

Manufacturing Establishments in the Contribution of National Income of Nepal

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INTRODUCTION

In the Gross Domestic Product (GDP) of Nepal manufacturing establishments contributed 1.91 percent in 1967/68. The share has been increasing ever since. In 1971/72 it was 2.75 percent while in 1976/77 it reached to 4.13 percent of the total.¹ The census of manufacturing establishments 1981/82 shows the total value added by these establishments has reached to Rs. 234 million which is about 7.6 percent of the total GDP of the year 1981/82 in Nepal.² In the process of economic development this is clearly an optimistic indication. But it does not mean that one should be satisfied in the pace. This is rather slow. The share could have been increased even at faster rate if, along with other considerations, proper attention had been given to the factors influencing value added to increase it and action had been taken accordingly.

Several factors influence the value added in manufacturing establishments. Wage and salary is the major component from which the value is added to the economy. In this paper a few of the factors viz. size in terms of the number of employees engaged, fixed capital involved, wages and salaries paid to the employees, fuel consumption and raw materials consumption are considered. To see the extent of their influences regression analysis is carried out. The individual effects of these factors are not the same as joint effect and rarely can be separated. All the other factors remaining at a given level, size, for example, bears direct relationship with the volume of value added in general. Similarly, one of the major elements to affect value added directly is the wage and salary component. This wage and salary component also affects value added indirectly via the variation in productivity due to job satisfaction to the employees. However, as the size of the firm gets larger employees may be satisfied even at lower wage because of their perception of security in a larger establishment and thus the volume of value added may be higher with lower wage rates. Thus the joint effect of the two variables may be quite different. These factors cannot be studied in isolation to each other. Fortunately regression analysis does a very effective job to indicate marginal effect of any one variable in the presence of other variables as well.

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The present analysis will be based on the censuses of manufacturing establishments of 1976/77 and 1981/82 conducted by Central Bureau of Statistics Nepal. Industries are classified by their principal economic activities by Central Bureau of Statistics itself and the same classification is adopted here for this analysis.

METHODOLOGY

The contribution of each producer to total production is measured by the value he adds to the product. The value added in an industry is defined as the value of its sales plus increases in stock minus the value of goods and services purchased from other industries. The value added by the group of industries is the main focus of this study and is treated here as the dependent variable for the regression analysis. Five potential explanatory variables are selected for the analysis. The explanatory variables included are:

Size: Average number of persons engaged per establishment;

W/s: Wages and salaries in Rs. per person in the establishment;

FC : Fixed capital involved in Rs. per establishment;

Fuel: Consumption of fuel in Rs. per establishment;

RM : Consumption of raw material in Rs. per establishment.

To select the explanatory variables to include in the model, the method utilized here is the "Stepwise Forward Selection Technique." This method computes a sequence of regression equations. The procedure, first, investigates all the explanatory variables one at a time and at each step an explanatory variable is added until the model does not significantly improve. The improvement in the model is judged by the improvement in the adjusted Coefficient of Determination R^2 at each step while not dropping t-statistic for any coefficient in the model from significant to insignificant level. It is to be noted here that the simple Coefficient of Determination, R^2 , cannot be compared for models with varying explanatory variables.

The variable to be included is decided by F-Statistics; whichever the variable produces highest F-statistic when included in the model is retained for next step. As long as adjusted coefficient of determination improves, not dropping t-statistics with significant to insignificant level to any coefficient, variables will be included until not all exhausted.

Looking at the coefficients in a linear model where variables are in different scales of measurement, one cannot infer about the degree of their influences in the dependent variable. To avoid this difficulty non-linear double log models are also observed using the same variables selected for the linear models. A major advantage in the double log model is that the elasticity of the variables can be obtained directly which in turn can be compared for different variables involved in the model.

CHARACTERISTICS OF THE VARIABLES

a. Value added: The value added per establishment is calculated for each of the defined class of industries both for 1976/77 and 1981/82 census data (See Appendix 1 and 2). According to 1976/77 census, the average value added per establishment was just over Rs. 150 thousand whereas according to 1981/82 Census it reached to nearly Rs. 2 million. In 1976/77, the types of establishments contributing less than Rs. 50 thousand to the national income were Ice and Ice Cream Industries, Repairing Works, Printing Press, Paper Manufacturing, Soap Manufacturing and Cap Industries. On the other hand in 1981/82 only Ice and Ice Cream Industries were found contributing less than Rs. 50 thousand per establishment. All other industries were found contributing higher. Particularly Jute Processing Industries, Sugar Refineries, Animal Feed Industries, Polythene Pipe Industries, Foot Wear and Tanning are among the top in the list to contribute to the national income.

b. Size: (Average number of persons engaged per establishment): Size of an establishment can be defined in various ways. For present purpose average number of persons engaged per establishment is taken as the proxy for firm size. In terms of size, employing more than 100 persons per establishment in 1981/82, Jute Processing Industries (with an average of 753 persons per establishment, Sugar Refineries (with an average of 333 persons per establishment) Biri Making and Milk and Milk Product Industries are among the largest.

Oil and Grain Mills appear smallest in size on an average with 5 persons per establishment. But Oil and Grain Mills constitute the largest in number of industries in the country. In 1981/82 there were 3532 Oil and Grain Mills, 72 percent of the total number of establishments. This also indicates that even if there were a few large Oil and Grain Mills, most of the others were very small in size. In 1976/77 there were 2637 Oil and Grain Mills with an average size of 6 persons per establishment. The number of establishments increased to 3532 in 1981/82 but the average size further declined to 5 persons per establishment. This again indicates that most of the Oil and Grain Mills that were added up later were smaller in size.

c. Wage and Salary: A national average of the wage and salary paid to the employees by the industrial establishments in 1976/77 appeared to be Rs. 2650 per person per year.² In 1981/82 the average wage and salary is calculated to be Rs. 4456 per person per year.⁴ Among the industry groups Polythene Pipe, Yarn and Textile, Metallic Vessels, Fruit Canning, Jute Processing, Knitting Mills were the ones paying more than Rs. 6000 per person per year during 1981/82. On the otherhand, industries like Bricks and Tiles, Tea Packing, Drugs and Medicine, Biri Making, Ice and Ice Cream Products, Jewelry and Curios and Cap Industries were found spending low in wage and salaries, lower than Rs. 2500 per person per year. It should be remembered, however, that paying low wages or high wages by any industry cannot be attached to any bad or good connotations. Any industry requiring many technically skilled persons automatically will be paying higher wage and salary per person per year.

- d. Fixed Capital: For each class of industries fixed capital per establishment is calculated. Cement and Cement Products, Milk and Milk Products, Polythene Pipe, Sugar Refineries are found to be the industries involving more than Rs. 5 million of fixed capital. The industries involving low average fixed capital per establishment (less than Rs. 200 thousand) are found to be Carpets and Rugs, Oil and Grain Mills, Biri Making, Ice and Ice Cream, Jewelry and Curios and Saw Mills. Here one should be careful that this is a gross picture and may or may not be valid for any particular establishment. Within the group of industries there may be a high variation in the fixed capital involvement as in the case of any other variable.
- e. Fuel Consumption: There are industries like Caps, Ice and Ice Cream Products, Repairing Works, Jewellery and Curios and Fruit Canning Consuming a very low amount of fuel (less than Rs. 5000 per year per establishment in 1981/82) to industries like Cement and Cement Products, Milk and Milk Products Consuming more than Rs. 500 thousand per year per establishment in 1981/82. Industries consuming fuel of more than Rs. 100 thousand to Rs. 500 thousand per year per establishment are Sugar Refineries, Biri Making, Bricks and Tiles, Jute Processing, Soap, Metallic Vessals, Distillaries and Tea Packing industries. It is found that involvement of fixed capital bears a high correlation ($r = 0.84$) with the fuel consumption by the industries (Appendix 3). During 1976/77 Knitting Mills were found non-consuming fuel at all. However, by 1981/82 some Knitting Mills were established requiring fuel to consume a lot so that average fuel consumption per year per establishment in 1981/82 is found to be a little higher than a value of Rs. 40 thousand.
- f. Raw Material Consumption: The money value of raw material consumption per establishment is calculated for the given class of industries. Raw material consumption is found to have a high correlation, next to the size of the establishments with the value added. In general, industries consuming high values of raw materials are also found to be of the higher size and paying higher wages and salaries as well. During 1976/77 raw material consumption had a very high correlation ($r = 0.98$) with fixed capital but during 1981/82 the correlation between them is not found so high (Appendix 3). During 1981/82, Animal Feed, Polythene Pipe, Jute Processing, Milk and Milk Products, Sugar Refineries are among the top in the list of consuming high value of raw materials. Ice and Ice Cream Products, Repairing Works, Jewellery and Curios use a very low value of raw materials.

REGRESSION RESULTS

In an analysis of 1976/77 data, fixed capital is appeared to be a significant variable in explaining the value added by manufacturing establishments. This variable alone could explain about 90 percent of the total variation in value added.⁵ However in an analysis of 1981/82 data, size is found to be the most significant variable which alone could explain about 82 percent of the total variation in value added. The result is not much in contradiction, however. Fixed capital is another way of looking the size of the establishment. Use of raw material is another variable to appear significant to explain value added. Wage and salary component was also found highly significant explanatory vari-

able in the analysis of 1976/77 data. But in the analysis of 1981/82 data this variable did not appear significant. This may be due to the fact that many of the establishments which were paying low to their employees have raised the wage and salaries more than what the other establishments did, so that the wage and salary component is no more an effective variable to the value added.⁶ The level of fuel consumption of establishments was not a significant component either in 1976/77 or in 1981/82 data to explain the value added by manufacturing establishments.

With stepwise forward selection technique finally selected model for 1976/77 data appeared to be⁷

$$VA = - 344993.83 + 1200.43 \text{ size} + 180.25 \text{ W/s} + 0.59 \text{ Fc} - 2.57 \text{ Fuel}$$

$$(1.03) \quad (3.70)* \quad (9.60)* \quad (1.61)$$

$$\bar{R}^2 = 0.94$$

$$F = 85.6$$

and for 1981/82 data

$$VA = - 785207.40 + 10835.94 \text{ size} + 149.87 \text{ W/s} + 1.51 \text{ Fuel} + 0.45 \text{ RM}$$

$$(9.24)* \quad (2.00) \quad (1.48) \quad (7.17)*$$

$$\bar{R}^2 = 0.91$$

$$F = 79.9$$

To obtain the elasticity coefficients regression was run in double log form for those variables which were finally retained for the linear multiple regression models both for 1976/77 data and for 1981/82 data.

The model for 1976/77 data in double-log form is

$$L_n VA = - 9.42 + 0.4 L_n \text{ Size} + 1.92 L_n \text{ W/s} + 0.42 L_n \text{ Fc} - 0.02 L_n \text{ Fuel}$$

$$(2.34)* \quad (5.89)* \quad (2.91)* \quad (0.30)$$

$$\bar{R}^2 = 0.85$$

$$F = 28.9$$

and the model for 1981/82 data in double-log form is

$$L_n VA = - 1.02 + 0.32 L_n \text{ Size} + 0.34 L_n \text{ W/s} + 0.06 L_n \text{ Fuel} + 0.72 L_n \text{ RM}$$

$$(3.11)* \quad (1.64) \quad (0.99) \quad (8.85)*$$

$$\bar{R}^2 = 0.88$$

$$F = 60.4$$

The wage and salary component was found most elastic to value added according to the 1976/77 data. But that component was found insignificant to value added according to the 1981/82 data. According to 1981/82 data though raw material consumption is found to be the most elastic to value added in relation to the other variables, its elasticity is not crossing the value one. 10 percent increase in raw material consumption brings about 7 percent increases in value added.

The models presented above indicate that the size (in terms of persons engaged, and consumption of raw material) were the major and significant influencing factors in value added in the manufacturing establishments in 1981/82. Other variables such as Wage and Salary, and Fuel Consumption also influenced value added positively in 1981/82 but they were not of significantly important to explain value added. In 1976/77 instead of raw material consumption fixed capital involvement was of significantly important.

FOOTNOTES

1. Central Bureau of Statistics, Statistical Pocket Book, 1982, p. 191.
2. The figure provided by Ministry of Finance is, however, different, "Against the backdrop of industrial census in FY 1976/77 the contribution of industrial sector in GDP was 5.4 percent which went up to 7.9 percent in FY 1981/82 and further up to 10.5 percent at the end of the sixth plan period". Ministry of Finance (1975): Economic Survey, Fiscal Year 1986/87, p. 29.
3. While calculating this average figure unpaid family workers are also counted in the denominator. Hence actual average figure must be higher than this. If the proportion of unpaid family worker is assumed to be the same as in 1981/82 census the national average figure rises to Rs. 2914 per person per year.
4. Unpaid family workers are deducted to arrive at this average.
5. For detail analysis of 1976/77 data see authors' "An Analysis of Value Added by Manufacturing Establishments in Nepal", Research Paper Series 7, Nepal Institute of Development Studies, Kathmandu Nepal, November 1984 (Memo.)
6. When the simple correlation coefficient between average wage and salary in 1976/77 and the increment in wage and salary by 1981/82 is calculated, the coefficient is found to be negative ($r = -0.45$) That is, in general, the establishments with lower wage base increased wage and salary more than the establishments with higher wage and salaries.
7. t-statistic in paranthesis. *significant at 5 percent level of significance.

Appendix 1. Value added and principal factors affecting it (1976/77)

Activities	Size (Average Number of persons en- gaged/establi- shment)	Value in Rs.				
		Wages/ Person	Fixed Capital/ Establishment	Fuel Cost/ Establishment	Raw Materials/ Establishment	Value Added/ Establishment
Oil and Grain Mills	6	1750	246722	6078	1094035	103897
Bakery Product	22	1937	460073	9317	384537	306976
Sugar Refinery	326	3464	7193000	153833	7097167	4551000
Distillaries	30	4020	940800	129400	911200	775800
Tea Packing	220	1354	1016222	93444	366444	86333
Biri Making	69	2881	38247	6329	486096	146288
Yarn & Textile	26	3055	522892	21554	410692	303323
Knitting Mills	16	2857	112266	0	126571	157000
Carpets & Rugs	42	2518	46935	1419	148258	81323
Caps	40	1314	82667	222	89444	49444
Foot Wear	48	4911	484143	16857	523286	503429
Saw Mills	24	2775	84400	38545	699764	278945
Fur. & Sta. Prod. (Wood)	12	3130	51190	1599	224894	127085
Fur. & Sta. Prod. (Steel)	37	4109	412692	88077	1226462	363769
Paper Manufacturing	24	1486	44167	2417	18500	41333
Printing Press	15	2684	115603	1362	68612	35448
Drugs & Medicines	43	2710	421000	12667	429000	662667
Soaps	12	2296	49813	3688	291000	44875
Matches	172	4427	620000	61750	854000	1382250
Bricks & Tiles	62	1426	101258	62939	49289	95907
Metallic Vessals	31	4026	563125	96375	587563	316375
Repairing Works	7	2077	42714	1400	16286	19714
Jewellery & Curios	25	3649	119167	1667	73500	747167
Ice & Ice Cream	5	761	42107	750	4500	1893
National Average	14	2650	270276	10621	928607	150916

Source: Central Bureau of Statistics, Census of Manufacturing Establishments (1976/77), Kathmandu, Nepal.

Appendix 2. Values added and principal factors affecting it (1981/82)

Activities	Size Av. persons/ Establishment	Wages/ Person	Fixed Capital/ Establishment	Fuel Cost/ Establishment	Raw Materials/ Establishment	Value Added/ Establishment
Animal Feed	39	5063	112400	12600	11261200	5054000
Bakery Product	27	2999	451887	16377	777811	4823358
Biri Making	135	2131	110507	253411	3378027	3751863
Bricks & Tiles	846	937	211487	202016	107759	168817
Cement Product	69	5658	18208143	599000	1461857	2462286
Caps	47	2482	337000	250	165625	144500
Carpets & Rugs	40	2885	40239	11672	1695224	1082045
Distillaries	31	2608	3793867	113933	341267	1128867
Drugs & Medicine	12	2101	1507286	33571	1655429	620429
Fruit Canning	29	6850	2129400	4900	1386500	1611600
Footwear/Tanning	72	5037	1593929	51429	3490571	4264357
Furniture (Wood)	13	5590	211838	10445	461895	452144
Furniture (Steel)	34	3267	911688	30625	1748875	460000
Ice & Ice Cream	57	2145	113528	2222	22972	20778
Jute Processing	753	6600	3641500	177750	7266375	11237125
Jewellery & Curio	43	2153	159750	4500	97000	108000
Knitting Mills	38	6087	1589467	40667	689000	835300
Matches	92	5613	609286	45857	1613286	1813571
Metallic Vessels	28	6969	386414	126586	1091862	731793
Oil & Gr. Mill	5	3405	110224	6726	750442	248911
Paper Manufacturing	16	3140	226750	21313	147000	140250
Printing Press	19	3467	315128	5160	276352	301272
Plastic & Rubber						
Polythene Pipe	30	10261	7654333	33222	7659222	4847556
Repairing Works	13	5682	2635000	2308	67808	125808
Sugar Refines	333	5458	6831545	362909	5897182	9057909
Saw Mill	15	5908	190381	12540	3663937	975254
Soap	15	6026	871895	153211	1217316	845053
Tea Packing	167	1591	4869706	111294	550059	347706
Yarn & Textiles	21	7373	904462	86110	529366	152841
Milk & Milk Powder	127	4186	14779333	535500	6908500	3843667
National Average	80	4456	2554512	102270	2212657	1910535

Source: Central Bureau of Statistics, Census of Manufacturing Establishments (1981/82), Kathmandu, Nepal.

Appendix 3.A. Correlation Matrix of Value added and the factors affecting it (for census data 1976/77)

	VA	Size	W/s	Fc	Fuel	RM
VA	1	0.79	0.37	0.95	-0.08	0.95
Size		1	0.15	0.82	0.87	0.76
W/s			1	0.21	0.38	0.27
FC				1	0.67	0.98
Fuel					1	0.65
RM						1

Source: Table Appendix 1.

B. Correlation Matrix of value added and the factors affecting it (for census data 1981/82)

	VA	Size	W/s	Fc	Fuel	RM
VA	1	0.82	0.38	0.37	0.41	0.79
Size		1	0.11	0.21	0.34	0.44
W/s			1	0.25	0.05	0.41
FC				1	0.84	0.34
Fuel					1	0.27
RM						1

Source: Table Appendix 2.