Estimating Productivity of Household Industry with Multivariate Regression: A Study of Handloom Industry in Koch Bihar District, West Bengal

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Abstract

The handloom industry is one of the oldest and the largest household based industry in India, representing and preserving the vibrant Indian culture. A large number of handloom industrial units are found in Koch Bihar district, which are mostly located in the rural areas. The biggest constraint towards this sector from developing have been the irregular and scanty supply of raw materials for entrepreneurial use. Productivity of handloom industry involves a process which is accounted for the actions and reactions of numerous social and economic factors. Some of these factors directly determine the above-mentioned process while some others operate indirectly. These factors are again closely interconnected with one another and a change in one is reciprocated by the others. Multiple regression provides a means of objectively assessing the degree and character of the relationship among these factors forming the variate of independent variables and then examining the magnitude, sign and statistical significance of the regression coefficient for each independent variable. Seventeen factors have been identified for the productivity of handloom industry of the selected villages of Koch Bihar district which have dominant influence. Using multiple regression model the paper attempts to examine how productivity of this household based industry is influenced by these identified factors. Based on the empirical analysis some policy measures have been suggested for the development of the sector.

Key Words: Handloom, Productivity Multivariate regression, Development, Policy Implications.

Introduction

Household industries are defined by census of India (1961) as industries which are conducted by the head of the household and/or by the members of family at home or within the village in the rural areas and in the precincts of the house in the urban areas. The larger proportion of workers in a household industry consist of members of the household including

the head. The household industries which include the village and cottage industries form an integral part of the structure of India's economy (Planning Commission, 1981). These industries not only raise the per capita income and standard of living of the people by providing employment opportunities but also reduce the disparities in the economic structure. Besides, the promotion of household industries provides an opportunity for the optimum utilisation of local resources to serve the local needs. They play important role in overall economic development of the country and contribute to the export earnings. Besides economic aspects, the social role household industries are quite significant in achieving various social goals such as removal of poverty, attainment of self-reliance, reduction in disparities in income, wealth and standard of living and regional imbalances (Kasemi, 2013).

The handloom industry is one of the oldest and the largest household based industry in India, representing and preserving the vibrant Indian culture. Indian artists are now distinguished world-wide for their hand spinning, weaving and printing elegance. The operations of this industry are primarily household-based, wherein various members of the family work together in a systematic manner. Most of the members are involved in industrial activity and put joint efforts for production.

A large number of handloom industrial units are found in the study area. The industrial units are located mostly in rural areas. Due to wide prevalence of illiteracy and poverty they lack scientific and technical knowledge and as a result of these their techniques of production remains inferior and the products lack standardization. The products are mostly sold in the local market. Middlemen play a powerful role in marketing these indigenous products. The prevalence of outdated mode of production has hampered the growth and development of the sector. The biggest constraint towards the sector from developing has been the irregular and scanty supply of raw materials for entrepreneurial use.

Productivity simply indicates the relation between the value-added (VA) or the quantity supplied and the inputs of production. Every incremental increase in productivity implies increased value-generation (value-added) with regard to inputs (Gurak, 1999).

Productivity of handloom industry involves a process which is accounted for the actions and reactions of numerous social and economic factors. Some of these factors directly determine the above mentioned process while some others operate indirectly. These factors are again closely interconnected with one another and a change in one is reciprocated by the others. Multiple regression provides a means of objectively assessing the degree and character of the relationship among these factors forming the variate of independent variables and then

examining the magnitude, sign and statistical significance of the regression coefficient for each independent variable.

Seventeen factors/variables have been identified for the productivity of handloom industry of the selected villages of Koch Bihar district which have dominant influence. Using multiple regression model the paper attempts to examine how productivity of this household industry is influenced by these identified factors. Based on the empirical analysis some policy measures have been suggested for the development of this household industry in the study area.

Objectives

The main objectives of the study are:

- To examine the structural relationship among the identified factors related to productivity of handloom industrial units in the study area
- To estimate the productivity of the handloom industrial units
- To derive policy implications from the analysis with regard to the development of the sector

Study Area

The district Koch Bihar is extended between $25^0$57'47" to $26^0$36'2" North latitude and between $89^0$54'35" to $88^0$47'44" East longitude. The area of the district is 3387 km^2, which contributes 3.82 per cent of the land mass of the State of West Bengal. Koch Bihar is a district under the Jalpaiguri Division of the state of West Bengal. It is located in the north-eastern part of the state and bounded by the district of Jalpaiguri in the north, state of Assam in the east and the international border in the form of Indo-Bangladesh boundary in the south as well as in the west. As per the Census 2011, Koch Bihar had population of 2,819,086 of which male and female were 1,451,542 and 1,367,544 respectively.

Data Base

The present study is based on a primary survey, designed to collect data on the general and economic performance of the handloom industrial sector. 65 sample units have been drawn from 10 villages of 4 community development blocks of Koch Bihar district with simple random sampling method without replacement. The sampling has been done with the help of random number table (Random Sampling Number arranged by Tippet).

Methodology

Productivity of handloom industry comprises of several interdependent subsystems each involving several variables or factors. Multiple regression models have been used in the present study to predict productivity of handloom industry. In the process of estimating the models, several factors related to it are identified as model variables.

Multiple regression analysis, a form of general linear modelling, is a multivariate statistical technique used to examine the relationship between a single dependent variable and a set of independent variables. Each independent variable is weighted by the regression procedure to ensure maximal prediction from the set of independent variables. The weights denote the relative contribution of the independent variables to the overall prediction and facilitate interpretation as to the influence of each variable in making the prediction, although correlations among the independent variables complicate the interpretative process. The set of weighted independent variables forms the regression variate, a linear combination of independent variables that best predicts the dependent variable. The regression variate, also referred to as the regression equation or regression model, is the most widely known example of a variate among the multivariate techniques. In the present regression model, productivity of pottery industry is the dependent variable. Seventeen parameters like standard mandays, duration of daily hours of operation, experience, and educational level of the workers etc. have been identified as the predictors.

Based on the computed data collected from field survey the model has been constructed using statistical software SPSS-22. The method of least square has been used to estimate the equation.

Models of the mechanism depicting the causal relationships among the principal objectives and their determinants have been devised. Estimation of the model has been done with appropriate techniques to yield structural relations/equations. Structural relations has been studied which reveals of the pattern of working of the objective and policy variables in an internally linked fashion. They also indicate the impact of policy variables on principal objectives and intermediate variables (Kasemi, 2014).

Modelling of Variables for Estimating Productivity

Models have been developed to estimate the relevant structural equations and to interpret the co-efficient associated with different explanatory variables in the broad framework of productivity increase mechanism in the Handloom Industrial Units.

The models which represent the mechanism of income generation has been developed assuming the following notational form:

Y_1 f (X_2, X_3, X_{10}, X_{11}, X_{16})

Y_2 f (X_{11}, X_{12}, X_{13})

Y_3 f (X_4, X_5, X_8, X_9 X_{14}, X_{15})

Y_4 f (X_3, X_{16}, X_{17})

Y_5 f (X_1, X_4, X_7 X_8, X_{17})

Y_6 f (X_1, X_6)

Where we have,

Objective Variables

Y_1 Total production per unit in Rs.

Y_2 Value added per unit in Rs.

Y_3 Duration of daily operation of total workers per unit in hours

Y_4 Value of fixed capital per unit in Rs.

Y_5 Value of working capital per unit in Rs.

Y_6 Net income per household in Rs.

Policy Variables

X_1 Standard mandays as defined by total man-hours worked per unit / 8 (taking as standard shift hour)

X_2 Size of unit in terms of employment

X_3 Duration of daily operation of main workers per unit in hours

X_4 Percentage of part-time workers to total workers per unit

X_5 Percentage of skilled workers to total workers per unit

X_6 Percentage of partly skilled workers to total workers per unit

X_7 Age of the workers (in code taking a 5-point scale)

X_8 Experience level of the workers (in code taking a 3-point scale)

X_9 Percentage of finished products sold to customers

X_{10} Percentage of finished products sold to middlemen

X_{11} Maximum distance covered for purchase of raw materials

X_{12} Percentage of income outside household industry

X_{13} Value of total capital per unit in Rs.

X_{14} Total production per unit in Rs.

X_{15} Value of fixed capital per unit in Rs.

X_{16} Value of working capital per unit in Rs.

X_{17} Net income per household in Rs.

Estimation of the Model

The models which have been developed above is characterized by a set of simultaneous equations. In estimating the equations method of two stage least squares has been used. Estimated structural parameters obtained from two stage least squares analysis are presented below:

Table: Structural Equations/Models of Variables of Handloom Industrial units

Y_i Coefficients for variables/ Intercepts/R^2	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6
X_1					19.566** (2.023)	66.435** (6.245)
X_2	3.213** (811.693)					
X_3	198.551* (51.487)			2.628** (0.533)		
X_4			0.141* (0.014)		-27.430** (3.563)	
X_5			-0.864* (0.061)			
X_6						321.228** (51.873)
X_7					-158.118 (75.705)	
X_8			0.795** (0.033)		267.448 (165.327)	
X_9			-0.082** (0.019)			
X_{10}	-58.312* (21.471)					
X_{11}	318.401 (0.346)	219.105** (43.630)				
X_{12}		54.691 (18.041)				

X_{13}		2.670** (0.065)				
X_{14}			8.341** (0.011)			
X_{15}			-1.208* (0.019)			
X_{16}	2.610** (0.094)			-4.517** (0.325)		
X_{17}				11.246** (0.022)	0.121** (0.035)	
Intercepts	2401.552** (475.184)	6893.453 (956.576)	317.234** (67.884)	349.782** (4.696)	-1129.274** (1470.109)	13420.406** (3254.149)
R^2	0.875**	0.793**	0.687**	0.782**	0.791**	0.493**

*Figures in the parenthesis are corresponding standard errors and ** and * indicate that the parameters are statistically significant at 1 per cent and 5 per cent level of significance respectively for n-p[1] degree of freedom. R^2 represents the square of multiple correlation-coefficient (coefficient of determination)*

Emperical Results and Discussions

The structural equations obtained (Table 1) empirically have reveals the following:

Total Production per Unit (Y_1)

1. All the explanatory variables except percentage of finished products sold to middlemen (X_{10}) have positive impact on the dependent variable as increasing value of these variables ensure higher production. This variable has negative influence because middlemen pay lower price for the product and exploit the workers. However, impact of variable maximum distance covered for purchase of raw materials (X_{11}) and duration of daily operation of main workers per unit in hours (X_3) is greater than the other variables and influence of all the variables are statistically significant.

2. **Value Added per Unit (Y_2)**

   All the explanatory variables have positive impact, which are in conformity with the hypothesis. Influence of distance covered for purchase of raw materials (X_{11}) is found to be high compared to other explanatory variables. These variables have favourable impact on the dependent variable as they ensure increase in value added.

3. **Duration of Daily Operation of Total Workers per Unit (Y_3)**

   Experience level of the workers (X_8) and total production (X_{14}) have positive influence on duration of daily operation (Y_3). While the other variables like percentage pf part-time workers (X_4), skilled workers (X_5), products sold to customers (X_9) and fixed

capital (X_{15}) have influenced adversely on the dependent variable. However, magnitude of influence of all the variables is low. The negative contribution of part-time workers and partly skilled workers are mainly due to their poor skill and help only in works associated with processing of raw materials. The adverse impact of products sold to customers (X_9) is due to the fact when volume of production increases a large quantity of articles is directly sold to the customers at low prices. Duration of daily operation influenced adversely on fixed capital because of the fact that most of tools and accessories are low cost and the workers has nothing to do with these increased fixed capital assets.

4. **Value of Fixed Capital per Unit (Y_4)**

Duration of daily operation (X_3) and net income of household (X_{17}) have positive impact and establish the hypothesis, while working capital (X_{16}) has adverse impact on the dependent variable. However, the variables are statistically significant.

5. **Value of Working Capital per Unit (Y_5)**

The variables standard mandays (X_1), experience level (X_8) and net income (X_{17}) have positive impact on Y_5, which establishes the hypothesis that higher production requires larger working capital. Percentage pf part-time workers (X_4) has negative impact on the ground that higher production requires more working capital and skilled workers, which the part-time workers cannot ensure. Negative influence of age of the workers (X_7) is because of the fact that aged workers cannot use their full working capacity and they has very little to do with higher working capital.

6. **Net income per Household (Y_6)**

Net income per household (Y_6) is conceived to be determined by two variable namely, standard mandays (X_1) and percentage of partly skilled workers to total workers per unit (X_6). Both the variables are statistically significant and have positive impact on net income per household.

Policy Recommendations

The observation reveals that standard mandays, hours of daily operation, working capital, experience, and education are important factors which influence the productivity of pottery industry. In order to raise productivity, the basic recommendation therefore, is to

provide adequate capital, raw materials, marketing facilities etc. These will obviously increase the standard mandays as well as daily hours of operation.

The empirical findings have important implications for productivity of handloom industrial units.

First of all, the development of the sector needs improvement of skill of the artisan workers through training and education. The experienced and educated entrepreneurs can handle problems more competently. Government, through District Industries Centres (DICs) and other organization should make comprehensive policy plan for such training, technical support and education. Workshops and training programmes can be organised in different blocks or at least in the clusters for the benefits of the workers. Secondly, the provision of raw materials to the units, dispersed over wide areas, is not in tune with the requirements. As such it is recommended that a common organisation should handle the raw material problems at the block and district levels. There is an immediate need for the organisation of cooperative societies on the ground that they will take up the issue of supply of raw materials, purchase of finished goods from the artisans, marketing and provision of credits (Bhattacharya, 1980). For this purpose, cooperative societies should be given adequate financial assistance by the government. Establishment of such societies will free the artisans from the clutches of middlemen who always squeeze profit. Lastly, since inadequate capital is a problem of the sector, loan should be provided to the entrepreneurs. Co-operative banks, commercial banks and rural banks can play an important role in this connection.

Conclusion

The analysis reveals that productivity of the handloom-industry is determined by several socio-economic factors. The multiple linear regression models have provided insight into the relationships among the variables in the prediction of the dependent measure. It is therefore, necessary to realize the suggested policy measures so that value of predictors may increase sufficiently, because an increase of predictors ensures the increase of productivity.

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