A C T A U N I V E R S I T A T I S L O D Z I E N S I S
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THE QUARTERLY FORECASTING MODEL OF THE POLISH ECONOMY

1. Introduction

The short-term forecasting model of the Polish economy has been elaborated at the Research Centre for Statistics and Economics since 1984. The main purpose of this model is forecasting of the economy in short time periods, namely in quarters and its analyzing, because forecasting is rarely the aim in itself.

There are two general reasons which determined the scope and main features of this model. The first one is the crisis of the Polish economy and necessity of consideration of such phenomena as shortage of domestic production and imported goods, balance of payments, degree of the capacity utilization, disequilibrium at consumers market and high rate of inflation. The second reason is introduction of the new economic system to the Polish economy which creates the new role of central planning[1] and promotes the new behaviour of enterprises. Especially increasing role of enterprices and their financial results are of special importance. It is obvious that national product and its structure, the final product categories and all factors which are the "bottleneck" of the economy ought to be the matter of analyzing and forecasting as well.

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[1] The role of central planning becomes partly obligatory and partly informative so the new instruments have to be used by planning centers for the fulfilling the plans is very important.

The short-term forecasting model can be divided into three sub-models. The first sub-model consists of trend or Box-Jenkins forecasting models for exogenous variables. The levels of production (in phisical terms) of some special products and number of quarterly elaborated man-hours are among the sets of exogenous variables.

The second sub-model is the quarterly model of production aggregated due to the 26 sectors of industry and sectors of the economy. It represents the connections between production and factors of production. The set of explanatory variables consists of lag production of another sectors of industry when such technological connection exists, production of some crucial products used in production process, the number of the man-hours quarterly used by each branch of industry, value of total import designed for production, values of some special imported goods, seasonal variables and - for some branches of industry - lagged endogenous variables.

The input-output relations and another yearly-modelled categories as fixed asstes, investments, employment and financial results of the enterprises, are third sub-model.

The integration of the quarterly model of production and input-output relations enables obtaining the final categories of national product and estimation of national income in quarters.

The comparison of final product categories such as individual consumption, investment, export, treated as supply of these categories on the one side, and demand for these categories estimated on the basis of econometric models on the other side, allows for the analyzing of shortages of the Polish economy. For example, the number of employees at each sector of economy, and the average sectorial wage plus the pensions, scholarships and another money transfers determine the incomes of population. The incomes can be compared to supply of consumer goods obtained from the model of production, integrated with input-output relations and thus disequilibrium on consumer market may be analyzed. The capacity utilization, stability of the input-output relations; especially rate of material costs in total imput, structural change of production, structural change of final demand and all symptoms of disequilibrium will be also the matter of the analysis.

All the collected data are diveded into four data banks according to the units of observation: monthly, guarterla, half-yearly and yearly. There are possibilities of aggregating more frequently observed data to the data of longer distance of observation and joining these data together. Ordinary and two stage least squares methods of fix-point and iterative instrumental variables methods are available[2]. The new observations are introduced by monitor terminale or by perforated cards during two weeks after the end of each quarter and new forecasts and analysis are prepared. Financial categories are introduced from the magnetic tape immediately.

2. The Specification of the Short-Term Forecasting Model

The specification of econometric forecasting model is based partly on the a priori information from economic theory or earlier econometric research. In particular, special method of selecting explanatory variables elaborated by the author was used which idea is based on the similarity measures. The description of this method is in the Appendix A. All equations are linear what enables to obtain the reduced and final form of the model. We are going to specify the model as recursively dependent everywhere it is possible. Especially quarterly model of production is recursive what is also the case with simplified investment model and fixed assets equations as well. It was possible to determine the recursive dependence between sectors of industries after analyzing the input-output relations. For the sectors heavily dependent on their own production, the lagged endogenous variables have been introduced into the set of explanatory variables, dynamizing the model this way. In the case of sectors of industry

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[2]. Computer programs elaborated by dr J. Gajda have been obtained from the University of Łódź.

where input of energy per unit of production is high, the set of explanatory variables contains also supply of energy and fuels. Import is also very important variable determining the level of production in many sectors of industry. Especially, import from western countries is very crucial factor limiting the volume of production. Number of man-hours, lagged production of another sectors, lagged endogenous variables, total import or import from western countries are explanatory variables in production model.

For quarterly production so called saled production data were used. These data had to be transformed into category of gross production for integrating quarterly production model and input--output relations. It was performed on the basis of yearly data for both categories and by estimating regression equations. As gross production is measured in constant prices and sold production in current prices it was necessary to introduce trend or dummy variables for recent years observations when the growth of prices was very high.

The input-output relations for years 1971-1982 were expressed in constant prices of 1982 and the stability analysis of the final product to gross production ratio, and stability analysis of the coefficients of final product for each sector of production were provided. Finally, the matrix of coefficients dividing the final product of each sector for categories of final product was established. The rate of final product in the gross production calculated as average of observations or was forecasted by using trend function.

The equations which determine the export production or particular industry in quarters are also estimated. The total export, export to the rouble area and export to the hard currency area, disaggregated by 26 sectors of industry and other sectors of the Polish economy (construction and agriculture) are endogenous variables. The values of sold production, seasonal variables and dummies which relate to deep decrease of export in crisis periods are the determining variables. The specification of dummies is different for different sectors of industry as there are differences between sectors of industries in evaluation of crisis.

The special attention was devoted to specification of investment equations, as investment processes are the main source of the new technology introduced into production and the main factor of leaing the economy towards equilibrium in long run, on the one hand. But on the other hand, the overinvestment of the Polish economy is the factor of disequilibrium in the whole economy. It creates the unadequate structure of the economy and leads to inflation. The bad experience of the Polish economy during last years proved that investments are the crucial problem in the process of managing the whole economy. Now, according to the new system of management the central planning of investment ought to be connected very closely with financial sources for investments and the role of enterprises ought to be more significant than in previous years.

The investment funds of the enterprises, bank credits and central investment funds are the sources of the financing of investments and rate of interest (different in time and different for branches) regulates the level and structure of investments. The total value of investment funds minus the costs of credits and repayments may be treated as the total demand for investment goods and services. It may be compared to the final production of investment goods and services from input-output relations. Such comparison enables for the estimation of degree of desequilibrium at the market of investment goods.

There are of course a few feedbacks and simultaneous interdependences between endogenous variables. The finished investments, for example, increase fixed assets and production. The growth of production leads to the growth of investments funds and growth of supply of investment and consumption goods what enables the biginning of new investments or faster completion of those not completed. There is interdependence between the level of new investments and investments being continued.

Now the time series of financial categories are too short to enable the estimation of sub-model for investment process. At our disposal there are only yearly data 1961-1983 on investment outlays for sectors of economy and sectors of industry. So the respqcification of the model must be done.

The new simplified specification introduced the lagged investment outlays, lagged national income, investment credits and dummy variables related to the tremendous decrease of investments in recent years, or investment boom in seventies. There are also introduced trend functions (linear or parabolic) to the sets of variables explaining the investment outlays.

The one year lagged fixed assets and lagged investments outlays are the explanatory variables in fixed assets model.

3. The Results of Estimation

The estimated equations are presented in Appendix B. The results of estimation are quite good (high R^2, significant t-ratios and small residuals). The regression equations for sold production are determined by total imports for industry or imports some special raw materials being used in some sectors of industry (among others: fuel industry, ferrous metallurgy, nonferrous metallurgy, engineering industry, precision instruments and apparatus industry, electrical engineering and electronic industry, chemical industry, textile industry, leather and leather products industry and industry total).

The number of man hours worked is also good explanatory variable especially for coal industry, non-ferrous metallurgy, machinery and structural metal products, precision instruments and apparatus, transport equipment industry, wearing apparel industry and food industry.

The sold production of coal industry is explanatory variable in equations of sold production for ferrous metallurgy and power industry, for example. The sold production of the ferrous industry determines the sold production of machinery and structural metal products industry and engineering industry etc.

In some equations (for branches highly dependent on their own production) lagged endogenous variables are in the sets of explanatory variables. There are also dummy variables for seasonal efects. So the production sub-model is recursive dynamic model and two-stage least squares method has been used for its estimation.

The simplified equations for investment outlays are also rather good. The significant estimators of parameters were obtained for one or three years lagged endogenous variables, one--year lagged value of the national income, linear of parabolic trends and dummy variables defined as it is shown in the Appendix B.

The estimation results for fixed assets equations are quite good, especially R^2 coefficients are high and residuals very small. The significant estimators of parameters are obtained for one-year lagged endogenous variables and lagged (usually one or two years) investment outlays variables (see Appendix B).

4. Forecasting

The forecasts of sold production based on the quarterly model of production are presented in Table C. 1 (Appendix C). The horizon of those forecasts is not too long because the actualisation of the forecasts will be done after each off going quarter. The comparison between real values and forecasts will be possible for the first quarter of 1985. The errors for almost half the forecasts are less than 5%. But for example forecasting errors for building materials industry and paper industry are very high: +15.3% and -18.9% respectively. The other forecasting errors lay between 5.1% and 10%.

The forecasts ex-post errors for investments in 1984 are greater than for sold production (see Table 2). The reason for this fact probably lays in unadequate determination of the values of dummy variables. So for some branches of industry and sectors of economy the averages of optimistic and pesimistic forecasts had to be used. It took place for transportation, coal industry, fuel industry and building materials industry.

The forecasts of fixed assets are presented in Table C. 3 (Appendix C). All forecasting ex-post errors are small and do not excess 2% (11 of them are below 1%). Only for coal industry, machinery and structural metal industry and paper industry the errors are greater.

The decrease of forecasted investment outlays are observed for commerce and coal industry. The great increase of investment outlays has been forecasted for power industry, ferrous metallurgy, non-ferrous metallurgy, building materials and food industry.

Appendix A

The idea of the method proposed has its origin in the information theory presented by H. Theil. Among many suggestions on applications of the information theory to economic researches H. Theil has proposed the index of information inaccuracy for comparison of two income distributions or improvement of prediction. The index of information inaccuracy is defined as follows:

$$I(y:x) = \sum_{i=1}^{n} y_i \log\left(\frac{y_i}{x_i}\right) \tag{1}$$

where:

$y_1, \ldots, y_n$ are the shares of the first population distribution,

$x_1, \ldots, x_n$ are the shares of the second population distribution,

n is the number of groups considered,

y_i, x_i are nonnegative and they should add up to 1:

$$\sum_{i=1}^{n} x_i = 1 \qquad \sum_{i=1}^{n} y_1 = 1. \tag{2}$$

The value of $I(y:x)$ is zero when the appropriate fractions of the both distributions are equal, i.e. when

$y_i = x_i$ for all $i = 1, 2, \ldots, n$.

But $I(y:x)$ does not achieve the finite maximum value because one or more fractions of X may equal zero and the limit value of $y_i \log \frac{y_i}{x_i}$ is approaching infinity as x_i is approaching zero.

The problem of selecting variables to an econometric equation may be treated as selecting variables whose relative changes are similar. Suppose that Y is endogenous variable explained by variable X. If we are dealing with time series the changes of these variables should be parallel in relation to time, and when we are examining cross-section data changes in relation to objects should be parallel as possible. Of course the changes of negatively correlated variables ought to be parallel but in opposite way. There is also possible a change of the character of dependency of variables by special transformation[3].

Because of condition (2) variables must be standardized in such manner that each of the observations is diveded by sum of all observations. After this standardization we obtain the variables which determine vectors of shares and can be interpreted as decomposition of the initial variables in relation to time or objects.

The information inaccuracy has one bad property namely that its upper limit does not exist. It is possible to reformulate the measure of likeness to avoid this deficiency. The normalization presented below gives us a new measure of similarity.

$$P(y:x) = \frac{1}{1 + I(y:x)} \qquad (3)$$

which is approaching zero for $I(y:x) \to \infty$ and is equal 1 for $I(y:x)$ equal 0. So now we have the bounded measure

$$0 \leqslant P(y:x) \leqslant 1 \qquad (4)$$

with good intuitive interpretation as measure of similarity of two variables and it may be used for ordering the set of independent variables due to likeness to the dependent variable.

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[3] For example such as below transformation on X chanqes the character of dependency between variables: $x_1' = x_1$ and $x_i' = x_i + \delta_i$ for $i = 2, \ldots, n$ where $\delta_i = -(x_i - x_{i-1})$ but it is possible to be done when $\delta_i \leqslant x_i$ for all $i = 2, \ldots, n$.

The two variables are more similar when $P(y:x)$ is nearly one ($P(y:x)$ is equal one when all appropriate shares of both distributions are equal), and nearly zero when there are big differences between these shares. So the ordering of independent variables due to descending values of $P(y:x)$ is criterium of selecting variables to econometric equation.

We can show that it is simple to select one explanatory variable to the econometric equation searching for the highest value of P. The second explanatory variable may be selected as the next variable from the variables set ordered due to descending values of measure of similarity P. But now the problem of repeating the information by this new joint variable occurs. So it is desirable that the value of similarity measure between the first and the second joint variable should be small. It means that the inaccuracy of information between explanatory variables ought to be big[4] what guarantees non repeating of information. It leads to a simple way of joining the second and the following variables on the base of such relation as below

$$R_j = \frac{P(y/x_j)}{P(x_o:x_j)} \qquad j = 1, 2, \ldots, k - 1 \quad 0 \neq j \tag{5}$$

where:

$P(y:x_j)$ is the measure of similarity between dependent variable Y and independent variable x_j,

$P(x_o:x_j)$ is the measure of similarity between the last of previous explanatory variables x_o and joining new variable x_j,

l is the number of variables selected to econometric equation.

The highest value of R_j indicates the following joint variable. The number of explanatory variables in the econometric equation must be a priori limited. It is possible to limit this number in relation to desirable degrees of freedom for example.

Alternative way of solving this problem is joining one variable which has the highest value of similarity, estimating the regression equation and treating the residuals as new variable which ought to be explained by a following variable within the

[4] This same, the measure of similarity ought to be small.

set of dependent variables, after excluding the first selected one. Such iterative procedure is continued up to achieving the desirable values R, but it does not save time and is rather expensive.

Now we try to determine the method of specification, based on similarity measures, for simultaneous equations model. Let us assume that there exist m endogenous variables $Y_1, \ldots, Y_m$ which we are interested in, and that we have not any a priori information about their nature. It means that we do not know which of them are simultaneously dependent.

The information inaccuracies $I(y_i:y_j)$ and $I(y_j:y_i)$ are not symmetric, so the measure of similarity are not symmetric too, what means that $P_{ij} \neq P_{ji}$. Thus the matrix P of similarity measures P_{ij}, for m endogenous variables is not symmetric matrix. This asymmetric property denotes that great similarity of one variable to another does not guarantee that the same relation exists when variables are conversly interrelated.

The row elements of matrix P are the measures of similarity for particular variables j (j = 1, 2, ..., m) to variable i (i = 1, 2, ..., m)

$$P = \begin{bmatrix} P_{11} & \cdots\cdots & P_{1m} \\ \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots \\ P_{m1} & \cdots\cdots & P_{mm} \end{bmatrix}$$

The main diagonal of matrix P consists of ones and remaining elements which are not symmetric may become the basis of determination for simultaneously dependent variable.

Suppose that for constant i and j P_{ij} is sufficiently near P_{ji} so we can determine the Y_i and Y_j as simultaneously dependent variables. Of course it is necessary to determine the critical value of the difference between P_{ij} and $P_{ij} - \delta_0$.

Next, for all sets p_s of the pairs P_{ij} and P_{ji} we chose maximum at each pair value

$$\max P_s = \max(P_{ij}, P_{ji}) \quad \text{for } i \neq j \quad i, j = 1, 2, \ldots, m \quad (7)$$

which determine the dependence between appropriate andogenous variables

$$Y_i \longrightarrow Y_j \quad \text{if} \quad P_{ji} > P_{ij} \tag{8}$$

Finding for example that in the set P_s for i = 1 and J = 3 P_{13} - the measure of similarity variable Y_3 to variable Y_1 is greater then the measure of similarity Y_1 to Y_3, we determine the reccursive dependence between y_1 and Y_3. Next, it is necessary to examine the difference between $\max P_s$ and $\min P_s$. If this difference is equal or less critical value δ_0 we determine the simultaneously dependence between variable Y_i and Y_j.

$$Y_i \rightleftarrows Y_j \quad \begin{array}{l} \text{if } \max P_s - \min P_s \leqslant \delta_0 \\ \text{for } i, j = 1, 2, \ldots, m \\ i \neq j \end{array} \tag{9}$$

The number of simultaneously dependent variables dependsonn the value of δ_0 which is established arbitrary. So, if δ_0 is small - for example $\delta_0 = 0.05$ - the number of simultaneously dependent equations obtained in this way is smaller than for greater δ_0, say $\delta_0 = 0.1$.

Let us assume that five endogenous variables exist and matrix of similarity measures is such as below

$$P = \begin{bmatrix} 1.000 & 0.940 & 0.825 & 0.691 & 0.831 \\ 0.866 & 1.000 & 0.980 & 0.820 & 0.985 \\ 0.990 & 0.730 & 1.000 & 0.985 & 0.980 \\ 0.959 & 0.950 & 0.981 & 1.000 & 0.934 \\ 0.954 & 0.977 & 0.928 & 0.811 & 1.000 \end{bmatrix}$$

So, for $\delta_0 = 0.05$ the appropriate matrix B determining the simultaneous variables has a form

$$B = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 1 \end{bmatrix} \quad \text{for } \delta_o = 0.05$$

where symmetrically placed ones point the simultaneously dependent variables. Is this example only two equations are simultaneously dependent because the backward relations exist only between y_2 and Y_5, Y_3 and Y_4. After changing the level of critical value δ_o into $\delta_o = 0.1$, matrix B takes the form

$$B = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \end{bmatrix} \quad \text{for } \delta_o = 0.1$$

and four equations are simultaneously dependent, because backward relations exist for following variables

$$Y_1 \rightleftarrows Y_2, \quad Y_2 \rightleftarrows Y_5, \quad Y_3 \rightleftarrows Y_4, \quad Y_3 \rightleftarrows Y_5$$

Another way of specification is eliminating explanatory variables Y_j for each Y_i using the critical value P_o. So the matrix B is determined on the basis of the following inequalities

$$Y_j \longrightarrow Y_i \quad \text{if} \quad P_{ij} \geqslant P_o \tag{10}$$

for $i, j = 1, 2, \ldots, m \quad i \neq j$

On the one hand this way of specification may lead to establishing simultaneously dependent variables for which large differences between similarity measures P_{ij} and P_{ji} exist. On the another hand the process of eliminating explanatory variables is homogenous for all variables, however, sometimes it may lead to excessive simplification of the model, especially when some variables are hard to be explained.

After determining simultaneously dependent variables the further specification of the model is continued and ordinary way is applied as to the single equation model. Of course, the special attention must be payed for the conditions of identification, because this method does not assure such conditions.

The similarity measures may also be used for specification of large medels, when a priori recognition between andogenous and explanatory variables does not exist, however in such circumstances the data about future values of exogenous variables must be available, or time series predictive models for those variables should be estimated.

The analysis of the elements for particular row of matrix P enables to eliminate some number of variables for which the values of P_{ij} are equal or greater than critical value P_0 what is equivalent to fulfill condition (10). Thus, the mechanism of backward relation is obtained by cancelling some variables, what means that zeros have appeared at some places of matrix B. Further, if for any row of matrix P all P_{ij} are less than P_0

$$P_{ij} < P_0 \quad \text{for } j \neq i, \quad j = 1, 2, \ldots, m \tag{11}$$

such variable ought to be treated as exogenous because of critical value P_0 predetermined a priori there is not any variable able to determine Y_i. Of course, it is necessary to examine the condition of identification, similarly if model would be specified on the a priori economic relations.

The method presented in this paper based on similarity measures is very simple and may be applied to nonlinear relations too. Thus, when the number of variables is great, or some relations are nonlinear the application of this method is very useful. It is also important that similarity measure is the transformation of conditional entropy and therefore has a clear interpretation.

Appendix B

Notation

Endogenous variables:

SP - sold production in the branches of industry:

W	- coal	EL	- electric engineering and electronic
P	- fuel	CH	- chemical
EN	- power	MB	- building materials
HZ	- ferrous metallurgy	SZ	- glass and pottery
MN	- non-ferrous metallurgy	DR	- wood
MET	- machinery and structural metal products	PAP	- paper
MAS	- engineering	WL	- textile
PR	- precision instruments and apparatus	OD	- wearing apparel
ST	- transport equipment	SK	- leather and leather products
OG	- total (current prices)	SP	- food

PPBCS - basic production of construction in constant prices (1982)
PPBCB - basic production of construction in current prices
PLAD - freight transport (million tons)

Explanatory variables:

IMRU (1 nad 2) - import of iron ore (total and in the brackets: socialist - other countries)
IMCE (1 and 2) - import of cellulose
IMAL (1 and 2) - import of aluminium
IMZ (1 and 2) - imports for production
RH - man-hours worked per 100 workers for each branch (the same natation as for sold production SP)
POWW - daily coal output (average)
PCEL - production of cellulose
SKML - purchase of milk

SKM - purchase of meat

LIZB - number of rooms in residential buildings (socialized sector)

PREN - electric power output (million KWh)

Z_i - dummy variable (i - number of the quarter of the year)

T - time variable

Subscript -1 means 1 period lag.

The values of t-statistics are given in brackets.

The Results of Estimation

Estimated production equations

1. Coal Industry

$$SPW = \underset{(5.96)}{9.569}\ RHW + \underset{(12.17)}{0.754}\ PMAS_{-1} + \underset{(0.99)}{6.140}\ Z_1 + \underset{(2.13)}{14.65}\ Z_2 + \underset{(1.39)}{9.489}\ Z_3 - \underset{(6.22)}{471.55}$$

$R^2 = 0.974$

2. Fuel industry

$$SPP = \underset{(0.88)}{4.963}\ RHP + \underset{(2.90)}{0.538}\ SPP_{-1} + \underset{(2.68)}{0.272}\ IKZ + \underset{(2.01)}{16.06}\ Z_1 + \underset{(0.84)}{9.82}\ Z_2 + \underset{(1.10)}{18.79}\ Z_3 - \underset{(0.84)}{229.92}$$

$R^2 = 0.96$

3. Power industry

$$SPEN = \underset{(0.72)}{1.881}\ RHEN + \underset{(12.77)}{0.518}\ SPW + \underset{(0.22)}{1.12}\ Z_1 - \underset{(0.55)}{3.936}\ Z_2 - \underset{(0.17)}{2.022}\ Z_3 - \underset{(0.65)}{85.21}$$

$R^2 = 0.94$

4. Ferrous metallurgy

$$SPHZ = \underset{(1.26)}{14.24}\ RHHZ + \underset{(6.79)}{0.419}\ IMZ + \underset{(2.78)}{25.54}\ Z_1 + \underset{(1.85)}{35.74}\ Z_2 + \underset{(1.59)}{55.60}\ Z_3 - \underset{(1.24)}{658.92}$$

$R^2 = 0.91$

5. Non-ferrous metallurgy

$$SPMN = \underset{(1.85)}{6.462}\ RHMN + \underset{(0.64)}{0.423}\ IMAL2 + \underset{(9.79)}{0.01}\ PREN - \underset{(0.55)}{3.936}\ Z_1 + \underset{(0.72)}{68.05}\ Z_2 + \underset{(8.96)}{83.84}\ Z_3 - \underset{(3.87)}{574.58}$$

$R^2 = 0.96$

6. Machinery and structural metal industry

a) $$SPMET = \underset{(4.77)}{0.377}\ SPHZ_{-1} + \underset{(2.80)}{0.107}\ IMZ + \underset{(3.48)}{14.442}\ Z_1 + \underset{(0.29)}{1.25}\ Z_2 - \underset{(1.00)}{4.389}\ Z_3 + \underset{(3.53)}{16.53}$$

$R^2 = 0.96$

b) $$SPMET = \underset{(6.30)}{0.05}\ PREN + \underset{(7.59)}{0.164}\ IMZ + \underset{(2.40)}{8.473}\ Z_1 + \underset{(5.80)}{34.76}\ Z_2 + \underset{(5.30)}{35.55}\ Z_3 - \underset{(5.34)}{143.09}$$

$R^2 = 0.97$

c) $$SPMET = \underset{(1.93)}{7.575}\ RHMET + \underset{(6.85)}{0.228}\ IMZ + \underset{(1.65)}{10.98}\ Z_1 + \underset{(1.87)}{18.63}\ Z_2 + \underset{(1.66)}{22.52}\ Z_3 - \underset{(1.79)}{317.14}$$

$R^2 = 0.91$

7. Engineering industry

a) $$SPMAS = \underset{(0.40)}{2.461}\ RHMAS + \underset{(6.34)}{0.464}\ IMZ + \underset{(1.79)}{19.78}\ Z_1 + \underset{(0.62)}{10.88}\ Z_2 + \underset{(0.37)}{9.264}\ Z_3 - \underset{(0.25)}{71.36}$$

$R^2 = 0.916$

b) $$SPMAS = \underset{(4.55)}{0.679}\ PHZ + \underset{(2.61)}{0.186}\ IMZ + \underset{(0.01)}{0.102}\ Z_1 - \underset{(0.62)}{4.427}\ Z_2 - \underset{(1.21)}{8.473}\ Z_3 + \underset{(4.41)}{31.35}$$

$R^2 = 0.970$

8. Precision instruments and apparatus industry

a) $$\underset{}{SPPR} = \underset{(1.65)}{1.029}\ RHPR + \underset{(8.95)}{0.13}\ IMZ2 + \underset{(1.17)}{1.423}\ Z_1 + \underset{(0.93)}{1.409}\ Z_2 + \underset{(0.86)}{2.262}\ Z_3 - \underset{(1.36)}{38.65}$$

$R^2 = 0.945$

b) $$SPPR = \underset{(5.04)}{0.0462}\ SPPR_{-1} + \underset{(6.13)}{0.085}\ IMZ2 + \underset{(0.10)}{0.079}\ Z_1 - \underset{(1.28)}{1.032}\ Z_2 - \underset{(3.11)}{2.459}\ Z_3 + \underset{5.49}{5.229}$$

$R^2 = 0.979$

9. Transport equipment industry

a) $$SPST = \underset{(6.74)}{34.67}\ RHST - \underset{(1.13)}{19.12}\ Z_1 + \underset{(3.07)}{66.66}\ Z_2 + \underset{(4.10)}{110.92}\ Z_3 - \underset{(0.83)}{1.485}$$

$R^2 = 0.799$

b) $$SPST = \underset{(0.37)}{1.462}\ RHST + \underset{(4.06)}{0.877}\ SPMAS + \underset{(0.73)}{0.07}\ IMZ - \underset{(1.27)}{9.095}\ Z_1 - \underset{(0.44)}{4.786}\ Z_2 - \underset{(0.55)}{8.871}\ Z_3 - \underset{(0.28)}{49.29}$$

$R^2 = 0.979$

10. Electric engineering and electronic industry

$$SPEL = \underset{(6.44)}{0.604}\ SPEL_{-1} + \underset{(4.67)}{0.305}\ IMZ2 + \underset{(0.21)}{0.804}\ Z_1 - \underset{(1.29)}{4.882}\ Z_2 - \underset{(4.08)}{15.20}Z_3 + \underset{(4.34)}{17.21}$$

$R^2 = 0.980$

11. Chemical industry

a) $$SPCH = \underset{(1.59)}{12.19}\ RHCH + \underset{(13.31)}{0.567}\ IMZ + \underset{(2.36)}{24.19}\ Z_1 + \underset{(1.53)}{24.62}\ Z_2 + \underset{(1.40)}{44.84}\ Z_3 - \underset{(1.45)}{496.18}$$

$R^2 = 0.978$

b) $$SPCH = \underset{(2.88)}{0.301}\ SPCH_{-1} + \underset{(8.40)}{0.333}\ IMZ + \underset{(2.63)}{0.05}\ PREN + \underset{(3.27)}{14.31}\ Z_1 + \underset{(2.11)}{25.56}\ Z_{22} + \underset{(1.57)}{21.53}\ Z_3 - \underset{(2.10)}{105.16}$$

$R^2 = 0.992$

12. Building materials industry

$$SPMB = \underset{(1.25)}{1.435}\ RMMB + \underset{(10.12)}{0.892}\ SPMB_{-1} + \underset{(1.54)}{6.998}\ Z_1 + \underset{(2.23)}{10.63}\ Z_2 + \underset{(1.19)}{6.319}\ Z_3 - \underset{(1.24)}{65.79}$$

$R^2 = 0.922$

13. Glass and pottery industry

a) $$SPSZ = \underset{(1.58)}{1.023}\ RHSZ + \underset{(10.99)}{0.072}\ OMZ + \underset{(1.88)}{2.949}\ Z_1 + \underset{(1.55)}{2.764}\ Z_2 + \underset{(1.01)}{1.964}\ Z_3 - \underset{(1.42)}{39.40}$$

$R^2 = 0.933$

b) $$SPSZ = \underset{(0.62)}{0.243}\ RHSZ + \underset{(9.88)}{0.051}\ IMZ + \underset{(5.32)}{0.001}\ PREN + \underset{(2.32)}{1.995}\ Z_1 + \underset{(5.90)}{8.424}\ Z_2 + \underset{(5.28)}{8.451}\ Z_3 - \underset{(2.85)}{42.28}$$

$R^2 = 0.983$

14. Wood industry

$$SPDR = \underset{(4.04)}{0.474}\ SPDR_{-1} + \underset{(4.68)}{0.116}\ IMZ + \underset{(2.35)}{6.365}\ Z_1 - \underset{(0.58)}{1.652}\ Z_2 - \underset{(2.38)}{6.695}\ Z_3 + \underset{(3.90)}{12.02}$$

$R^2 = 0.975$

15. Paper industry

a) $$SPPAP = \underset{(0.97)}{0.796}\ RHPAP + \underset{(9.10)}{0.075}\ IMZ + \underset{(3.48)}{5.119}\ Z_1 + \underset{(1.20)}{2.226}\ Z_2 + \underset{(1.20)}{3.587}\ Z_3 - \underset{(0.86)}{32.04}$$

$R^2 = 0.943$

b) $$\underset{(2.38)}{SPPAP = 0.398\ SPPAP_{-1}} + \underset{(3.81)}{0.051\ IMZ} + \underset{(3.65)}{4.615\ Z_1} + \underset{(0.25)}{0.335\ Z_2} + \underset{(0.36)}{0.473\ Z_3} - \underset{(1.56)}{2.330}$$

$R^2 = 0.959$

16. Textile industry

a) $$SPWL = \underset{(8.85)}{0.127\ SPWL_{-1}} + \underset{(3.02)}{0.236\ IMZ2} + \underset{(2.14)}{10.34\ Z_1} - \underset{(1.44)}{7.327\ Z_2} - \underset{(2.80)}{13.79\ Z_3} + \underset{(1.66)}{10.11}$$

$R^2 = 0.079$

b) $$SPWL = \underset{(1.34)}{9.149\ RHWL} + \underset{(3.68)}{0.294\ IMZ} + \underset{(0.91)}{13.33\ Z_1} + \underset{(0.89)}{14.08\ Z_2} + \underset{(1.03)}{27.20\ Z_3} - \underset{(1.19)}{345.69}$$

$R^2 = 0.832$

17. Wearing apparel industry

a) $$SPOD = \underset{(1.84)}{0.881\ RHOD} + \underset{(24.74)}{0,358\ SPWL} - \underset{(4.39)}{6.224\ Z_1} - \underset{(2.47)}{3.723\ Z_2} - \underset{(0.83)}{3.723\ Z_3} - \underset{(1.55)}{33.10}$$

$R^2 = 0.986$

a) $$SPOD = \underset{(1.70)}{0.878\ RHOD} + \underset{(9.25)}{0.780\ SPOD_{-1}} + \underset{(3.10)}{0.083\ IMZ} - \underset{(4.67)}{9.036\ Z_1} - \underset{(5.02)}{9.585\ Z_2} - \underset{(2.78)}{11.67\ Z_3} - \underset{(1.11)}{25.66}$$

$R^2 = 0.986$

18. Leather and leather products industry

a) $$SPSK = \underset{(1.83)}{3.112\ RHSK} + \underset{(5.02)}{0.131\ IMZ} + \underset{(0.89)}{4.637\ Z_1} + \underset{(0.45)}{2.686\ Z_2} + \underset{(0.98)}{10.92\ Z_3} - \underset{(1.66)}{123.75}$$

$R^2 = 0.85$

b) $$SPSK = \underset{(0.16)}{0.129}\ RHSK + \underset{(7.49)}{0806}\ SPSK_{-1} + \underset{(2.85)}{0{,}045}\ IMZ - \underset{(1.54)}{3.680}\ Z_1 - \underset{(2.84)}{8.046}\ Z_2 - \underset{(2.22)}{12.17}\ Z_3 + \underset{(0.08)}{2.677}$$

$R^2 = 0.97$

19. Food industry

a) $$SPSP = \underset{(0.90)}{12.37}\ RHSP + \underset{(2.84)}{0.187}\ SKML + \underset{(9.67)}{3.277}\ IMZ2 + \underset{(2.82)}{140.65}\ Z_1 - \underset{(0.33)}{36.91}\ Z_2 - \underset{(0.94)}{123.11}\ Z_3 - \underset{(1.33)}{855.23}$$

$R^2 = 0.978$

b) $$SPSP = \underset{(2.08)}{25.22}\ RHSP - \underset{(1.62)}{0.267}\ SKM + \underset{(2.32)}{0.135}\ SKML + \underset{(12.88)}{1.567}\ IMZ + \underset{(4.21)}{187.43}\ Z_1 + \underset{(0.53)}{51.57}\ Z_2 - \underset{(0.05)}{5.487}\ Z_3 -$$

$$- \underset{(2.52)}{1305}$$

$R^2 = 0.989$

20. Industry total

$$SPOG = \underset{(1.16)}{37.56}\ RHOG + \underset{(9.18)}{7.071}\ IMZ + \underset{(2.20)}{358.13}\ Z_1 + \underset{(0.91)}{192{,}81}\ Z_2 + \underset{(0.81)}{196.68}\ Z_3 - \underset{(0.81)}{1240}$$

$R^2 = 0.931$

Basic production of construction

a) current prices

$$PPBCB = \underset{(21.07)}{3.516}\ PMB + \underset{(0.11)}{0.026}\ LIZB_{-1} - \underset{(1.91)}{29.02}\ Z_1 - \underset{(1.07)}{9.842}\ Z_2 - \underset{(1.20)}{11.61}\ Z_3 + \underset{(0.78)}{15.62}$$

$R^2 = 0.977$

$$PPBCB = \underset{(0.76)}{4.057}\ RHBUD - \underset{(1.98)}{1.165}\ LIZB_{-1} + \underset{(5.33)}{0.028}\ PREN + \underset{(1.01)}{47.78}\ Z_1 + \underset{(4.84)}{180.51}\ Z_2 + \underset{(5.19)}{234.58}\ Z_3 - \underset{(3.11)}{874.2}$$

$R^2 = 0.827$

b) constant prices

$$PPBCS = \underset{(0.80)}{1.236}\ RHBUD + \underset{(2.97)}{0.523}\ LIZB + \underset{(1.42)}{23.08}\ Z_1 + \underset{(4.33)}{49.09}\ Z_2 + \underset{(3.68)}{51.76}\ Z_3 + \underset{(0.22)}{14.14}$$

$R^2 = 0.862$

Transport

$$PLAD = \underset{(2.69)}{64.60}\ SPOG - \underset{(9.90)}{34758}\ T + \underset{(6.64)}{903.83}\ T^2 - \underset{(3.09)}{37513}\ Z_1 + \underset{(0.42)}{5145}\ Z_2 + \underset{(1.59)}{19246}\ Z_3 + \underset{(23.19)}{444697}$$

$R^2 = 0.93$

<u>The model of investment outlays</u>

Total

$$NIO = \underset{(8.11)}{1.362}\ NIO_{-1} - \underset{(1.55)}{0.360}\ NIO_{-2} - \underset{(2.77)}{218.25}\ Z_o + \underset{(1.45)}{60.77}$$

$R^2 = 0.974$ D-W = 1.346

where z_o is dummy variable such that: $Z_o = 1$ for 1979-1982

$Z_o = 0$ otherwise

Total in industry NIP

$$NIP = \underset{(13.24)}{1.714}\ NIP_{-1} - \underset{(6.45)}{0.809}\ NIP_{-2} + \underset{(2.19)}{38.0}$$

$$R^2 = 0.97 \qquad D\text{-}W = 1.693$$

Construction NIB

$$NIB = \underset{(5.68)}{1.380}\ NIB_{-1} - \underset{(1.63)}{0,457}\ NIB_{-2} - \underset{(1.08)}{7.879}\ Z_B + \underset{(1.90)}{5.226}$$

$$R^2 = 0.928 \qquad D\text{-}W = 1.411$$

where Z_B is dummy variable such that: $Z_B = 1$ for 1979-1983

$Z_B = 0$ otherwise

or

$$NIB = \underset{(10.74)}{0.862}\ NIB_{-1} + \underset{(2.43)}{1.101}\ T - \underset{(5.07)}{26.99}\ Z_B - \underset{(0.71)}{2.662}$$

$$R^2 = 0.940 \qquad D\text{-}W = 1.497$$

or

$$NIB = \underset{(2.89)}{0.0109}\ DN_{-1} + \underset{(3.37)}{0.555}NIB_{-1} - \underset{(5.50)}{29.02} - \underset{(2.22)}{17.48}$$

$$R^2 = 0,945 \qquad D\text{-}W = 1.452$$

where DN_{-1} is one year lagged national income

Agriculture NIR

$$NIR = \underset{(42.08)}{0.068}\ DN_{-1} - \underset{(10.08)}{61.07}\ Z_R - \underset{(9.62)}{58.57}$$

$\bar{R}^2 = 0.988 \quad D\text{-}W = 1.378$

where Z_R is dummy variable such that: $Z_R = 1$ for 1980-1983

$Z_R = 0$ otherwise

Coal industry NIPW

$$NIPW = \underset{(4.38)}{0.579}\ NIPW_{-1} + \underset{(4.26)}{0.616}\ NIPW_{-2} - \underset{(6.08)}{27.43}\ Z_1 - \underset{(2.25)}{12.08}\ Z_2 + \underset{(0.22)}{0.505}$$

$R^2 = 0.963 \quad D\text{-}W = 2.527$

where Z_1 is dummy variable such that: $Z_1 = 1$ for 1981-1983

$Z_1 = 0$ otherwise

Z_2 is dummy variable such that: $Z_2 = 1$ in 1966

$Z_2 = 0$ otherwise

Fuel industry NIPP

$$NIPP = \underset{(4.82)}{0.0048}\ DN_{-1} + \underset{(3.45)}{0.550}\ NIPP_{-1} - \underset{(0.75)}{0.1106}\ NIPP_{-2} - \underset{(5.98)}{18.61}\ Z_{PP} - \underset{(0.97)}{2.504}$$

$R^2 = 0.886 \quad D\text{-}W = 1.666$

or

$$NIPP = \underset{(1.95)}{0.0048}\ DN_{-1} + \underset{(4.37)}{0.454}\ NIPP_{-1} + \underset{(0.03)}{0.016}\ T - \underset{(5.69)}{19.35}\ Z_{PP} - \underset{(0.01)}{0.050}\ Z_{1PP} - \underset{(0.78)}{2.461}$$

$R^2 = 0.878 \quad D\text{-}W = 1.497$

where Z_{PP} is dummy variable such that: $Z_{PP} = 1$ for 1976-1983

$Z_{PP} = 0$ otherwise

Z_{1PP} is dummy variable such that: $Z_{1PP} = 1$ for 1981-1983

$Z_{1PP} = 0$ otherwise

Power industry Nien

$$NIEN = \underset{(4.82)}{0.0135}\, DN_{-1} + \underset{(2.86)}{7.582}\, Z_{EN} - \underset{(3.08)}{7.550}$$

$R^2 = 0.955$ D-W = 1.319

where Z_{EN} is dummy variable such that: $Z_{EN} = 1$ for 1981-1983

$Z_{EN} = 0$ otherwise

Ferrous industry NIHZ

$$NIHZ = \underset{(10.24)}{0.031}\, DN_{-1} + \underset{(2.40)}{0.137}\, T^2 - \underset{(3.90)}{5.723}\, T - \underset{(6.54)}{51.76}\, Z_{HZ} - \underset{(4.44)}{30.65}$$

$R^2 = 0.926$ D-W = 1.724

where Z_{HZ} is dummy variable such that: $Z_{HZ} = 1$ for 1979-1983

$Z_{HZ} = 0$ otherwise

or

$$NIHZ = \underset{(2.88)}{0.015}\, DN_{-1} + \underset{(1.28)}{0.412}\, NIHZ_{-1}$$

Non-ferrous metallurgy NIMN

$$NIMN = \underset{(5.35)}{1.413} \, MIMN_{-1} - \underset{(2.58)}{0.678} \, NIMN_{-2} + \underset{(1.80)}{0.348} \, T - \underset{(1.11)}{3.642} \, Z_{MN} + \underset{(0.21)}{0.326}$$

$R^2 = 0.94$ D-W = 1.55

Machinery and structural metal industry NIME

$$NIME = \underset{(4.73)}{0.0088} \, DN_{-1} - \underset{(1.52)}{0.265} \, NIME_{-3} + \underset{(0.96)}{0.333} \, T - \underset{(4.30)}{12.75} \, Z_{ME} - \underset{(5.83)}{16.19}$$

$R^2 = 0.945$ D-W = 1.229

where Z_{ME} is dummy variable such that: $Z_{ME} = 1$ for 1980-1983

$Z_{ME} = 0$ otherwise

or

$$NIME = \underset{(0.66)}{0.025} \, DN_{-1} + \underset{(1.84)}{0.428} \, NIME_{-1} - \underset{(0.68)}{0.123} \, NIME_{-3} + \underset{(2.00)}{0.886} \, T - \underset{(4.96)}{14.58} \, Z_{ME} - \underset{(1.51)}{7.873}$$

$R^2 = 0.952$ D-W = 1.789

or

$$NIME = \underset{(8.46)}{0.101} \, DN_{-1} - \underset{(1.74)}{0.298} \, NIME_{-3} - \underset{(5.14)}{10.73} \, Z_{ME} - \underset{(6.23)}{16.81}$$

$R^2 = 0.945$ D-W = 1.918

Engineering industry NIMAS

$$NIMAS = \underset{(10.93)}{1.649} \, NIMA_{-1} - \underset{(5.01)}{0.733} \, NIMA_{-2} + \underset{(1.84)}{2.194}$$

$R^2 = 0.96$ D-W = 1.45

Precision instruments and apparatus NIPR

$$NIPR = \underset{(4.08)}{0.579}\, NIPR_{-1} + \underset{(0.66)}{0.003}\, T^2 + \underset{(0.62)}{0.071}\, T - \underset{(2.52)}{2.079}\, Z_{PR} - \underset{(0.27)}{0.153}$$

$R^2 = 0.887 \quad D\text{-}W = 1.348$

where Z_{PR} is dummy variable such that: $Z_{PR} = 1$ for 1979-1983

$Z_{PR} = 0$ otherwise

Transport equipment industry NIST

$$NIST = \underset{(5.24)}{1.29}\, NIST_{-1} - \underset{(1.39)}{0.369}\, NIST_{-2} - \underset{(1.08)}{4.293}\, Z_{ST} + \underset{(1.76)}{3.331}$$

$R^2 = 0.92 \quad D\text{-}W = 1.6$

where Z_{ST} is dummy variable such that: $Z_{ST} = 1$ for 1979-1983

$Z_{ST} = 0$ otherwise

or

$$NIST = \underset{(8.49)}{0.765}\, NIST_{-1} - \underset{(2.85)}{0.905}\, T - \underset{(4.47)}{16.32}\, Z_{ST} - \underset{(0.88)}{2.161}$$

$R^2 = 0.932 \quad D\text{-}W = 1.189$

Electric engineering and electronic industry NIEL

$$NIEL = \underset{(13.77)}{1.027}\, NIEL_{-1} - \underset{(3.15)}{4.075}\, Z_{EL} + \underset{(1.33)}{1.133}$$

$R^2 = 0.9$ D-W = 1.97

where Z_{EL} is dummy variable such that: $Z_{EL} = 1$ for 1978-1982

$Z_{EL} = 0$ otherwise

Chemical industry NICH

$$NICH = \underset{(6.84)}{0.016}\, DN_{-1} - \underset{(1.60)}{0.304}\, NICH_{-1} - \underset{(5.07)}{23.92}\, Z_{CH} - \underset{(1.31)}{6.097}$$

$R^2 = 0.871$ D-W = 1.469

where Z_{CH} is dummy variab.e such that: $Z_{CH} = 1$ for 1980-1983

$Z_{CH} = 0$ otherwise

Building materials industry NIMB

$$NIMB = \underset{(11.4)}{0.820}\, NIMB_{-1} + \underset{(3.18)}{0.571}\, t - \underset{(4.93)}{11.64}\, Z_{MB} - \underset{(0.37)}{0.604}$$

$R^2 = 0.9$ D-W = 2.35

where Z_{MB} is dummy variable such that: $Z_{MB} = 1$ for 1977-1983

$Z_{MB} = 0$ otherwise

Glass and pottery industry NICZ

$$NICZ = \underset{(3.32)}{0.466}\, NICZ_{-1} - \underset{(0.30)}{0.059}\, NICZ_{-3} + \underset{(3.51)}{0.236}\, T - \underset{(4.38)}{3.489}\, Z_{CZ} - \underset{(0.73)}{0.408}$$

$R^2 = 0.807$ D-W = 2.490

where Z_{Cz} is dummy variable such that: $Z_{CZ} = 1$ for 1980-1983

$Z_{CZ} = 0$ otherwise

or

$$NICZ = \underset{(4.94)}{0.002}\, DN_{-1} - \underset{(1.73)}{0.311}\, NICZ_{-3} - \underset{(0.78)}{0.077}\, T - \underset{(2.36)}{1.912}\, Z_{CZ} - \underset{(2.97)}{1.484}$$

$R^2 = 0.871$ D-W = 2.073

Wood industry NIDR

$$NIDR = \underset{(6.01)}{0.003}\, DN_{-1} + \underset{(9.39)}{0.789}\, NIDR_{-1} - \underset{(3.61)}{0.420}\, NIDR_{-3} - \underset{(5.07)}{5.943}\, Z_{DR} - \underset{(4.72)}{6.820}$$

$R^2 = 0.962$ D-W = 1.918

where Z_{DR} is dummy variable such that: $Z_{DR} = 1$ for 1977-1983

$Z_{DR} = 0$ otherwise

Paper industry NIPAP

$$NIPAD = \underset{(3.85)}{0.758}\, NIPAP - \underset{(3.32)}{0.492}\, NIPAP + \underset{(3.79)}{7.140}\, Z_{PAP} + \underset{(4.36)}{3.847}$$

$R^2 = 0.850$ D-W = 1.037

where Z_{PAP} is dummy variable such that: $Z_{PAP} = 1$ for 1977-1980

$Z_{PAP} = 0$ otherwise

Z_{PAP} expresses extremly high investment outlays.

Textile industry NIWL

$$NIWL = \underset{(14.60)}{1.025}\, NIWL_{-1} - \underset{(3.68)}{4.928}\, Z_{Wl} + \underset{(1.29)}{1.307}$$

$R^2 = 0.908$ D-W = 1.211

where Z_{WL} is dummy variable such that: $Z_{WL} = 1$ for 1976-1983

$Z_{WL} = 0$ otherwise

Wearing apparel industry NIOD

$$NIOD = \underset{(5.76)}{0.677} NIOD_{-1} + \underset{(3.04)}{0.072} T - \underset{(3.54)}{0.880} Z_{OD} - \underset{(0.40)}{0.069}$$

$R^2 = 0.909$ D-W = 1.993

where Z_{OD} is dummy variable such that: $Z_{OD} = 1$ for 1978-1983

$Z_{OD} = 0$ otherwise

Leather and leather products industry NISK

$$NISK = \underset{(6.52)}{0.559} NISK_{-1} + \underset{(5.61)}{0.133} T - \underset{(6.54)}{1.832} Z_{SK} - \underset{(1.43)}{0.248}$$

$R^2 = 0.94$ D-W = 2.40

where Z_{SK} is dummy variable such that: $Z_{SK} = 1$ for 1978-1982

$Z_{SK} = 0$ otherwise

Food industry NISP

$$NISP = \underset{(7.01)}{0.996} NISP_{-1} - \underset{(2.17)}{0.328} NISP_{-3} + \underset{(2.51)}{1.279} T - \underset{(1.72)}{10.277} Z_{SP} - \underset{(0.55)}{2.275}$$

$R^2 = 0.916$ D-W = 1.644

where Z_{SP} is dummy variable such that: $Z_{SP} = 1$ for 1978-1983

$Z_{SP} = 0$ otherwise

Transportation NIT

$$NIT = \underset{(4.24)}{0.569}\ NIT_{-1} - \underset{(0.66)}{0.065}\ T^2 + \underset{(1.92)}{4.778}\ T - \underset{(3.18)}{56}\ Z_T - \underset{(0.06)}{0.687}$$

$R^2 = 0.932$ D-W = 1.236

where Z_T is dummy variable such that: $Z_T = 1$ for 1981-1983

$Z_T = 0$ otherwise

Internal trade NIH

$$NIH = \underset{(6.16)}{1.633}\ NIH_{-1} - \underset{(2.54)}{1.107}\ NIH_{-2} + \underset{(1.46)}{0.395}\ NIH_{-3} - \underset{(0.2)}{0.423}\ Z_H + \underset{(1.42)}{2.733}$$

$R^2 = 0.908$ D-W = 1.800

where Z_H is dummy variable such that: $Z_H = 1$ for 1979-1983

$Z_H = 0$ otherwise

Table C.1

Appendix C

Forecasted values of production in I, II, III quarters 1985 (current prices)

Sectors of industry and economy	Quarters					
	I		II		III	
	percentage errors	forecasted production	percentage errors	forecasted production	percentage errors	forecasted production
1	2	3	4	5	6	7
1. Coal industry	-7.4	151.7	5.1	170.0	3.9	171.7
2. Fuel industry	-9,4	158.2	-3.9	159.2	-5.1	178.2
3. Power industry	-10.7	91.7	6.1	89.4	12.7	89.7
4. Ferrous metallurgy	3.2	177.7	-3.7	177.5	1.0	187.6
5. Non-ferrous metallurgy	0.7	99.4	-15.2	87.3	-22.7	79.0
6. Machinery and structural metal industry	-6.4	110.5	-12.7	105.9	4.9	113.5
7. Engineering industry	2.0	198.3	-8.5	186.3	4.0	203.9
8. Precision instruments and apparatus	-0.7	26.9	-14.5	25.7	-3.5	29.4
9. Transport equipment industry	3.7	201.3	-12.4	190.1	5.3	205.0
10. Electric engineering and electronic industry	-2.0	121.3	-8.5	119.4	0.4	124.3

Table C.1 (contd)

1	2	3	4	5	6	7
11. Chemical industry	-5.6	214.8	1.0	249.5	0.4	246.1
12. Building materials industry	15.3	71.0	-16.3	68.4	0.2	82.0
13. Glass, glass products and pottery industry	-3.3	26.6	-12.6	24.9	-10.7	24.3
14. Wood industry	-9.3	76.8	-12.9	75.7	-3.0	81.0
15. Paper industry	-18.9	26.1	-18.4	26.6	-9.4	30.9
16. Textile industry	-8.4	169.5	-5.2	181.1	0.4	188.4
17. Wearing apparel industry	-3.3	64.0	1.8	68.9	28.7	72.2
18. Leather and leather products industry	-9.6	60.5	2.3	64.2	-2.5	57.8
19. Food industry	0.8	652.9	4.7	645.4	-10.6	619.4
20. Industry total	-7.4	1 627.7	7.9	2 233.8	-4.8	2 168.9
21. Gross production of construction						
in current prices	1.2	208.4	7.5	247.6	-2.5	292.2
in constant prices	-9.5	126.7	5.4	183.4	-10.6	172.8
22. Freight transport	6.3	245.6		266.9		282.7

S o u r c e: Author's calculations.

Table C. 2

Investment outlays by sectors of industry and economy

Sectors of industry and economy	Investment outlays in 1984	Percentage errors	Forecasts		
			1984	1985	1986
1	2	3	4	5	6
Economy total	1 258.9	0.3	1 259.8	1 358.5	1 456.8
Industry total	361.5	-3.6	348.6	394.3	424.6
Coal industry	55.6	-19.0	60.8	55.5	53.4
Fuel industry	14.6	-0.02	14.3	20.15	24.0
Power industry	57.2	0.7	57.8	61.5	65.6
Ferrous metallurgy	12.2	-7.38	11.3	21.0	32.2
Non-ferrous metallurgy	9.9	64.3	13.5	11.3	16.5
Machinery and structural metal industry	14.9	13.3	16.9	20.5	23.6
Engineering industry	28.0	2.81	28.9	28.7	28.9
Precision instruments and apparatus	3.7	-5.41	3.5	4.1	4.6
Transport equipment industry	23.3	2.15	23.8	25.9	28.1
Electric engineering and electronic	11.0	12.72	12.4	12.6	14.3
Chemical industry	36.1	8.31	39.1	45.0	48.9
Building materials industry	13.1	-22.14	10.2	13.4	14.1

Table C. 2 (contd)

1	2	3	4	5	6
Glass, glass product and pottery industry	2.7	11.11	3.0	3.4	3.9
Wood industry	6.3	-4.76	6.0	7.8	10.0
Paper industry	5.7	-10.53	5.1	6.0	5.6
Textile industry	12.1	-19.01	9.8	13.7	15.3
Wearing apparel industry	3.6	5.56	3.8	4.2	4.8
Leather and leather products	3.0	-16.67	2.5	3.1	3.2
Food industry	43.1	2.55	44.2	51.5	60.6
Construction	28.1	-2.14	27.5	33.8	39.0
Agriculture	216.7	-1.94	212.5	231.2	252.3
Transportation	91.3	-0.01	90.5	103.5	111.8

S o u r c e: Author's calculations.

Table C. 3

Fixed assets by sectors of industry (constant prices)

Sectors of industry	Fixed assets in 1984	Percentage errors	Forecasts		
			1984	1985	1986
1	2	3	4	5	6
Industry total	9 038.5	-0.54	8 989.3	9 269.9	9 520.7
Fuel and power industry	2 484.4	-1.84	2 438.7	2 559.6	2 645.6
Coal	841.3	-3.89	808.6	836.4	849.5
Fuel	422.3	0.28	423.5	442.4	460.9
Power	1 220.8	-1.57	1 201.6	1 268.9	1 319.3
Metallurgic industry	1 163.5	-3.12	1 166.6	1 180.8	1 240.9
Ferrous	844.2	0.71	850.2	858.8	881.1
Non-ferrous metals	319.3	0.25	320.1	325.9	332.6
Electro-engineering industry	1 995.4	1.08	2 016.9	2 072.9	2 161.0
Machinery and structural metal prod.	362.6	3.83	376.5	382.2	399.6
Engineering	691.7	-0.30	689.6	713.5	738.9
Transport equipment	583.9	-0.98	578.2	595.7	609.2
Precision instruments and apparatus	63.1	-0.92	62.0	63.7	68.6
Electric engineering and electronic	295.6	0.39	296.7	306.1	317.9
Chemical industry	888.7	0.36	885.9	943.6	965.8

Table C. 3 (contd)

1	2	3	4	5	6
Mineral industry	528.5	0.38	530.5	539.8	551.5
Building materials	435.6	0.30	436.9	444.7	453.8
Glass, glass products and pottery industry	92.5	1.30	93.7	94.8	97.4
Wood and paper industry	365.8	1.07	369.7	375.8	386.4
Wood	203.7	1.10	201.5	207.0	217.6
Paper	162.1	-7.4	174.1	174.0	186.6
Light industry	555.5	-0.22	554.3	570.7	588.3
Textile	450.3	-0.20	449.4	460.5	472.5
Wearing apparel	46.7	-1.07	46.2	49.2	52.1
Food industry	884.2	0.27	886.6	908.8	939.5
Other industrial branches	172.4	7.77	185.8	192.8	215.7

S o u r c e: Author's calculations.

Izabella Kudrycka

KWARTALNY PROGNOSTYCZNY MODEL
GOSPODARKI POLSKI

Celem modelu jest krótkookresowe prognozowanie gospodarki Polski. Zakres i własności modelu są określone przez dwie podstawowe przyczyny, po pierwsze, kryzys gospodarki polskiej i konieczność rozważania niedoborów w produkcji i imporcie bilansu płatniczego, stopnia wykorzystania zdolności produkcyjnych, nierównowagi rynkowej i wysokiej inflacji. Po drugie, w modelu uwzględniono reformę w gospodarce polskiej, tworzącą nową rolę centralnego planisty i określającą rosnące znaczenia przedsiębiorstw.

Przedmiotem analiz i prognozowania jest dochód narodowy, jego struktura, kategorie popytu finalnego i czynniki będące "wąskim gardłem" w gospodarce. Model składa się z trzech podmodeli. Pierwszy z nich zawiera modele trendu oraz modele typu Boxa-Jenkinsa dla zmiennych egzogenicznych. Drugi podmodel jest modelem produkcji w podziale na 26 gałęzi gospodarki. Relacje typu input-output oraz kategorie typu majątek produkcyjny, inwestycje, zatrudnienie, akumulacja finansowa przedsiębiorstw tworzą trzeci podmodel.