.9 | 100.0 |

Table D18. Delivering sectors with one or more deliveries not possitively correlated with output in receiving sectors

| | Number of specified deliveries | Of these non-proportional | Of these not positively correlated: Number | Of these not positively correlated: Per cent |
|---|---|---|---|---|
| **Norwegian sectors** | | | | |
| 03 Hunting etc. | 1 | 1 | 1 | 100.0 |
| 63 Ocean transportation | 1 | 1 | 1 | 100.0 |
| 06 Coal mining | 6 | 2 | 2 | 33.3 |
| 61 Real estate | 14 | 5 | 4 | 28.6 |
| 46 Other metals | 10 | 2 | 2 | 20.0 |
| 27 Wood and cork | 7 | 1 | 1 | 14.3 |
| 01 Agriculture | 11 | 2 | 1 | 9.1 |
| **Unspecified** | | | | |
| 82 Unspecified services | 32 | 6 | 4 | 12.5 |
| 80 Unspecified office supplies | 33 | 2 | 2 | 6.1 |
| **Import sectors** | | | | |
| 03 Hunting etc. | 4 | 1 | 1 | 25.0 |
| 39 Vegetable oil | 6 | 1 | 1 | 16.7 |
| 01 Agriculture, competitive | 9 | 2 | 1 | 11.1 |
| 37 Other chemicals | 38 | 3 | 1 | 2.6 |
| **Competitive inputs combined** | | | | |
| 03 Hunting etc. | 4 | 2 | 2 | 50.0 |
| 39 Vegetable oil | 6 | 1 | 1 | 16.7 |
| 21 Textiles | 10 | 1 | 1 | 10.0 |
| 37 Other chemicals | 49 | 4 | 4 | 8.2 |
| 48 Metal products | 22 | 1 | 1 | 4.5 |

Table D19. Characteristics of delivering sectors. Distribution of Norwegian delivering sectors according to results for specified deliveries and type of delivering sector

| | Type of delivering sector | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Extractive and service | Commodity processing | Unspecified | Total | Extractive and service | Commodity processing | Unspecified | Total |
| | Number of sectors | | | | Percentage distribution | | | |
| All specified deliveries in classes with significant positive correlation with output in receiving sectors | 16 | 32 | 2 | 50 | 76.2 | 94.1 | 50.0 | 84.7 |
| Of these: All in the classes Proportional | 15 | 27 | 2 | 44 | 71.4 | 79.4 | 50.0 | 74.6 |
| 70 per cent or more in the class Proportional, no trend | 7 | 16 | 1 | 24 | 33.3 | 47.1 | 25.0 | 40.7 |
| 50-70 per cent in the class Proportional, no trend | 3 | 12 | 1 | 16 | 14.3 | 35.3 | 25.0 | 27.1 |
| One or more deliveries in classes without significant positive correlation with output in receiving sectors | 5 | 2 | 2 | 9 | 23.8 | 5.9 | 50.0 | 15.3 |
| Of these: Less than 50 per cent in the class Proportional, no trend | 4 | - | - | 4 | 19.0 | - | - | 6.8 |
| Total | 21 | 34 | 4 | 59 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D20. Characteristics of delivering sectors. Distribution of import sectors according to results for specified deliveries and type of delivering sector

| | Type of delivering sector | | | | | |
|---|---|---|---|---|---|---|
| | Extractive and service | Commodity processing | Total | Extractive and service | Commodity processing | Total |
| | Number of sectors | | | Percentage distribution | | |
| All specified deliveries in classes with significant positive correlation with output in receiving sectors ...................... | 12 | 26 | 38 | 85.7 | 92.9 | 90.5 |
| Of these: All in the classes Proportional . | 11 | 24 | 35 | 78.6 | 85.7 | 83.3 |
| 70 per cent or more in the class Proportional, no trend .......... | 6 | 14 | 20 | 42.9 | 50.0 | 47.6 |
| 50-70 per cent in the class Proportional, no trend .......... | 5 | 7 | 12 | 35.7 | 25.0 | 28.6 |
| One or more deliveries in classes without significant positive correlation with output in receiving sectors ............... | 2 | 2 | 4 | 14.3 | 7.1 | 9.5 |
| Of these: Less than 50 per cent in the class Proportional, no trend .... | 1 | - | 1 | 7.1 | - | 2.4 |
| Total ..................................... | 14 | 28 | 42 | 100.0 | 100.0 | 100.0 |

Table D21. Characteristics of delivering sectors. Distribution of delivering sectors for Competitive inputs combined according to results for specified deliveries and type of delivering sector

| | Type of delivering sector | | | | | |
|---|---|---|---|---|---|---|
| | Extractive and service | Commodity processing | Total | Extractive and service | Commodity processing | Total |
| | Number of sectors | | | Percentage distribution | | |
| All specified inputs in classes with significant positive correlation with output in receiving sector ................ | 8 | 29 | 37 | 88.8 | 87.9 | 88.1 |
| Of these: All in classes Proportional ..... | 8 | 27 | 35 | 88.8 | 81.8 | 83.3 |
| 70 per cent or more in the class Proportional, no trend .......... | 4 | 9 | 13 | 44.4 | 27.3 | 31.0 |
| 50-70 per cent in the class Proportional, no trend .......... | 1 | 15 | 16 | 11.1 | 45.5 | 38.1 |
| One or more deliveries in classes without significant positive correlation with output in receiving sectors ...................... | 1 | 4 | 5 | 11.1 | 12.1 | 11.9 |
| Of these: Less than 50 per cent in the class Proportional, no trend .... | 1 | - | 1 | 11.1 | - | 2.4 |
| Total ..................................... | 9 | 33 | 42 | 100.0 | 100.0 | 100.0 |

Table D22. Characteristics of delivering sectors. Distribution of Norwegian delivering sectors according to results for specified deliveries and number of specified deliveries

| | Number of specified deliveries | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2-4 | Over 4 | Total | 1 | 2-4 | Over 4 | Total |
| | Number of sectors | | | | Percentage distribution | | | |
| All specified deliveries in classes with significant positive correlation with output in receiving sectors ........... | 11 | 28 | 11 | 50 | 84.5 | 100.0 | 61.1 | 84.7 |
| Of these: All in the classes Proportional ..................... | 11 | 24 | 9 | 44 | 84.5 | 85.7 | 50.0 | 74.6 |
| 70 per cent or more in the class Proportional, no trend. | 8 | 12 | 4 | 24 | 61.5 | 42.9 | 22.2 | 40.7 |
| 50-70 per cent in the class Proportional, no trend ...... | - | 10 | 6 | 16 | - | 35.7 | 33.3 | 27.1 |
| One delivery in classes without significant positive correlation with output in receiving sectors ..................... | 2 | - | 2 | 4 | 15.4 | - | 11.1 | 6.8 |
| Two or more deliveries in classes without significant positive correlation with output in receiving sectors (constituting from 6.1 to 3.3 per cent of specified deliveries) .............. | - | - | 5 | 5 | - | - | 27.8 | 8.5 |
| Total ................................ | 13 | 28 | 18 | 59 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D23. Characteristics of delivering sectors. Distribution of Import sectors according to results for specified deliveries and number of specified deliveries

| | Number of specified deliveries | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2-4 | Over 4 | Total | 1 | 2-4 | Over 4 | Total |
| | Number of sectors | | | | Percentage distribution | | | |
| All specified deliveries in classes with significant positive correlation with output in receiving sectors ........... | 20 | 9 | 9 | 38 | 100.0 | 90.0 | 75.0 | 90.5 |
| Of these: All in the classes Proportional | 20 | 8 | 7 | 35 | 100.0 | 80.0 | 58.4 | 83.3 |
| 70 per cent or more in the class Proportional, no trend. | 14 | 4 | 2 | 20 | 70.0 | 40.0 | 16.7 | 47.6 |
| 50-70 per cent in the class Proportional, no trend ...... | - | 5 | 7 | 12 | - | 50.0 | 58.3 | 28.6 |
| One delivery in classes without significant possitive correlation with output in receiving sectors ........... | - | 1 | 3 | 4 | - | 10.0 | 25.0 | 9.5 |
| Total ................................ | 20 | 10 | 12 | 42 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D24. Characteristics of delivering sectors. Distribution of delivering sectors for Competitive inputs combined according to results for specified deliveries and number of specified deliveries

| | Number of specified deliveries | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2-4 | Over 4 | Total | 1 | 2-4 | Over 4 | Total |
| | Number of sectors | | | | Percentage distribution | | | |
| All specified deliveries in classes with significant positive correlation with output in receiving sectors .... | 7 | 21 | 9 | 37 | 100.0 | 95.5 | 69.2 | 88.1 |
| Of these: All in the classes Proportional .................. | 7 | 20 | 8 | 35 | 100.0 | 90.9 | 61.5 | 83.3 |
| 70 per cent or more in the class Proportional, no trend .................... | 4 | 7 | 2 | 13 | 57.4 | 31.8 | 15.4 | 31.0 |
| 50-70 per cent in the class Proportional, no trend .................... | - | 12 | 4 | 16 | - | 54.5 | 30.8 | 38.1 |
| One delivery in classes without significant positive correlation with output in receiving sectors ......... | - | - | 3 | 3 | - | - | 23.1 | 7.1 |
| Two or more deliveries in classes without significant positive correlation with output in receiving sectors ............................ | - | 1 | 1 | 2 | - | 4.5 | 7.7 | 4.8 |
| Total .............................. | 7 | 22 | 13 | 42 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D25. Forms of the regressions of inputs on outputs for basic categories of inputs, classified by type of receiving sectors. Numbers of input items

| Type of receiving sector<br>Form of regression | Norwegian, competitive | Norwegian, non-competitive | Imports, competitive | Imports, non-competitive | All specified inputs | Competitive inputs combined | Fuels combined | Substitution groups | Import sums | Gross value added |
|---|---|---|---|---|---|---|---|---|---|---|
| Extractive and service sectors | | | | | | | | | | |
| Proportional, no trend ....... | 11 | 45 | 10 | 10 | 76 | 20 | 6 | 8 | 13 | 21 |
| Proportional, trend .......... | 13 | 32 | 6 | 3 | 54 | 12 | 3 | 3 | 8 | 11 |
| Proportional, total .......... | 24 | 77 | 16 | 13 | 130 | 32 | 9 | 11 | 21 | 32 |
| Linear, positive, no trend ... | 1 | 1 | 1 | - | 3 | - | - | - | 1 | 2 |
| Linear, positive, trend ...... | - | 1 | - | - | 1 | - | - | - | 2 | 3 |
| Linear, positive, total ...... | 1 | 2 | 1 | - | 4 | - | - | - | 3 | 5 |
| Linear, negative, no trend ... | - | 3 | - | - | 3 | - | 1 | - | - | - |
| Linear, negative, trend ...... | 1 | 4 | 1 | - | 6 | 3 | 1 | 1 | 1 | - |
| Linear, negative, total ...... | 1 | 7 | 1 | - | 9 | 3 | 2 | 1 | 1 | - |
| Independent, no trend ........ | - | 1 | - | - | 1 | - | - | - | - | - |
| Independent, trend ........... | - | 3 | - | - | 3 | - | - | - | 1 | - |
| Independent, total ........... | - | 4 | - | - | 4 | - | - | - | 1 | - |
| Total ........................ | 26 | 90 | 18 | 13 | 147 | 35 | 11 | 12 | 26 | 37 |
| Commodity processing sectors | | | | | | | | | | |
| Proportional, no trend ....... | 96 | 42 | 86 | 6 | 230 | 127 | 27 | 22 | 32 | 27 |
| Proportional, trend .......... | 30 | 17 | 26 | 6 | 79 | 55 | 10 | 16 | 8 | 9 |
| Proportional, total .......... | 126 | 59 | 112 | 12 | 309 | 182 | 37 | 38 | 40 | 36 |
| Linear, positive, no trend ... | 2 | 2 | 2 | - | 6 | 1 | 1 | 1 | 1 | 3 |
| Linear, positive, trend ...... | 1 | 1 | 2 | 1 | 5 | 1 | 1 | 1 | 1 | - |
| Linear, positive, total ...... | 3 | 3 | 4 | 1 | 11 | 2 | 2 | 2 | 2 | 3 |
| Linear, negative, no trend ... | 3 | - | 1 | - | 4 | 1 | 2 | - | - | 1 |
| Linear, negative, trend ...... | 2 | 1 | 2 | - | 5 | 3 | - | - | - | 1 |
| Linear, negative, total ...... | 5 | 1 | 3 | - | 9 | 4 | 2 | - | - | 2 |
| Independent, no trend ........ | - | - | - | - | - | - | 1 | - | - | - |
| Independent, trend ........... | 1 | - | - | - | 1 | 2 | - | 1 | - | 1 |
| Independent, total ........... | 1 | - | - | - | 1 | 2 | 1 | 1 | - | 1 |
| Total ........................ | 135 | 63 | 119 | 13 | 330 | 190 | 42 | 41 | 42 | 42 |

Table D26. Forms of regressions of inputs on outputs for basic categories of inputs, classified by type of receiving sector. Percentage distributions

| Type of receiving sector<br>Form of regression | Norwegian, competitive | Norwegian, non-competitive | Imports, competitive | Imports, non-competitive | All specified inputs | Competitive inputs combined | Fuels combined | Substitution groups | Import sums | Gross value added |
|---|---|---|---|---|---|---|---|---|---|---|
| **Extractive and service sectors** | | | | | | | | | | |
| Proportional, no trend ....... | 42.3 | 50.0 | 55.5 | 76.9 | 51.7 | 57.1 | 54.5 | 66.7 | 50.0 | 56.8 |
| Proportional, trend .......... | 50.0 | 35.5 | 33.4 | 23.1 | 36.7 | 34.3 | 27.3 | 25.0 | 30.8 | 29.7 |
| Proportional, total .......... | 92.3 | 85.5 | 88.9 | 100.0 | 88.4 | 91.4 | 81.8 | 91.7 | 80.8 | 86.5 |
| Linear,positive, no trend .... | 3.9 | 1.1 | 5.6 | - | 2.0 | - | - | - | 3.8 | 5.4 |
| Linear,positive, trend ....... | - | 1.1 | - | - | 0.7 | - | - | - | 7.7 | 8.1 |
| Linear,positive, total ....... | 3.9 | 2.2 | 5.6 | - | 2.7 | - | - | - | 11.5 | 13.5 |
| Linear,negative, no trend .... | - | 3.3 | - | - | 2.1 | - | 9.1 | - | - | - |
| Linear,negative, trend ....... | 3.8 | 4.5 | 5.5 | - | 4.1 | 8.6 | 9.1 | 8.3 | 3.8 | - |
| Linear,negative, total ....... | 3.8 | 7.8 | 5.5 | - | 6.2 | 8.6 | 18.2 | 8.3 | 3.8 | - |
| Independent, no trend ........ | - | 1.1 | - | - | 0.7 | - | - | - | - | - |
| Independnet, trend ........... | - | 3.4 | - | - | 2.0 | - | - | - | 3.9 | - |
| Independent, total ........... | - | 4.5 | - | - | 2.7 | - | - | - | 3.9 | - |
| Total ........................ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| **Commodity processing sectors** | | | | | | | | | | |
| Proportional, no trend ....... | 71.2 | 66.6 | 72.3 | 46.1 | 69.7 | 66.8 | 64.3 | 53.7 | 76.2 | 64.3 |
| Proportional, trend .......... | 22.2 | 27.0 | 21.8 | 46.2 | 23.9 | 28.9 | 23.8 | 39.0 | 19.0 | 21.4 |
| Proportional, total .......... | 93.4 | 93.6 | 94.1 | 92.3 | 93.6 | 95.7 | 88.1 | 92.7 | 95.2 | 85.7 |
| Linear,positive, no trend .... | 1.5 | 3.2 | 1.7 | - | 1.8 | 0.5 | 2.4 | 2.5 | 2.4 | 7.1 |
| Linear,positive, trend ....... | 0.7 | 1.6 | 1.7 | 7.7 | 1.5 | 0.6 | 2.4 | 2.4 | 2.4 | - |
| Linear positive, total ....... | 2.2 | 4.8 | 3.4 | 7.7 | 3.3 | 1.1 | 4.8 | 4.9 | 4.8 | 7.1 |
| Linear,negative, no trend .... | 2.2 | - | 0.8 | - | 1.2 | 0.5 | 4.7 | - | - | 2.4 |
| Linear,negative, trend ....... | 1.5 | 1.6 | 1.7 | - | 1.6 | 1.6 | - | - | - | 2.4 |
| Linear,negative, total ....... | 3.7 | 1.6 | 2.5 | - | 2.8 | 2.1 | 4.7 | - | - | 4.8 |
| Independent, no trend ........ | - | - | - | - | - | - | 2.4 | - | - | - |
| Independent, trend ........... | 0.7 | - | - | - | 0.3 | 1.1 | - | 2.4 | - | 2.4 |
| Independent, total ........... | 0.7 | - | - | - | 0.3 | 1.1 | 2.4 | 2.4 | - | 2.4 |
| Total ........................ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D27. Forms of the regressions of inputs on outputs. Classification by type of receiving sector and size in kroner of input item. All specified inputs

| Type of receiving sector / Form of regression | Average size of input items in million 1955-kroner: 0 - 10.0 | | 10.1 - 50.0 | | Over 50.0 | |
|---|---|---|---|---|---|---|
| | Number of items | Per cent | Number of items | Per cent | Number of items | Per cent |
| Extractive and service sectors | | | | | | |
| Proportional, no trend .............. | 46 | 49.5 | 20 | 69.0 | 10 | 40.0 |
| Proportional, trend .................. | 35 | 37.6 | 5 | 17.2 | 14 | 56.0 |
| Proportional, total .................. | 81 | 87.1 | 25 | 86.2 | 24 | 96.0 |
| Linear,positive, no trend ........... | 2 | 2.1 | - | - | 1 | 4.0 |
| Linear,positive, trend .............. | 1 | 1.1 | - | - | - | - |
| Linear,positive, total .............. | 3 | 3.2 | - | - | 1 | 4.0 |
| Confirmation, total .................. | 84 | 90.3 | 25 | 86.2 | 25 | 100.0 |
| Linear,negative, no trend ........... | 3 | 3.2 | - | - | - | - |
| Linear,negative, trend .............. | 4 | 4.3 | 2 | 6.9 | - | - |
| Linear,negative, total .............. | 7 | 7.5 | 2 | 6.9 | - | - |
| Independent, no trend ................ | 1 | 1.1 | - | - | - | - |
| Independent, trend ................... | 1 | 1.1 | 2 | 6.9 | - | - |
| Independnet, total ................... | 2 | 2.2 | 2 | 6.9 | - | - |
| Rejection, total ..................... | 9 | 9.7 | 4 | 13.8 | - | - |
| Total ................................ | 93 | 100.0 | 29 | 100.0 | 25 | 100.0 |
| Commodity processing sectors | | | | | | |
| Proportional, no trend .............. | 132 | 71.8 | 73 | 68.9 | 25 | 62.5 |
| Proportional, trend .................. | 42 | 22.8 | 26 | 24.6 | 11 | 27.5 |
| Proportional, total .................. | 174 | 94.6 | 99 | 93.5 | 36 | 90.0 |
| Linear,positive, no trend ........... | 2 | 1.1 | 3 | 2.8 | 1 | 2.5 |
| Linear,positive, trend .............. | 2 | 1.1 | 1 | 0.9 | 2 | 5.0 |
| Linear,positive, total .............. | 4 | 2.2 | 4 | 3.7 | 3 | 7.5 |
| Confirmation, total .................. | 178 | 96.8 | 103 | 97.2 | 39 | 97.5 |
| Linear,negative, no trend ........... | 2 | 1.1 | 2 | 1.9 | - | - |
| Linear,negative, trend .............. | 3 | 1.6 | 1 | 0.9 | 1 | 2.5 |
| Linear,negative, total .............. | 5 | 2.7 | 3 | 2.8 | 1 | 2.5 |
| Independent, no trend ................ | - | - | - | - | - | - |
| Independnet, trend ................... | 1 | 0.5 | - | - | - | - |
| Independent, total ................... | 1 | 0.5 | - | - | - | - |
| Rejection, total ..................... | 6 | 3.2 | 3 | 2.8 | 1 | 2.5 |
| Total ................................ | 184 | 100.0 | 106 | 100.0 | 40 | 100.0 |

Table D28. Forms of the regressions of inputs on outputs for basic categories of inputs, classified by the size in 1955-kroner of the average production value of receiving sectors. Numbers of input items

| Basic category<br>Production values, million kroner | Form of regression: Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | |
| **Norwegian, competitive** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 16 | 1 | 17 | - | - | - | 1 | - | 1 | - | 1 | 1 | 19 |
| 100.0 - 499.9 ...... | 55 | 22 | 77 | - | - | - | 1 | 1 | 2 | - | - | - | 79 |
| 500.0 + ........... | 36 | 20 | 56 | 3 | 1 | 4 | 1 | 2 | 3 | - | - | - | 63 |
| **Norwegian, non-competitive** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 14 | 9 | 23 | - | - | - | 1 | 1 | 2 | 1 | 1 | 2 | 27 |
| 100.0 - 499.9 ...... | 52 | 33 | 85 | 1 | 2 | 3 | 2 | 2 | 4 | - | 2 | 2 | 94 |
| 500.0 + ........... | 21 | 7 | 28 | 2 | - | 2 | - | 2 | 2 | - | - | - | 32 |
| **Imports** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 15 | 5 | 20 | - | 1 | 1 | - | 1 | 1 | - | - | - | 22 |
| 100.0 - 499.9 ...... | 66 | 24 | 90 | 3 | - | 3 | 1 | - | 1 | - | - | - | 94 |
| 500.0 + ........... | 31 | 12 | 43 | - | 2 | 2 | - | 2 | 2 | - | - | - | 47 |
| **All specified inputs** | | | | | | | | | | | | | |
| 0 - 30.8 ...... | 14 | 5 | 19 | - | - | - | 2 | - | 2 | - | - | - | 21 |
| 30.9 - 99.9 ...... | 31 | 10 | 41 | - | 1 | 1 | - | 2 | 2 | 1 | 2 | 3 | 47 |
| 100.0 - 499.9 ...... | 173 | 79 | 252 | 4 | 2 | 6 | 4 | 3 | 7 | - | 2 | 2 | 267 |
| 500.0 - 999.9 ...... | 71 | 25 | 96 | 3 | 3 | 6 | 1 | 4 | 5 | - | - | - | 107 |
| 1000.0 + ........... | 17 | 14 | 31 | 2 | - | 2 | - | 2 | 2 | - | - | - | 35 |
| **Competitive inputs combined** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 21 | 5 | 26 | - | - | - | - | 1 | 1 | - | - | - | 27 |
| 100.0 - 499.9 ...... | 72 | 39 | 111 | - | - | - | - | 3 | 3 | - | 2 | 2 | 116 |
| 500.0 + ........... | 54 | 23 | 77 | 1 | 1 | 2 | 1 | 2 | 3 | - | - | - | 82 |
| **Fuels combined** | | | | | | | | | | | | | |
| 0 - 499.9 ...... | 21 | 7 | 28 | 1 | - | 1 | 2 | - | 2 | 1 | - | 1 | 32 |
| 500.0 + ........... | 12 | 6 | 18 | - | 1 | 1 | 1 | 1 | 2 | - | - | - | 21 |
| **Substitution groups** | | | | | | | | | | | | | |
| 0 - 499.9 ...... | 13 | 13 | 26 | 1 | 1 | 2 | - | - | - | - | 1 | 1 | 29 |
| 500.0 + ........... | 17 | 6 | 23 | - | - | - | - | 1 | 1 | - | - | - | 24 |
| **Import sums** | | | | | | | | | | | | | |
| 0 - 499.9 ...... | 29 | 11 | 40 | 2 | 2 | 4 | - | - | - | - | - | - | 44 |
| 500.0 + ........... | 16 | 5 | 21 | - | 1 | 1 | - | 1 | 1 | - | 1 | 1 | 24 |
| **Gross value added** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 7 | 2 | 9 | 1 | 1 | 2 | 1 | 1 | 2 | - | 1 | 1 | 14 |
| 100.0 - 499.9 ...... | 25 | 12 | 37 | 2 | 1 | 3 | - | - | - | - | - | - | 40 |
| 500.0 + ........... | 16 | 6 | 22 | 2 | 1 | 3 | - | - | - | - | - | - | 25 |

Table D29. Forms of the regressions of inputs on outputs for basic categories of inputs, classified by the size in 1955-kroner of the average production value of receiving sectors. Percentage distribution

| Basic category<br>Production values, million kroner | Form of regression: Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | |
| **Norwegian, competitive** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 84.2 | 5.3 | 89.5 | - | - | - | 5.3 | - | 5.3 | - | 5.2 | 5.2 | 100.0 |
| 100.0 - 499.9 ...... | 69.6 | 27.9 | 97.5 | - | - | - | 1.3 | 1.2 | 2.5 | - | - | - | 100.0 |
| 500.0 + ........... | 57.2 | 31.7 | 88.9 | 4.7 | 1.6 | 6.3 | 1.6 | 3.2 | 4.8 | - | - | - | 100.0 |
| **Norwegian, non-competitive** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 51.9 | 33.3 | 85.2 | - | - | - | 3.7 | 3.7 | 7.4 | 3.7 | 3.7 | 7.4 | 100.0 |
| 100.0 - 499.9 ...... | 55.4 | 35.1 | 90.5 | 1.1 | 2.1 | 3.2 | 2.1 | 2.1 | 4.2 | - | 2.1 | 2.1 | 100.0 |
| 500.0 + ........... | 65.7 | 21.8 | 87.5 | 6.3 | - | 6.3 | - | 6.2 | 6.2 | - | - | - | 100.0 |
| **Imports** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 68.2 | 22.7 | 90.9 | - | 4.6 | 4.6 | - | 4.5 | 4.5 | - | - | - | 100.0 |
| 100.0 - 499.9 ...... | 70.2 | 25.5 | 95.7 | 3.2 | - | 3.2 | 1.1 | - | 1.1 | - | - | - | 100.0 |
| 500.0 + ........... | 66.0 | 25.5 | 91.5 | - | 4.3 | 4.3 | - | 4.2 | 4.2 | - | - | - | 100.0 |
| **All specified inputs** | | | | | | | | | | | | | |
| 0 - 30.8 ...... | 66.7 | 23.8 | 90.5 | - | - | - | 9.5 | - | 9.5 | - | - | - | 100.0 |
| 30.9 - 99.9 ...... | 65.9 | 21.3 | 87.2 | - | 2.1 | 2.1 | - | 4.3 | 4.3 | 2.1 | 4.3 | 6.4 | 100.0 |
| 100.0 - 499.9 ...... | 64.8 | 29.6 | 94.4 | 1.5 | 0.8 | 2.3 | 1.5 | 1.1 | 2.6 | - | 0.7 | 0.7 | 100.0 |
| 500.0 - 999.9 ...... | 66.3 | 23.4 | 89.7 | 2.8 | 2.8 | 5.6 | 0.9 | 3.8 | 4.7 | - | - | - | 100.0 |
| 1000.0 + ........... | 48.6 | 40.0 | 88.6 | 5.7 | - | 5.7 | - | 5.7 | 5.7 | - | - | - | 100.0 |
| **Competitive inputs combined** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 77.8 | 18.5 | 96.3 | - | - | - | - | 3.7 | 3.7 | - | - | - | 100.0 |
| 100.0 - 499.9 ...... | 62.0 | 33.7 | 95.7 | - | - | - | - | 2.6 | 2.6 | - | 1.7 | 1.7 | 100.0 |
| 500.0 + ........... | 65.9 | 28.0 | 93.9 | 1.2 | 1.2 | 2.4 | 1.2 | 2.5 | 3.7 | - | - | - | 100.0 |
| **Fuels combined** | | | | | | | | | | | | | |
| 0 - 499.9 ...... | 65.7 | 21.8 | 87.5 | 3.1 | - | 3.1 | 6.3 | - | 6.3 | 3.1 | - | 3.1 | 100.0 |
| 500.0 + ........... | 57.1 | 28.6 | 85.7 | - | 4.8 | 4.8 | 4.8 | 4.7 | 9.5 | - | - | - | 100.0 |
| **Substitution groups** | | | | | | | | | | | | | |
| 0 - 499.9 ...... | 44.9 | 44.8 | 89.7 | 3.5 | 3.4 | 6.9 | - | - | - | - | 3.4 | 3.4 | 100.0 |
| 500.0 + ........... | 70.8 | 25.0 | 95.8 | - | - | - | - | 4.2 | 4.2 | - | - | - | 100.0 |
| **Import sums** | | | | | | | | | | | | | |
| 0 - 499.9 ...... | 65.9 | 25.0 | 90.9 | 4.5 | 4.6 | 9.1 | - | - | - | - | - | - | 100.0 |
| 500.0 + ........... | 66.7 | 20.8 | 87.5 | - | 4.2 | 4.2 | - | 4.1 | 4.1 | - | 4.2 | 4.2 | 100.0 |
| **Gross value added** | | | | | | | | | | | | | |
| 0 - 99.9 ...... | 50.0 | 14.3 | 64.3 | 7.1 | 7.2 | 14.3 | 7.2 | 7.1 | 14.3 | - | 7.1 | 7.1 | 100.0 |
| 100.0 - 499.9 ...... | 62.5 | 30.0 | 92.5 | 5.0 | 2.5 | 7.5 | - | - | - | - | - | - | 100.0 |
| 500.0 + ........... | 64.0 | 24.0 | 88.0 | 8.0 | 4.0 | 12.0 | - | - | - | - | - | - | 100.0 |

Table D30. Characteristics of receiving sectors. Distribution of sectors according to results for specified input items and size of average production in million 1955-kroner

| | Average production in million 1955-kroner | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 - 99.9 | 100 - 499.9 | 500 and over | Total | 0 - 99.9 | 100 - 499.9 | 500 and over | Total |
| | Number of sectors | | | | Percentage distribution | | | |
| 70 per cent and more of specified input items in the class Proportional, no trend ............................ | 5 | 20 | 15 | 40 | 38.5 | 51.3 | 57.7 | 51.3 |
| All specified input items in the classes Proportional, majority without trend ........................ | 5 | 22 | 13 | 40 | 38.5 | 56.4 | 50.0 | 51.3 |
| All specified input items in the classes Proportional ................. | 6 | 28 | 15 | 49 | 46.1 | 71.8 | 57.7 | 62.8 |
| All specified input items in classes with significant positive correlation between input and output ............ | 7 | 31 | 19 | 57 | 53.8 | 79.5 | 73.0 | 73.1 |
| All sectors with specified input items | 13 | 39 | 26 | 78 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D31. Forms of the regressions of inputs on outputs for basic categories of inputs, classified by the relative dispersion of production in receiving sectors. Numbers of input items

| Basic category | Form of regression | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Standard deviation in per cent of average production | Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | Total |
| | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | |
| Norwegian, competitive | | | | | | | | | | | | | |
| 0 - 14 ........... | 54 | 23 | 77 | 2 | - | 2 | - | 2 | 2 | - | 1 | 1 | 82 |
| 15 + .............. | 53 | 20 | 73 | 1 | 1 | 2 | 3 | 1 | 4 | - | - | - | 79 |
| Norwegian, non-competitive | | | | | | | | | | | | | |
| 0 - 14 ........... | 53 | 33 | 86 | - | 2 | 2 | 2 | 3 | 5 | 1 | 3 | 4 | 97 |
| 15 + .............. | 34 | 16 | 50 | 3 | - | 3 | 1 | 2 | 3 | - | - | - | 56 |
| Imports | | | | | | | | | | | | | |
| 0 - 14 ........... | 50 | 23 | 73 | 1 | 1 | 2 | - | 2 | 2 | - | - | - | 77 |
| 15 + .............. | 62 | 18 | 80 | 2 | 2 | 4 | 1 | 1 | 2 | - | - | - | 86 |
| All specified inputs | | | | | | | | | | | | | |
| 0 - 9 ........... | 40 | 27 | 67 | 1 | 2 | 3 | - | - | - | 1 | 1 | 2 | 72 |
| 10 - 14 ........... | 117 | 52 | 169 | 2 | 1 | 3 | 2 | 7 | 9 | - | 3 | 3 | 184 |
| 15 - 19 ........... | 37 | 13 | 50 | 1 | - | 1 | 2 | 1 | 3 | - | - | - | 54 |
| 20 - 24 ........... | 76 | 20 | 96 | 3 | 1 | 4 | 1 | 2 | 3 | - | - | - | 103 |
| 25 + .............. | 36 | 21 | 57 | 2 | 2 | 4 | 2 | 1 | 3 | - | - | - | 64 |
| Competitive inputs combined | | | | | | | | | | | | | |
| 0 - 14 ........... | 64 | 35 | 99 | - | - | - | - | 5 | 5 | - | 1 | 1 | 105 |
| 15 - 24 ........... | 58 | 19 | 77 | 1 | - | 1 | - | 1 | 1 | - | 1 | 1 | 80 |
| 25 + .............. | 25 | 13 | 38 | - | 1 | 1 | 1 | - | 1 | - | - | - | 40 |
| Fuels combined | | | | | | | | | | | | | |
| 0 - 14 ........... | 15 | 10 | 25 | 1 | - | 1 | 2 | 1 | 3 | - | - | - | 29 |
| 15 + .............. | 18 | 3 | 21 | - | 1 | 1 | 1 | - | 1 | 1 | - | 1 | 24 |
| Substitution groups | | | | | | | | | | | | | |
| 0 - 14 ........... | 18 | 10 | 28 | 1 | 1 | 2 | - | 1 | 1 | - | 1 | 1 | 32 |
| 15 + .............. | 12 | 9 | 21 | - | - | - | - | - | - | - | - | - | 21 |
| Import sums | | | | | | | | | | | | | |
| 0 - 14 ........... | 28 | 8 | 36 | 1 | 2 | 3 | - | 1 | 1 | - | 1 | 1 | 41 |
| 15 + .............. | 17 | 8 | 25 | 1 | 1 | 2 | - | - | - | - | - | - | 27 |
| Gross value added | | | | | | | | | | | | | |
| 0 - 14 ........... | 25 | 13 | 38 | 3 | 3 | 6 | 1 | 1 | 2 | - | - | - | 46 |
| 15 + .............. | 23 | 7 | 30 | 2 | - | 2 | - | - | - | - | 1 | 1 | 33 |

Table D32. Forms of the regressions of inputs on outputs for basic categories of inputs, classified by the relative dispersion of production in receiving sectors. Percentage distribution

| Basic category<br>Standard deviation in per cent of average production value | Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | |
| Norwegian, competitive | | | | | | | | | | | | | |
| 0 - 14 .......... | 65.8 | 28.1 | 93.9 | 2.4 | - | 2.4 | - | 2.5 | 2.5 | - | 1.2 | 1.2 | 100.0 |
| 15 + ............ | 67.1 | 25.3 | 92.4 | 1.3 | 1.2 | 2.5 | 3.8 | 1.3 | 5.1 | - | - | - | 100.0 |
| Norwegian, non-competitive | | | | | | | | | | | | | |
| 0 - 14 .......... | 54.7 | 34.0 | 88.7 | - | 2.0 | 2.0 | 2.1 | 3.1 | 5.2 | 1.0 | 3.1 | 4.1 | 100.0 |
| 15 + ............ | 60.7 | 28.6 | 89.3 | 5.3 | - | 5.3 | 1.8 | 3.6 | 5.4 | - | - | - | 100.0 |
| Imports | | | | | | | | | | | | | |
| 0 - 14 .......... | 64.9 | 29.9 | 94.8 | 1.3 | 1.3 | 2.6 | - | 2.6 | 2.6 | - | - | - | 100.0 |
| 15 + ............ | 72.1 | 20.9 | 93.0 | 2.3 | 2.3 | 4.6 | 1.2 | 1.2 | 2.4 | - | - | - | 100.0 |
| All specified inputs | | | | | | | | | | | | | |
| 0 - 9 .......... | 55.5 | 37.5 | 93.0 | 1.4 | 2.8 | 4.2 | - | - | - | 1.4 | 1.4 | 2.8 | 100.0 |
| 10 - 14 .......... | 63.6 | 28.3 | 91.9 | 1.1 | 0.5 | 1.6 | 1.1 | 3.8 | 4.9 | - | 1.6 | 1.6 | 100.0 |
| 15 - 19 .......... | 68.5 | 24.1 | 92.6 | 1.9 | - | 1.9 | 3.7 | 1.8 | 5.5 | - | - | - | 100.0 |
| 20 - 24 .......... | 73.8 | 19.4 | 93.2 | 2.9 | 1.0 | 3.9 | 1.0 | 1.9 | 2.9 | - | - | - | 100.0 |
| 25 + ............ | 56.3 | 32.8 | 89.1 | 3.1 | 3.1 | 6.2 | 3.1 | 1.6 | 4.7 | - | - | - | 100.0 |
| Competitive inputs combined | | | | | | | | | | | | | |
| 0 - 14 .......... | 61.0 | 33.3 | 94.3 | - | - | - | - | 4.8 | 4.8 | - | 0.9 | 0.9 | 100.0 |
| 15 - 24 .......... | 72.5 | 23.8 | 96.3 | 1.2 | - | 1.2 | - | 1.3 | 1.3 | - | 1.2 | 1.2 | 100.0 |
| 25 + ............ | 62.5 | 32.5 | 95.0 | - | 2.5 | 2.5 | 2.5 | - | 2.5 | - | - | - | 100.0 |
| Fuels combined | | | | | | | | | | | | | |
| 0 - 14 .......... | 51.7 | 34.5 | 86.2 | 3.5 | - | 3.5 | 6.9 | 3.4 | 10.3 | - | - | - | 100.0 |
| 15 + ............ | 75.0 | 12.5 | 87.5 | - | 4.1 | 4.1 | 4.2 | - | 4.2 | 4.2 | - | 4.2 | 100.0 |
| Substitution groups | | | | | | | | | | | | | |
| 0 - 14 .......... | 56.3 | 31.2 | 87.5 | 3.1 | 3.2 | 6.3 | - | 3.1 | 3.1 | - | 3.1 | 3.1 | 100.0 |
| 15 + ............ | 57.2 | 42.8 | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 |
| Import sums | | | | | | | | | | | | | |
| 0 - 14 .......... | 68.3 | 19.5 | 87.8 | 2.5 | 4.9 | 7.4 | - | 2.4 | 2.4 | - | 2.4 | 2.4 | 100.0 |
| 15 + ............ | 63.0 | 29.6 | 92.6 | 3.7 | 3.7 | 7.4 | - | - | - | - | - | - | 100.0 |
| Gross value added | | | | | | | | | | | | | |
| 0 - 14 .......... | 54.3 | 28.3 | 82.6 | 6.5 | 6.5 | 13.0 | 2.2 | 2.2 | 4.4 | - | - | - | 100.0 |
| 15 + ............ | 69.7 | 21.2 | 90.9 | 6.1 | - | 6.1 | - | - | - | - | 3.0 | 3.0 | 100.0 |

Table D33. Characteristics of receiving sectors. Distribution of sectors according to results for specified input items and dispersion in production

| | Standard deviation in per cent of average production value | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0-9 | 10-14 | 15-19 | 20-24 | Over 24 | Total | 0-9 | 10-14 | 15-19 | 20-24 | Over 24 | Total |
| | Number of sectors | | | | | | Percentage distribution | | | | | |
| 70 per cent or more of specified input items in the class Proportional, no trend ......... | 5 | 15 | 6 | 9 | 5 | 40 | 35.7 | 46.8 | 50.0 | 75.0 | 62.5 | 51.3 |
| All specified input items in the classes Proportional, majority without trend .................. | 6 | 16 | 7 | 6 | 5 | 40 | 42.8 | 50.0 | 58.3 | 50.0 | 62.5 | 51.3 |
| All specified input items in the classes Proportional ........... | 10 | 19 | 8 | 6 | 6 | 49 | 71.4 | 59.4 | 66.7 | 50.0 | 75.0 | 62.9 |
| All specified input items in classes with significant positive correlation between input and output ......................... | 12 | 21 | 9 | 9 | 6 | 57 | 85.7 | 65.7 | 75.0 | 75.0 | 75.0 | 73.1 |
| All sectors with specified input items .......................... | 14 | 32 | 12 | 12 | 8 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D34. Forms of the regressions of inputs on outputs for basic categories of inputs, classified by dispersion and trend characteristics of outputs in receiving sectors. Numbers of input items

| Basic category: Standard deviation per cent | Trend character | Form of regression: Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | |
| **Norwegian, competitive** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 17 | 7 | 24 | - | - | - | - | - | - | - | 1 | 1 | 25 |
| 10 - 14 | Not clear trend | 17 | 5 | 22 | - | - | - | - | 1 | 1 | - | - | - | 23 |
| | Clear trend ... | 20 | 11 | 31 | 2 | - | 2 | - | 1 | 1 | - | - | - | 34 |
| 15 and | Not clear trend | 4 | 2 | 6 | - | - | - | 1 | - | 1 | - | - | - | 7 |
| over | Clear trend ... | 49 | 18 | 67 | 1 | 1 | 2 | 2 | 1 | 3 | - | - | - | 72 |
| **Norwegian, non-competitive** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 10 | 13 | 23 | - | 1 | 1 | - | - | - | 1 | - | 1 | 25 |
| 10 - 14 | Not clear trend | 12 | 5 | 17 | - | 1 | 1 | - | - | - | - | 1 | 1 | 19 |
| | Clear trend ... | 31 | 15 | 46 | - | - | - | 2 | 3 | 5 | - | 2 | 2 | 53 |
| 15 and | Not clear trend | - | - | - | 1 | - | 1 | - | - | - | - | - | - | 1 |
| over | Clear trend ... | 34 | 16 | 50 | 2 | - | 2 | 1 | 2 | 3 | - | - | - | 55 |
| **Imports** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 13 | 7 | 20 | 1 | 1 | 2 | - | - | - | - | - | - | 22 |
| 10 - 14 | Not clear trend | 16 | 7 | 23 | - | - | - | - | 1 | 1 | - | - | - | 24 |
| | Clear trend ... | 21 | 9 | 30 | - | - | - | - | 1 | 1 | - | - | - | 31 |
| 15 and | Not clear trend | 9 | - | 9 | 2 | - | 2 | - | - | - | - | - | - | 11 |
| over | Clear trend ... | 53 | 18 | 71 | - | 2 | 2 | 1 | 1 | 2 | - | - | - | 75 |
| **All specified inputs** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 40 | 27 | 67 | 1 | 2 | 3 | - | - | - | 1 | 1 | 2 | 72 |
| 10 - 14 | Not clear trend | 45 | 17 | 62 | - | 1 | 1 | - | 2 | 2 | - | 1 | 1 | 66 |
| | Clear trend ... | 72 | 35 | 107 | 2 | - | 2 | 2 | 5 | 7 | - | 2 | 2 | 118 |
| 15 and | Not clear trend | 13 | 2 | 15 | 3 | - | 3 | 1 | - | 1 | - | - | - | 19 |
| over | Clear trend ... | 136 | 52 | 188 | 3 | 3 | 6 | 4 | 4 | 8 | - | - | - | 202 |
| **Competitive inputs combined** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 23 | 9 | 32 | - | - | - | - | 1 | 1 | - | - | - | 33 |
| 10 - 14 | Not clear trend | 14 | 13 | 27 | - | - | - | - | 2 | 2 | - | 1 | 1 | 30 |
| | Clear trend ... | 27 | 13 | 40 | - | - | - | - | 2 | 2 | - | - | - | 42 |
| 15 and | Not clear trend | 8 | 2 | 10 | - | - | - | - | 1 | 1 | - | 1 | 1 | 12 |
| over | Clear trend ... | 75 | 30 | 105 | 1 | 1 | 2 | 1 | - | 1 | - | - | - | 108 |
| **Substitution groups and fuels** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 10 | 6 | 16 | - | - | - | - | 1 | 1 | - | - | - | 17 |
| 10 and | Not clear trend | 8 | 8 | 16 | 1 | - | 1 | 2 | - | 2 | 1 | 1 | 2 | 21 |
| over | Clear trend ... | 45 | 18 | 63 | 1 | 2 | 3 | 1 | 1 | 2 | - | - | - | 68 |
| **Import sums** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 11 | 2 | 13 | - | - | - | - | - | - | - | - | - | 13 |
| 10 and | Not clear trend | 7 | 1 | 8 | 1 | - | 1 | - | - | - | - | 1 | 1 | 10 |
| over | Clear trend ... | 27 | 13 | 40 | 1 | 3 | 4 | - | 1 | 1 | - | - | - | 45 |
| **Gross value added** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 10 | 2 | 12 | 1 | - | 1 | - | 1 | 1 | - | - | - | 14 |
| 10 and | Not clear trend | 6 | 2 | 8 | 2 | 1 | 3 | - | - | - | - | - | - | 11 |
| over | Clear trend ... | 32 | 16 | 48 | 2 | 2 | 4 | 1 | - | 1 | - | 1 | 1 | 54 |

Table D35. Forms of the regressions of inputs on outputs for basic categories of inputs classified by dispersion and trend characteristics of outputs in receiving sectors. Percentage distribution

| Basic category: Standard deviation per cent | Trend character | Form of regression: Proportional | | | Linear, positive | | | Linear, negative | | | Independent | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | No trend | Trend | Total | |
| **Norwegian, competitive** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 68.0 | 28.0 | 96.0 | - | - | - | - | - | - | - | 4.0 | 4.0 | 100.0 |
| 10 - 14 | Not clear trend | 73.9 | 21.8 | 95.7 | - | - | - | - | 4.3 | 4.3 | - | - | - | 100.0 |
| | Clear trend ... | 58.8 | 32.4 | 91.2 | 5.9 | - | 5.9 | - | 2.9 | 2.9 | - | - | - | 100.0 |
| 15 and over | Not clear trend | 57.1 | 28.6 | 85.7 | - | - | - | 14.3 | - | 14.3 | - | - | - | 100.0 |
| | Clear trend ... | 68.1 | 25.0 | 93.1 | 1.4 | 1.4 | 2.8 | 2.7 | 1.4 | 4.1 | - | - | - | 100.0 |
| **Norwegian, non-competitive** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 40.0 | 52.0 | 92.0 | - | 4.0 | 4.0 | - | - | - | 4.0 | - | 4.0 | 100.0 |
| 10 - 14 | Not clear trend | 63.2 | 26.3 | 89.5 | - | 5.3 | 5.3 | - | - | - | - | 5.2 | 5.2 | 100.0 |
| | Clear trend ... | 58.5 | 28.3 | 86.8 | - | - | - | 3.8 | 5.6 | 9.4 | - | 3.8 | 3.8 | 100.0 |
| 15 and over | Not clear trend | - | - | - | (100.0) | - | (100.0) | - | - | - | - | - | - | (100.0) |
| | Clear trend ... | 61.8 | 29.1 | 90.9 | 3.7 | - | 3.7 | 1.8 | 3.6 | 5.4 | - | - | - | 100.0 |
| **Imports** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 59.1 | 31.8 | 90.9 | 4.5 | 4.6 | 9.1 | - | - | - | - | - | - | 100.0 |
| 10 - 14 | Not clear trend | 66.7 | 29.1 | 95.8 | - | - | - | - | 4.2 | 4.2 | - | - | - | 100.0 |
| | Clear trend ... | 67.8 | 29.0 | 96.8 | - | - | - | - | 3.2 | 3.2 | - | - | - | 100.0 |
| 15 and over | Not clear trend | 81.8 | - | 81.8 | 18.2 | - | 18.2 | - | - | - | - | - | - | 100.0 |
| | Clear trend ... | 70.7 | 24.0 | 94.7 | - | 2.7 | 2.7 | 1.3 | 1.3 | 2.6 | - | - | - | 100.0 |
| **All specified inputs** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 55.5 | 37.5 | 93.0 | 1.4 | 2.8 | 4.2 | - | - | - | 1.4 | 1.4 | 2.8 | 100.0 |
| 10 - 14 | Not clear trend | 68.2 | 25.8 | 94.0 | - | 1.5 | 1.5 | - | 3.0 | 3.0 | - | 1.5 | 1.5 | 100.0 |
| | Clear trend ... | 61.0 | 29.7 | 90.7 | 1.7 | - | 1.7 | 1.7 | 4.2 | 5.9 | - | 1.7 | 1.7 | 100.0 |
| 15 and over | Not clear trend | 68.4 | 10.5 | 78.9 | 15.8 | - | 15.8 | 5.3 | - | 5.3 | - | - | - | 100.0 |
| | Clear trend ... | 67.3 | 25.7 | 93.0 | 1.5 | 1.5 | 3.0 | 2.0 | 2.0 | 4.0 | - | - | - | 100.0 |
| **Competitive inputs combined** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 69.7 | 27.3 | 97.0 | - | - | - | - | 3.0 | 3.0 | - | - | - | 100.0 |
| 10 - 14 | Not clear trend | 46.7 | 43.3 | 90.0 | - | - | - | - | 6.7 | 6.7 | - | 3.3 | 3.3 | 100.0 |
| | Clear trend ... | 64.3 | 30.9 | 95.2 | - | - | - | - | 4.8 | 4.8 | - | - | - | 100.0 |
| 15 and over | Not clear trend | 66.7 | 16.7 | 83.4 | - | - | - | - | 8.3 | 8.3 | - | 8.3 | 8.3 | 100.0 |
| | Clear trend ... | 69.4 | 27.8 | 97.2 | 0.9 | 1.0 | 1.9 | 0.9 | - | 0.9 | - | - | - | 100.0 |
| **Substitution groups and fuels** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 58.8 | 35.3 | 94.1 | - | - | - | - | 5.9 | 5.9 | - | - | - | 100.0 |
| 10 and over | Not clear trend | 38.1 | 38.1 | 76.2 | 4.8 | - | 4.8 | 9.5 | - | 9.5 | 4.7 | 4.8 | 9.5 | 100.0 |
| | Clear trend ... | 66.2 | 26.5 | 92.7 | 1.5 | 2.9 | 4.4 | 1.5 | 1.4 | 2.9 | - | - | - | 100.0 |
| **Import sums** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 84.6 | 15.4 | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 |
| 10 and over | Not clear trend | 70.0 | 10.0 | 80.0 | 10.0 | - | 10.0 | - | - | - | - | 10.0 | 10.0 | 100.0 |
| | Clear trend ... | 60.0 | 28.9 | 88.9 | 2.2 | 6.7 | 8.9 | - | 2.2 | 2.2 | - | - | - | 100.0 |
| **Gross value added** | | | | | | | | | | | | | | |
| 0 - 9 | All ........... | 71.4 | 14.3 | 85.7 | 7.1 | - | 7.1 | - | 7.2 | 7.2 | - | - | - | 100.0 |
| 10 and over | Not clear trend | 54.5 | 18.2 | 72.7 | 18.2 | 9.1 | 27.3 | - | - | - | - | - | - | 100.0 |
| | Clear trend ... | 59.3 | 29.6 | 88.9 | 3.7 | 3.7 | 7.4 | 1.9 | - | 1.9 | - | 1.8 | 1.8 | 100.0 |

Table D36. Characteristics of receiving sectors. Distribution of sectors according to results for specified input items and number of specified input items

| | Number of specified input items | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-4 | 5-8 | Over 8 | Total | 0-4 | 5-8 | Over 8 | Total |
| | Number of sectors | | | | Percentage distribution | | | |
| All specified input items in classes with significant positive correlation between input and output ........... | 21 | 24 | 12 | 57 | 67.8 | 80.0 | 70.6 | 73.1 |
| Of these: All in the classes Proportional ............. | 18 | 22 | 9 | 49 | 58.1 | 73.3 | 53.0 | 62.8 |
| 70 per cent or more in the class Proportional, no trend .................... | 12 | 15 | 7 | 34 | 38.7 | 50.0 | 41.2 | 43.6 |
| 1 specified input item in classes without significant positive correlation between input and output. | 9 | 6 | 4 | 19 | 29.0 | 20.0 | 23.5 | 24.4 |
| Of these: 70 per cent or more in the class Proportional, no trend .................... | 1 | 3 | 2 | 6 | 3.2 | 10.0 | 11.8 | 7.7 |
| 2 specified input items in classes without significant positive correlation between input and output. | 1 | - | 1 | 2 | 3.2 | - | 5.9 | 2.5 |
| Total ............................... | 31 | 30 | 17 | 78 | 100.0 | 100.0 | 100.0 | 100.0 |

Table D37. Characteristics of receiving sectors. Distribution of sectors according to results for specified input items and total number of input items

| | Total number of input items | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-9 | 10-17 | Over 17 | Total | 0-9 | 10-17 | Over 17 | Total |
| | Number of sectors | | | | Percentage distribution | | | |
| All specified input items in classes with significant positive correlation between input and output ........... | 17 | 26 | 14 | 57 | 63.0 | 83.9 | 70.0 | 73.1 |
| Of these: All in the classes Proportional ............. | 16 | 22 | 11 | 49 | 59.3 | 71.0 | 55.0 | 62.8 |
| 70 per cent or more in the class Proportional, no trend .................... | 9 | 17 | 8 | 34 | 33.3 | 54.8 | 40.0 | 43.6 |
| 7-25 per cent of specified input items in classes without significant positive correlation between input and output .......................... | 2 | 5 | 6 | 13 | 7.4 | 16.1 | 30.0 | 16.7 |
| Of these: 70 per cent or more in the class Proportional, no trend .................... | - | 3 | 3 | 6 | - | 9.7 | 15.0 | 7.7 |
| Over 25 per cent of specified input items in classes without significant positive correlation between input and output. (All of these had less than five specified input items and only one had 2 items in the actual class) ............................ | 8 | - | - | 8 | 29.6 | - | - | 10.2 |
| Total .............................. | 27 | 31 | 20 | 78 | 100.0 | 100.0 | 100.0 | 100.0 |

Appendix table I. Results for inputs characterized by delivering sectors

| Sector Num-ber | Sector Ty-pe | Type of delivery: Name of delivering sector | Average production Million 1955-kroner | Number of specified deliveries | Test results (Number of deliveries): Proportional, No trend | Proportional, Trend | Linear positive, No trend | Linear positive, Trend | Confirmation total | Linear negative, No trend | Linear negative, Trend | Independent, No trend | Independent, Trend | Rejection total | Percentage distribution: Proportional, No trend | Proportional, Trend | Linear positive, No trend | Linear positive, Trend | Confirmation total | Linear negative, No trend | Linear negative, Trend | Independent, No trend | Independent, Trend | Rejection total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Norwegian, competitive and non-competitive | | | | | | | | | | | | | | | | | | | | | | |
| 02 | 0 | Forestry .......... | 866 | 4 | 4 | - | - | - | 4 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 08 | 0 | Quarrying .......... | 93 | 4 | 4 | - | - | - | 4 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 11 | 1 | Margarine .......... | 183 | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 14 | 1 | Grain mills ........ | 511 | 3 | 3 | - | - | - | 3 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 17 | 1 | Other food ......... | 135 | 4 | 4 | - | - | - | 4 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 19 | 1 | Breweries .......... | 232 | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 23 | 1 | Cordage ............ | 74 | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 25 | 1 | Apparel ............ | 695 | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 33 | 0 | Printing ........... | 337 | 3 | 3 | - | - | - | 3 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 42 | 1 | Ferro-alloys ....... | 264 | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 44 | 1 | Foundries .......... | 109 | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 45 | 1 | Aluminium works .... | 257 | 3 | 3 | - | - | - | 3 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 47 | 1 | Non-ferrous foundries | 15 | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 51 | 1 | Miscellaneous manuf. | 217 | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 60 | 0 | Non-life insurance | 200 | 3 | 3 | - | - | - | 3 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 64 | 0 | Coastal transportation | 307 | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 68 | 0 | Transport n.e.c. ... | 668 | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 76 | 0 | Consultants ........ | 232 | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 21 | 1 | Textiles ........... | 515 | 8 | 7 | 1 | - | - | 8 | - | - | - | - | - | 87.5 | 12.5 | - | - | 100.0 | - | - | - | - | - |
| 31 | 1 | Paper products ..... | 251 | 13 | 11 | 2 | - | - | 13 | - | - | - | - | - | 84.6 | 15.4 | - | - | 100.0 | - | - | - | - | - |
| 53 | 0 | Electricity ........ | 582 | 12 | 10 | 2 | - | - | 12 | - | - | - | - | - | 83.3 | 16.7 | - | - | 100.0 | - | - | - | - | - |
| 39 | 1 | Vegetable oil ...... | 99 | 4 | 3 | 1 | - | - | 4 | - | - | - | - | - | 75.0 | 25.0 | - | - | 100.0 | - | - | - | - | - |
| 49 | 1 | Electrical machinery etc. .............. | 543 | 4 | 3 | 1 | - | - | 4 | - | - | - | - | - | 75.0 | 25.0 | - | - | 100.0 | - | - | - | - | - |
| 28 | 1 | Pulp ............... | 884 | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 38 | 1 | Herring oil ........ | 275 | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 43 | 1 | Steel works ........ | 208 | 5 | 3 | 2 | - | - | 5 | - | - | - | - | - | 60.0 | 40.0 | - | - | 100.0 | - | - | - | - | - |
| 26 | 1 | Saw mills etc. ..... | 540 | 7 | 4 | 3 | - | - | 7 | - | - | - | - | - | 57.1 | 42.9 | - | - | 100.0 | - | - | - | - | - |
| 04 | 0 | Fisheries etc. ..... | 653 | 6 | 3 | 3 | - | - | 6 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 29 | 1 | Paper .............. | 737 | 4 | 2 | 2 | - | - | 4 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 34 | 1 | Leather ............ | 116 | 2 | 1 | 1 | - | - | 2 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 35 | 1 | Rubber products .... | 141 | 2 | 1 | 1 | - | - | 2 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 36 | 1 | Fertilizers etc. ... | 457 | 4 | 2 | 2 | - | - | 4 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 41 | 1 | Non-metallic minerals | 411 | 6 | 3 | 3 | - | - | 6 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 66 | 0 | Railways ........... | 440 | 2 | 1 | 1 | - | - | 2 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 50 | 1 | Shipbuilding ....... | 838 | 5 | 2 | 3 | - | - | 5 | - | - | - | - | - | 40.0 | 60.0 | - | - | 100.0 | - | - | - | - | - |
| 40 | 1 | Oil refineries ..... | 309 | 4 | 1 | 3 | - | - | 4 | - | - | - | - | - | 25.0 | 75.0 | - | - | 100.0 | - | - | - | - | - |

Appendix table I (cont.). Results for inputs characterized by delivering sectors

| Sector Number | Sector Type | Type of delivery: Name of delivering sector | Average production Million 1955-kroner | Number of specified deliveries | Proportional: No trend | Proportional: Trend | Linear positive: No trend | Linear positive: Trend | Confirmation total | Linear negative: No trend | Linear negative: Trend | Independent: No trend | Independent: Trend | Rejection total | Proportional: No trend (%) | Proportional: Trend (%) | Linear positive: No trend (%) | Linear positive: Trend (%) | Confirmation total (%) | Linear negative: No trend (%) | Linear negative: Trend (%) | Independent: No trend (%) | Independent: Trend (%) | Rejection total (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Number of deliveries | | | | | | | | | | Percentage distribution | | | | | | | | | |
| | | **Norwegian, competitive and non-competitive** | | | | | | | | | | | | | | | | | | | | | | |
| 05 | 0 | Whaling ........... | 286 | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 07 | 0 | Metal mining ...... | 205 | 2 | - | 2 | - | - | 2 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 18 | 1 | Spirits ........... | 96 | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 55 | 0 | Trade ............. | 5693 | 2 | - | 2 | - | - | 2 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 70 | 0 | Forwarding etc. ... | 98 | 2 | - | 2 | - | - | 2 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 71 | 0 | Communications .... | 389 | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 48 | 1 | Metal products .... | 1716 | 20 | 17 | 2 | - | 1 | 20 | - | - | - | - | - | 85.0 | 10.0 | - | 5.0 | 100.0 | - | - | - | - | - |
| 37 | 1 | Other chemicals ... | 628 | 20 | 12 | 7 | 1 | - | 20 | - | - | - | - | - | 60.0 | 35.0 | 5.0 | - | 100.0 | - | - | - | - | - |
| 10 | 1 | Dairies ........... | 622 | 3 | 2 | - | 1 | - | 3 | - | - | - | - | - | 66.7 | - | 33.3 | - | 100.0 | - | - | - | - | - |
| 13 | 1 | Fish processing ... | 513 | 3 | 1 | 1 | 1 | - | 3 | - | - | - | - | - | 33.4 | 33.3 | 33.3 | - | 100.0 | - | - | - | - | - |
| 09 | 1 | Slaughtering ...... | 712 | 2 | 1 | - | 1 | - | 2 | - | - | - | - | - | 50.0 | - | 50.0 | - | 100.0 | - | - | - | - | - |
| 65 | 0 | Post services ..... | 281 | 2 | 1 | - | 1 | - | 2 | - | - | - | - | - | 50.0 | - | 50.0 | - | 100.0 | - | - | - | - | - |
| 01 | 0 | Agriculture ....... | 2201 | 11 | 6 | 3 | 1 | - | 10 | - | - | - | 1 | 1 | 54.5 | 27.3 | 9.1 | - | 90.0 | - | - | - | 9.1 | 9.1 |
| 27 | 1 | Wood and cork ..... | 644 | 7 | 4 | 2 | - | - | 6 | - | 1 | - | - | 1 | 57.1 | 28.6 | - | - | 85.7 | - | 14.3 | - | - | 14.3 |
| 46 | 1 | Other metals ...... | 606 | 10 | 6 | 2 | - | - | 8 | 1 | 1 | - | - | 2 | 60.0 | 20.0 | - | - | 80.0 | 10.0 | 10.0 | - | - | 20.0 |
| 61 | 0 | Real estate ....... | 252 | 14 | 3 | 6 | - | 1 | 10 | 1 | 2 | - | 1 | 4 | 21.4 | 42.9 | - | 7.1 | 71.4 | 7.1 | 14.3 | - | 7.2 | 28.6 |
| 06 | 0 | Coal mining ....... | 31 | 6 | 1 | 3 | - | - | 4 | 2 | - | - | - | 2 | 16.7 | 50.0 | - | - | 66.7 | 33.3 | - | - | - | 33.3 |
| 03 | 0 | Hunting etc. ...... | 36 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 |
| 63 | 0 | Ocean transportation | 4535 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | 100.0 | 100.0 |
| | | **Unspecified etc.** | | | | | | | | | | | | | | | | | | | | | | |
| 86 | | Transfers .......... | - | 2 | 1 | 1 | - | - | 1 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 81 | | Unspecified energy . | - | 6 | 3 | 3 | - | - | 6 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 80 | | Unspecified office supplies ........... | - | 33 | 17 | 14 | - | - | 31 | 1 | - | - | 1 | 2 | 51.5 | 42.4 | - | - | 93.9 | 3.0 | - | - | 3.1 | 6.1 |
| 82 | | Unspecified services | - | 32 | 20 | 6 | 1 | 1 | 28 | 1 | 2 | 1 | - | 4 | 62.5 | 18.9 | 3.1 | 3.1 | 87.6 | 3.1 | 6.2 | 3.1 | - | 12.4 |
| | | **Imports, competitive and non-competitive** | | | | | | | | | | | | | | | | | | | | | | |
| 04 | 0 | Fisheries etc. ..... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 05 | 0 | Whaling ........... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 09 | 1 | Slaughtering etc. .. | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 13 | 1 | Fish processing .... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 18 | 1 | Spirits ............ | - | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 21 | 1 | Textiles ........... | - | 10 | 10 | - | - | - | 10 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 23 | 1 | Cordage ............ | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 27 | 1 | Wood and cork ...... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 29 | 1 | Paper .............. | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 31 | 1 | Paper products ..... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 36 | 1 | Fertilizers ........ | - | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 38 | 1 | Herring oil ........ | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 40 | 1 | Oil refineries ..... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 41 | 1 | Non-metallic minerals | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |

| Sector Number | Sector Type | Type of delivery: Name of delivering sector | Average production Million 1955-kroner | Number of specified deliveries | Proportional: No trend | Proportional: Trend | Linear positive: No trend | Linear positive: Trend | Confirmation total | Linear negative: No trend | Linear negative: Trend | Independent: No trend | Independent: Trend | Rejection total | % Proportional: No trend | % Proportional: Trend | % Linear positive: No trend | % Linear positive: Trend | % Confirmation total | % Linear negative: No trend | % Linear negative: Trend | % Independent: No trend | % Independent: Trend | % Rejection total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Number of deliveries | | | | | | | | | | Percentage distribution | | | | | | | | | |
| 50 | 1 | Shipbuilding ...... | - | 3 | 3 | - | - | - | 3 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 55 | 0 | Trade ............. | - | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 60 | 0 | Non-life insurance | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 65 | 0 | Post services etc. | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 71 | 0 | Communications .... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 48 | 1 | Metal products .... | - | 7 | 6 | 1 | - | - | 7 | - | - | - | - | - | 85.7 | 14.3 | - | - | 100.0 | - | - | - | - | - |
| 07 | 0 | Metal mining ...... | - | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 26 | 1 | Sawmills etc. ..... | - | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 51 | 1 | Miscellaneous manuf. | - | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 02 | 0 | Forestry .......... | - | 5 | 3 | 2 | - | - | 5 | - | - | - | - | - | 60.0 | 40.0 | - | - | 100.0 | - | - | - | - | - |
| 08 | 0 | Quarrying ......... | - | 5 | 3 | 2 | - | - | 5 | - | - | - | - | - | 60.0 | 40.0 | - | - | 100.0 | - | - | - | - | - |
| 17 | 1 | Other food ........ | - | 5 | 3 | 2 | - | - | 5 | - | - | - | - | - | 60.0 | 40.0 | - | - | 100.0 | - | - | - | - | - |
| 84 | x | Unspecified input . | - | 5 | 3 | 2 | - | - | 5 | - | - | - | - | - | 60.0 | 40.0 | - | - | 100.0 | - | - | - | - | - |
| 06 | 0 | Coal mining ....... | - | 6 | 3 | 3 | - | - | 6 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 34 | 1 | Leather ........... | - | 2 | 1 | 1 | - | - | 2 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 46 | 1 | Other metals ...... | - | 6 | 3 | 3 | - | - | 6 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 14 | 1 | Grain mills ....... | - | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 28 | 1 | Pulp .............. | - | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 35 | 1 | Rubber products ... | - | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 45 | 1 | Aluminium works ... | - | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 49 | 1 | Electrical machinery etc. ............. | - | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 77 | 0 | Recreation ........ | - | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 43 | 1 | Steel works ....... | - | 7 | 4 | 2 | - | 1 | 7 | - | - | - | - | - | 57.1 | 28.5 | - | 14.3 | 100.0 | - | - | - | - | - |
| 54 | 1 | Gas supply ........ | - | 6 | 4 | 1 | - | 1 | 6 | - | - | - | - | - | 66.7 | 16.6 | - | 16.7 | 100.0 | - | - | - | - | - |
| 01 | 0 | Agriculture, non-competitive ....... | - | 4 | 2 | 1 | - | 1 | 4 | - | - | - | - | - | 50.0 | 25.0 | - | 25.0 | 100.0 | - | - | - | - | - |
| 37 | 1 | Other chemicals ... | - | 38 | 27 | 8 | 2 | - | 37 | - | 1 | - | - | 1 | 71.1 | 21.0 | 5.3 | - | 97.4 | - | 2.6 | - | - | 2.6 |
| 01 | 0 | Agriculture, competitive ............ | - | 9 | 5 | 2 | 1 | - | 8 | 1 | - | - | - | 1 | 55.6 | 22.2 | 11.1 | - | 88.9 | 11.1 | - | - | - | 11.1 |
| 39 | 1 | Vegetable oil ..... | - | 6 | 4 | 1 | - | - | 5 | - | 1 | - | - | 1 | 66.7 | 16.6 | - | - | 83.3 | - | 16.7 | - | - | - |
| 03 | 0 | Hunting etc. ...... | - | 4 | 1 | 2 | - | - | 3 | - | 1 | - | - | 1 | 25.0 | 50.0 | - | - | 75.0 | - | 25.0 | - | - | 25.0 |
| | | Competitive inputs combined | | | | | | | | | | | | | | | | | | | | | | |
| 02 | 0 | Forestry .......... | - | 4 | 4 | - | - | - | 4 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 04 | 0 | Fisheries ......... | - | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 08 | 0 | Quarrying ......... | - | 6 | 6 | - | - | - | 6 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 09 | 1 | Slaughtering ...... | - | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 13 | 1 | Fish processing ... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 19 | 1 | Breweries ......... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 23 | 1 | Cordage ........... | - | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 25 | 1 | Apparel ........... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 33 | 0 | Printing .......... | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 42 | 1 | Ferro-alloys ...... | - | 2 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 49 | 1 | Electrical machinery etc. ......... | - | 4 | 4 | - | - | - | 4 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 41 | 1 | Non-metallic minerals | - | 7 | 6 | 1 | - | - | 7 | - | - | - | - | - | 85.7 | 14.3 | - | - | 100.0 | - | - | - | - | - |

Appendix table I (cont.). Results for inputs characterized by delivering sectors

| Sector Number | Sector Type | Type of delivery: Name of delivering sector | Average production Million 1955-kroner | Number of specified deliveries | Test results: Proportional, No trend | Proportional, Trend | Linear positive, No trend | Linear positive, Trend | Confirmation total | Linear negative, No trend | Linear negative, Trend | Independent, No trend | Independent, Trend | Rejection total | Proportional, No trend | Proportional, Trend | Linear positive, No trend | Linear positive, Trend | Confirmation total | Linear negative, No trend | Linear negative, Trend | Independent, No trend | Independent, Trend | Rejection total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Number of deliveries | | | | | | | | | | Percentage distribution | | | | | | | | | |
| 07 | 0 | Metal mining ...... | - | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 14 | 1 | Grain mills ....... | - | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 17 | 1 | Other food ........ | - | 6 | 4 | 2 | - | - | 6 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 28 | 1 | Pulp .............. | - | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 36 | 1 | Fertilizers etc. .. | - | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 45 | 1 | Aluminium works ... | - | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 26 | 1 | Sawmills etc. ..... | - | 5 | 3 | 2 | - | - | 5 | - | - | - | - | - | 60.0 | 40.0 | - | - | 100.0 | - | - | - | - | - |
| 31 | 1 | Paper products .... | - | 7 | 4 | 3 | - | - | 7 | - | - | - | - | - | 57.1 | 42.9 | - | - | 100.0 | - | - | - | - | - |
| 18 | 1 | Spirits ........... | - | 2 | 1 | 1 | - | - | 2 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 27 | 1 | Wood and cork ..... | - | 2 | 1 | 1 | - | - | 2 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 29 | 1 | Paper ............ | - | 4 | 2 | 2 | - | - | 4 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 34 | 1 | Leather ........... | - | 2 | 1 | 1 | - | - | 2 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 35 | 1 | Rubber products ... | - | 2 | 1 | 1 | - | - | 2 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 44 | 1 | Foundries ......... | - | 2 | 1 | 1 | - | - | 2 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 46 | 1 | Other metals ...... | - | 12 | 6 | 6 | - | - | 12 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 51 | 1 | Miscellaneous manuf. | - | 4 | 2 | 2 | - | - | 4 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 01 | 0 | Agriculture ....... | - | 12 | 5 | 7 | - | - | 12 | - | - | - | - | - | 41.7 | 58.3 | - | - | 100.0 | - | - | - | - | - |
| 06 | 0 | Coal mining ....... | - | 6 | 2 | 4 | - | - | 6 | - | - | - | - | - | 33.3 | 66.7 | - | - | 100.0 | - | - | - | - | - |
| 50 | 1 | Shipbuilding ...... | - | 3 | 1 | 2 | - | - | 3 | - | - | - | - | - | 33.3 | 66.7 | - | - | 100.0 | - | - | - | - | - |
| 05 | 0 | Whaling ........... | - | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 10 | 1 | Dairies ........... | - | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 38 | 1 | Herring oil ....... | - | 1 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 40 | 1 | Oil refineries .... | - | 3 | - | 3 | - | - | 3 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 43 | 1 | Steel works ....... | - | 7 | 3 | 3 | 1 | - | 7 | - | - | - | - | - | 42.8 | 42.9 | 14.3 | - | 100.0 | - | - | - | - | - |
| 54 | 1 | Gas Supply ........ | - | 4 | 3 | - | - | 1 | 4 | - | - | - | - | - | 75.0 | - | - | 25.0 | 100.0 | - | - | - | - | - |
| 48 | 1 | Metal products ... | - | 22 | 18 | 3 | - | - | 21 | - | - | - | 1 | 1 | 81.8 | 13.7 | - | - | 95.5 | - | - | - | 4.5 | 4.5 |
| 37 | 1 | Other chemicals ... | - | 49 | 33 | 12 | - | - | 45 | - | 4 | - | - | 4 | 67.3 | 24.5 | - | - | 91.8 | - | 8.2 | - | - | 8.2 |
| 21 | 1 | Textiles .......... | - | 10 | 8 | 1 | - | - | 9 | - | - | - | 1 | 1 | 80.0 | 10.0 | - | - | 90.0 | - | - | - | 10.0 | 10.0 |
| 39 | 1 | Vegetable oil ..... | - | 6 | 5 | - | - | - | 5 | 1 | - | - | - | 1 | 83.3 | - | - | - | 83.3 | 16.7 | - | - | - | 16.7 |
| 03 | 0 | Hunting etc. ...... | - | 4 | 1 | 1 | - | - | 2 | - | 2 | - | - | 2 | 25.0 | 25.0 | - | - | 50.0 | - | 50.0 | - | - | 50.0 |

Appendix table II. Characteristics of "receiving sectors"

| Sector code | Sector name | Average production Mill. kr. | Number of spesified inputs | Total number of input items | The results for specified inputs: Number of input items: Proportional: No trend | Proportional: Trend | Linear, positive: No trend | Linear, positive: Trend | Confirmation, total | Linear, negative: No trend | Linear, negative: Trend | Independent: No trend | Independent: Trend | Rejection, total | Percentage distribution: Proportional: No trend | Proportional: Trend | Linear, positive: No trend | Linear, positive: Trend | Confirmation, total | Linear, negative: No trend | Linear, negative: Trend | Independent: No trend | Independent: Trend | Rejection, total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01X0404 | Agriculture ..... | 2 201 | 4 | 13 | 3 | 1 | - | - | 4 | - | - | - | - | - | 75.0 | 25.0 | - | - | 100.0 | - | - | - | - | - |
| 02X0300 | Forestry ........ | 866 | 1 | 4 | - | 1 | - | - | 1 | - | - | - | - | - | - | 100.0 | - | - | 100.0 | - | - | - | - | - |
| 03X0110 | Hunting etc. .... | 36 | 2 | 3 | - | 1 | - | - | 1 | - | - | - | 1 | 1 | - | 50.0 | - | - | 50.0 | - | - | - | 50.0 | 50.0 |
| 04X0310 | Fisheries etc.... | 653 | 3 | 8 | 1 | 1 | - | - | 2 | - | 1 | - | - | 1 | 33.3 | 33.3 | - | - | 66.7 | - | 33.3 | - | - | 33.3 |
| 05X0212 | Whaling ......... | 286 | 4 | 8 | 1 | 1 | - | - | 2 | 1 | - | - | 1 | 2 | 25.0 | 25.0 | - | - | 50.0 | 25.0 | - | - | 25.0 | 50.0 |
| 06X0032 | Coal mining ..... | 31 | 4 | 8 | 3 | 1 | - | - | 4 | - | - | - | - | - | 75.0 | 25.0 | - | - | 100.0 | - | - | - | - | - |
| 07X0234 | Metal mining .... | 205 | 5 | 11 | 4 | - | - | - | 4 | 1 | - | - | - | 1 | 80.0 | - | - | - | 80.0 | 20.0 | - | - | - | 20.0 |
| 08X0112 | Quarrying ....... | 93 | 6 | 13 | 4 | 2 | - | - | 6 | - | - | - | - | - | 66.7 | 33.3 |  | - | 100.0 | - | - | - | - | - |
| 09X1325 | Slaughtering etc. | 712 | 4 | 11 | 2 | 1 | 1 | - | 4 | - | - | - | - | - | 50.0 | 25.0 | 25.0 | - | 100.0 | - | - | - | - | - |
| 10X1314 | Dairies ......... | 622 | 3 | 11 | - | 2 | 1 | - | 3 | - | - | - | - | - | - | 66.7 | 33.3 | - | 100.0 | - | - | - | - | - |
| 11X1212 | Margarine ....... | 183 | 8 | 19 | 5 | 3 | - | - | 8 | - | - | - | - | - | 62.5 | 37.5 | - | - | 100.0 | - | - | - | - | - |
| 12X1200 | Fish canning .... | 205 | 12 | 25 | 8 | 4 | - | - | 12 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 13X1311 | Fish processing . | 513 | 7 | 14 | 5 | 2 | - | - | 7 | - | - | - | - | - | 71.5 | 28.5 | - | - | 100.0 | - | - | - | - | - |
| 14X1334 | Grain mills ..... | 511 | 7 | 15 | 7 | - | - | - | 7 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 15X1201 | Bakeries ........ | 334 | 7 | 16 | 5 | 2 | - | - | 7 | - | - | - | - | - | 71.5 | 28.5 | - | - | 100.0 | - | - | - | - | - |
| 16X1210 | Chocolate ....... | 234 | 8 | 16 | 6 | 2 | - | - | 8 | - | - | - | - | - | 75.0 | 25.0 | - | - | 100.0 | - | - | - | - | - |
| 17X1210 | Other food ...... | 135 | 11 | 22 | 9 | 1 | - | - | 10 | - | 1 | - | - | 1 | 81.8 | 9.1 | - | - | 90.9 | - | 9.1 | - | - | 9.1 |
| 18X1100 | Spirits ......... | 96 | 5 | 14 | 3 | 1 | - | - | 4 | - | - | - | 1 | 1 | 60.0 | 20.0 | - | - | 80.0 | - | - | - | 20.0 | 20.0 |
| 19X1225 | Breweries ....... | 232 | 9 | 20 | 5 | 3 | - | - | 8 | 1 | - | - | - | 1 | 55.5 | 33.4 | - | - | 88.9 | 11.1 | - | - | - | 11.1 |
| 20X1202 | Tobacco ......... | 333 | 3 | 8 | 1 | 2 | - | - | 3 | - | - | - | - | - | 33.3 | 66.7 | - | - | 100.0 | - | - | - | - | - |
| 21X1300 | Textiles ........ | 515 | 7 | 15 | 5 | 2 | - | - | 7 | - | - | - | - | - | 71.5 | 28.5 | - | - | 100.0 | - | - | - | - | - |
| 22X1210 | Knitting mills .. | 193 | 7 | 15 | 7 | - | - | - | 7 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 23X1112 | Cordage ......... | 74 | 7 | 16 | 6 | - | - | - | 6 | - | 1 | - | - | 1 | 85.7 | - | - | - | 85.7 | - | 14.3 | - | - | 14.3 |
| 24X1210 | Shoes, and repair | 270 | 10 | 20 | 2 | 7 | - | 1 | 10 | - | - | - | - | - | 20.0 | 70.0 | - | 10.0 | 100.0 | - | - | - | - | - |
| 25X1313 | Apparel ......... | 695 | 3 | 10 | 3 | - | - | - | 3 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 26X1300 | Sawmills etc. ... | 540 | 5 | 12 | 4 | 1 | - | - | 5 | - | - | - | - | - | 80.0 | 20.0 | - | - | 100.0 | - | - | - | - | - |
| 27X1314 | Wood and cork ... | 644 | 9 | 20 | 9 | - | - | - | 9 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 28X1314 | Pulp ............ | 889 | 3 | 10 | 3 | - | - | - | 3 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 29X1324 | Paper ........... | 737 | 4 | 12 | 3 | 1 | - | - | 4 | - | - | - | - | - | 75.0 | 25.0 | - | - | 100.0 | - | - | - | - | - |
| 30X1134 | Wallboards ...... | 64 | 13 | 24 | 11 | 2 | - | - | 13 | - | - | - | - | - | 84.6 | 15.4 | - | - | 100.0 | - | - | - | - | - |
| 31X1224 | Paper products .. | 251 | 5 | 14 | 5 | - | - | - | 5 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 32X0224 | Publishing ...... | 313 | 4 | 8 | 4 | - | - | - | 4 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 33X0215 | Printing ........ | 337 | 5 | 12 | 3 | 2 | - | - | 5 | - | - | - | - | - | 60.0 | 40.0 | - | - | 100.0 | - | - | - | - | - |
| 34X1231 | Leather ......... | 116 | 14 | 29 | 11 | 1 | 2 | - | 14 | - | - | - | - | - | 78.5 | 7.2 | 14.3 | - | 100.0 | - | - | - | - | - |
| 35X1211 | Rubber products . | 141 | 10 | 21 | 8 | 2 | - | - | 10 | - | - | - | - | - | 80.0 | 20.0 | - | - | 100.0 | - | - | - | - | - |
| 36X1225 | Fertilizers etc.. | 457 | 9 | 17 | 7 | 2 | - | - | 9 | - | - | - | - | - | 77.8 | 22.2 | - | - | 100.0 | - | - | - | - | - |
| 37X1345 | Other chemicals . | 628 | 15 | 31 | 5 | 5 | 1 | 2 | 13 | 1 | 1 | - | - | 2 | 33.3 | 33.3 | 6.7 | 13.3 | 86.6 | 6.7 | 6.7 | - | - | 13.4 |
| 38X1240 | Herring oil ..... | 275 | 5 | 13 | 2 | 1 | 1 | - | 4 | 1 | - | - | - | 1 | 40.0 | 20.0 | 20.0 | - | 80.0 | 20.0 | - | - | - | 20.0 |
| 39X1101 | Vegetable oil ... | 99 | 5 | 12 | 3 | 1 | - | 1 | 5 | - | - | - | - | - | 60.0 | 20.0 | - | 20.0 | 100.0 | - | - | - | - | - |
| 40X1210 | Oil refineries .. | 309 | 8 | 18 | 7 | 1 | - | - | 8 | - | - | - | - | - | 87.5 | 12.5 | - | - | 100.0 | - | - | - | - | - |

Appendix table II (cont.). Characteristics of "receiving sectors"

| Sector code | Sector name | Average production Mill. kr. | Number of specified inputs | Total number of inputs items | The results for specified inputs: Number of input items: Proportional: No trend | Proportional: Trend | Linear, positive: No trend | Linear, positive: Trend | Confirmation, total | Linear, negative: No trend | Linear, negative: Trend | Independent: No trend | Independent: Trend | Rejection, total | Percentage distribution: Proportional: No trend | Proportional: Trend | Linear, positive: No trend | Linear, positive: Trend | Confirmation, total | Linear, negative: No trend | Linear, negative: Trend | Independent: No trend | Independent: Trend | Rejection, total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 41X1235 | Non-metallic minerals | 411 | 11 | 21 | 9 | 2 | - | - | 11 | - | - | - | - | - | 81.8 | 18.2 | - | - | 100.0 | - | - | - | - | - |
| 42X1233 | Ferro-alloys ......... | 264 | 7 | 17 | 6 | 1 | - | - | 7 | - | - | - | - | - | 85.7 | 14.3 | - | - | 100.0 | - | - | - | - | - |
| 43X1254 | Steel works .......... | 208 | 14 | 26 | 6 | 8 | - | - | 14 | - | - | - | - | - | 42.8 | 57.2 | - | - | 100.0 | - | - | - | - | - |
| 44X1245 | Foundries ............ | 109 | 8 | 19 | 7 | 1 | - | - | 8 | - | - | - | - | - | 87.5 | 12.5 | - | - | 100.0 | - | - | - | - | - |
| 45X1254 | Aluminium works ...... | 257 | 10 | 19 | 7 | 3 | - | - | 10 | - | - | - | - | - | 70.0 | 30.0 | - | - | 100.0 | - | - | - | - | - |
| 46X1345 | Other metals ......... | 606 | 7 | 17 | 5 | 2 | - | - | 7 | - | - | - | - | - | 71.5 | 28.5 | - | - | 100.0 | - | - | - | - | - |
| 47X1012 | Non-ferrous foundries. | 15 | 7 | 14 | 6 | 1 | - | - | 7 | - | - | - | - | - | 85.7 | 14.3 | - | - | 100.0 | - | - | - | - | - |
| 48X1435 | Metal products ....... | 1 716 | 8 | 18 | 6 | 1 | - | - | 7 | - | 1 | - | - | 1 | 75.0 | 12.5 | - | - | 87.5 | - | 12.5 | - | - | 12.5 |
| 49X1334 | Electrical machinery etc. ................. | 543 | 10 | 21 | 7 | 2 | - | - | 9 | - | 1 | - | - | 1 | 70.0 | 20.0 | - | - | 90.0 | - | 10.0 | - | - | 10.0 |
| 50X1335 | Shipbuilding ......... | 838 | 9 | 22 | 4 | 4 | - | 1 | 9 | - | - | - | - | - | 44.5 | 44.4 | - | 11.1 | 100.0 | - | - | - | - | - |
| 51X1235 | Miscellaneous ........ | 217 | 12 | 24 | 7 | 5 | - | - | 12 | - | - | - | - | - | 58.4 | 41.6 | - | - | 100.0 | - | - | - | - | - |
| 52X0413 | Construction ......... | 4 170 | 14 | 32 | 5 | 7 | 1 | - | 13 | - | 1 | - | - | 1 | 35.7 | 50.0 | 7.1 | - | 92.8 | - | 7.2 | - | - | 7.2 |
| 53X0345 | Electricity .......... | 582 | 1 | 6 | 1 | - | - | - | 1 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 54X1024 | Gas supply ........... | 21 | 4 | 11 | 3 | - | - | - | 3 | 1 | - | - | - | 1 | 75.0 | - | - | - | 75.0 | 25.0 | - | - | - | 25.0 |
| 55X0415 | Trade ................ | 5 693 | 6 | 13 | 2 | 4 | - | - | 6 | - | - | - | - | - | 33.3 | 66.7 | - | - | 100.0 | - | - | - | - | - |
| 56X0013 | Central bank ......... | 19 | 3 | 4 | 1 | 1 | - | - | 2 | 1 | - | - | - | 1 | 33.3 | 33.3 | - | - | 66.7 | 33.3 | - | - | - | 33.3 |
| 57X0025 | State banks .......... | 13 | 3 | 4 | 1 | 2 | - | - | 3 | - | - | - | - | - | 33.3 | 66.7 | - | - | 100.0 | - | - | - | - | - |
| 58X0225 | Commercial banks ..... | 299 | 4 | 6 | 2 | 2 | - | - | 4 | - | - | - | - | - | 50.0 | 50.0 | - | - | 100.0 | - | - | - | - | - |
| 59X0125 | Life insurance ....... | 56 | 3 | 5 | 1 | 1 | - | - | 2 | - | 1 | - | - | 1 | 33.3 | 33.3 | - | - | 66.7 | - | 33.3 | - | - | 33.3 |
| 60X0215 | Non-life insurance ... | 200 | 3 | 6 | 3 | - | - | - | 3 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 61X0215 | Real estate .......... | 252 | 2 | 4 | 1 | - | - | - | 1 | - | 1 | - | - | 1 | 50.0 | - | - | - | 50.0 | - | 50.0 | - | - | 50.0 |
| 62X0305 | Dwellings ............ | 964 | 2 | 4 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 63X0435 | Ocean transportation . | 4 535 | 3 | 9 | 1 | 1 | 1 | - | 3 | - | - | - | - | - | 33.3 | 33.3 | 33.3 | - | 100.0 | - | - | - | - | - |
| 64X0203 | Coastal transportation | 307 | 6 | 12 | 2 | 4 | - | - | 6 | - | - | - | - | - | 33.3 | 66.7 | - | - | 100.0 | - | - | - | - | - |
| 65X0214 | Port services etc. ... | 281 | 5 | 8 | 3 | 1 | - | - | 4 | - | 1 | - | - | 1 | 60.0 | 20.0 | - | - | 80.0 | - | 20.0 | - | - | 20.0 |
| 66X0204 | Railways ............. | 440 | 6 | 12 | 2 | 4 | - | - | 6 | - | - | - | - | - | 33.3 | 66.7 | - | - | 100.0 | - | - | - | - | - |
| 67X0104 | Tramways ............. | 623 | 3 | 6 | 1 | 1 | - | - | 2 | - | - | 1 | - | 1 | 33.3 | 33.3 | - | - | 66.7 | - | - | 33.3 | - | 33.3 |
| 68X0315 | Transport n.e.c. ..... | 668 | 3 | 7 | 1 | 1 | - | - | 2 | - | 1 | - | - | 1 | 33.3 | 33.3 | - | - | 66.7 | - | 33.3 | - | - | 33.3 |
| 69X0255 | Air transport ........ | 190 | 4 | 8 | 3 | 1 | - | - | 4 | - | - | - | - | - | 75.0 | 25.0 | - | - | 100.0 | - | - | - | - | - |
| 70X0125 | Forwarding etc. ...... | 98 | 3 | 5 | 2 | 1 | - | - | 3 | - | - | - | - | - | 66.7 | 33.3 | - | - | 100.0 | - | - | - | - | - |
| 71X0215 | Communications ....... | 389 | 6 | 10 | 5 | 1 | - | - | 6 | - | - | - | - | - | 83.4 | 16.6 | - | - | 100.0 | - | - | - | - | - |
| 72X0235 | Education ............ | 449 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 73X0315 | Health services ...... | 559 | 4 | 8 | 4 | - | - | - | 4 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 74X0225 | Religious organisations | 103 | 2 | 4 | 2 | - | - | - | 2 | - | - | - | - | - | 100.0 | - | - | - | 100.0 | - | - | - | - | - |
| 75X0215 | Institutions ......... | 127 | 5 | 8 | 4 | 1 | - | - | 5 | - | - | - | - | - | 80.0 | 20.0 | - | - | 100.0 | - | - | - | - | - |
| 76X0214 | Consultants .......... | 232 | 3 | 6 | 1 | 2 | - | - | 3 | - | - | - | - | - | 33.3 | 66.7 | - | - | 100.0 | - | - | - | - | - |
| 77X0215 | Recreation ........... | 194 | 5 | 8 | 2 | 3 | - | - | 5 | - | - | - | - | - | 40.0 | 60.0 | - | - | 100.0 | - | - | - | - | - |
| 78X0215 | Hotels etc. .......... | 280 | 4 | 6 | - | 3 | - | - | 3 | - | - | - | 1 | 1 | - | 75.0 | - | - | 75.0 | - | - | - | 25.0 | 25.0 |
| 79X0205 | Laundry etc. ......... | 148 | 6 | 10 | 1 | 3 | 1 | 1 | 6 | - | - | - | - | - | 16.7 | 50.0 | 16.7 | 16.6 | 100.0 | - | - | - | - | - |

# Appendix A

## DESCRIPTION OF THE TEST PROGRAM

In this description we shall write the hypotheses:

(0) $y(t) = a + bx_1(t) + cx_2(t) + dx_3(t) + u(t)$

(1) $y(t) = b_1x_1(t) + u_1(t)$

(2) $y(t) = b_{13}x_1(t) + d_{13}x_3(t) + u_{13}(t)$

(3) $y(t) = a_{01} + b_{01}x_1(t) + u_{01}(t)$

We will also write the additional forms estimated by the regression program:

(4) $y(t) = a_{013} + b_{013}x_1(t) + d_{013}x_3(t)$

(5) $y(t) = a_{012} + b_{012}x_1(t) + c_{012}x_2(t)$

We have written

$y(t)$ for $x_{ij}(t)$
$x_1(t)$ for $x_j(t)$
$x_2(t)$ for $t$
$x_3(t)$ for $tx_j(t)$

and we have indexed the coefficients and the residuals with the numbers of the variables in the regressions, with a 0 for the constant term. Only the complete regression function with all the variables is written without subscripts.

We will also write:

$$\bar{y} = \frac{1}{n}\sum_t y(t)$$

$$\bar{x}_1 = \frac{1}{n}\sum_t x_1(t)$$

$$\bar{x}_2 = \frac{1}{n}\sum_t x_2(t)$$

$$\bar{x}_3 = \frac{1}{n}\sum_t x_3(t)$$

$$m_{yy} = \frac{1}{n} \sum_t (y(t) - \bar{y})^2$$

$$m_{y1} = \frac{1}{n} \sum_t (y(t)-\bar{y})(x_1(t)-\bar{x}_1)$$

$$m_{11} = \frac{1}{n} \sum_t (x_1(t) - \bar{x}_1)^2$$

$$m_{13} = \frac{1}{n} \sum_t (x_1(t) - \bar{x}_1)(x_3(t) - \bar{x}_3)$$

$$m_{33} = \frac{1}{n} \sum_t (x_3(t) - \bar{x}_3)^2$$

Also, using "hats" (^) to indicate estimated variables we will write:

$$s^2 = \frac{1}{n-4} \sum_t (\hat{u}(t))^2$$

$$s_{01}^2 = \frac{1}{n-2} \sum_t (\hat{u}_{01}(t))^2$$

$$s_{013}^2 = \frac{1}{n-3} \sum_t (\hat{u}_{013}(t))^2$$

For the estimated variances of the coefficient estimates we can write

$$\text{Est. var. } \hat{a}_{01} = s_{a_{01}}^2 = \frac{1}{12} s_{01}^2 \frac{m_{11} + \bar{x}_1^2}{m_{11}} = \frac{1}{12-2} (m_{yy} - \frac{m_{y1}^2}{m_{11}}) \frac{m_{11} + \bar{x}_1^2}{m_{11}}$$

$$\text{Est. var. } \hat{a}_{013} = s_{a_{013}}^2 = \frac{1}{12} s_{013}^2 (1 + \frac{m_{33}\bar{x}_1^2 - 2m_{13}\bar{x}_1\bar{x}_3 + m_{11}\bar{x}_3^2}{m_{11}m_{22} - m_{13}^2}$$

$$\text{Est. var. } \hat{c} = s_c^2$$

<u>Test 1</u> was $a=c=d=0$ i.e. $y(t) = bx_1(t) + u(t)$

We need the statistic

$$F_{3.8} = \frac{\sum_t (\hat{u}_1(t))^2 - \sum_t (\hat{u}(t))^2}{\sum_t (\hat{u}(t))^2} \cdot \frac{12-3-1}{3}$$

Omitting the time index we will write

$$F_{3.8} = \frac{\Sigma\hat{u}_1^{\,2} - \Sigma\hat{u}^2}{\Sigma\hat{u}^2} \cdot \frac{8}{3}$$

The regression program used did not give $\Sigma\hat{u}_1^{\,2}$, so instead we used the following procedures:

$$F_{3.8} = \frac{8}{3}\,\frac{(\Sigma\hat{u}_1^{\,2} - \Sigma\hat{u}_{01}^2) + (\Sigma\hat{u}_{01}^2 - \Sigma\hat{u}^2)}{\Sigma\hat{u}^2}$$

$$F'_{2,8} = \frac{\Sigma\hat{u}_{01}^2 - \Sigma\hat{u}^2}{\Sigma\hat{u}^2} \cdot \frac{12-3-1}{2} \qquad \text{i.e.}$$

$$\frac{\Sigma\hat{u}_{01}^2}{\Sigma\hat{u}^2} = \frac{2}{8}\,F'_{2.8} + 1$$

$$F''_{1.10} = \frac{\Sigma\hat{u}_1^2 - \Sigma\hat{u}_{01}^2}{\Sigma\hat{u}_{01}^2} \cdot \frac{12-1-1}{1} = \left(\frac{\hat{a}_{01}}{s_{a_{01}}}\right)^2$$

Here $F'_{2.8}$ is the test statistic for testing the hypothesis $c=d=0$ (in (0)) and $F''_{1.10}$ is the test statistic for testing the hypothesis $a_{01} = 0$ (in (3)). (The last expression for $F''_{1.10}$ may be checked by insertion and illustrates the connection between the "F-statistic" and the "t-statistic" $\left(\frac{\hat{a}_{01}}{s_{a_{01}}}\right)$, when "k", the number of coefficients to be tested is 1).

Inserting in $F_{3.8}$ we have

$$F_{3.8} = \frac{8}{3}\,\frac{\Sigma\hat{u}_{01}^2}{\Sigma\hat{u}^2} \cdot \frac{1}{10} \cdot \frac{10}{1}\,\frac{\Sigma\hat{u}_1^2 - \Sigma\hat{u}_{01}^2}{\Sigma\hat{u}_{01}^2} + \frac{8}{3}\,\frac{2}{8} \cdot \frac{8}{2} \cdot \frac{\Sigma\hat{u}_{01}^2 - \Sigma\hat{u}^2}{\Sigma\hat{u}^2}$$

$$= \frac{1}{3}\,(0{,}2F'_{2.8} + 0{,}8)\,\left(\frac{\hat{a}_{01}}{s_{a_{01}}}\right)^2 + \frac{2}{3}\,F'_{2.8}$$

Expressing $F'_{2.8}$ by the coefficients of multiple correlation, we have

$$F'_{2.8} = \frac{8}{2}\,\frac{\Sigma\hat{u}_{01}^2 - \Sigma\hat{u}^2}{\Sigma\hat{u}^2} = 4\,\frac{R^2 - R_{01}^2}{1-R^2}$$

where

$$R^2 = 1 - \frac{\Sigma\hat{u}^2}{n\cdot m_{yy}}$$

$$R_{01}^2 = 1 - \frac{\Sigma\hat{u}_{01}^2}{n\cdot m_{yy}}$$

R and $R_{01}$ are given by the cpmputer program, and we can consequently compute $F'_{2.8}$. $\hat{a}_{01}$ is also given by the program, whereas $s_{a_{01}}$ had to be computed from the formula

$$s_{a_{01}} = \frac{1}{12} s_{01}^2 \frac{m_{11} + \bar{x}_1^2}{m_{11}},$$

where $s_{01}^2$, $m_{11}$ and $\bar{x}_1$ are given by the computer program.

We thus have the elements for calculating $F_{3.8}$. However, we are only interested in the critical values for $F_{3.8}$. Under our assumptions $F_{3.8} \leq 4.07$ in 95% of all cases and $F_{3.8} \leq 7.59$ in 99% of all cases if our hypothesis a = c = d = 0 is correct. We consequently worked out a procedure by which we could decide the size of $F_{3.8}$ in relation to the two critical values above in the following way:
First, we tabulated the function

$$F'_{2.8} = 4\,\frac{R^2 - R_{01}^2}{1 - R^2},$$

or rather

$$R_{01} = \sqrt{R^2 - \frac{1}{4}(1-R^2)F'_{2.8}}$$

For concequtive values of R, from 1,000 to .447 and for the following values of $F'_{2.8}$: 1.00, 2.23, 4.46, 5.416, 6.11, 8.65, 10.92 and 11.39. By reading off R and $R_{01}$ from the computer program, we could then decide in which intervall $F'_{2.8}$ would be.
Further, from the formula for $F_{3.8}$, we can decide, for any given value of $F'_{2.8}$ how big $(\frac{\hat{a}_{01}}{s_{a_{01}}})^2$ can be before $F_{3.8}$ exceeds 4.07, and before it exceeds 7.59.

The results of this testing are indicated by code numbers in the following way:

| Value of $F_{3.8}$ | Value of $F'_{2.8}$ | Code number |
|---|---|---|
| $F_{3.8} \leq 4.07$ | | 0 |
| 1) $4.07 \gtrless F_{3.8} \leq 7.59$ | | 1 |
| $4.07 < F_{3.8} \leq 7.59$ | | 2 |
| $7.59 < F_{3.8}$ | $F'_{2.8} \leq 4.46$ | 6 |
| $7.59 < F_{3.8}$ | $4.46 < F'_{2.8} \leq 8.65$ | 7 |
| $7.59 < F_{3.8}$ | $8.65 < F'_{2.8}$ | 8 |

The reason for differensiating between the $F'_{2.8}$-values when $F_{3.8} > 7.59$ is that we need the $F'_{2.8}$-values in test 4.

Under our assumptions $F_{3.8}$ will exceed 4.07 in 1 of 20 cases and it will exceed 7.59 in 1 of 100 cases if the hypothesis is correct. The input items with code numbers 6, 7 and 8 were subjected to further testing of alternative hypotheses.

Test 2 was applied to those input items for which the hypothesis a = e = d = 0 was rejected, giving a value of $F_{3.8}$ exceeding 7.59, i.e. a value which would only be realized 1 time in a hundred if the hypothesis was correct.

The hypothesis now is a = c = 0 i.e.

$$y = b\,x_1 + d\,x_3 + u$$

We now need the statistic

$$F_{2.8} = \frac{12-3-1}{2}\,\frac{\Sigma\hat{u}^2_{13} - \Sigma\hat{u}^2}{\Sigma\hat{u}^2}$$

Here, again the computer program did not give $\Sigma\hat{u}_{13}$ and we used the following formulations

$$F_{2.8} = \frac{12-3-1}{2}\,\frac{(\Sigma\hat{u}^2_{13} - \Sigma\hat{u}^2_{013}) + (\Sigma\hat{u}^2_{013} - \Sigma\hat{u}^2)}{\Sigma\hat{u}^2}$$

1) Some of these items could be somewhat less than 4.07.

$$F'_{1.8} = \frac{12-3-1}{1} \, \frac{\Sigma\hat{u}^2_{013} - \Sigma\hat{u}^2}{\Sigma\hat{u}^2} = \left(\frac{\hat{c}}{s_c}\right)^2$$

$$F'_{1.9} = \frac{12-2-1}{1} \, \frac{\Sigma\hat{u}^2_{13} - \Sigma\hat{u}^2_{013}}{\Sigma\hat{u}^2_{013}} \qquad \left(\frac{\hat{a}_{013}}{s_{a_{013}}}\right)^2$$

We have now

$$F_{2.8} = \frac{12-3-1}{12-2-1} \cdot \frac{1}{2} \, \frac{\Sigma\hat{u}^2_{013}}{\Sigma\hat{u}^2} \, \frac{12-2-1}{1} \, \frac{\Sigma\hat{u}^2_{13} - \Sigma\hat{u}^2_{013}}{\Sigma\hat{u}^2_{013}}$$

$$+ \frac{1}{2} \, \frac{12-3-1}{1} \, \frac{\Sigma\hat{u}^2_{013} - \Sigma\hat{u}^2}{\Sigma\hat{u}^2}$$

$$= \frac{1}{2} \, \frac{\frac{1}{9} \, \Sigma\hat{u}^2_{013}}{\frac{1}{8} \, \Sigma\hat{u}^2} \cdot \left(\frac{\hat{a}_{013}}{s_{a_{013}}}\right)^2 + \frac{1}{2} \left(\frac{\hat{c}}{s_c}\right)^2$$

$$= \frac{1}{2} \, \frac{s^2_{013}}{s^2} \cdot \left(\frac{\hat{a}_{013}}{s_{a_{013}}}\right)^2 + \frac{1}{2} \left(\frac{\hat{c}}{s_c}\right)^2$$

Here $s^2$, $s^2_{013}$, $\hat{a}_{013}$ and $\frac{\hat{c}}{s_c}$ are given by the computer program, whereas $s^2_{a_{013}}$ must be computed from the formula

$$s^2_{a_{013}} = \frac{1}{12} \, s^2_{013} \left(1 + \frac{m_{33}\bar{x}_1^2 - 2m_{13}\bar{x}_1\bar{x}_3 + m_{11}\bar{x}_3^2}{m_{11}m_{33} - m^2_{13}}\right)$$

where $s^2_{013}$, $m_{11}$, $m_{13}$, $m_{33}$, $\bar{x}_1$ and $\bar{x}_3$ are given by the computer program.

We thus have the elements for calculating $F_{2.8}$. Under our assumptions $F_{2.8}$ will exceed 4.46 in 1 of 20 cases and it will exceed 8.65 in 1 of 100 cases if the hypothesis is correct.

We gave a code zipher 0 to those input items for which $F_{2.8} \leq 4.16$, 1 to those with $4.16 < F_{2.8} \leq 8.65$ and 2 to those with $F > 8.65$. The input items with code 2 were then the subjects of further testing of alternative hypotheses.

<u>Test</u> 3 was applied to those input items for which the hypothesis $a = c = 0$ (as well as $a = c = d = 0$) was rejected at the 99 per cent level, i.e. giving values of $F_{2.8}$ exceeding 8.65.

The hypothesis to be tested was

$b = c = d = 0$ i.e. $y = a + u$

We need the statistic

$$F'_{3.8} = \frac{\Sigma\hat{u}_0^2 - \Sigma\hat{u}^2}{\Sigma\hat{u}^2} \quad \frac{12-3-1}{3} = \frac{8}{3}\ \frac{1-(1-R^2)}{1-R^2} = 2\frac{2}{3}\ \frac{R^2}{1-R^2}$$

R is given by our computer program.

Under our assumptions $F'_{3.8} > 4.07$ in 1 of 20 cases and $> 7.59$ in 1 of 100 cases if the hypothesis is correct, and

$F \leq 4.07$ when $R \leq 0.777$

$F \leq 7.59$ when $R \leq 0.860$

We gave code zipher 0 to those input items for which $R \leq 0.777$, 1 to those for which $0.777 < R \leq 0.860$ and 2 to those for which $R > 0.860$.

Since the present null-hypothesis assumes input to be independent of output, and thus is contrary to the Leontief theory we apply a test level of 95%, and consider the hypothesis as rejected for inputs for which $R > 0.777$. These input items were then subjected to further testing.

Test 4 was applied to those input items for which both the hypotheses $a = c = 0$ (and $a = c = d = 0$) and $b = c = d = 0$ were rejected.

The hypothesis to be tested was

$c = d = 0$ i.e. $y = a + bx_1 + u$

We need the statistic

$$F'_{2.8} = \frac{\Sigma\hat{u}_{01}^2 - \Sigma\hat{u}^2}{\Sigma\hat{u}^2} \cdot \frac{12-3-1}{2}$$

But this statistic was already computed under test 1 and the results have been identified in the code giving also the results of test 1.

We have: the code number of test 1

is 6 if $F'_{2.8} \leq 4.46$

7 " $4.46 < F'_{2.8} \leq 8.65$

8 " $8.65 < F'_{2.8}$

Under our assumptions $F'_{2.8}$ will exceed 4.46 in 1 of 20 cases and it will exceed 8.65 in 1 of 100 cases if our hypothesis is correct. The input items with code number 8 were subjected to further testing.

Test 5 was applied to those input items for which the hypotheses $a = c = 0$ (and $a = c = d = 0$) and $c = d = 0$ (and $b = c = d = 0$) were rejected.

The hypothesis to be tested was

$b = d = 0$ i.e. $y = a_{02} + c_{02}t + u$

The statistic we need is

$$F''_{2.8} = \frac{\Sigma\hat{u}^2_{02} - \Sigma\hat{u}^2}{\Sigma\hat{u}^2} \; \frac{12-3-1}{2} = 4 \; \frac{R^2 - R^2_{02}}{1 - R^2}$$

Our program did not compute $R_{02}$, so it had to be computed from

$$R_{02} = \frac{m_{y1}}{\sqrt{m_{yy} m_{11}}}$$

On the basis of $R$ and $R_{02}$ we could decide the size of $F''_{2.8}$.

Under our assumptions $F''_{2.8}$ will exceed 4.46 in 1 of 20 cases and it will exceed 8.65 in 1 of 100 cases if the hypothesis is correct.

We gave code number 0 if $F''_{2.8} \leq 4.46$

code number 1 if $4.46 < F''_{2.8} \leq 8.65$

and code number 2 if $8.65 < F''_{2.8}$

Since the present hypothesis is contrary to the Leontief theory, we considered it as rejected if $F''_{2.8} > 4.46$.

Test 5 was the final test.

Appendix B. Relationship between the test statistics $F_{3.8}$ and $F_{2.8}$ when one of the hypotheses implies the other.

Let us use the following notations for the residuals:

$\hat{u}(t)$ is the residual term for year t in the estimate of the full equation with four coefficients (including the constant, n =3)

$\Sigma\hat{u}^2 = \Sigma_t(\hat{u}(t))^2$

$\hat{u}_3(t)$ is the residual term for year t in the estimate of the equation with 3 constants set to zeroe(k=3)

$\Sigma\hat{u}_3^2 = \Sigma_t(\hat{u}_3\ (t))^2$

$\hat{u}_2(t)$ is the residual term for year t in the estimate of the equation with only 2 of the constants set to zeroe, these being two of the three constants set to zeroe in the computation of $\hat{u}_3(t)$

$\Sigma\hat{u}_2^2 = \Sigma_t(\hat{u}_2(t))^2$

We must then have

(1) $\Sigma\hat{u}_3^2 \geq \Sigma\hat{u}_2^2$

Further:

(2) $$F_{2.8} = \frac{\Sigma\hat{u}_2^2 - \Sigma\hat{u}^2}{\Sigma\hat{u}^2} \cdot \frac{8}{2}$$

and

(3) $$F_{3.8} = \frac{\Sigma\hat{u}_3^2 - \Sigma\hat{u}^2}{\Sigma\hat{u}^2} \cdot \frac{8}{3} = \frac{(\Sigma\hat{u}_3^2 - \Sigma\hat{u}_2^2) + (\Sigma\hat{u}_2^2 - \Sigma\hat{u}^2)}{\Sigma\hat{u}^2} \cdot \frac{8}{3}$$

$$= \frac{2}{3} F_{2.8} + \frac{\Sigma\hat{u}_3^2 - \Sigma\hat{u}_2^2}{\Sigma\hat{u}^2} \cdot \frac{8}{3} \geq \frac{2}{3} F_{2.8}$$

Since we know that equality is not excluded in (1), it is also not excluded in (3). Thus, if we have two critical values, $\bar{F}_{3.8}$ and $\bar{F}_{2.8}$, such that for the given probability level, the values are

(4) $$\bar{F}_{3.8} = \frac{9}{10} \bar{F}_{2.8}$$

we may happen to find

(5) $$F_{3.8} < \bar{F}_{3.8}$$

(6) $F_{2.8} > \bar{F}_{2.8}$

Using (3), (4), (5) and (6), we have

$$\frac{2}{3} F_{2.8} \leq F_{3.8} < \bar{F}_{3.8} = \frac{9}{10} \bar{F}_{2.8} < \frac{9}{10} F_{2.8}$$

which gives

$$20 F_{2.8} \leq 30 F_{3.8} < 27 F_{2.8},$$

which need not be inconsistent.