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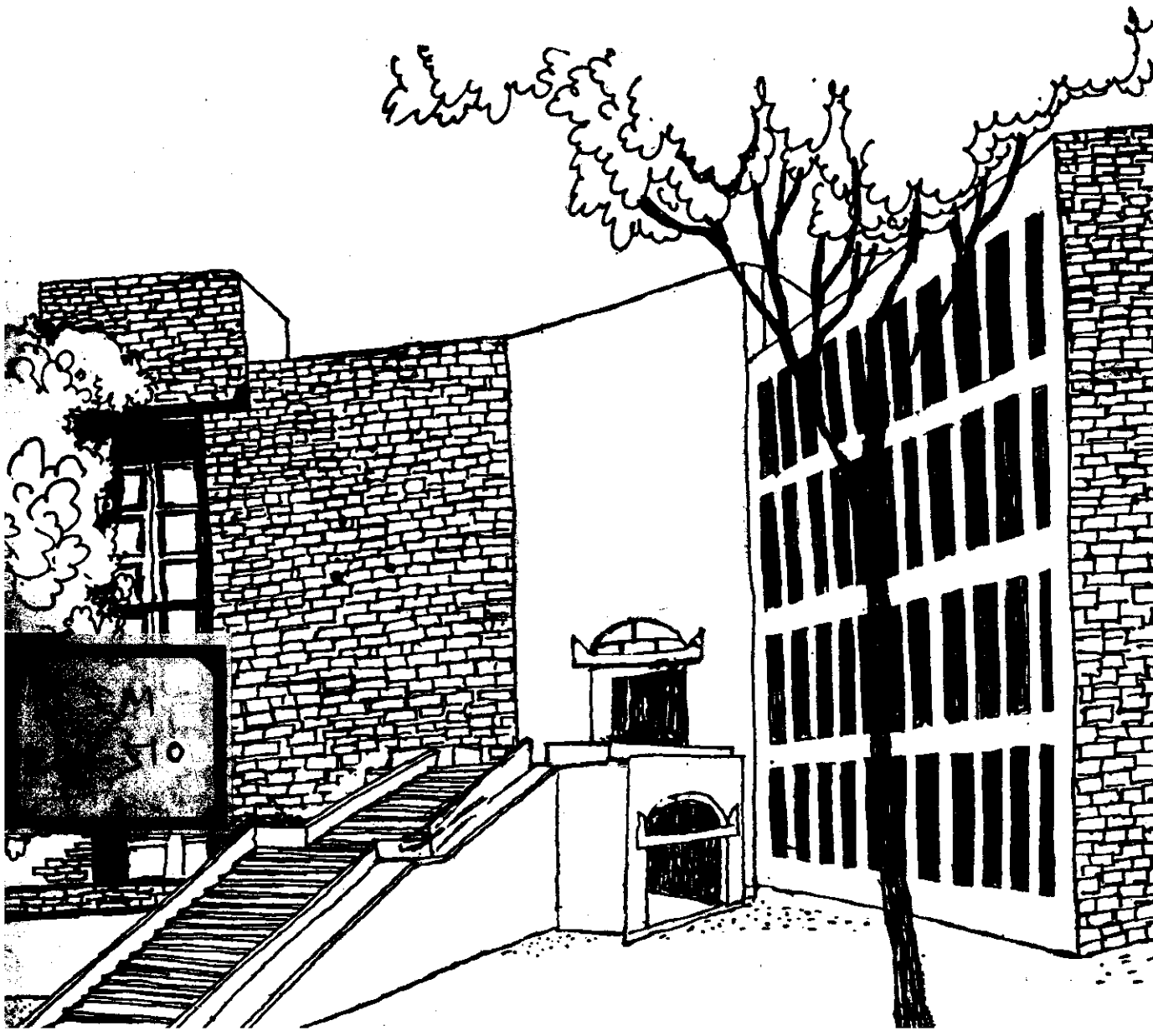

QUANTIFICATION OF OPTIMAL ROLE OF GOVERNMENT EXPENDITURE ON EDUCATION FOR REGIONAL DEVELOPMENT IN GUJARAT, INDIA

By

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QUANTIFICATION OF OPTIMAL ROLE OF GOVERNMENT EXPENDITURE ON EDUCATION FOR REGIONAL DEVELOPMENT IN GUJARAT, INDIA.

by

P.N.Misra*

The Problem

Education is perceived to be principal source of knowledge as well as skill. Since acquisition of relevant education makes one accessible to non-orally communicated information which in turns opens up all kinds of ways and means of production and distribution of goods and services that have been recorded in past, this kind of effort is also interpreted as investment in human capital. Education also contributes to expansion of socio-political communication and general awareness and, if done properly, this should lead to better distribution of income and choice of relevant government. Thus education is supposed to foster growth and better distribution of goods and services in the sense of maximisation of social welfare. Planning for more relevant education should be viewed from this angle. This paper provides an approach to achieve this task both in conceptual as well as quantitative sense. This problem has been discussed by the author in a separate study [1] where education is seen as one segment of social services which in turn is examined in relation to real sector of economy. This paper is extracted from this study with a view to examine the issue in question in sufficient details.

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A natural classification of education will be as follows:

(1) Primary education

(2) Technical education

(3) Secondary education

(4) Agricultural education

(5) Rest of the education including University education, Special education, General education, etc.

Though primary education is the first step for moving on to higher level of education, the reverse is also true in causative sense because educated couples would have more demand for primary or technical education for their children than others. Therefore such basic components of education as primary and technical education are in fact endogenous variables which are causal variables in some relations and effect variables in others. Further, while quantifying the relations, education can be treated as independent sector or part of a system. In either case the following analytical cum policy questions would arise and the same have to be resolved in a sensible manner:

(1) How to quantify impact of educational variables on other variables and vice-versa?

(2) How to use these estimates to arrive at an optimal expenditure cum achievement policy decision?

(3) Should such a decision be arrived at state level or taluk levels and if yes what are the likely benefits?

These questions are planned to be attempted conceptually as well as empirically in the present study. The study relates to Gujarat State of

Indian Union. Three typical talukas of Gujarat, namely, Dhoraji, Senand and Dharampur are selected to extend the study in regional context. Talukas in Gujarat are same as development blocks and the three talukas mentioned above represent three levels of development within the State. Dhoraji represents developed regions, Sanand represents regions of medium level of development and Dharampur represents backward regions. This is done for the sake of saving space otherwise the study can be easily extended to all the talukas of the State which will certainly make a better implementational sense.

2. Data, Their Trends and Emerging Issues

Considering system as a whole as we shall specify at a later stage, we can divide the variables into two groups. The first group consists of expenditure variables while the second group consists of relevant economic, social and demographic variables. A brief description of these is given in Appendix 1 for reference. Using time series data from 1961-62, the inception year of Gujarat, to 1977-78, upto which data were available during the study, we computed mean, standard deviation and coefficient of variation for preliminary identification of issues involved. Actual data are reported in full in the original study. We also used figures relating to budgets(B), revised budgets (RB) and actual expenditures (A) over the years to identify types of mismatching errors in the dominant sense, as given in Table 1 below:

Table 1: Types of Dominant Errors

Error Type	Error description
I	B < A, RB > A
II	B > A, RB > A
III	B < A, RB < A
IV	B > A, RB < A

The summary statistics as mentioned above and the error types as given in Table 1 are presented together for educational expenditure figures in Table 2 below. All the measurements are in Rs. crores.

Table 2: Error types and Estimated Statistics

Actual expenditure on	Mean	Standard Deviation	Coefficient of variation	Error Type
Primary education	22.33	17.59	0.79	I
Technical education	1.95	0.97	0.50	II
Secondary education	13.19	11.99	0.91	I
Agricultural education	0.82	1.11	1.35	I
Rest of the education	9.85	5.0	0.51	I
All education	51.66	39.16	0.76	I

It is obvious from the above table that all expenditure variable on education except technical education are associated with budgeting error type I. This means that a common tendency of budget makers in respect of education in general except technical education has been over the years to underestimate in the beginning of the year, overestimate during the middle of the year and end up with actual expenditure being less than the revised estimate. At the same time the original study

shows that expenditures on such politically sensitive areas as family planning, rural water supply, housing for rural poor, etc. are subject to error of type II as is expenditure on technical education. This implies that budgetary allocations have been invariably shown to be on the higher side on both the occasions of original and revised budgets in case of sensitive areas to present a rosy picture for mass consumption. Putting together one finds that expenditure on education except technical education is guided more by inbuilt structural needs implying a smoother trend than any strong demand for the same or a planned effort to boost it up in view of its perceived impact of the right kind. Coefficients of variation, given in Table 2, suggests relatively slower growth of expenditure on technical education provides an interesting example where attempt has been made to boost it up in budgetary game but actual growth has been kept at lower level. What actually caused this phenomenon could be an interesting problem to investigate.

The indication provided by coefficients of variation relating to growth rates was pursued further to cover all the variables of the system. For this purpose compound growth rates were computed from the corresponding exponential trend function and the same are given in Table 3 where meaning of symbols are same as in Appendix 1.

Table 3: Compound Growth Rates

Variable	Growth Rate	Variable	Growth Rate	Variable	Growth Rate	Variable	Growth Rate
PEE	16	APH	15	ETD	20	RUP	2
TEE	13	FPE	30	AGP	10	URP	4
SEE	21	RWS	9	INP	12	FLR	2
AGE	28	ECS	14	TOW	1	BRT	-2
REE	10	AHE	22	IMR	-3	DRT	-3
ALE	16	FAD	357	SDP	11	RDP	13
HRP	31	ENP	88	INW	2	REW	1

Considering the results given in Tables 2 and 3 together we observe that variables with lower growth rates have lower coefficient of variation. This is what one would have expected in context to time-series data. Expenditures on rest of the education, technical education and agricultural education have exhibited growth rates in increasing order. Are these important to the economy in the same order? Expenditure variables have shown higher growth rates in comparison to production variables. Can this pattern be allowed to continue? If not what is the better alternative and in what sense? In other words, government expenditure policy in general and on education in particular should be determined in some optimal sense while optimisation be done in context to objectives of the society in question.

Direct linking of expenditure on education with socio-economic variables can be done in the present case with disadvantage because the former have tended to show fluctuating pattern while the latter have tended to exhibit relatively smoother path. This can happen when causation

is multidirectional and multivariate. In such cases simultaneous equations modelling is better than sectoral or partial approaches.

In regional context, however, one must raise additional issues like which one of global and regional expenditure decisions is more efficient and how to work them out? Intuitively it appears that regionalisation of expenditure decisions should lead to improvement in effectiveness, relevance, balanced regional development and implementational feasibility but, wherever possible, these assertions require to be empirically justified to make them more convincing.

3. Estimation of Model and Quantification of Impacts

As discussed in the introductory section we should hypothesise the model in present context so that primary and technical education are endogenous variables. The specification should be realistic in the sense of incorporating in it the causative pattern the way it is in actual practice, it should be logical in behaviourial sense and it must be compatible with observed facts. In actual practice one has to try several alternatives to satisfy these requirements but we report below the one that came closest to meet our criteria. This is done to save space. In general we may specify such relations to explain expenditure on primary and technical education in the following manner.

$$(3.1) \qquad PEE = f(OPE, RUP, URP, SDP, FLR, u_1)$$

$$TEE = f(SEE, ECS, INW, u_2)$$

where symbols are same as explained in Appendix 1 and u_1, u_2 represent errors in respective relations. Taking sectoral view these relations can

be estimated independently of each other according to ordinary least squares (OLS) procedure. These estimates are given below:

$$(3.2) \quad PEE = 72.39 + 1.59^{*}\ OPE - 7.66^{*}\ RUP + 4.66^{*}\ URP + 0.0001\ SDP + 0.41^{*}\ FLR \qquad R^2 = 0.98$$

$$TEE = -7.31^{*} + 0.02\ SEE + 0.002\ ECS + 0.008^{*}\ INW \qquad R^2 = 0.97$$

The symbol * represents that the coefficient is statistically significant at 90 percent level of confidence and R^2 represents squared multiple correlation.

It was pointed out earlier that considering relation in (3.1) as part of relevant system would make better sense. This has been done in the original study by the author where the system was estimated according to two-stage least-squares (2SLS) procedure. The entire system so estimated is given in Appendix 2 of this paper.

Estimated relations in (3.2) show that other than primary education expenditure (OPE), urban population (URP) and female literacy rate (FLR) variables made positive and significant contribution on primary education expenditure (PEE) while rural population made significant but negative contribution. This may be owing to possibility of urbanites exercising more effective pressure on government to provide them primary education while rural folks are ignored owing to thier indifference or lack of organised pressure emerging from their side. Facts relating to primary schools in rural and urban areas speak out in favour of this possibility. As regards expenditure on technical education is concerned only employment in industry made significant and positive contribution. Others did contri-

bute in the right direction but could not stand the 90 percent level of test of significance. These inferences are not enough to answer the questions we raised earlier. We will go beyond these in the next section.

Before moving on to next section we must examine the distributional impact of expenditure on education. In this context we reproduce below relevant findings in the original study where distributional impact was estimated in accordance with the following three criteria:

Criteria 1: Estimation of distributional impact on output generating sectors such as producers of food-grains and those in industry and trade. The former are designated as poor while latter are designated as rich in context to Indian conditions.

Criteria 2: Estimation of distributional impact in accordance with expenditure in employees and others.

Criteria 3: Estimation of distributional impact in accordance with material benefits of recipient group.

Estimates relating to these criteria are given below for expenditur on education as a whole:

Table 4: Distributional Impact

Criteria	Recipient Group	Percentage Share
1	Poor	78.48
	Rich	21.51
	Government	0.01
	Total	100.00
2	Employees	82.14
	Others	17.86
	Total	100.00
3	Material benefit	1.60
	Others	98.40
	Total	100.00

Results in Table 4 show that according to present structure of expenditure in education sector Rs.78.48 goes to industry and trade and Rs.21.51 goes to producers of foodgrain for every Rs.100 expenditure by government. Thus a vast majority, belonging to production of food grains sector, receive relatively far less from whatever is spent via government on education. Looking from employment angle Rs.82.14 out of 100 goes to them but viewed from the point of view of material benefits to students only Rs.1.60 out of 100 goes to them while the remaineder is spent on sustaining the departmental structure. In other words, the present expenditure on education is almost entirely used up in maintaining the structure created by it and while doing so leads to benefit secondary and tertiary sector of economy. This happens every year in financial terms and evidence abounds that even those who are educated by investing savings from the rural sector seek employment in secondary and tertiary sectors and contribute to their growth in whatever manner they get employed.

4. Determination of Optimal Government Expenditure Policy at State and Block Levels

First of all we must clarify the concept of optimality used in the present study. It has been done in three stages. Firstly, at the stage of estimation of the structure, as given in Appendix 2 or relation (3.2), where error sum of squares gets minimised. Secondly, at the stage of determination of optimal solutions where quadratic loss function gets minimised. Thirdly, at the stage of evaluating alternative expenditure plans by examining the one that maximises the following efficiency criterion:

$$(4.1) \qquad e = \frac{\text{marginal increase in domestic product}}{\text{marginal increase in government expenditure}}$$

It is possible at the third stage that efficiency criterion e is replaced by maximisation of employment, or minimisation of infant mortality rate, or a trade off between any two objectives. This freedom is available to decision makers depending upon the objective preferred by the society.

Having estimated the structure in accordance with first criterion of optimality, the second criterion was employed in the following manner. The endogenous variables were treated as instruments. Alternative levels were assigned to goal variables from all possible considerations. Then the solution for instruments were obtained so that if these levels were operated upon the emerging levels of endogenous variables from the estimated structure would be closest to respective goals assigned to them. Details of this method as developed by the author can be seen in the original study.

Set of goal and instrument variables so determined is termed as a policy alternative. Several such alternatives were evaluated on the basis of efficiency criterion, as defined in (4.1), for the state as well as block levels. Those found efficient from this consideration were examined from the point of view of percentage increase over the previous year. These percentage increases are reported for selected variables in the following table for year 1980-81 for illustrating the regional as well as state level implications of the emerging results:

Table 5: Growth Corresponding to State and Block Level Optimal Policy Decisions

Variable	State Level	Dhoraji	Sanand	Dharampur
PEE	3.7	12.2	17.5	27.6
TEE	8.3	33.0	50.0	233.0
SEE	5.5	8.7	19.0	19.1
REE	4.9	9.1	18.2	2.0
AGP	4.6	13.4	9.0	14.4
INP	6.0	14.7	29.0	33.0
RDP	4.7	14.5	15.4	17.0
INW	1.7	2.0	9.0	34.0
REW	0.5	3.2	1.4	2.1
ECS	4.7	12.0	17.0	21.0

5. Conclusions

Results reported in Table 5 provide all the relevant conclusions emerging from the issues raised in this paper. First of all we note a general feature that growth rates corresponding to regional decisions are much higher than the state level decisions in respect of expenditure,

domestic product and employment. This implies that the absorptive capacity of expenditures, growth possibilities and employment possibilities can be improved via regional decisions. Growth rates of expenditure variables and production variables in Table 5 are relatively closer than those given in Table 3. Thus it is possible that optimal expenditure decisions could narrow it down further if the process is continued over a long period of time.

In terms of components of education, expenditure on technical education aught to be given much bigger push in more backward regions than relatively developed regions. Further, technical education should get highest priority followed by primary education, secondary education and rest of the education. Thus we find that the optimal pattern is widely different from the pattern that emerged in past as we saw in Table 3.

Looking at the production sectors, industry premises much higher growth in backward regions than developed ones. The same relative pattern is promised by agriculture and tertiary sectors but with a much more reduced distinctiveness in context to backward and developed regions. Employment possibilities are also revealed to be much faster in industrial sector pertaining to backward regions than in other sectors or in developed regions.

Considering all the variables in Table 5 we find that backward regions require much faster growth of expenditure but in turn promise much faster growth in production as well as employment. If this policy is adopted in a scientific manner as brought out in this paper regional

disparities will not only get reduced but this could happen within shortest possible span of time.

State level growth rates in Table 5 are relatively low because alternative goals were set at levels compatible with trends pertaining to most recent years which themselves were lower then the corresponding growth rate pertaining to entire time span. Besides, the optimality exercise has shown a tendency of low growth rates in the initial years owing to implicit balancing required in the process but if the process is continued over several years the growth rates keep on improving year after year. A similar exercise has actually been done in the original study to see where the economy of Gujarat would have been if optimal expenditure decisions were made right from the inception year of the State. It was found that if this were done actual SDP figure corresponding to year 1977-78 would have been surpassed by the year 1965-66 itself. Similarly, it was found that even without changing tax rate total revenue of Gujarat in the year 1970-71 would have been surpassed by only additional revenue generated from additional SDP created in the process. Thus social opportunity loss of not following a scientific budgeting process is tremendously high in the long run. This has been found to hold good in case of education as well as other sectors belonging to social services. All the available indications suggest that this is likely to be true in general.

REFERENCE

[1] Misra P.N. Optimal Government Expenditure Policy: A Case Study of Expenditure on Social Services in Gujarat, India, PSG Monograph No.28, Indian Institute of Management, Vastrapur Ahmedabad, Gujarat, India 380 015.

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Appendix 1

Sr.No.	Symbol	Unit as measure-ment	Description
1	PEE	Rs. in crores	Expenditure on primary education
2	TEE	Rs. in crores	Expenditure on technical education
3	HRP	Rs. in lakhs	Housing for rural poor including various schemes, namely, slum Clearence Scheme, Rural Housing Scheme, Low Income Group Housing Scheme, SC/ST/Nomadic Tribes Scheme, Middle Income Group Scheme, Schemes financed from HUDCO and Save a Rupee Scheme.
4	APH	Rs. in lakhs	Expenditure on aggregate primary health including expenditure on eradication of diseases such as Small-pox, malaria, filaria, T.B., Leprosy, trachoma, etc.
5	FPE	Rs. in lakhs	Expenditure on family planning
6	RWS	Rs. in lakhs	Rural Water Supply
7	AGP	Rs. in crores	State Domestic Product at current prices as originating from agriculture, forestry, logging and fishing etc.
8	INP	Rs. in crores	State Domestic Product at current prices as originating from mining, quarrying, manufacturing, construction, electricity, gas and water supply etc.
9	TOW	No.in thousands	Total workers
10	IMR	Per thousand	Infant Mortality Rate
11	ALE	Rs. in crores	Expenditure on all education including primary education, secondary education, university education, special education, general education, sports and youth welfare, agriculture education and medical education.
12	SDP	Rs. in crores	State Domestic Product at current prices
13	INW	No.in thousands	Industrial workers
14	RUP	No. in lakhs	Rural population

Appendix 1 (contd.)

Sr. No.	Symbol	Unit as measure-ment	Description
15	URP	No.in lakhs	Urban population
16	FLR	per ten thou-sand	Female literacy rate in Gujarat as measured by literate women per 10,000 of female population
17	SEE	Rs. in crores	Expenditure on secondary education
18	ECS	Rs. in crores	Expenditure on economic services
19	AHE	Rs. in lakhs	Expenditure on all housing activities
20	FAD	Rs. in lakhs	Expenditure on food adulteration and drug control services
21	BRT	per thousand	Birth rate
22	AGE	Rs. in crores	Expenditure on agriculture education
23	DRT	per thousand	Death rate
24	ROP	Rs. in crores	Rest of the domestic product at current prices including all components of SDP except those originating from agriculture and industry.
25	REE	Rs. in crores	Expenditure on remaining education includes expenditure for all education except primary education, secondary education, technical education and agricultural education.
26	REW	No.in thousands	Rest of the workers representing workers other than industry.
27	ENP	Rs. in lakhs	Expenditure on nutritional programmes
28	ETD	Rs. in lakhs	Training of Dais (Auxiliary midwives)

Appendix-2

2SLS ESTIMATED MODEL

$$PEE = 64.55 + 1.46\ OPE - 6.67\ RUP + 3.83\ URP + 0.004\ SDP + 0.36\ FLR$$

$$TEE = -7.31 + 0.02\ SEE + 0.092\ ECS + 0.008\ INW$$

$$\text{Log } HRP = -12.08 + 0.0004\ SDP + 0.10\ RUP - 0.04\ PEE - 0.03\ SEE$$

$$APH = -820.66 - 12.91\ RUP + 57.91\ URP + 6.63 \log AHE - 9.10\ ALE - 17.96\ FAD + 1.30\ FPE$$

$$FPE = -867.71 + 9.86\ ALE + 113.67\ RUP - 60.37\ URP - 0.32\ SDP - 6.35\ FLR - 1.90\ BRT$$

$$RWS = -7266.1 + 4.14\ FLR - 123.17 \log HRP - 39.90\ PEE + 677.99\ AGE - 0.23\ AGP + 55.44\ DRT - 6.24\ RUP$$

$$AGP = -2606.82 - 0.43\ RWS + 19.72\ RUP + 77.06\ AGE$$

$$INP = -988.84 + 1.07\ INW + 0.49\ ALE + 13.40 \log AHE + 2.05\ ECS$$

$$TDW = 7381.48 + 0.88\ AGP + 0.95\ INP - 0.24\ RDP - 21.92\ PEE + 24.78\ OPE$$

$$IMR = 112.43 - 0.01\ FPE - 0.008\ RWS - 0.04\ FLR + 3.06\ DRT + 0.02\ INP$$

$$ALE = PEE + OPE$$

$$OPE = TEE + SEE + AGE + REE$$

$$SDP = AGP + IGP + RDP$$

$$INW = TDW - REW$$