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Productivity and Growth of Manufacturing Industries in Nepal

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Abstract

This paper examines efficiencies measures including factors influencing on output, total factor productivity (TFPG) and factors affecting on TFPG of manufacturing industries of Nepal. Regression equation is estimated to find factors influencing on output and factors affecting on TFPG. Extended Cobb-Douglas production function is examined to find TFPG. As it is disclosed by efficiencies measures such as labour productivity, capital productivity and material efficiency, there is not coherent relation among efficiency measures and output rather than in few cases. It implies that output increase due to many reasons such as protection, internal demand, availability of material input, comparative advantage and so on. As it is evident by the regression result; output is mainly interrelated with the inherent components like labour, capital and material input though road is also noticed as positive factor. Liberalization dummy notifies negative impact on output. Improved TFPG at post-liberalization phase is realized to those years in which capital is also increased which suggests increment in capital probably with improved technology is required to increase overall efficiencies. Capital intensity, export incentive and foreign direct investment are found as factors affecting on TFPG. This study underscores the importance of comparative advantage production since there is not coherence on productivity, growth and efficiencies measures.

Key Words: Productivity; Input Efficiency, Input as percentage of output

Introduction

Productivity is simply understood as the ratio of outputs to inputs and higher productivity means more output with same input. However, Dias explains different methods of productivity measure: (I) productivity in relation to a particular input which would give a measure of partial productivity and (II) productivity in relation to all inputs i.e. total factor productivity (Dias, 1991).Concerning the total factor productivity Diewert refers the total factor productivity of a firm, industry or group of industries as the real output produced by the firm or industry over a period of time divided by the real

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input used by the same set of production units over the same time period (Diewert, 1976. P. 223).

Productivity has vital role in economy. At the national level, productivity growth raises living standards through real income which increase people's ability to buy goods and services, develop housing, benefit from leisure, education and finally contribute to social advancement. As a foundation of economic growth, productivity growth is important to the firm so that firm can meet its compulsion to shareholders, workers, clients, suppliers, and governments, remain competitive and improve its competitiveness. The people of developed countries consume more because they are more productive and the people of the less developed world consume less in comparison to the people of developed countries but more than their ancestors for the reason that the present day productivity is increased. Productivity also affects competitive position: the more productive, the better ability would be to compete in world markets. In short, productivity is the source of the high standard of living as enjoyed by the people of developed countries than to the developing. Manufacturing productivity is described as the efficient use of resources i.e., labour, capital, technology, land, entrepreneurship, materials, energy, information etc. in the production of goods. In an individual firm's viewpoint it is what entrepreneur gets in return from his/her effort. From national standpoint it is what they get in terms of employment, revenue generation, export promotion, import substitution, impact on balance of trade, foreign currency reserve, and ultimately government expenditure on welfare consideration. Accordingly, the principal foundation of economic growth is the raise in productivity which results direct increase in the standard of living condition by reducing unemployment, controlling inflation, and mobilizing resources (Dias, 1991). Hence, a higher productivity is prerequisite for a nations' development. And, it is also guidance for planning and development decision.

Literature Review

The main contribution of this study is to find determinants of manufacturing output, TFPG, factors affecting on TFPG (from 1982 to 2012) and productivity difference inside and outside industrial estates by primary survey. No research has been carried out on the given time frame and area. Hence, it is a study of own kind.

Productivity and growth are concerned with so many factors. It may differ in nature of goods to produce; technology used; policies adopted; infrastructure available; level of education, training and so on. For its sake, many researches are carried on. As per the concern of liberalization, Lee (1996) carried out a research on the trade protection of the manufacturing productivity and effect of industrial policy in Korea using weighted least squares (WLS) technique showed that trade protections, such as tariffs and import restriction, were negatively correlated with the growth rates of value added, capital stock, and total factor productivity. Contrary to protection, Andersson (2001) found openness as being influencing factor for the growth rate of total factor productivity, innovative activity, entry and exit. Similarly, the study of Weinhold and Rauch (1999), Kathuria

(2002), Ferreira and Rossi (2003), Park, Li and Tse (2006), and Widodo (2008) showed the increased productivity after liberalization though the improvement in efficiency was greater for the foreign-owned firms. But, In the case of Zimbabwe; Bjurek and Durevall (2000) and in the case of Pakistan; Majeed, Ahmed, and Butt (2010) found no liberalization effect on TFP rather than import growth and foreign aid inflow.

Goedhuys, Janz, and Mohnen (2008) examined the determinants of productivity in firm-level in Tanzanian manufacturing firms. The findings did not show any significant effect of technology in the productivity of Tanzanian manufacturing. Wan and Xu (2012) also found negative impact of technology (only in terms of import) on TFP growth in Chinese manufacturing. But, Choudhari and Hakura (2000) found technological import enhance productivity growth in the case of developing economy. Likewise, Hsieh (1999) in Singapore, and UNIDO (2014) in Pakistan and India got the adaption of new technology as being major contributor of productivity growth. Gunn and Douglas (1941), found labour as being major contributor of TFP growth in USA; however, Nadiri (1980) got growth rate of capital labour ratio and R&D, Nadiri and Schankerman (1981) got demand growth, real factor price, and R&D as major contributor of TFP; Hulten (1992) found technical change as a source of economic growth; and Kruger (2008) obtained structural change.

Mitra, Varoudakis, and Varoudakis (2002) investigated the effect of infrastructure on productivity of manufacturing in Indian estates. They found the positive relationship between the availability of physical infrastructure and industrial performance. This case was found true in total factor productivity as well as for technical efficiency. As per concern of training and productivity, Sepulveda (2010) got positive effect of on-the-job training. In terms education's relation Goedhuys, Janz, and Mohnen (2013) showed higher educated management companies more productive.

Other researches such as; Apergis, Economidou, and Filippidis (2008), got innovation, technology transfer, R&D, trade, and human capital as being the major factors of productivity in manufacturing industries of EU. In UK; Disney, Haskel, and Heden (2003) found external restructuring as being major cause of TFP growth; Aghion et al. (2004), found entry of foreign firm being major factor of faster TFP growth; and Symeonidis (2008), got cartelized industries more productive than non-cartelized. Gebreeyesus (2008) found new entrants as being more productive in Ethiopean manufacturing. Mahadevan (1999), and Mahadevan (2002) in Singaporean manufacturing and Gu, Lee, and Tang (2000) in Canadian manufacturing found technical change and factor inputs as being important measure of potential output. In the case of Indian manufacturing, Goel (2003) and Srinivasan (2006) obtained infrastructure as being cause to enhance productivity by reducing the costs in the sector; and Madheswaren, Leao, and Rath (2007) found technological progress as major factor of TFP growth which was similar to the findings of Chang and Hong (2006) in U. S. manufacturing. In Spanish manufacturing, Marcos and Jaumandreu (2004) found significant positive impact of investment intensity, import penetration, and gross entry and exit on productivity growth.

Nepalese Context

Nepal has been implementing periodic economic plans since late 1950s, adopted open policies during mid 1980s with the beginning of financial sector reforms and the massive liberalization was adopted in 1991 with the formulation of various trade and industrial related act. However, very few researches have been carried out to know the likely impact of liberalization and assessment of factors contributing to productivity growth, except than some studies on trade and FDI, and their effects on industrial sector development. Productivity related researches carried out by Upadhaya (1988), Kondos (1991), Sharma (2000), World Bank (2003), Pradhan and Kurmi (2004), and Ghimere (2009), were related only with trade and industrial issues, and explained only in terms of trend and pattern. The study of Paudyal (2007) confined only with labour productivity of public enterprises; the study of Gyanwaly (2014) was related with productivity but explained only in macroeconomic context. The research more closer to the manufacturing productivity was carried out by Regmi (2006) who tried to identify total factor productivity as well as the sources of output growth in the Nepalese manufacturing industries over the period 1982- 2002. But his study was limited solely upon secondary data. His study has not concluded the pre and post-liberalization effect since the data taken by him lies on both period. The study of Sharma (2000) is very close to this study, however, he only took the post liberalization period after 1985, and the post liberalization data were only confined with 1994. But, industry related various acts were promulgated mainly in 1991. Likewise, the analysis carried out by Rijal (2014) relating manufacturing industries covers only the period of two census of manufacturing establishment i.e. of 2002 and 2007.

Aforementioned reviews show that there are two different factors influencing on productivity- internal and external. Internal factors are much more concerned with labour, capital, infrastructure, R&D, capacity utilization etc. External factors are mainly import of foreign technology, FDI, export, import penetration, etc. The earlier research in Nepalese context mainly concerned with trade related problems with little contribution on factor productivity. The trade related issues are less likely to be the area of study since there is not promotion and development of manufacturing industries. How it is possible to promote export and substitute import while there is problem in production itself, and in the situation that the manufacturing industries are suffering themselves. Taking all above rationales in mind, this study is carried out to find productivity, growth; factors affecting on manufacturing output and determinants of TFPG.

Data and Methodology

En route to accomplish the objective of this study various efficiency measures (such as input as percent of output, input efficiency, labour productivity, capital productivity, labour productivity growth, capital productivity growth vis-a-vis factors influencing on output, TFPG, and factors influencing on TFPG) are analyzed based on secondary data. Performance, productivity and productivity growth of manufacturing are analyzed on national level and manufacturing categorized as leading industries, emerging industries

and other industries. Though the advance data recording system of manufacturing initiated from 1977 albeit of new industrial classification introduced from 1982; they are taken accordingly. Since the manufacturing census data are available up to 2012 and no new census is published up to 2019, they are taken accordingly. Data were collected from the following sources:

(a) Economic Survey: Ministry of Finance: GDP, manufacturing GDP, population

(b) Department of Industry: FDI

(c) NRB: Lending interest rate, export, import

(d) Census of Manufacturing Establishment: Input, output, employment, wage, value-added, capital

Variables Defined

Variables are defined as per definition of Census of Manufacturing Establishments Nepal.

$$\textbf{\textit{Input}}=TCm+TCf+Ve+Isc+Vs++Nisc$$

Where: = total cost of materials, and supplies purchased,= total cost of fuels purchased, = cost of electricity purchased, = cost of industrial and other services, = change in value of stocks of materials and fuels, = non industrial services cost. Non-industrial services cost is the cost of rent, advertisement, water, communication, transportation expenses, patent right, legal advice, agent commission, travel and daily allowances and miscellaneous.

$$\textbf{\textit{Output}}=Vs+Rios+Cow+Cvs+Inis$$

Where: = total value of shipments (including own consumption), = total receipts from industrial and other services, = total cost of work done on own account, change in value of the stocks of finished goods, semi finished goods and goods sold in the same condition as purchased, = income from non-industrial services. Income from non-industrial services is receipt from rent, transportation, agency commission and miscellaneous.

$$\textbf{\textit{Capital}}=L+B+Me+Te+Ff+Ot$$

Where: value of land, = Value of buildings, = Value of machinery & equipment, = Value of transport equipment, = Value of furniture and fixtures and = others, at the given year.

$$\textbf{\textit{Wage}}=Dw+Iw$$

Where: = Direct wages, salaries and facilities (cash remuneration of current work performed) and = remuneration for time not worked (direct cash payment in respect of public holidays, annual vacations and other leave facilities).

$$\textbf{\textit{Value Added}}=Output-Input$$

Efficiency and Productivity Measurement

Efficiency Measurement

Input as Percentage of Output

$$\text{Input as percent of Output} = \frac{Input}{Output} \times 100$$

Input as percentage of output illustrates the input per 100 outputs. Hence, higher value of indicator depicts lower performance and vice versa.

Material Efficiency

Material Efficiency is the ratio of value added and output calculated as:

$$\text{Material Efficiency} = \frac{Value\ Added}{Output}$$

Value added output ratio measures the efficiency of the use of materials inputs or the profit margin without tax deduction.

Productivity Measurement

Labour Productivity

Value added per employee is measure of labour productivity in manufacturing which indicates the average amount of value added produced by an employee.

$$\text{Labour Productivity} = \frac{Value\ Added}{Employmen}$$

It is also the easiest approximation of the labour productivity in manufacturing. If more capital is used by a labour or when a labour is more skilled, will result more value added. Labour productivity therefore presents a mixed measure of labour skills and capital intensity. For consistency checks of the survey results, it is quite common to compute the average value added per person engaged.

Capital Productivity

Capital productivity is the ratio of value added and value of fixed asset at given year.

$$\text{Capital Productivity} = \frac{Value\ Added}{Value\ of\ Fixed\ Asset}$$

Capital productivity measures the efficiency and effectiveness of fixed assets in the generation of output of manufacturing industries as well as its sub sectors.

Factors Influencing on Output and Total Factor Productivity Growth

The relationship of factor inputs influence on manufacturing output is estimated from ordinary least square (OLS) method. Since the unavoidable factors of production on manufacturing industries are labour, capital and material input, the other factors influencing on manufacturing output was thoroughly searched. With the various efforts, incorporating variables used in internal, the nearest possible factors affecting on output is found as:

$$Y_t = a + \beta_1 L_t + \beta_2 K_t + \beta_3 M_t + \beta_4 LIBD_t + \beta_5 EDN_t + \beta_6 EXPINC_t + \beta_7 INF_t + \beta_8 IR_t + \beta_9 GKEXP_t + \beta_{10} FDII_t + \beta_{11} NCON_t + \beta_{12} RD_t + \beta_{13} PTD_t \ldots\ldots\ldots U_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 1$$

Where: = Manufacturing output; = Labour; = Capital; = Material Input; = Liberalization Dummy (1 for the post-liberalization period and 0 for the pre-liberalization period) to capture the effect of liberalization; = Education; = Export incentive; = Infrastructure development; = Interest rate; = Government capital expenditure; = Foreign direct investment intensity;= National consumption;= road; = Patent, design and trade mark; and = error term

Extended Cobb-Douglas production function developed by Hulten and Schwab (1991) and applied to Indian manufacturing sector by Mohommad (2010) is used to find the TFPG.

Let the production function be:

$$V_t = A\, L_t^{\beta_1} K_t^{\beta_2} M_t^{\beta_3} e^{u_t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(a)}$$

Where: Value Added, labour, capital, material input and error term

It is assumed that $\beta_1 + \beta_2 + \beta_3 = 1$

After log transformation we get:

$$\ln V_t = \ln A + \beta_1 \ln L_t + \beta_2 \ln K_t + \beta_3 \ln M_t + \cdots U_t \ldots\ldots\ldots\ldots \text{(b)}$$

This equation is estimated by OLS method

TFP growth is estimated as:

$$TFPG_t = \frac{1}{V}\frac{dV}{dt} - \widehat{\beta_1}\frac{1}{L}\frac{dL}{dt} - \widehat{\beta_2}\frac{1}{K}\frac{dK}{dt} - \widehat{\beta_3}\frac{1}{M}\frac{dM}{dt} \ldots\ldots\ldots\ldots \text{(c)}$$

Factors affecting on productivity is tried using the model specified by Sharma (2000).

The above model used by Sharma (2000) is modified since the all the data used in the model is not available in present context and some variables are modified for the consistency of definition. Nominal rate of protection and quantitative restriction data is no more reliable since the economy is liberalized; public sector dominance is not prevalence as most of the public manufacturing are privatized. Hence, relying upon aforementioned reviews, rigorous effort[2] was made to find the factors affecting on TFP growth. However, similar as it is noticed on factors affecting on output, it is also looked upon factors influencing on TFPG and the model is changed as:

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2 To find the factors affecting on output and TFPG, rigorous effort was made. Variables that could affect on output and TFPG are listed on Annex K.

$$TFPG_t = a + \beta_1 \, D(lnEDN_t) + \beta_2 \, lnEXPINC_t + \beta_3 \, lnFDII_t + \beta_4 \, D(ln\, IELT_t) + \beta_5 \, D(lnINF_t) + \beta_6 \, D(lnKINT_t) + \beta_7 \, D(lnIR_t) + \beta_8 \, D(lnMINT_t) + \beta_9 \, D(lnNCON_t) + \beta_{10} \, LIBD_t \ldots\ldots U_t \ldots\ldots (2)$$

Where: = Total factor productivity growth; = Education; = Export incentive; = Foreign direct investment intensity; = Industrial electricity; = Infrastructure development; = Capital intensity; = Interest rate; = Material intensity;= National consumption; = Liberalization Dummy (1 for the post-liberalization period and 0 for the pre-liberalization period) to capture the effect of liberalization; = error term

Specification of Variables

The research of Sepulveda (2010) and Goedhuys, Janz, and Mohnen (2013) found the education as being one of the factors affecting on productivity. Manufacturing employment education is not found recorded by any organization. For that reason, education is calculated as:

$$EDN = \frac{SLC}{LF} \mathbf{x} \, L$$

Where: EDN= Education, SLC= No. of SLC passed students for the given year, LF = Labour force (the population above 15 years of age as per ILO definition and below 60 years of age as per average pension life in Nepal) and L= Manufacturing labour. No. of SLC passed students is taken from Economic Survey and population data is taken from various Statistical Year Book of CBS.

Capital Intensity is measured as: $\mathrm{KINT} = \mathrm{K/L}$

Where: KINT=Capital Intensity, K=Manufacturing capital, L=Manufacturing employment

EXPINC= Export incentive (the amount of duty drawback paid to the exporter)

INF= Infrastructure development measured as:

$$INF = \frac{ELTC + RD}{2}$$

Where: INF= Infrastructure development, ELTC= Electricity consumption on KWH, RD = Length of road.

$$\mathrm{RD} = \frac{PR+GR}{2}$$

Where: RD=Length of Road, PR= Length of Pitched Road, GR = Length of Graveled Road

IR = Interest rate, is lending interest acquired from various Quarterly Economic Bulletin of NRB.

MINT = Material intensity or input intensity = measured as the ratio of imported intermediate input to domestic manufacturing input.

Since, foreign direct investment is only committed amount and the amount is not only committed for manufacturing, it is adjusted with the ratio of manufacturing capital. So, FDII is the ratio of FDI

to manufacturing capital investment. The data of FDI is taken from MoI and the data of manufacturing capital is derived from various Census of Manufacturing Establishment. As it is found in literature that the industries that has patent, design, and trade mark have higher productivity. Therefore, the total number of registered trade mark, patent and design is also taken as an independent variable to look upon their likely effect on output and TFP. Imported material input is also a concern of manufacturing sector since it is used to produce final goods. There is also ongoing debate that some of material inputs are imported and re-exported for the lure of duty draw back return. Hence, to check the efficiency of imported material input as well as to know the importance of domestic raw materials use, input intensity is also taken as a likely factor affecting variable. Input intensity is the ratio of imported intermediate input to the domestic input.

As it was found from the study of Mitra, Varoudakis and Varoudakis (2002), Goel (2003), Srinivasan (2006), Mohommad (2010) that infrastructure development plays significant role in manufacturing output; electricity and road is also taken into account to find their likely effect on output as well as on TFP growth. Electricity is the total consumption of industrial sector in KWH. Since it is not found any record of manufacturing electricity consumption, industrial electricity consumption is adjusted with manufacturing output calculating as industrial electricity consumption manufacturing output ratio. The data of road is taken from Department of Road. The length of pitched and graveled road is considered as the total length of road since fair weathered road is rarely or not used for manufacturing purpose. The length of road is either constant or in increasing trend. However, the manufacturing output may be on fluctuating trend due to various reason like structural break, quota phase out, removal of protection, internal problems like conflict, strikes closure, infrastructure bottleneck etc. Consequently, the variable generated as road output ratio.

Variables other than unit form (like employment, electricity, road, dummy variables) are converted into real values using GDP deflator and they are normalized transforming in log values. Dummy variable and TFPG variable are not normalized since they are naturally very small in size and indicative in nature.

Interpolation

To execute the time series analysis the five years difference manufacturing data are interpolated using the Wolfenden's suggestion (Wolfenden, 1925).

$$P_e = P_1 + \frac{N}{n}(P_2 - P_1)$$

Where: = Population estimated for a given year, =Second last census population, = Last census population = Number of years between census period, = Numbers of years from census to the date of estimate.

Test Statistics

The estimated regression equations are tested using various statistical tools such as unit root test to check the stationary of variables, coefficient of multiple determination (R^2) to find the ratio of explained sum of square to total sum of square, standard error of estimate (SEE) to check the dispersion of the distribution of regression line, Durbin-Watson (D-W) test to know the presence of autocorrelation, Students t-statistics to find if the estimated coefficients are different from zero, Fisher's F-distribution (F-statistics) to check the overall validity of the model.

Performance and Productivity of Manufacturing Industries on National Level

The input as percentage of output for the first CME (Census of Manufacturing Establishment) years was highest to the whole study period means lowest performance. With the increasing efficiency, it arrived to lowest point depicting 59.44 for the year 1992. Again with decreasing inefficiency it is recorded about 75 in 2012. On an average 69 inputs have been used to produce 100 outputs during the whole CME years. It demonstrates that the higher amount of inputs have been employing to produce lesser amount of output. Labour productivity was 0.013 in 1977 but it is observed highest in 2012 recording 0.024 which implies the increasing contribution of labour. Labour productivity is increased almost by 47 percent in post-liberalization.

Table 1: Performance and Productivity of Manufacturing Industries (Rs. in Million)

Fiscal Year	Input as % of Output	Labour Productivity	Capital Productivity	Input Efficiency
1977	86.26	0.013	0.544	0.135
1982	66.73	0.021	1.511	0.333
1987	59.44	0.012	0.939	0.406
1992	58.63	0.015	0.680	0.414
1997	60.17	0.018	0.826	0.398
2002	65.61	0.022	0.808	0.344
2007	73.77	0.023	0.520	0.262
2012	74.95	0.024	0.675	0.250
Average	68.20	0.018	0.813	0.318
Pre-liberalization	67.77	0.015	0.919	0.322
Post-liberalization	68.63	0.022	0.707	0.314

Note: Input efficiency is value added output ratio

Source: Authors' calculation based on CBS data

There was efficient capital utilization in 1982 despite the worst period in 2007 and 1977. Pre-liberalization period was efficient since average values are 0.92 and 0.71 for respective period. But,

this result may not hold true if manufacturing tend towards capital intensive industries it is because labour intensive industries deserves capital efficiency. It is evident from above data that capital intensive technology is either increasing or capital efficiency is decreasing. The decreasing trend on value added output ratio from 0.41 in 1991 to 0.25 in 2012 indicates inefficiency in the use of inputs or decreasing profit margin which might have occurred because of unfavorable prices for products and purchases, or poor control of stocks as compare to the previous CME years. But, material input efficiency is decreased from 0.32 to 0.31 at post liberalization phase.

Growth of Productivity

Despite the rate of growth is smaller labour productivity is positive almost in every census. The average labour productivity growth in pre-phase is -0.19 and 0.13 at post-phase clarifies increased labour efficiency. Since labour productivity is the percentage increase in value added due to percentage increase in labour; the findings suggests an increment in labour to increase value added. But the increasing labour productivity can be noticed also form adaptation of capital intensive technology. Capital productivity growth is increasing at post-phase. It is improving result though there is negative sign. The larger negative capital growth at pre-liberalization period might have noticed due to high investment on capital at public manufacturing which are privatized and dissolved in post-liberalization period.

Table 2: Growth of Labour and Capital Productivity Growth

Fiscal Year	Labour Productivity Growth	Capital Productivity Growth
1982	-	-
1987	-0.604	-0.476
1992	0.230	-0.322
1997	0.284	0.194
2002	0.188	-0.022
2007	0.009	-0.441
2012	0.030	0.261
Average	0.023	-0.134
Pre-liberalization	-0.187	-0.399
Post-liberalization	0.128	-0.002

Source: Authors' calculation based on CBS data

Both absolute measure (share on value added of other component) and relative measure (percentage change in value added due to change in other components) shows post liberalization period is better than pre-liberalization period though absolute measure of capital productivity is seen higher at pre-liberalization phase. To conclude, labour productivity is better at post liberalization period than capital productivity.

Performance and Productivity of Categorized Manufacturing Industries

Performance and Productivity of Leading Manufacturing Industries

It is seen that capital productivity of grain mill and sugar products are largely decreased though labour productivity is remained same. But, the labour productivity of sugar is slightly increased. Tobacco, carpet and rugs, furniture, carpentry and joinery, and clay and ceramic products have decreased output input gap with increased material efficiency at post-liberalization which imply that either those products', input cost is decreased or output price increased otherwise both. It means, ignoring wage and capital cost investment on those products is profitable. But, decreased labour productivity on tobacco products, slavish decreased in capital productivity of carpets and rugs, decreased in both labour and capital productivity of furniture, carpentry and joinery, decreased in labour and capital products of clay and ceramic products are threats. Satisfactory finding is perceived only on clay and ceramic production that labour productivity, capital productivity and material efficiency is increased at post-liberalization period. Cement, concrete, lime and plaster production also have increased labour and capital productivity at post-liberalization phase though input efficiency is decreased.

Table 3: Performance and Productivity of Leading Manufacturing Industries (Rs. in Million)

Particular (Bace Price 1982	Input as % of Output	Labour Productivity	Capital Productivity	Input Efficiency
Grain Mill Products	80.25 (84.61)	0.04 (0.04)	1.24 (0.60)	0.20 (0.15)
Manufacture of Sugar	53.35 (73.17)	0.02 (0.03)	1.27 (0.24)	0.47 (0.27)
Manufacture of Tobacco Products	41.62 (24.99)	0.05 (0.40)	4.17 (5.20)	0.58 (0.75)
Spinning, Weaving, and Finishing of Textiles	67.78 (74.10)	0.02 (0.02)	0.32 (0.31)	0.32 (0.26)
Carpet and Rugs	58.82 (52.70)	0.02 (0.02)	12.24 (1.35)	0.41 (0.47)
Manuf. Of Wearing apparel except fur	53.97 (67.94)	0.02 (0.02)	2.44 (1.14)	0.46 (0.32)
Saw Milling and Planning of Wood	66.70 (70.39)	0.04 (0.02)	2.90 (0.91)	0.33 (0.30)
Manuf. Of Jute and Jute Products	51.73 (60.72)	0.01 (0.01)	1.62 (0.60)	0.48 (0.39)
Furniture, Carpentry and Joinery	54.44 (43.90)	0.02 (0.01)	1.59 (0.60)	0.46 (0.31)
Manuf. Of Plastic Product	66.97 (75.23)	0.06 (0.04)	0.75 (0.57)	0.33 (0.25)
Non-refectory Clay and Ceramic Product	47.81 (46.31)	0.0035 (0.005)	1.40 (1.41)	0.52 (0.54)

Cement, Concrete, Lime and Plaster	44.25 (67.24)	0.05 (0.06)	0.35 (0.38)	0.56 (0.33)
Casting and Manuf. Of Iron and Steel	73.50 (83.48)	0.05 (0.08)	0.87 (0.63)	0.26 (0.17)
Structural Metal Products	65.73 (75.23)	0.03 (0.08)	1.21 (1.19)	0.34 (0.25)
Non Machinery Fabricated Metal	72.44 (81.62)	0.02 (0.06)	4.42 (0.96)	0.28 (0.18)
Veg. and Animal Oils and Fat	59.11 (85.02)	0.13 (0.11)	1.32 (1.07)	0.41 (0.15)
Animal Feeds	71.93 (78.99)	0.08 (0.06)	2.52 (1.13)	0.28 (0.21)

Note: Results on parenthesis denotes Post-liberalization indicators

Source: Authors' calculation based on CBS data

Heavy slash on capital productivity of carpet and rugs, wearing apparel, jute products, metal products, fabricated metal etc., denotes the increasing cost of capital either because of dissemination of new plants or low utilization due to the decreased production. The labour productivity of labour intensive industries such as of grain mill products; spinning, weaving, and finishing of textiles; carpet and rugs; saw milling and planning of wood, and jute and jute products are unchanged for both phase. Decreased labour productivity is worse than decrease in capital productivity and decrease in input efficiency because capital productivity may also decrease due to increase cost of new technology and decreased material efficiency may because of increase in material price. To conclude; grain mill products; spinning, weaving, and finishing of textiles; carpet and rugs; saw milling and planning of wood, and jute and jute products don't have satisfactory.

Performance and Productivity of Manufacturing that Appeared After Liberalization

Cutting/shaping stone products, machinery products, work cork/other wood products have higher gap of material input and output. But, plastic in primary form, glass products, fertilizer and nitrogen compounds, other textile, noodles and similar products, and radio, TV, and communication equipment have lesser output input gap which signify high material cost industries. The robust material efficiency measure calculated as value added output ratio also show similar situation as of input as percentage of output measure in the sense that industries with high gap between input and output have lesser material efficiency and vice versa. Those industries that have higher input output gap are labour intensive industries and the industries that have lower input output gap are capital intensive industries.

Table 4: Performance and Productivity of Emerging Manufacturing Industries Rs. in Million

Particular (Base Price 1982	Input as % of Output	Labour Productivity	Capital Productivity	Input Efficiency
Veneer Sheet and Ply wood	68.86	0.06	0.64	0.31
Manufacture of Meat Products	69.67	0.15	1.65	0.30
Noodles and similar Products	70.32	0.16	1.03	0.30
Manuf. of Other Textile NEC	72.37	0.09	0.28	0.28
Wood Cork and Other Wood Products	58.35	0.03	0.84	0.42
Refined Petroleum Products	63.85	0.46	3.68	0.36
Plastic in Primary form	80.36	0.16	0.53	0.20
Fertilizers and Nitrogen Compounds	74.63	0.11	0.51	0.25
Paints and Printing Ink	66.64	0.20	1.49	0.33
Glass and Glass Products	75.46	0.04	0.37	0.25
Clay Buildings Materials and Ceramic Products	53.89	0.02	1.19	0.46
Cutting, Shaping Stone Products	50.56	0.12	0.55	0.49
Engine and Turbine	67.51	0.10	1.36	0.32
Pumps, Compressors, Taps, Oven, Burner etc.	69.79	0.06	0.97	0.30
Machinery Products	55.24	0.07	0.52	0.45
Radio, TV and Communication Equip.	70.16	0.15	1.44	0.30
Bodies, Parts and Accessories of Motor Vehicles	69.10	0.06	0.55	0.31

Source: Authors' calculation based on CBS Data

Performance and Productivity of Other Manufacturing Industries

Printing and allied; soap, detergent, perfumes & toilette; canning/preserving of fruits & vegetable alcoholic drinks; food products are better performing almost on all respects. Bakery products; paper; foot wear; cocoa & confectionery; rubber, tyre & tube; and other manufacturing have decreased capital productivity and input efficiency at post-liberalization; despite they have increased labour productivity. It means these industries don't have satisfactory situation. If it is observed output scenario; bakery products; canning, preserving of fruits & vegetables; dairy products; pharmaceutical products; soap, detergent, perfumes & other toilette products; soft drinks and carbonated water; and alcoholic have significant growth. It indicates that productivity measured in monetary form is not the sole factor to determine overall development while comparative study, quota, concession, internal protection also matters for survival and development of manufacturing industries.

Table 5: Performance and Productivity of Other Manufacturing Industries (Rs. in Million)

Particular (Base Price 1982)	Input as % of Output	Labour Productivity	Capital Productivity	Input Efficiency
Dairy Products	71.53 (75.65)	0.03 (0.06)	0.49 (0.59)	0.28 (0.24)
Bakery Products	65.52 (72.81)	0.02 (0.02)	0.82 (0.54)	0.34 (0.27)
Paper and Paper Product	63.77 (66.11)	0.02 (0.04)	0.50 (0.49)	0.36 (0.34)
Printing and Allied Industries	58.44 (54.86)	0.02 (0.03)	0.79 (0.70)	0.42 (0.45)
Manufacture of Pharmaceuticals	63.28 (64.12)	0.03 (0.05)	0.46 (0.43)	0.37 (0.36)
Manuf. of Soap, Detergent, Perfumes and Toilette	68.11 (63.09)	0.05 (0.14)	1.12 (1.52)	0.32 (0.37)
Canning/Preserving of Fruits and Veg.	61.61 (66.35)	0.03 (0.03)	0.93 (1.43)	0.38 (0.34)
Cocoa and Confectionary products	62.85 (74.44)	0.01 (0.03)	1.17 (0.38)	0.37 (0.26)
Food Products	70.41 (63.20)	0.01 (0.02)	0.24 (0.39)	0.30 (0.37)
Alcoholic Drinks	44.40 (30.86)	0.07 (0.26)	0.80 (1.73)	0.56 (0.69)
Soft Drinks and Carbonated Water	45.34 (62.04)	0.06 (0.13)	0.68 (0.70)	0.53 (0.38)
Non-wearing Textile Goods	67.01 (59.40)	0.02 (0.03)	0.83 (1.19)	0.33 (0.41)
Leather and Leather Products	67.33 (75.32)	0.08 (0.06)	1.21 (3.18)	0.33 (0.25)
Foot Wear Manufacturing	54.82 (69.18)	0.03 (0.02)	1.82 (0.64)	0.45 (0.31)
Chemical Products	63.14 (75.22)	0.03 (0.03)	0.35 (0.68)	0.37 (0.25)
Rubber, Tyre and Tube Products	59.30 (67.51)	0.04 (0.06)	1.41 (0.48)	0.41 (0.32)
Cutlery, Hand Tolls and Hand Ware	90.23 (70.34)	0.04 (0.03)	0.62 (1.01)	1.47 (0.30)
Metallic Furniture and Fixture	67.55 (38.46)	0.02 (0.03)	0.62 (4.99)	0.32 (0.12)
Electrical Apparatus NEC	67.55 (78.29)	0.05 (0.05)	1.11 (0.90)	0.32 (0.22)
Jewellery and Related Articles	62.98 (72.34)	0.003 (0.03)	0.76 (0.77)	0.37 (0.28)
Other Manuf. Industries	62.84 (64.41)	0.02 (0.02)	0.63 (0.28)	0.37 (0.36)

Note: Results on parenthesis shows post-liberalization indicators

Source: Authors' calculation based on CBS data

Dairy, printing and allied; soap, detergent, perfumes and toilette; alcoholic drinks; food production have increased input output gap, improved material efficiency, higher labour productivity and elevated capital productivity (other than in printing and allied industries) at

post-liberalization period. Theses mutual ties are really seen other industries. It implies that these are the fast growing having prospects in Nepalese economy. Pharmaceutical is another product which has also increased labour productivity with increase in input efficiency though there is a slightly decrease in capital productivity. Soft drinks and carbonated water also have increased labour and capital productivity though the material efficiency is decreased at post-phase. The decreased material efficiency might because of increase in material input respecting with increase on its price. Overall measurement scenario depict that dairy products; pharmaceuticals products; soap, detergent, perfumes and toilette products; alcoholic drinks, and soft drinks and carbonated water products have increasing output with improvement on overall efficiency measures.

Factors Influencing on Output, Productivity and Growth Total Factors

Factors Influencing on Output

The F-value of the model shows the validity of model at one percent level, R^2 value 0.99 guarantees that explain 99 percent variation on output is explained by the included independent variables, and D-W value 2.13 shows the absence of autocorrelation.

Table 6: Factors Influencing on Output

Least Square Method Model - 1	
Dependent Variable Y	
Variables	**Coefficients**
C	-364.92** (-2.272)
L	0.00601*** (7.167)
K	1.014*** (24.528)
M	1.041*** (62.595)
LIBD	-113.7368* (-2.080)
EDN	-0.0613** (-2.347)
EXPINC	0.5434 (1.162)
INF	-0.449* (-1.882)
IR	-5.309 (-0.504)
GKEXP	0.0003 (-0.416)
FDII	-587.794 (-1.207)
NCON	0.007** (2.232)
RD	0.223* (1.825)
PTD	-0.034 (-0.626)
F-Value	98867.61***
R^2	0.99
AIC	10.20
SC	10.85
DW	1.794

Note: * Significant at 0.10 percent, ** Significant at 0.5 percent, ***significant at 0.1 percent and Results on parentheses are t-statistics of coefficients

Source: Authors' estimation

The coefficient of L 0.006 depicts that one unit changes in labour input cause about Rs. 0.006 million changes in output. Similarly, the coefficient of K 1.014 and the coefficient of M 1.041 imply that Rs. one million changes in capital gives the output by 1.014 and Rs. one million changes in material input brings about 1.041 million changes in output. Liberalization dummy coefficient -113.73 notifies that the mean difference after liberalization is -113.73 million which notifies negative impact on output after liberalization. Similarly, NCON coefficient 0.007 notifies that manufacturing output has very little contribution on national consumption. Similarly the coefficient of RD 0.223 denotes that the increase in one KM of road access helps to change in manufacturing output about by 0.223 million on output. Unexpectedly, education and infrastructure have shown the negative impact which might have occurred due the inconsistency relation on education and on manufacturing employment. Likewise, the unexpected result in infrastructure development might have happened due to misspecification of variable. As it is evident by the result; output is mainly interrelated with the inherent components like labour, capital and material input.

Influency on Productivity and Growth of Total Factors

Productivity and Growth of Total Factor

The efficiency concern is another main aspect of manufacturing. Technical efficiency, managerial skills, improvements in capital utilization, improvements in work place environment, better quality inputs etc., is explained by TFPG.

Table 7: Productivity Growth of Total Factors

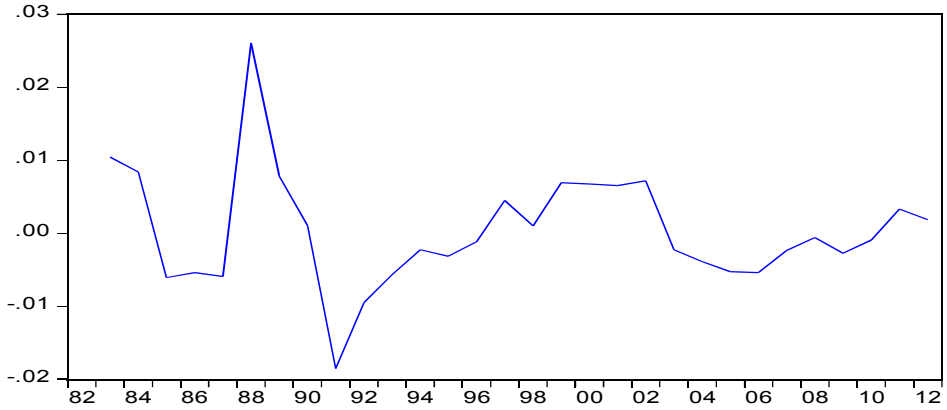
Year	TFP Growth
1982-87	0.0002739
1987-92	0.0013711
1992-97	-0.001568
1997-02	0.0056615
2002-07	-0.003842
2007-12	0.0001661
Pre-liberalization	0.0008225
Post-Liberalization	0.0001041
Average	0.0003435

Source: Authors' estimation based on CBS data

Despite average TFPG is positive at post-phase, it is observed negative at most of the years. However, pre-phase is still greater than post phase. It signifies that liberalization has not increased technical efficiency in comparison to pre-liberalization era. TFPG is noticed positive during 1997-02 and 2007-12 period. It means TFP growth is associated with capital rather than on labour.

TFPG is highly on fluctuating trend at pre liberalization phase. Despite negative TFP growth in most of the census, the rate is being smaller and smaller with fluctuating trend with improving scenario mainly after 2007. So far as TFP growth also captures improvements in capacity utilization, better management practices, improvements in work place environment and better quality of inputs; the findings of this results shows somehow improving scenario at later phase of post liberalization period though the pre-liberalization ere was comparatively better. The finding of the TFPG suggests the increment in capital probably with improved technology to increase the overall efficiencies on productivity.

Figure 1: Total Factor Productivity and Growth of Total Factors



Source: Authors' estimation based on CBS data

Factors Influencing on Productivity and Growth of Total Factors

Since efficiency concern is another main aspect of manufacturing and TFPG is its measure; it is likely to find the factors affecting on TFPG. The F-value shows the validity of model at two percent level. The value of R^2 0.64 guarantees that 64 % variation on output is explained by the included independent variables. D-W value 1.52 is greater than R^2 value 0.64 as proposed by Maddala that in the use of first difference D-W< R^2 (Maddala, 1977). All it assures the entire validity of model.

Export incentive has shown positive significant association with TFPG which might have occurred because of large volume of production that decreases the cost of production via division of labour and overall efficiencies. The other noticeable factor is FDII which is positively associated with TFP growth. Changes in foreign direct investment intensity results 0.3 percent increase in TFPG. It means foreign industries in Nepal are more efficient than industries invested by locals. The finding show that increase in KINT by 100 percent lead to increase the TFPG by five percent. It implies that technology is positively associated with technical efficiency. Seeing as the coefficient of KINT has the largest positive impact on TFPG; it can be said that capital employment ratio is to be increase to increase the technical efficiency.

Table 8: Factors Influencing on TFPG

Least Square Method: Model 2	
Dependent Variable TFPG	
Variables	Coefficients
C	0.0032 (0.705)
D(LnEDN)	0.0026 (-0.653)
LnEXPINC	0.0021* (2.073)
LnFDII	0.0033*** (3.197)
D(LnIELT)	2.40 (0.0012)
D(LnINF)	0.0214 (0.872)
D(LnKINT)	0.0549*** (3.123)
D(LnIR)	-0.0044 (-0.229)
D(LnMINT)	-0.0002 (-0.039)
D(LnNCON)	0.0490 (1.583)
LIBD	-0.0027 (-0.628)
F-Value	3.443**
R^2	0.644
AIC	-7.174
SC	-6.659
DW	1.52

Note: * Significant at 0.10 percent level, ** Significant at 0.5 percent level, ***significant at 0.01 percent; Results on parentheses are t-statistics of coefficients

Source: Authors' estimation

Liberalization dummy depicted the negative signs but do not show the significant coefficient though it has shown significant negative impact on output. It means liberalization has inverse impact on output but no impact in efficiency which is also clarified by the trend of TFPG. Increase in output and increase in efficiency are two different things though they look same. Output might be able to increase with increase in labour, capital, material etc. increase in output which is not explained by labour, capital, and material is efficiency increase (TFP growth). Hence, it can be concluded that though liberalization have inverse effect on output, they have not significant affect on efficiency.

The positive effect of capital intensity is similar as the findings of Dias (1991). Likewise, this finding is closely associated with the finding of Kim and Park (2003), Goedhuys, Janz and Mohnen (2008), Sharma (2010) in the sense that foreign own industries either efficiently

working or they have positive impact on output and TFP growth contrary to the finding of Majeed, Ahmed, and Butt (2010). Nevertheless the findings of Lee (1996), Widodo (2008) have shown negative impact of protection; this study has disclosed the positive impact of export incentive. The findings of this research suggest that export incentive, foreign direct investment intensity, and capital intensity is to be increased to gain likely impact on efficiency of production.

Conclusion

Increased input output gap of leading industries such as of tobacco, carpet and rugs, furniture, carpentry and joinery, and clay and ceramic products implies that ignoring wage and capital cost, investment on those products is profitable. Nevertheless, a decrease in labour productivity of tobacco, slavish decline in capital productivity of carpets and rugs, decrease in both labour and capital productivity of furniture, and reduce in labour productivity of carpentry and joinery products are the threats for those industries. Amazingly, labour productivity, capital productivity and material efficiency have found increased at post-liberalization period of clay and ceramic products. Carpet and rugs, wearing apparel, jute products, and metal production is decrease due to reduction of the demand on foreign countries. Despite the declining material efficiency; plastic products, casting and manufacturing of iron and steel, structural metal products, and animal feeds products depicts the increasing production implying the importance of comparative efficiency measures. On the other hand, cement concrete, lime and plaster; and non-refectory clay and ceramic products have better performance almost on all respects.

The industries that appeared after liberalization (veneer sheet and ply wood, meat, wood cork and other wood products, glass products; and bodies, parts and accessories of motor vehicles) demonstrates an increasing trend on employment and output growth even though material efficiency has shown decreasing trend. Among the industries that fall in the other groups; only dairy, printing and allied; soap, detergent, perfumes and toilette; alcoholic drinks; food production industries exhibited better performance almost on all respects at post-liberalization phase. This kind of positive environment implies the prospects of aforesaid industries in Nepalese economy. Pharmaceutical products also have an increment in labour productivity with increase in input efficiency. Pharmaceutical products, soft drinks and carbonated water production are also increasing though some unfavorable efficiency measures.

Development of roads and national consumption are the pertinent factors to influence on output as it is disclosed by multiple regression model. It is also found that manufacturing is not benefited from the provision of liberalization. TFP efficiency measurement shows somehow improved scenario at later phase of post liberalization. Moreover, total factor productivity is increased when there has been increment in capital productivity. The factors influencing on TFPG such as export incentive, foreign direct investment intensity, and capital intensity seem to be more important to determine the TFPG.

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