

ISSN : 2231-2374

# RESEARCH HIGHLIGHTS



A Journal of

*Avinashilingam*

Institute for Home Science and Higher Education for Women

*University*

(Established as per UGC Act 1956)

Cumillore - 611 043, Tamil Nadu, India

(Deemed University under Category 'A' by MHRD)

Re-accredited with 'A' Grade by NAAC

Vol. 24, No.1

\*

Quarterly

\*

January 2014

## Research Highlights

Vol. 24, No. 1, 2014

### RESEARCH ARTICLES

1. Indian Monetary System, Challenges Ahead  
*Meenakshisundaram, T.S.K.* .... 1
  2. A Study on Adolescents Preferences for Ready-made Garments in Guwahati City, Kamrup District in Assam  
*Shabnam Hazarika* .... 4
  3. Dietary and Lifestyle Pattern of Peptic Ulcer Patients Among Tribal and Non-Tribal Population  
*Padmavathi and Saitluangpuii Saito* .... 11
  4. Status Quo of Women Construction Labourers in Coimbatore  
*Sagufia Ahmed and Visalakshi Rajeswari, S.* .... 21
  5. Some Properties of Level Subsets in Fuzzy Set in a  $T$ -near-ring  
*Jegatheeshwari, R.* .... 28
  6. Bioaccumulation of Heavy Metals in Commercially Important Edible Marine Fishes  
*Chitra, G. and Krishnaveni, N.* .... 32
  7. Analysis of Performance of Aggregate Manufacturing Sector of India in the Pre and Post Liberalisation Period by Testing Select Indicators of Industrial Growth  
*Manonmani, M.* .... 40
  8. Alienation and Crisis of Identity in Upamanyu Chatterjee's *The Last Burden*  
*Chitra, S. and Kalamani, S.* .... 47
  9. Relationship Between Psycho-social Adjustment and Academic Achievement of Hearing Impaired Students at Higher Secondary Level  
*Celine Pereira and Sreeja, S.* .... 56
- Research Abstract .... 62
- News Maker .... 65
- Short Communication .... 67
- Book Reviews .... 69

## **ANALYSIS OF PERFORMANCE OF AGGREGATE MANUFACTURING SECTOR OF INDIA IN THE PRE AND POST LIBERALISATION PERIOD BY TESTING SELECT INDICATORS OF INDUSTRIAL GROWTH**

\* MANONMANI, M.

### **Abstract**

Since Independence India has achieved self sufficiency in the manufacturing sector. It is assumed that growth is needed in manufacturing sector to eliminate poverty. Hence an attempt in this paper is made to analyse the performance of aggregate manufacturing sector of India considering the pre and post liberalisation period by testing certain indicators of development such as ability to pay hypothesis, verdoorn's law, and wage-technology relationship. The reference period of the study for the pre liberalization covers between 1972-73 and 199-91 and post liberalization period between 1991-92 and 2010-11. Augmented Dicky Fuller (ADF) test and linear regression model were applied to analyse the data. It was found that labour productivity influenced the level of wage strongly in both the periods. In both the periods' verdoorns law was approved. It was concluded that productivity can be augmented only through employment generation and higher wages.

### **Introduction**

The economic development of a country depends mainly on industrial development. In manufacturing sector, the scope for internal as well as external economies is greater than in other sectors. It acts as an instrument both for creating capacity to absorb excess labour power and for diversifying the market required to boost economic development. Since independence, India has achieved a reasonably well level of self-sufficiency in manufacturing a variety of basic and capital goods. Growth in the manufacturing sector has the potential to elevate much of the Indian population above poverty line by diverting the majority of the workforce out of low-wage agriculture. This would create a more stable and prosperous India and in turn, attract more business. India is well on its way to becoming the premier manufacturing location for companies around the world. Liberalization, privatization and globalization are causing a transition in the world economy and Indian manufacturing is no exception. The last decade following the liberalization has

---

\* *Professor in Economics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore-641043*

revolutionary changes in the state of manufacturing in India. Therefore, the present study is attempted to analyze the performance of aggregate manufacturing sector in the pre and post liberalization period by testing some important indicators such as ability to pay hypothesis, Verdoorn's law, hypothesis of efficiency-wage and wage-technology relationship. The ability to pay hypothesis states that labour productivity is an important determinant of wage rates. Assuming theory of productivity states that average wage would be equal to the marginal product of labour. Cobb-Douglas production function equates the marginal product of labour to the average product of labour (Man Preet Kaur and Ravi Kiran, 2008)

Technology plays an important role in the rise of labour productivity. The capital-labour ratio was used as the proxy for technology. Investment of capital for installation of advanced technology to examine the importance of technology in the determination of wages, or up-gradation of existing machinery leads to rise in capital-labour ratio. Highly skilled workers and competent supervisors are required to operate modern and complex machineries. This necessitates to impart training to the already employed workers and recruitment of skilled workers and supervisors. However, experienced and skilled labour is available at relatively higher wages in the competent labour markets. Therefore, capital intensity and wage rates are expected to have linear relationship.

The term Verdoorn's law refers to the statistical relation between the growth of manufacturing output and the growth of labour productivity in manufacturing, where causality runs primarily from the former to the latter. This relationship is named after the Dutch economist Verdoorn, who was among the first to find such empirical regularity in a cross section of industries. Verdoorn's law is usually interpreted to provide evidence of the existence of static and dynamic increasing returns within industry. The basic argument is that an initial growth in output induces productivity gains that allow for reduction of unit labour costs and, given a mark-up pricing rule, for fall in prices, increasing the competitiveness of a country or region. These gains, in turn, allow for further output expansion through increasing exports, which reinitiate the cycle. In conclusion, once a country or region acquires a growth advantage, it will tend to keep it through the process of increasing returns and consequent competitive gains that growth itself induces (Aggarwal and Ganesh Kumar, 1991). Production function estimates show the technological relationship between the maximum output obtainable from a given set of inputs and the relationship between the inputs themselves in the existing state of technological change. The production function measure the efficiency of production technology, returns to scale, the degree of capital intensity of technology and the degree of factor substitution between factors of production. The direct estimation of production function

has an advantage as it is necessary to assume competitive equilibrium in order to derive estimates of productive growth. The efficiency term describes the maximum outputs attainable from utilizing the available inputs. A production is efficient if it cannot improve any of its inputs or outputs without worsening some of its other inputs or outputs. Efficiency can be increased by minimizing inputs while holding output constant or by maximizing output while holding inputs constant or a combination of both may increase efficiency (Alias Radam et al, 2010). The efficiency wage model asserts that the productivity of workers in firms is positively correlated with the wages they receive. Most efficiency wage theories assume that productivity depends on the relative wage inside and outside the firm.

## Methodology

The reference period chosen for the study covers both pre and post liberalization period. The pre liberalization period covers between 1972-73 and 1990-91 and post liberalization period between 1991-92 and 2010-11. The data for the current study is collected from secondary sources. They were collected from Annual Survey of Industries and Economic Survey (various issues). The following statistical tools were applied to analyse the data.

### 1. Augmented Dicky Fuller Test

In the present study non-stationarity or the presence of a unit-root was tested using the Augmented Dickey Fuller (1979,

1981) test. To test if a sequence  $Y_t$  contains a unit-root, two different regression equations are considered.

$$\Delta Y_t = \Delta + \Delta Y_{t-i} + \Delta t + \Delta i \Delta Y_{t-i} + \Delta i. \quad (1)$$

$$\Delta Y_t = \Delta Y_{t-i} + \Delta i \Delta Y_{t-i} + \Delta i \quad (2)$$

The first equation includes both a drift term and a deterministic trend and the second does not contain an intercept but include the deterministic trend. In both the equations the parameter of interest is  $\Delta$ . If  $\Delta = 0$ , the  $Y_t$  sequence has a unit-root. The estimated 't' statistic is compared with the appropriate critical value of Dickey Fuller tables to determine if the null hypothesis is valid. However, if the variables are non-stationary, they are tested for the possibility of a co-integrating relationship.

### 2. Linear regression model

#### i) Testing ability to pay hypothesis (Model-1)

The linear relationship between wages and labour productivity was examined through the following regression equation:

$$\ln W = a + b \ln P_L$$

where

$W$  = Wage paid in the pre and post liberalization period

$P_L$  = Labour productivity in the pre and post liberalization period

$a$  = Constant or intercept of the regression line

$b$  = Elasticity of wage with respect to labour productivity ( $P_L$ )

$\ln$  = Natural log

**ii). Testing Verdoorn 's law ( Model-1I)**

The Verdoorn's law has been estimated as a linear relationship between labour productivity growth and output growth by applying the following linear regression formula.

$$\ln P_L = c + b \ln NVA$$

$P_L$  = Labour productivity in the pre and post liberalization period

NVA = Net Value Added in the pre and post liberalization period

C = Constant or intercept of the regression line

b = Elasticity of labour productivity with respect to output (NVA)

Ln = Natural log.

**iii) Testing impact of technology on wage (Model-1II)**

Testing impact of technology on wage in different sub-sectors of the industry was examined through the following regression equation:

$$\ln W = a + b \ln K/L$$

Where

W = Average wage paid in the pre and liberalization period

K/L = Capital-labour ratio (technology) in the pre and post liberalization period

a = Constant or intercept of the regression line,

b = Elasticity of wage with respect to capital intensity( K/L)

Ln = Natural log.

**Results and Discussion**

**1. Augmented Dicky Fuller Test**

Before the variables were involved in analysis, they were tested for their stationarity. The results of Augmented Dickey Fuller test for first difference in the pre and post liberalization period is presented in Table-1.

**Table 1. Co-efficient of Augmented Dickey Fuller (ADF) - Test**

Variables	ADF values	
	Pre-liberalization period	Post-liberalization period
Wages(w)	-5.6657*	-6.6565*
Labour productivity (PL)	-4.5355*	-7.5545*
Capital intensity (K/L)	-4.7531*	-7.7986*
Net value added(NVA)	-4.8834*	-5.8813*

Source: Estimation based on ASI data

Note: \* Significant at 5% level

The above results indicated that the null hypothesis of a unit-root process could be rejected for all the variables in their first difference at five per cent level indicating that the series were stationary for all the variables.

**2. Regression analysis**

**i) Ability to pay hypothesis**

The ability to pay hypothesis was tested using linear regression function during pre and post liberalization period under study and the results are presented in Table-2.

**Table 2. Regression co-efficient explaining approval/disapproval of ability to pay Hypothesis**

Period	Constant coefficient 'a'	Regression coefficient 'b'	R <sup>2</sup>	F- value	D-W statistics
Pre- liberalizationperiod	8.915* (4.565)	25.658* (2.442)	0.2180	3.816	1.683
Post- liberalization period	4.575* (5.015)	19.894* (2.063)	0.4852	0.695	1.681

Source: Estimation based on ASI data

Note: (i) Figures in parentheses indicate 't' value (ii) \* Significant at 5% level

Regression results for the ability to pay hypothesis explain the fact that the co-efficient of R<sup>2</sup> in pre-liberalization period was 0.2180, which means that only nearly 22 per cent of the variations of wages around its mean were explained by labour productivity. In post-liberalization period the value of R<sup>2</sup> was 0.4852, which means that nearly 49 per cent of the variations of wages around its mean were explained by labour productivity.

The coefficient of labour productivity 'b', represents the elasticity of wages with respect to labour productivity. It was positive and statistically significant in the regression equation for two periods. This means that an increase in labour productivity leads to the rise in wages in two periods. However, the extent of rise in wage due to the increase in labour productivity would vary from one period to

the other depending on the value of the coefficient 'b'. The value of coefficient 'b', for the pre-liberalization period was 25.658, which means that one per cent increase in labour productivity would lead to about 25.658 per cent increase in wage rates. In post-liberalization period coefficient 'b' was 19.894, which means that one per cent increase in labour productivity would lead to about 19.894 per cent increase in wage rate in the selected top ten richest industrial states of India. Thus the regression results support the hypothesis that labour productivity has strong influence on the determination of wages in the manufacturing sector.

#### 4. Testing Verdoorn's law

Verdoorn's law was tested during pre and post liberalization period under study by applying linear regression equation. The results are presented in Table 3.

**Table 3. Regression co-efficient explaining approval/dis- approval of verdoorn's law**

Period	Constant coefficient 'a'	Regression coefficient 'b'	R <sup>2</sup>	F- value	D-W statistics
Pre- liberalizationperiod	0.289* (5.336)	1.012* (9.866)	0.87	97.544	1.638
Post- liberalization period	2.119* (4.559)	1.008* (4.283)	0.55	18.672	1.545

Source: Estimation based on ASI data

Note: (i) Figures in parentheses indicate 't' value (ii) \* Significant at 5% level

The results regarding Verdoon's law for pre and post liberalization period showed that output was closely related to labour productivity. Thus, this finding supported Verdoon's law. The t-values were statistically significant at 5 per cent level in both pre and post liberalization period. The F-test statistics strengthens the explanatory power of the regression equation. Value of R<sup>2</sup> in pre-liberalization period was 0.87, which means that 85 per cent of the variations in labour productivity

around its mean were explained by output. In post-liberalization period the value of R<sup>2</sup> was 0.55, which means that 55 per cent of the variations of labour productivity was around its mean were explained by output.

### 5. Wage- technology relationship

The wage- technology relationship during pre and post liberalization period under study for the aggregate manufacturing sector of the top ten richest states of India are presented in Table 4.

**Table 4. Regression results explaining Wage-Technology Relationship**

Period	Constant coefficient 'a'	Regression coefficient 'b'	R <sup>2</sup>	F- value	D-W statistics
Pre- liberalization period	4.994 (.0231)	0.246 (0.997)	0.218	2.869	1.668
Post- liberalization period	2.362 (0.899)	0.281 (0.542)	0.432	0.965	1.905

Source: Estimation based on ASI data

Note: (i) Figures in parentheses indicate 't' value (ii) \* Significant at 5% level

The table shows that the 't' values were insignificant for two periods. In other words there was no linear relationship between wages and technology in pre and post liberalization period. The R<sup>2</sup> value in both the period imply that technology was not a strong determinant of wage rates.

### Conclusion

Labour productivity has strong influence on the determination of wages in the manufacturing sector. The hypothesis of efficiency-wage was supported in both the periods. Technology was not a strong

determinant of wage rates. Output was closely related to labour productivity. Coming to the policy recommendation, the manufacturing sector should further improve the labour productivity growth by improving wages and other benefits of the workers. The upward movement of labour productivity may increase wage rates and employment generation. The productivity can increase only through employment generation and higher wages. The government should give priorities to more export-intensive industries. So, without increasing the productivity, government

should not expect more employment generation and better standard of living of the workers in manufacturing sector. The government functioning needs to be more efficient to make Indian manufacturing globally competitive.

### REFERENCES

1. Alias Radam and Ismail Latiff (2000), "Technical Efficiency and Productivity Performance of Malaysian Manufacturing Industries", *The Asian Economic Review*, 42, 2, 249-262.
2. Manpreet Kaur and Ravi Kiran (2008), Indian Manufacturing Sector: Growth and Productivity under the New Policy Regime, *International Review of Business Research*, 4, 2, March 2008, 136-150
3. Aggarwal, A.K. and Ganesh Kumar (1991), " Indian Manufacturing Industry Verdoorn's Law Revisited", *Indian Economic Journal*, 2, 61-81.