PATH ANALYSIS OF SOCIO-ECONOMIC IMPACT OF MNREGA ON BENEFICIARIES

K. M. Parmar[1] M .R. Prajapati[2] and A. C. Jatapara[3]

1&3 Ph.D. Scholar, CPCA, SDAU, S.K.Nagar - 385506 (Gujarat) India
2 Rtd.Principal, C. P. C.A., S.D.A.U., S.K.Nagar - 385506 (Gujarat) India
Email: karanparmar3593@gmail.com

ABSTRACT

To know the cause and effect relationship between two variables, path coefficient analysis was carried out according to the procedure described by Dewey and Lau (1959) using the estimates of correlation coefficients. Correlation coefficients of independent variables with socio-economic impact of MNREGA were used to estimate the path coefficient for indirect effect of various independent variables on socio-economic impact of MNREGA. Looking to substantial indirect effect, Annual income exerted the highest positive effect through age upon socio-economic impact of MNREGA on beneficiaries.

Keywords: *path analysis: socio-economic impact of MNREGA*

INTRODUCTION

Path analysis was originally developed by geneticist Sewall Wright in the 1920s to examine the effects of hypothesized models in phylogenetic studies. Wright's analysis involved writing a system of equations based on the correlations among variables influencing the outcome and then solving for the unknown parameters in the model. According to Wright, the path analytic method was intended to measure "the direct effect along each separate path in such a system and thus of finding the degree to which variation of a given effect is determined by each particular cause." Wright also acknowledged the fact that often causal relations were uncertain and cautioned that this method was not intended to deduce causal relations simply from correlation coefficients. Rather, the method utilized information provided by the statistical correlations in conjunction with qualitative information regarding the causal relationships to find the consequences of hypothesized structures.

During the 1970s, path analysis became even more popular and numerous papers were published featuring path analytic methods in sociology, as well as psychology, economics, political science, ecology, and other fields. Since the early 1980s, path analysis has evolved into a variety of causal or structural equation modeling (SEM) programs and computer packages. Unlike earlier path models, which were based on least squares regression, these new methods of causal modeling utilize the general linear model approach. The advantages of these new approaches are discussed below in "Extensions and Computer Software."

OBJECTIVE

To study the path analysis of socio-economic impact of MNREGA on beneficiaries

METHODOLOGY

To know the cause and effect relationship between two variables, path coefficient analysis was carried out according to the procedure described by Dewey and Lau (1959) and Vinaya *et al.,* (2017) using the estimates of correlation coefficients. Correlation coefficients of selected independent variables with socio-economic impact of MNREGA were used to estimate the path coefficient for indirect effect of various selected independent variables on socio-economic impact of MNREGA.

The path coefficients were obtained by solving set of simultaneous equations given below.

$$r_{1y} = p_{1y} + r_{12y}p_{2y} + r_{13y}p_{3y} + \dots \quad r_{1iy}p_{iy} + \dots + r_{1ny}p_{ny}$$

$$r_{2y} = p_{2y} + r_{21y}p_{1y} + r_{23y}p_{3y} + \dots \quad r_{2iy}p_{iy} + \dots + r_{2ny}p_{ny}$$

$$\vdots \qquad \vdots \qquad \vdots \qquad\qquad \vdots \qquad\qquad \vdots$$

$$r_{iy} = p_{iy} + r_{i1y}p_{1y} + r_{i3y}p_{3y} + \dots \quad r_{i(i-1)y}p_{iy} + \dots + r_{iny}p_{ny}$$

$$\vdots \qquad \vdots \qquad \vdots \qquad\qquad \vdots \qquad\qquad \vdots$$

$$r_{ny} = p_{ny} + r_{n1y}p_{2n} + r_{n3y}p_{3n} + \dots \quad r_{n(n-1)y}p_{ny} + \dots + r_{nny}p_{ny}$$

Where,

r_{1y} to r_{iy}	=	Correlation coefficient between K^{th} independent variables and dependent variable (Y)
r_{i3} to $r_{i(i-1)}$	=	Correlation coefficient among independent variables
p_{iy} to p_{ny}	=	Direct effect of independent variables for 1 to n on dependent variable (Y) (Path coefficients)

The above equations were written in a matrix form are as under.

Matrix-A   **Matrix-C**   **Matrix-B**

$$
\begin{pmatrix} r_{1y} \\ r_{2y} \\ r_{3y} \\ \vdots \\ r_{iy} \\ \vdots \\ r_{ny} \end{pmatrix}
=
\begin{pmatrix}
1 & r_{12} & r_{13} & \dots & r_{1i} \\
r_{21} & 1 & r_{23} & \dots & r_{2i} \\
r_{31} & r_{32} & 1 & \dots & r_{3i} \\
\vdots & \vdots & & & \vdots \\
r_{i1} & r_{i2} & r_{i3}\dots 1 \dots & & r_{in} \\
\vdots & \vdots & & & \vdots \\
r_{n1} & r_{n2} & r_{n3}.r_{ni}\dots & & 1
\end{pmatrix}
\times
\begin{pmatrix} p_{1y} \\ p_{2y} \\ p_{3y} \\ \vdots \\ p_{iy} \\ \vdots \\ p_{ny} \end{pmatrix}
$$

With the help of matrix inversion the following form of inverted "C" matrix was obtained.

$$B = C^{-1} A$$

Where,

$$
C^{-1} =
\begin{pmatrix}
C_{11} & C_{12} & C_{13} & \dots & C_{1i} & \dots & C_{1n} \\
C_{21} & C_{22} & C_{23} & \dots & C_{2i} & \dots & C_{2n} \\
C_{31} & C_{32} & C_{33} & \dots & C_{3i} & \dots & C_{3n} \\
\vdots & \vdots & \vdots & & \vdots & & \vdots \\
C_{i1} & C_{i2} & C_{i3} & \dots & C_{ii} & \dots & C_{in} \\
\vdots & \vdots & \vdots & & \vdots & & \vdots \\
C_{n1} & C_{n2} & C_{n3} & \dots & C_{ni} & \dots & C_{nn}
\end{pmatrix}
$$

The direct effects were calculated as under.

$$p_{1y} = \sum_{i=1}^{n} C_{1i} \times r_{iy}$$

$$p_{2y} = \sum_{i=1}^{n} C_{2i} \times r_{iy}$$

$$p_{3y} = \sum_{i=1}^{n} C_{3i} \times r_{iy}$$

$$\vdots \qquad\qquad \vdots \qquad\qquad \vdots$$

$$p_{iy} = \sum_{i=1}^{n} C_{ii} \times r_{iy}$$

$$\vdots \qquad\qquad\qquad\qquad \vdots$$

$$p_{ny} = \sum_{i=1}^{n} C_{ni} \times r_{iy}$$

The indirect effects were calculated by taking the products of correlation coefficients between corresponding two variables and path coefficient (direct effect) connecting the causal effect with socio-economic impact of MNREGA.

$$R = [\, 1 - (p_{iy}\, r_{iy})\,]^{1/2}$$

Where,

$$p_{iy}\, r_{iy} = p_{1y}\, r_{1y} + p_{2y}\, r_{2y} + \ldots + p_{ny}\, r_{ny} = R^2$$

$$R^2 = \text{Coefficient of determination.}$$

RESULTS AND DISCUSSION

The correlation and regression analysis of data indicated association and relationship between independent (exogenous) and dependent (endogenous) variables in presence of all other variables, which were normally operative.

The association brought out by correlation studies could differ in another situation, where some of the independent variables may not exist in study or they may be latent.

The correlation coefficient (r) was found to be significant with respect to all independent variables (barring variable age) with the socio-economic impact of MNREGA on beneficiaries. In multiple regressions, 04 variables were found significant with the socio-economic impact of MNREGA on beneficiaries.

The data thus indicated that the observed relationship between the dependent and independent variables were only partly absolute and relative and a portion of observed relationship was the contribution made by other independent variables exercising their influence collectively.

It is therefore of interest to study influence of independent variables to the dependent variable both directly as well as through other variables present in the study. The complete Path coefficient analyses are given in Appendix 01. The direct, total indirect and first substantial indirect effect are presented in Table 1.

Table 1: Path coefficients showing the effect of independent variables on socio-economic impact of MNREGA on beneficiaries (n=200)

Sr. No.	Independent Variables	Direct effect	Total indirect effect	First Substantial indirect effect	
				(Through variable)	
X_1	Age	0.0629	0.0521	0.0384	X_{11}
X_2	Education	0.1293	0.3647	0.1499	X_{15}
X_3	Caste	-0.1551	-0.2579	-0.1091	X_{15}
X_4	Type of family	0.0130	0.395	0.1436	X_{11}
X_5	Size of family	0.0474	0.3446	0.1106	X_{15}
X_6	Land holding	-0.0350	-0.513	-0.1937	X_{11}
X_7	Annual income	-0.1836	0.8066	0.2184	X_{11}
X_8	Occupation	0.0651	0.3629	0.1544	X_{11}
X_9	Social participation	0.0731	0.3839	0.1414	X_{11}
X_{10}	Source of information	0.1087	0.5253	0.2028	X_{11}

Sr. No.	Independent Variables	Direct effect	Total indirect effect	First Substantial indirect effect	
				(Through variable)	
X_{11}	**Extension participation**	0.2770	0.424	0.1802	X_{15}
X_{12}	**Economic motivation**	-0.0469	0.6129	0.2049	X_{11}
X_{13}	**Innovativeness**	0.1188	0.5232	0.2131	X_{11}
X_{14}	**Attitude**	0.0161	0.5649	0.1994	X_{11}
X_{15}	**Knowledge**	0.3442	0.3328	0.1450	X_{11}

Direct effect

Out of the 15 independent variables analyzed, eleven independent variables exerted a positive direct effect and four independent variables exerted negative direct effect (Table 1) on the extent of socio-economic impact of MNREGA. The results are in line with Dahima and Thumar (2020).

Knowledge (0.3442) exerted largest direct and positive influence, extension participation (0.2770) followed it. The impact of remaining variables was comparatively negligible hence; knowledge was considered as important crucial variable followed by extension participation as far as direct positive effect are concerned.

Annual income (-0.1836) exerted largest direct negative effect. The remaining variables exerted comparatively negligible influence.

Total indirect effect

So far as total indirect effect is concerned, annual income exerted maximum positive indirect effect (0.8066) followed by economic motivation (0.6129), attitude (0.5649), source of information (0.5253), innovativeness (0.5232), extension participation (0.4240), type of family (0.3950),

social participation (0.3839), education (0.3647), occupation (0.3629), size of family (0.3446), knowledge (0.3328) and age (0.0521). Caste (-0.2579) and land holding (-0.5130) had negative indirect effect.

Substantial indirect effect (First)

Out of the 15 independent variables thirteen variables, exerted positive substantial indirect effect and two variable land holding (-0.1937) and caste (-0.1091) had negative substantial indirect effect. Annual income exerted maximum positive substantial indirect effect (0.2184) followed by innovativeness (0.2131), economic motivation (0.2049), source of information (0.2028), attitude (0.1994), extension participation (0.1802), occupation (0.1544), education (0.1499), knowledge (0.1450), type of family (0.1436), social participation (0.1414), size of family (0.1106) and age (0.0384) had negligible influence. Thus, these variables were considered important and crucial variables for socio-economic impact of MNREGA on beneficiaries as far as total indirect effect was concern. Majority of the variables exerted substantial indirect effect through extension participation (X11) inferring that in association with other variables extension participation was also an important crucial variable.

Appendix 1

Path coefficients matrix (Indirect/Direct) showing the effect of independent variables with socio-economic impact of MNREGA

Sr. No.	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	Corr. With Y
X_1	**0.0629**	-0.0224	-0.0045	0.0031	0.0175	0.0062	-0.0346	0.0134	0.0071	0.0147	0.0384	-0.0076	0.0235	0.0027	-0.0053	0.11492
X_2	-0.0109	**0.1293**	0.0341	0.0035	0.0091	0.0126	-0.0693	0.0102	0.0204	0.0381	0.1347	-0.0155	0.0423	0.0061	0.1499	0.49439
X_3	0.0018	-0.0284	**-0.1551**	-0.0014	-0.0047	-0.0107	0.0687	-0.0113	-0.0111	-0.0398	-0.0834	0.0145	-0.0382	-0.0047	-0.1091	-0.41304
X_4	0.0149	0.0345	0.0172	**0.0130**	0.0192	0.0134	-0.0855	0.0246	0.0236	0.0481	0.1436	-0.0221	0.0591	0.0075	0.0977	0.40873
X_5	0.0232	0.0247	0.0154	0.0052	**0.0474**	0.0078	-0.0572	0.0242	0.0150	0.0344	0.1024	-0.0136	0.0482	0.0049	0.1106	0.39266
X_6	0.0111	0.0465	0.0474	0.0049	0.0105	**0.0351**	-0.1480	0.0278	0.0324	0.0741	0.1937	-0.0284	0.0778	0.0101	0.1533	0.54825
X_7	0.0119	0.0488	0.0581	0.0060	0.0148	0.0283	**-0.1836**	0.0403	0.0454	0.0912	0.2184	-0.0374	0.1033	0.0131	0.1655	0.62357

Sr. No.	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	Corr. With Y
X_8	0.0129	0.0202	0.0270	0.0049	0.0176	0.0150	-0.1136	**0.0651**	0.0327	0.0626	0.1544	-0.0256	0.0764	0.0081	0.0705	0.42805
X_9	0.0061	0.0361	0.0235	0.0042	0.0097	0.0156	-0.1141	0.0291	**0.0731**	0.0529	0.1414	-0.0253	0.0676	0.0084	0.1286	0.45678
X_{10}	0.0085	0.0453	0.0568	0.0057	0.0150	0.0239	-0.1540	0.0375	0.0356	**0.1087**	0.2028	-0.0345	0.1003	0.0122	0.1697	0.63358
X_{11}	0.0087	0.0629	0.0467	0.0067	0.0175	0.0245	-0.1447	0.0363	0.0374	0.0796	**0.2770**	-0.0347	0.0914	0.0116	0.1806	0.70103
X_{12}	0.0102	0.0426	0.0479	0.0061	0.0138	0.0212	-0.1484	0.0355	0.0395	0.0798	0.2049	**-0.0469**	0.0947	0.0125	0.1530	0.56648
X_{13}	0.0125	0.0460	0.0499	0.0065	0.0193	0.0230	-0.1567	0.0419	0.0416	0.0918	0.2131	-0.0374	**0.1188**	0.0124	0.1629	0.64244
X_{14}	0.0106	0.0487	0.0455	0.0061	0.0145	0.0219	-0.1489	0.0329	0.0382	0.0824	0.1994	-0.0363	0.0915	**0.0161**	0.1585	0.58108
X_{15}	-0.0010	0.0563	0.0492	0.0037	0.0152	0.0156	-0.0883	0.0133	0.0273	0.0236	0.1450	-0.0209	0.0562	0.0074	**0.3442**	0.67703

R=0.5654 R^2= 0.6803

CONCLUSION

Knowledge was considered as important crucial variable as far as direct positive effect was concerned. Annual income exerted largest direct negative effect on socio-economic impact of MNREGA on beneficiaries. Annual income exerted highest positive total indirect effect and land holding exerted the highest negative total indirect effect on socio-economic impact of MNREGA on beneficiaries. Looking to substantial indirect effect, Annual income exerted the highest positive effect through age upon socio-economic impact of MNREGA on beneficiaries.

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