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Employment Dynamics : A Case of Punjab Manufacturing Sector

KEYWORDS: Employment Elasticity, Capital Deepening, Labour Productivity,

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ABSTRACT *This study endeavors to discover the employment dynamics based on the data pertaining to the period 1981-2009 to look into the employment potential of Punjab manufacturing sector of Punjab. Expansion in Punjab manufacturing sector was afflicted with the declining levels of efficiency overtime. Capital formation was labour displacing and additional capital seems to be devoid of new technology, for capital productivity did not contribute to the value addition. Punjab manufacturing sector did not show ample potential to generate employment. Labour productivity grew positively during the study period; however decelerating overtime, acted as a driving force to value addition in Punjab manufacturing sector. Positive growth in labour productivity reflected positively in wages even better than the growth in employment.*

Introduction:
It is, generally, accepted fact that higher output growth is accompanied by enhanced employment. However, rate of growth in employment may not be at the same pace as that of output. It depends on the levels of employment elasticity and the nature of technological change which the manufacturing sector deploys- labour displacing or labour absorbing. Labour productivity may improve, overtime, due to capital deepening and the skill development. Consequently, high labour productivity may reduce the employment creation and may bear the negative relationship with employment creation. Productivity growth reduces production costs and increases returns on investments, some of which provide greater income for business owners and investors, while some is reflected into higher wages. The virtuous circle between productivity and employment is also fed through the investment side of the economy, when some productivity gains are reinvested by a firm in product and process innovations, improvements in plant and equipment and measures to expand into new markets, which in turn spur further output growth and productivity. So, employment dynamics is very complex phenomenon and information of such dynamics is very crucial for respective governments for policy formulation.

The developing country like India has dual nature of production structure, agricultural sector with low productivity and surplus labour, and a capital intensive industrial sector characterized by technological change and increasing returns in many manufacturing groups. The transfer of the labour resources to this more productive sector (manufacturing sector) of the economy depends on the growth of latter's derived demand for labour (Jesus Felipe, 1998). Similarly, the production structure of Punjab also experienced such character, agriculture sector still dominate in the contribution to the state domestic product and absorption of labour force, for more than 40 percent of its work force even now earns its livelihood from agriculture sector, however, the manufacturing sector has been lingering with about 10 percent absorption of work force for last two decades. The agriculture sector performance of the state has already reached to the level of stagnation, and it has recorded negligible growth rate during the last decade. In addition, the existing cropping pattern (wheat-paddy rotation) seems to be unsustainable due to increasing costs, irrigation and environment problems. (Johl, 2005; Aulakh, 2005). Efforts made to change cropping pattern through the process of diversification to other crops by adopting the route of contract farming system failed to fructify. Consequently, this sector is unable to bear additional burden of increasing work force. The manufacturing sector holds the key to generate employment opportunities outside the farm sector. In addition, there are number of technical education imparting institutions continuously producing thousands of technocrats and drive them to the labour market in search of productive employment. They are required to be absorbed in the industrial sector, which necessitates dynamic manufacturing sector in the state with lot of employment generating potential.

In this background, this study has been carried out to study the employment dynamics in Punjab manufacturing to infer something concerning potential of this sector to generate employment. The level of employment, wage share, employment elasticity and its productivity, theoretically, bears a special relationship (Ghose, 1994), for the movement of these structural and technical variables, overtime, helps to work out the character of this sector to absorb the labour force.

Literature Review:
There are several studies that are relevant here to be discussed to have better insight towards the employment dynamics. It has already been stated, output growth bears positive relationship with employment growth. In this context, Okun (1962) stated that level of unemployment bears direct relationship with GDP growth in the economy. Every one percent increase in unemployment above a "natural unemployment" that GDP will decrease by anywhere from two to four percent from its potential.

Verdoorn's (1949) established strong relationship between the growth of industrial productivity and industrial output, for faster growth in output increases productivity due to increasing returns. He argued that "in the long run a change in the volume of production, say about 10 per cent, tends to be associated with an average increase in labor productivity of 4.5 per cent." The Verdoorn's coefficient close to 0.5 is also found in subsequent estimations of the law. Verdoorn's law differs from the "the usual hypothesis … that the growth of productivity is mainly to be explained by the progress of knowledge in science and technology" (Kaldor, 1966), as it typically is in neoclassical models of growth (e.g. the Solow model). Verdoorn's law is usually associated with cumulative causation models of growth, in which demand rather than supply determine the pace of accumulation.

Horst et al (2009) investigated the trade-off between employment and labour productivity in a panel of OECD countries in 1970-2003. The endogeneity of employment is shown to matter crucially for assessing its effect on productivity. Estimating a structural model with 3SLS, where employment depends on demographic variables and labour market institutions, the study found that employment tends to boost productivity. However, literature ignoring the endogeneity of employment incorrectly finds a negative or insignificant effect from employment on productivity. The productivity gain is, however, not a guaranteed by-product of additional employment, as regressions with rolling windows reveal.

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Akerlof (1982) argued that higher real wages lead to greater effort from workers. Additionally, higher real wages put upward pressure on labor costs and cause firms to substitute capital for labor, thereby increasing the marginal productivity of labor (Wakeford, 2004).

Klein (2012) looks at dynamics of employment in South Africa and examines the factors that contributed to the job-shedding observed during the recent financial crisis. The paper finds that the rapid growth of the real wage, which outpaced the labor productivity growth in most sectors, played an important role in suppressing employment creation. The paper also finds that while there is a co-integrating link between the real wage and labor productivity, the deviations from equilibrium are persistent and thus contribute to a weak link between real wage growth and labor productivity growth in the short term.

McMorrow et. al. (2005) dismissed the notion of a genuine trade-off between employment and productivity growth in the study of Portugal. The dynamic response of productivity to positive labour supply and wage shocks may entail a temporary reduction in productivity growth rates, which, in principle could be considered as benign; anyway, the size of a negative effect of this type is estimated to be fairly small. In particular, this paper reaches the following conclusions: (i) The increase in employment since the mid 90s has indeed been to a significant extent the result of such positive labour market shocks, with about one half of the additional jobs attributed to structural improvements; (ii) Positive employment shocks can only account for a very small fraction of the observed productivity slowdown; consequently, the decline of labour productivity growth must be considered as predominantly caused by other factors and probably not just a temporary phenomenon.

Marjit & Kar (2007) showed growth experience in India, and highlighted the role of skill-based service sector and productivity improvement rather than a significant rise in physical capital accumulation. They highlighted that more productive skilled workers depress informal wage in the short-run, but do not affect it in the long run, when capital is fully mobile across sectors. If the productivity of unskilled workers in the formal sector improves, it may have drastically different impact on the informal wage in the short and the long run. Secular labour productivity growth in the informal sector may lead to lower wage for informal workers if capital mobility is restricted between the formal and the informal.

Bhat and Siddharthan (2010) analysed the importance of human capital in determining the inter-state differences in labour productivity, its growth and differences in growth in employment in Indian states for the period 2003-2007. Due to the presence of skill bias in the new technology, persons with less education would become victims. The panel model results of Generalised Least Squares using cross section weights show that after controlling for other determinants, variables representing human capital emerge significant determinants of productivity. On the whole the results presented show strong skill bias in productivity and employment growth across states.

Several studies show presence of skill bias in the new technology and argue that persons with less education would remain unemployed. Feliciano (2001) found increased wage inequalities in Mexico due to new technology and liberalisation of the economy. For the Latin American countries, in general, Kim (1998) found that the inflow of investments consequent to liberalisation created jobs mainly for skilled labour. For India, Pandit and Siddharthan (2008) showed that employment increased mainly in skill and technology intensive industries.

Upender (2006) tried to look at the responsiveness of employment to the changes in Output during pre and post Indian economic reform periods by estimating a derived demand function for employment with an interaction variable. The empirical results based on the time series data from 1982-83 to 1999-00 period exemplify that the labour absorption capacity in private organized sector is relatively high as compared to public organized sector during post economic reform period as the differential output elasticity of employment estimated is significantly positive in private organized sector and significantly negative in public organized sector.

Majumdar (2000) in a international comparison of employment elasticity highlighted that major determinant of employment elasticity is the way the fruits of output growth are divided between employment growth and wage growth. The discussion depends on elasticity of the wage bill with respect to output –which determines the trend in the share of labor; and secondly, the price effect, depending partly on the rate of inflation and partly on the movements of producer prices relative to consumer prices.

There is no such study that exclusive studied the factor intensity in the Punjab manufacturing sector, but such studies are available for the Indian manufacturing sector. Chaudhuri (2002) studied the changes in labor intensity for 3-digit groups in the organized manufacturing sector of India for 1990-91 and 1997-98. He found that labor intensity had progressively gone down from 0.78 in 1990-91 to 0.56 in 1997-98. Umi and Unni (2004), observed a sharp growth in capital intensity (declining labor intensity) in both the organized and unorganized sectors. The positive growth in capital intensity was not accompanied by arise in capital productivity in both sectors, which again implied a substitution of capital for labor, without any technological up-gradation, across all industry groups at the 2-digit level in both the sectors.

Objectives of the Study:
- To study the growth in manufacturing sector of Punjab and its efficiency in achieving such levels.
- To examine the co-movement of the employment growth and growth in wage disbursement.
- To discover factors those determine the level of employment in the manufacturing sector of Punjab.
- To study the level of employment elasticity and nature of factor intensity in the manufacturing sector of Punjab.
- To study the relationship between employment and productivity in the manufacturing sector Punjab.
- To discover the level of factor productivity and technology in the growth of value added in the manufacturing sector of Punjab.

Hypotheses:
- Punjab manufacturing sector has achieved higher levels of output with increased efficiency levels.
- The wages in the Punjab manufacturing sector are positively related to labour productivity.
- Enhanced labour productivity in Punjab manufacturing sector is due to capital deepening and better management.
- The level of employment in Punjab manufacturing sector is negatively related to productivity. Capital is expected to be labour displacing.
- Given the product mix of Punjab manufacturing sector, the employment elasticity is expected to be positive.

Period of Study, Data and Methodology:
Period of study:
The study covers the period of 1981-2009 dictated by the availability of data. This period comprises the period of political turmoil and insurgency during 80's when development wheel of state was choked with low levels of investments. The period of 90s witnessed new economic reforms at the national level; however, state was still struggling with the damage repair. And expectedly could not board the bus with the national economy. However, during the recent decade, the state has observed remarkable growth momentum. Accordingly, the study period is divided into three period segments, 1981-90 (pre-reform period), 1991-2000 (first sub-period of post reforms) and 2001-09 (second sub-period of post reform period).

Data sources and prices:
Annual survey of industries (ASI), published by CSO and Statistical Abstract of Punjab are the major sources of detailed information on industrial characteristics such as value of output, value added, employment, capital assets, emoluments,

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material consumed etc. ASI provides information is available at national and at state level. State level information has been used to generate manufacturing data for entire manufacturing segment (single digit) and at the two-digit level manufacturing groups. The industrial classifications have officially changed in 1998 and 2004 and it was not possible to make discrete series directly. For this purpose, a vigorous exercise has been done by going to the level of three digit data (where required) and workable data series have been generated. For making price corrections in the reported data on value of output, gross value added, and material consumed and depreciation; wholesale price index for manufactured commodities has been used. Wholesale price index for machinery and equipment has been used to adjust the data on fixed capital and for depreciation. Consumer price index for industrial workers has been used to deflate the emoluments and wages. Every deflator has 2004-05 as a base year. Moreover, capital variable has been adjusted by Perpetual Inventory Method (PIM) to correct the fundamental flaw in the reported variable.

Methodology:
To estimate the growth in variables, overtime, trend growth rate has been estimated by using the semi-log trend method. Change in the employment share of distinct manufacturing groups in the total employment in manufacturing highlights the trend of labour absorption capacity of different groups' overtime. For this purpose, percentage of employment in the manufacturing group to total employment level for the years 1981-82, 1991-92, 2001-02 and 2009-10 is estimated. Share of emoluments in output levels and its change over time helps to apprehend many undercurrents regarding the employment dynamics. Hence, percentage of emoluments in total manufacturing output of the state are estimated for the years 1981-82, 1991-92, 2001-02 and 2009-10.

To get further depth of the determinants of the employment in the manufacturing sector of the Punjab, following fixed effect model has been estimated by the technique of Generalized Least Squares on the panel data of twelve industrial groups.

$$\text{Log } L_{it} = \beta 1 \text{LogK}_{it} + \beta_2 \text{LogY}_{it} + T \text{ -------- (1)}$$

In this equation, Lit stands for level of employment in ith manufacturing group in period t. Kit stands for the PIM adjusted real capital stocks in ith manufacturing group in period t and Yit is the level of real output in the ith group in period t. T is a time variable.

Employment elasticity has been calculated by estimating the following regression equation by ordinary Least Squares (OLS);

$$\text{Log Lt} = a_0 + a_1 \log Yt - a_2 \log Kt \text{ ---------- (2)}$$

Where: Lt: is the level of employment in period't'; Kt: is the level of capital in period't'

Yt: is the level of output in period't'
a_1 and a_2 are elasticity of employment with respect to output and capital respectively. $a_2 > 0$ implies labor and capital are complementary and $a_2 < 0$ implies labor and capital are substitutes.

Capital Labour Ratio a measure of capital deepening and partial productivity of labor and capital have been calculated by using the following formulas:

$$\text{Capital Labour Ratio} = \frac{\text{Captial Assets}}{\text{Labour Employed}}$$

$$\text{Labour Productivity} = \frac{\text{Gross Value Added}}{\text{Labour Employed}}$$

$$\text{Capital Productivity} = \frac{\text{Gross Value added}}{\text{Capital Employed}}$$

Factor productivity and technology are considered as important factors to influence the manufacturing value added. The improvement in labour productivity and capital productivity positively affects the value addition. The variable T, measures disembodied technological change, enables the existing factors to perform better and facilitates to increase in value-addition. In this regard, using panel data of 12 two digit manufacturing groups, following regression has been estimated by Generalized Least Squares after controlling the individual industry effects (fixed effect model).

$$\text{Log } V_{it} = \beta 1 \text{LogCP}_{it} + \beta 2 \text{LogLP}_{it} + T \text{ ---------- (3)}$$

Here, Vit stands for Gross Value Added of ith group in period t, CPit and LPit are capital productivity and labour productivity in the ith manufacturing group in period t and T stands for time. β1 and β2 are the elasticity of value added with respect to capital productivity and labour productivity respectively.

Growth Pattern, Employment and Wages:
Output growth, overtime, has implications for employment, wages, labour productivity, factor intensity and employment elasticity. Such relationships assist to ascertain the potential of the manufacturing sector to generate employment. Punjab manufacturing sector has followed cyclical pattern, as pre-reform period (1981-1990) has witnessed dramatic growth in output (10.5 percent per-annum). The output growth turned sluggish (5.1 percent per-annum) during the first post reform period (1991-2000), subsequently re-emerged as dynamic sector during the second post-reform period (2001-09) when it grew at the rate of 11.9 percent per-annum. During the entire study period, output grew at the rate of 5.6 percent per-annum (Table-1). So far the individual segment's performance is concerned, all other manufacturing groups have witnessed output growth pattern similar to entire manufacturing sector except for food, textiles, wood, leather and motor vehicles. Some groups which performed remarkably better in the pre-reform period could not pick up in the post reform period such as chemicals, petro products, motor vehicles and medical instruments (Table-1). This indicates tendency towards change in the patterns of manufacturing production.

Value addition is defined as difference in the value of output and the value of inputs, therefore, an indicator of manufacturing efficiency. Value added and output variables, generally, move in the same direction but the difference in the pace of these variables helps to capture some under-currents. Was the Punjab manufacturing sector more dynamic during the post-reform period? The numbers do not seem to favour this statement. As During the entire study period, and the pre-reform period the value added variable out-performed the output variable. However, value added variable under-performed the output variable during the both sub-periods of post reforms era (Table-1). Largest value addition growth has been registered by the food (11.4%) followed by paper (11.0%) leather (10.3%) wood and medical and precision instruments (8.8%). Textiles occupy significant share in the manufacturing sector of Punjab recorded mere 5.9% growth in value addition. Glance at the Table-1 also shows that value added growth was minimum during first sub-period of post reforms period except for wood, chemicals, petro etc.

The forgoing discussion highlights that so far as the output and the value added are concerned, pre-reform period and the second sub-period of the post-reform period are relatively better than the first sub-period of the post-reform period. Why did this happen in the manufacturing sector of Punjab? An attempt has been made to discover such patterns by pondering over the growth patterns of input variables.

Table-1: Trend Growth Rates of Output and Value Added in Distinct Manufacturing Groups (1981-2009)

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Industry Group	Output				Value Added			
	1981-1990	1991-2000	2001-2009	1981-2009	1981-1990	1991-2000	2001-2009	1981-2009
*Food, Beverages and Tobacco	9.6	10.9	12.0	9.9	11.8	6.5	16.9	11.4
*Textiles and Wearing Apparels	-2.0	0.9	13.9	4.5	12.5	3.5	11.4	5.9
*Wood and Furniture	1.5	7.1	8.8	9.0	6.2	18.1	2.2	8.8
*Paper, Paper Products, Publishing and Printing	21.7	6.7	16.5	11.4	23.0	3.4	22.7	11.0
*Leather and Leather Products	11.7	22.5	2.3	11.2	19.9	15.2	2.1	10.3
*Chemicals and Chemical Products	11.0	8.0	5.6	7.9	3.7	10.8	-22.2	2.3
*Rubber, Plastic, petrol and Coal Products	15.3	5.7	6.7	7.7	13.4	11.8	5.5	6.9
*Basic Metals	9.1	2.8	6.3	6.9	8.8	3.9	14.8	4.7
*Fabricated Metal Products (Except Machines and Equipments)	9.7	7.2	15.7	10.7	10.3	6.6	6.2	8.6
*Machines, Equipments, Office and Computing and ommunications	11.3	7.6	10.5	7.2	9.1	5.9	6.4	6.1
*Motor Vehicles and Other Transport Equipments	11.7	2.5	4.4	7.4	10.7	5.5	3.8	6.8
*Medical Precision, Opticals, Watches and Clocks	10.8	3.6	4.7	6.4	16.9	2.9	11.9	8.8
*Entire Manufacturing Sector	10.5	5.1	11.9	5.6	11.4	4.1	10.9	6.4

Output growth in manufacturing is, theoretically, contributed by capacity expansion and productivity growth. So far as the capital formation in the Punjab manufacturing sector is concerned it grew at the rate of 3% per annum during the entire study period. However, such growth was stagnant (0.4 percent) during the pre-reform period (1981-90) and recorded slow growth (4 percent per-annum) during the first sub-period in the post reforms period (Table-2). Such trends are, possibly, due to period of political turmoil and insurgency during pre-reform period in the Punjab and investors did not show interest in the economy of Punjab. However, when militancy receded after 1991 and new economic reforms provided ample opportunities for investments and capacity expansion, the investors did not respond vigorously, might be due to scare still lingering. Moreover, the Punjab government did not come forward with any concrete policy. In individual manufacturing groups, capital formation stayed sluggish in the major groups though it picked up in such groups in the first sub-period of post reforms period. Almost all the major groups (food, textiles, motor vehicles, engineering and metals) turned dynamic in the second sub-period of post reform period. It again proves the fact that period after 2000-01 is more vibrant in the Punjab Manufacturing sector (Table-2).

Table-2: Trend Growth Rates of Capital Assets and Labour Inputs in Distinct Manufacturing Groups (1981-2009)

Industry Group	Employment				Emoluments				Capital Assets			
	1981-1990	1991-2000	2001-2009	1981-2009	1981-1990	1991-2000	2001-2009	1981-2009	1981-1990	1991-2000	2001-2009	1981-2009
Food, Beverages and Tobacco	6.7	4.7	2.4	**3.1**	10.0	5.4	2.2	**5.0**	5.7	10.4	12.1	**6.4**
Textiles and Wearing Apparels	3.9	-0.6	7.7	**1.8**	8.1	-0.2	8.8	**3.8**	2.9	8.0	22.6	**7.3**
Wood and Furniture	-6.9	12.1	3.8	**5.0**	-1.4	9.8	3.4	**4.4**	6.4	26.5	-3.3	**9.8**
Paper, Paper Products, Publishing and Printing	8.8	2.4	5.7	**3.9**	15.9	2.4	6.7	**6.3**	-1.3	15.6	-5.0	**8.0**
Leather and Leather Products	10.8	11.2	-4.9	**6.1**	12.2	8.0	-7.9	**7.3**	-3.0	22.8	-4.5	**8.3**
Chemicals and Chemical Products	4.6	3.5	6.7	**2.3**	9.2	5.7	6.7	**2.3**	-6.4	2.8	11.9	**-0.7**
Rubber, Plastic, petrol and Coal Products Basic Metals	9.0	1.9	0.7	**4.2**	14.7	0.6	2.3	**5.7**	11.4	5.3	-4.2	**5.2**
Fabricated Metal Products (Except Machines and Equipments)	0.0	-0.1	8.7	**0.2**	3.6	-0.7	7.3	**1.6**	-0.6	0.0	11.0	**3.5**
Machines, Equipments, Office and Computing and Communications	0.2	4.5	10.5	**4.3**	2.9	2.4	10.5	**5.7**	0.6	9.0	23.0	**8.2**
Motor Vehicles and Other Transport Equipments	3.3	-0.1	4.6	**1.8**	7.3	2.1	3.3	**4.2**	7.1	3.3	-1.8	**0.4**
Medical Precision, Opticals, Watches and Clocks	6.4	-1.3	2.6	**2.8**	18.7	6.8	10.5	**12.2**	-5.2	-7.0	10.4	**5.2**
	4.8	2.1	12.6	**4.6**	9.9	0.8	14.3	**6.2**	26.2	7.8	11.4	**9.1**
Entire Manufacturing Sector	**5.6**	**-2.2**	**7.4**	**1.8**	**9.8**	**-0.1**	**6.5**	**2.8**	**0.4**	**4.0**	**19.8**	**3.0**

Rate of growth in employment in the manufacturing sector stayed behind the growth rates in the value added, output and capital stocks. Punjab employs around 10 percent of its workforce in the manufacturing sector during the entire study period. Such share is expected to grow as the share of industrial sector pick up in the state domestic product. As far as the distribution of labour in the individual industrial groups is concerned, the dominant groups have either consolidated or maintained their relative position in terms of providing employment overtime (Table-3). Table clearly reveals that food, textiles and transport groups remained dominant in absorbing the labour force. The production pattern of manufacturing sector in Punjab did not witness much change over time and it is dominated by the less capital intensive sectors. Hence, the employment shed by non-dominated manufacturing groups is absorbed by the dominant groups. This indicates that the non dominant groups are tilting more towards capital intensive techniques. To vindicate this fact, factor intensity has been calculated in next section.

What is the growth pattern in employment in the entire manufacturing sector and its individual sectors? Did the new economic policy create any niche for the continuously increasing labour force? Is manufacturing sector paying higher wages to its employees than before? Trend growth rates, in this regard, for employment and emoluments are presented in table-2. Table clearly states that employment in Punjab manufacturing sector grew at the rate of 1.8 percent per-annum during the entire study period. Unlike the manufacturing sector of India, which witnessed jobless growth during the pre-reform period, Punjab manufacturing sector witnessed considerable growth in employment (5.6 percent per-annum), however it turned into negative growth (-2.2 percent) after the onset of policy reforms only to pick up in the recent decade (7.4 percent per annum). Same story has been replicated in the context of emoluments. The table-2 clearly states that the emoluments grew faster than the level of employment except for the recent decade. This trend highlights the fact that Punjab manufacturing sector paid fewer wage in the second sub-period of post reform period. Unfortunately, the employment growth was higher in the non-dominant groups during this period. The importance of labour as factor of production has declined over time as the entire manufacturing sector and individual groups (except motor vehicles) have witnessed declining share of emoluments in the output over time. Its share

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was 8.42 percent in 1981 and declined to 3.14 percent in 2009, a remarkable decline (Table-4).

Table-3: Changes in Shares of Employment of Distinct Manufacturing Groups in the Employment of Entire Manufacturing Sector of Punjab (Percentage Figures)

Industry Group	1981-82	1991-92	2001-02	2009-10
Food, Beverages and Tobacco	15.80	13.92	16.00	19.25
Textiles and Wearing Apparels	24.20	18.82	23.64	23.20
Wood and Furniture	0.40	0.10	0.40	0.30
Paper, Paper Products, Publishing and Printing	1.22	1.75	2.63	2.70
Leather and Leather Products	0.40	0.62	1.72	0.80
Chemicals and Chemical Products	3.67	2.91	3.74	3.44
Rubber, Plastic, petrol and Coal Products	1.89	3.40	5.15	3.30
Basic Metals	9.56	6.47	6.74	6.13
Fabricated Metal Products (Except Machines and Equipments)	4.68	3.36	5.59	6.25
Machines, Equipments, Office and Computing and Communications	8.82	7.26	9.25	7.47
Motor Vehicles and Other Transport Equipments	9.22	12.80	13.33	10.00
Medical Precision, Opticals, Watches and Clocks	0.14	0.15	0.21	0.29
Others (Not Included Elsewhere)	20.00	28.44	11.60	16.87

Table-4: Changes in Emoluments Share of Distinct Manufacturing Groups in Output of Respective Groups (Percentage Figures)

Industry Group	1981-82	1991-92	2001-02	2009-10
Food, Beverages and Tobacco	3.86	3.78	3.90	2.15
Textiles and Wearing Apparels	8.04	6.75	10.96	4.23
Wood and Furniture	12.84	13.17	8.77	5.63
Paper, Paper Products, Publishing and Printing	14.43	8.32	6.00	3.45
Leather and Leather Products	8.00	11.42	5.22	3.55
Chemicals and Chemical Products	7.24	5.38	4.19	3.83
Rubber, Plastic, petrol and Coal Products	7.18	6.36	6.49	3.80
Basic Metals	4.55	3.12	2.52	1.15
Fabricated Metal Products (Except Machines and Equipments)	11.56	7.23	6.00	4.02
Machines, Equipments, Office and Computing and Communications	9.84	7.31	6.79	4.32
Motor Vehicles and Other Transport Equipments	1.51	3.55	5.40	8.00
Medical Precision, Opticals, Watches and Clocks	8.90	8.25	5.25	10.49
Entire Manufacturing Sector	8.42	6.30	4.64	3.14

To have, further, insight into the determinants of employment in the manufacturing sector of the Punjab, fixed effect model as specified in the methodology (equation-1) by the technique of Generalized Least Squares (GLS) has been estimated for the panel data of 12 two digit manufacturing sector data by controlling the heteroscedasticity. The variable employment has been regressed on the capital stocks, output and time variables. The variable employment is expected to be affected by the relative shift in capacity in the industry that also influence the capital-labour ratio and the enlarged availability of capital to the labour is expected to have influence on the level of employment. The investment in plant and machinery is viewed as an indicator of vertical growth symptomatic of the technical content of job/skill profiles in the industry. Axiomatically changing level of fixed capital could be independently viewed as a factor having strong potential to influence the employment levels. As the industry experience the increase in the output, the employment is expected to be positively significantly influenced. For, the demand for labour is derived demand and any increase in output is expected to generate employment. The influence of the residual factors is captured by T, time variable generally termed as technology variable; this may be having labour using and labour displacing impact depending on circumstances including the policy issues. The results of the estimation are presented in the Table-5. Here four regression are estimated, three for the sub-periods and one for the entire period. The model specification has been defended by the significant value of F-statistic. During the entire study period coefficient of output variable has turned out, as expected, positive and significant. However, the employment elasticity with respect to capital variable has resulted negatively significant which put a question mark on the employment creating capability of capital variable. Rather it has squeezed the employment growth in the state. Besides, the time variable coefficient has been registered as positive and significant indicates that employment in the manufacturing sector of Punjab has been positively affected by the disembodied technology. Same results have been replicated for the second sub-period of the post-reform period with more explanatory power. Again the capital investment is labour displacing and disembodied technical change is contributing to increase in employment. During the pre-reform period, only output is responsible for creation in employment, however technology in the embodied and disembodied format is unable to contribute for employment that justify our earlier results that capital investment did not improve substantially during this period and technological change was labour displacing also. During the first sub-period of post reform period, output variable performed expectedly and the technology improvement was also labour using, however, capital variable as usual behaved negatively so far contribution to employment is concerned. These results indicate that Punjab manufacturing sector did not create employment by capacity expansion but the disembodied technology change has some capacity to contribute something in this context.

Table-5: GLS Estimation of Fixed Effect Model of Determinants of Employment By Using Panel Data of Two Digit Manufacturing Groups (1981-2009) (Dependent Variable- Log Employment)

Variable	1981-1990	1991-2000	2001-2009	1981-2009
Log Kit	-0.05 (1.36)	-0.001(0.052)	-1.25* (23.65)	-0.03* (2.72)
Log Yit	1.02* (24.41)	0.22* (3.77)	3.81* (40.63)	0.48*(6.36)
T	-0.02* (12.85)	0.005*(2.13)	0.041*(36.86)	0.01*(3.21)
No. of Observations	120	120	108	348
R2	0.9955	0.8887	0.9912	0.7550
Adjusted R2	0.9949	0.8055	0.9899	0.7447
F-Statistic	1815.58*	12.21*	5294.89*	513.10*
Durban Watson	2.2422	1.2949	2.8962	1.7543

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Notes: Figures in the Parentheses are T Values * Indicates the Significant Values

Employment Elasticity:
Expansion of manufacturing sector alone cannot be expected to solve the unemployment and under-employment problem in many less developed countries (Morawetz, 1974). The employment elasticity with respect to output and capacity expansion should also be high. Elasticity measures the percentage rate of growth of employment resulting from a one percent rate of growth in output and capital stocks. Employment elasticity, therefore, also gives an idea of trend in labour productivity in comparison with growth in employment for the sector. Specifically, an elasticity that is greater than one indicates declining levels of productivity over a period; elasticity equal to one indicates labour productivity is maintained at the same level and an elasticity that is less than one reflects rising level of productivity (Suryanarayanan, 1995). Keeping in view the dismal scenario of educated unemployment and significant share of industrial sector in the state domestic product, employment elasticity with respect to output and capital has been calculated to discover the potential of industrial sector in generating employment. The calculated values of elasticities are presented in the Table-6. The picture revealed in the table is not encouraging. The employment elasticity with respect to output during the all three sub-periods remained less than one for all manuftauring groups and for the manufacturing sector as a whole. The results also vindicate the earlier results that the employment elasticity was highest during the pre-reform period (0.45) and as expected it has declined to 0.29 during the first sub-period of post reform period only to pick up during the recent decade to the level of (0.35). Unfortunately, the employment elasticity declined considerably in the dominant production groups' overtime except for motor vehicles. However, performance of elasticity was relatively better in the non- dominant groups in the recent decades. It may also be the indicator of higher labour productivity; it has been explored in the subsequent section.

Even more disappointing feature is depicted by the table-6 is the value of employment elasticity with respect to the capital stocks. The negative elasticity for the entire manufacturing sector during all three sub-periods indicates the fact that capital is labour substituting. Moreover, all

Table-6: Employment Elasticity of Various Manufacturing Groups Overtime

Industry Group	Employment Elasticity with respect to Output			Employment Elasticity with respect to Capital		
	1981-1990	1991-2000	2001-2009	1981-1990	1991-2000	2001-2009
Food, Beverages and Tobacco	0.60	0.44	0.17	-0.34	-0.07	0.04
Textiles and Wearing Apparels	0.41	-0.04	0.04	-0.04	-0.03	-0.35
Wood and Furniture	0.61	0.42	0.51	0.57	-0.36	0.02
Paper, Paper Products, Publishing and Printing	0.45	0.53	0.38	-0.51	-0.15	-0.25
Leather and Leather Products	0.80	0.48	-0.82	-0.05	-0.06	-0.17
Chemicals and Chemical Products	0.29	0.39	0.73	0.55	-0.45	-0.53
Rubber, Plastic, petrol and Coal Products	0.67	0.03	0.30	-0.83	-0.38	0.03
Basic Metals	0.12	0.14	0.56	-0.73	-0.26	-0.56
Fabricated Metal Products (Except Machines and Equipments)	0.20	0.54	0.66	-0.37	-0.13	-0.46
Machines, Equipments, Office and Computing and Communications	0.31	0.03	0.51	-0.43	-0.19	0.20
Motor Vehicles and Other Transport Equipments	0.56	0.31	0.42	+0.06	-0.31	-0.22
Medical Precision, Opticals, Watches and Clocks	0.44	0.26	0.62	-0.16	-0.04	-0.73
Entire Manufacturing Sector	0.45	0.29	0.35	-0.53	-0.26	-0.35

the dominating manufacturing groups' recorded negative coefficient does not support the labour absorbing character of the manufacturing in the pre-reform period. The situation did not change in the post-reform period. Wherever complimentarily appeared, it was with meager value and not much hopeful. To explore further, factor intensity, capital productivity and labour productivity are calculated in the next section.

Factor Intensity and Productivity:
Labour productivity in any manufacturing set up may change due to combined role of capital deepening and capital productivity (Ghosh, 1994). Capital deepening provides more capital per unit of labour and per unit more value addition by capital stocks highlights the improvements in the capital productivity. Growth in labour productivity effects employment generation adversely in short period as there may be inverse relationship between labour productivity and employment (Sharma & Saxena, 1998). In this context, trend growth rates in the labour productivity, capital productivity and factor intensity have been calculated and the results are presented in Table-7. During the entire study period, as expected, the manufacturing sector of Punjab witnessed positive trend growth rate in capital-labour ratio (2.74 percent) indicating the capital deepening. However, as already indicated the capital expansion did not take place in the Punjab industry during the pre-reform period, consequently this ratio has recorded negative growth (-1.5 percent) albeit pick up in the labour employment. During the post reform period, capital deepening has been recorded as positive and significant indicating further that the stagnation in the employment generation during the first sub-period of post reform period and relatively better capital formation as compared to employment generation. So far the individual manufacturing groups are concerned; food, textiles, paper, metals and motor vehicles have become more capital intensive during post reform period.

Labour productivity was also recorded higher during pre-reform period (6.4%) and decelerated subsequently in the successive sub-periods (4.5% and 3.3% respectively). Here it can be inferred that labour productivity grew positively during the study period with decelerating rate of growth. However, individual groups performed differently need to be further investigated. Relatively higher growth of emoluments as compared to growth in employment is vindicated by the fact of labour productivity gain. However, the reduction in the share of emoluments in output over time has also been justified by the fact of declining levels of labour productivity. Capital intensity has increased during the post-reform period which is contrary to the decreasing labour productivity put question mark on the capital productivity also. Hence, capital productivity has been calculated in the Table-7. The levels of capital productivity growth are positive but slow during the entire study period (1.2 percent); however it was recorded negative during the post reform period. Therefore, it seems that capital investments, overtime, were not loaded with new technology. These results were even true for the individual manufacturing groups except for the Petro. The fall in the growth of labour productivity during post-reform period is explained by the fall in capital productivity and acceleration in capital deepening in the Post-reforms period. It can also be inferred that the capital invested in the post reform period is devoid of improved embodied technology element.

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Table-7: Trend Growth Rates of Capital Labour Ratio, Labor Productivity and Capital Productivity in Distinct Manufacturing Groups (1981-2009)

Industry Group	Capital-Labour Ratio				Labour Productivity				Capital Productivity			
	1981-1990	1991-2000	2001-2009	1981-2009	1981-1990	1991-2000	2001-2009	1981-2009	1981-1990	1991-2000	2001-2009	1981-2009
Food, Beverages and Tobacco	-0.9	5.2	12.0	3.2	3.0	3.5	9.3	3.5	3.9	1.9	0.1	0.3
Textiles and Wearing Apparels	-1.8	9.0	22.2	10.0	4.1	1.5	5.6	4.1	5.2	-7.9	-7.7	-1.2
Wood and Furniture	13.8	19.4	-7.4	4.8	8.6	4.3	4.7	4.1	-4.7	-14.4	2.5	-0.7
Paper, Paper Products, Publishing and Printing	-9.9	12.8	18.4	4.1	11.8	4.1	10.4	7.5	23.0	-8.2	-7.3	3.3
Leather and Leather Products	-14.1	10.5	0.7	2.1	0.8	10.4	7.5	4.7	-14.1	10.5	0.7	2.1
Chemicals and Chemical Products	-11.3	-0.8	5.2	-3.0	6.2	4.2	-0.7	4.8	18.2	5.1	-5.9	8.1
Rubber, Plastic, petrol and Coal Products	0.9	4.0	-5.1	1.0	4.7	3.7	5.9	3.4	3.7	-0.2	11.2	2.3
Basic Metals	-1.1	1.1	5.0	3.4	8.5	4.3	6.9	6.6	9.6	3.1	1.9	3.1
Fabricated Metal Products (Except Machines and Equipments)	0.0	4.3	11.4	3.7	9.5	2.5	4.7	5.2	9.4	-1.7	-6.4	1.6
Machines, Equipments, Office and Computing and Communications	14.8	3.4	-5.8	-1.2	7.7	5.4	5.5	5.4	3.9	2.0	11.7	6.6
Motor Vehicles and Other Transport Equipments	-12.0	-5.6	7.6	2.4	5.0	4.1	1.6	4.6	17.7	10.0	-5.8	2.0
Medical Precision, Opticals, Watches and Clocks	20.5	5.7	-3.0	2.4	5.7	1.5	-9.5	1.8	-14.0	-4.1	-6.4	-0.7
Entire Manufacturing Sector	-1.5	5.7	5.2	2.7	6.4	4.5	3.3	4.5	1.3	-0.5	-1.2	1.2

Factor productivity and technology are considered as important factors to influence the manufacturing value added. The improvement in labour productivity and capital productivity positively affect the value addition. The variable T, measures the disembodied technological change, enables the existing factors to perform better and facilitates to increase in value addition. In this regard using panel data of 12 two digit manufacturing groups, Value added variable has been regressed on the capital productivity, labour productivity and time related factors (equation-3) for the entire study period and for three sub-periods. The results are presented in the Table-8.

Table-8: GLS Estimation of Fixed Effect Model of Productivity Determinants of Value Added by Using Panel Data of Two Digit Manufacturing Groups (1980-2001)(Dependent Variable- Log Value Added)

Variable	1981-1990	1991-2000	2001-2009	1981-2009
Log CPit	0.01 (0.07)	-0.09*(5.04)	-1.37* (10.11)	-0.03 (1.49)
Log LPit	1.45* (10.71)	0.46* (6.26)	-0.61* (5.78)	0.19*(2.97)
T	0.03* (8.02)	0.007*(2.63)	-0.01*(3.26)	0.03*(48.41)
No. of Observations	120	120	108	348
R2	0.9093	0.5235	0.8519	0.8185
Adjusted R2	0.8973	0.4601	0.8296	0.8109
F-Statistic	526.89*	57.71*	267.57*	751.22*
Durban Watson	1.7390	2.1351	2.7649	1.7043

Notes: Figures in the Parentheses are T Values * Indicates the Significant Values

The significant value of F in all periods defends the model. The coefficient of capital productivity shows that it either did not contribute to the value added or played a negative role irrespective of the time segment used. Labour productivity turned out to be a driving force to add value addition in the manufacturing sector Punjab. Disembodied technology coefficient is significant for the entire study period and for the first two sub periods. However, disembodied technology contribution to value addition turned out to be negative during the recent decade.

Concluding Remarks:

Output and value added growth during the first sub-period of post reforms (1991-2000) was sluggish; however, pre-reforms period (1981-90) and second sub-period (2001-09) were relatively better. It seems that in spite of politically disturbed period (Pre-reforms period); value added grew better than the growth in output and reflects higher levels of efficiency. However, such levels of efficiency could not be maintained in the successive sub-periods.

Despite the expansion in the Punjab manufacturing sector, it could not generate employment for the mounting educated unemployed. Capital formation during the pre-reform period was negligible and it could pick up in the post reforms period. The capital expansion was labour displacing, for expansion in capacity contributed to the capital intensity in the manufacturing sector of Punjab and employment elasticity with respect to capital turned out to be negative. Additional capital was devoid of new technology, as capital productivity either could not contribute or played negative role towards value addition. However, the employment elasticity with respect to output was positive but less than one. Hence, the entire scenario put a question mark on the employment generating capacity of the Punjab manufacturing sector.

Labour productivity grew positively during the study period; however decelerating overtime, acted as a driving force to value addition in Punjab manufacturing sector. Positive growth in labour productivity reflected positively in wages even better than the growth in employment. Punjab manufacturing sector is paying better to its skill based workers and labour productivity, intuitively established negative relationship with employment.

Policy Implications:

1. The state should develop vibrant manufacturing with labour intensive incline and the share of manufacturing sector should increase in the SGDP and the share shed by the agriculture sector should be absorbed by this sector.
2. Agro- processing industry offers large potential for employment, therefore, deserved to be encouraged. State should create appropriate milieu for the growth of this manufacturing group.
3. The manufacturing groups which are at margin in the Punjab manufacturing sector should be given heed as the existing structure is lacking strong forward and backward linkages.

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