Analyzing the Input Output Relationship of Small and Medium Enterprises in Pakistan: An Econometric Approach

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Abstract
The establishment and promotion of the SMEs is considered to be the solution to many of the problems of the developing economies. This SME panacea compels the researchers to observe how this sector contributes in the economy of Pakistan. The core objective of the present paper remains to analyze the Input output relationship in this sector. so the study contains the productivity analysis of the small and medium scale manufacturing sector of Pakistan. This will unleash the role of the various inputs in production here. Extended Cobb Douglas Production Function has been utilized on the secondary, cross section data of the 3-digit forty eight SMEs of Pakistan for the year 2005-2006.Different variables like labor male and female, local and imported material, sales tax, excise duty, advertisement and capital are selected to analyze their effects on output of SMEs. Most of the variables are significant having expected relationship with output, however female labor both production and non-production have shown negative relationship with output. Heteroscedasticity is checked by White test, concluding no evidence found for its presence in the data. The policy recommendations are that government should play a vital role in hand holding and development of SMEs in Pakistan so that productivity of factors of production can be increased. Especially the measures should be taken to increase the productivity of women who make 52% of Pakistan's population.

Introduction

Developing countries have to face a lot of challenges especially of employment generation, equitable income distribution, reduction of poverty and low growth rate. SMEs are considered as one of the most important driving forces behind economic development, employment generation and poverty reduction. Pakistan is also a developing country and faces many hurdles in the process of its development. The need of the time is rapid industrialization. Large scale firms are difficult to establish. SMEs are left the only panacea for industrialization.

No doubt SMEs are one of the building blocks of the Pakistan's economy, providing the country with many opportunities for increased employment (including female employment), poverty eradicationespecially for less educated and unskilled workers, in both urban and rural areas., enhanced productivity growth, competitiveness and international market penetration.So the solution to many of the problems of Pakistan lies in the establishment and promotion of the SMEs.

According to Economic Survey of Pakistan, the contribution of manufacturing sector to GDP was 18.5%, generating employment upto 13% and fixed invesmtment rate was 16.2% in 2010. SMEs jointly contributed approximately 40% to GDP in 2010-11. According to economic survey 2010-11, the importance of SMEs in economic development is endorsed by the fact that, in 2009-10, a period during which real GDP of Pakistan grew by 3.8 percent, the small scale sector provided much support to overall growth pattern and grew by 7.5 percent thus proving that in times of economic downturn, SMEs outperform large enterprises, providing much support to overall economic growth. Small and medium enterprises (SMEs) is employing up to 80% of non-agricultural labor force, contribute25%to total exports and 35% to manufacturing value addition [Economic survey (2009-10)].

According to SME policy (2007) by SMEDA[1], there are approximately 3.2 million enterprises in Pakistan and 90% of enterprises are employing 99 persons. Their huge number in the various economic activities and the significant amount of goods and services they produce are evidence that suggest them important part of the economy.

Small and medium enterprises have been set up principally on 100% private initiatives, because of low investment requirements i.e. low working capital. SMEs involve in activities such as processing and production of raw materials such as food, beverage, metallic and non-metallic materials, tobacco, textile, wood, chemicals, plastic, petroleum, rubber, transport equipment, assembling and manufacturing of electrical and electronics appliances and components.

Due to political and economic changes, SMEs business activities have expanded rapidly and become an important component of the manufacturing sector in the Pakistan economy. Numerous initiatives have been adopted by the government of Pakistan, during different eras to improve the capacity of private sector as a mean of accelerating growth of SMEs. Figure 1, shows that 19 percent of SMEs in Pakistan have life stream of less than five years. Only four percent of SMEs survive beyond 25 years.

Figure 1: Life stream of SMEs (Percentage)

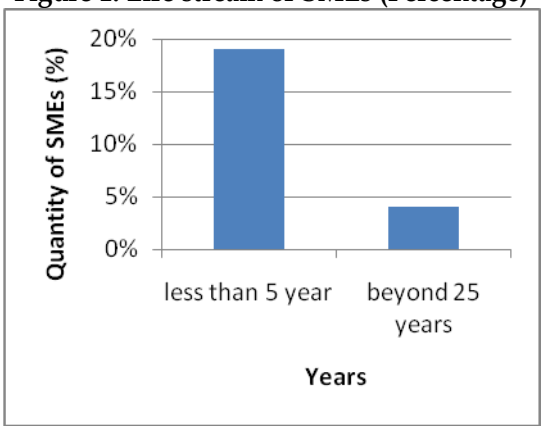
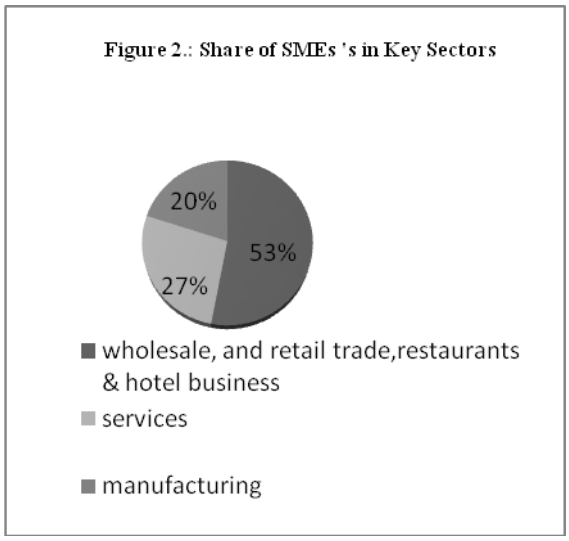


Figure 2 shows that major key sector of SMEs is wholesale, and retail trade, resturants and hotel business, whose share is 53 percent. The second key sector is services sector , whose share is 27 %. The third key sector is manufacturing, presenting a 20 % share in small and medium enterprises in Pakistan.



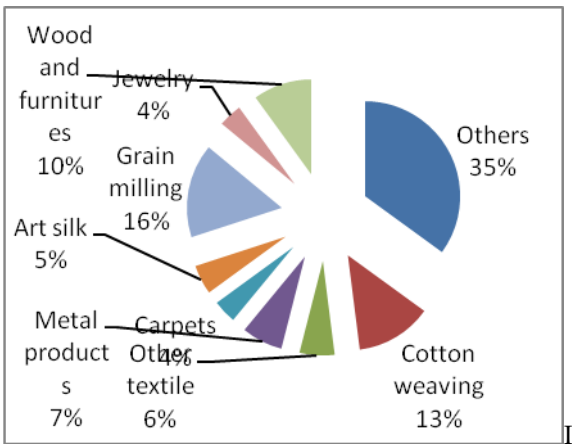
I n Figure 3 the share of sub key sectors of SMEs in Pakistan has been dispayed. The major key subsectors of SMEs in Pakistan are as follows. Cotton weaving, textile, Metal products, Carpets, Art silk, Grain milling, Jewelry, Wood and Furniture.

Table 1: Average laborProductivity in 3- digit SMEs of Pakistan (2005-06)

Industries	*Q/L*	Industries	*Q/L*
Meat, fruit, vegetables, oil & fats	11.48791	basic precious and non ferrous metals	24.07332
Dairy products	8.337585	casting of metals	19.77273
Grain mills products and Animal feed	30.48308	strucal metal products	8.776572
Other food products	14.61022	other fabricated metal products	11.10611
Beverages	30.43419	general purpose machinery	8.753499
Textile Spinning, Weaving and finishing	3.341373	special purpose machinery	13.87068
Other Textile	9.848807	domestic appliances	9.256005
Knitted and crochet fabrics and articles	6.02279	DC motor and generator and transformer	16.64411
wearing apparel except fur apparel / Articles of fur	6.352339	Electricity distri. And control apparatus	11.53691
Tanning and dressing of leather	9.656489	Insolated wire and cable	80.78017
foot wear	4.281023	Accumulator cells and batteries	8.855552
sawmilling and Planing of wood	4.812646	Electric lamp and lighting equipments	3.680519
Products of wood	13.35854	other Electrical equipments	4.899108
Paper and paper products	16.44864	Electronics walls and tubes	3.66965
Publishing	9.556719	TV radio and telegraphy apparatus	5.377792
Printing	11.04291	Sound videos apparatus of TV and radio	28.2513
Refing petroleum prducts	197.1676	Medical and measuring instruments	5.283307
basic chemicals	22.27135	Optical and photography equipments	3.439907
Other chemical products / manmade fibres	9.701147	motor vechicles	84.73984
Rubber products	13.98184	bodies for motor vechicles and goods	4.048533
Plastic products	15.96328	parts and accessories for motor vechiles	8.734399
Glass and glass products	2.617732	building and repair of ships and boats	4.732337
Non metallic mineral products	18.32899	Furniture	3.524826
Basic iron and steal	18.22317	manufacturing	56.37668

Source: constructed by the data used

Figure 3: Share of Sub -Key Sectors in SMEs



Because SMEs are claimed to provide large scale employment, contribute to export, valueadded, and GDP growth rate that is why the present study has been conducted. So that its input and output relationship could be analyzed. One of the significance of the present study is that it would examine the relationship of different factors of productions especially with output and labor(female and male) and output and capital, output and material(local and imported),output and sale tax, output and advertising and excise duty. The arrangement of the present study is as follows: section (ii) is conceptual framework (iii) is literature review, section (iv) depicts data and methodology and section (v) section includes estimation and results (v) outlines conclusion and policy implication.

Conceptual Framework

A production function shows the technical relationship that transforms the inputs into outputs.

Cobb Douglas production function is considered to be the most important ubiquitous category in both empirical and theoretical studies for growth and productivity. The original Cobb Douglas production is

found in seminal work of Cobb and Douglas (1928). They used data for the manufacturing sector of USA for the period 1899 to 1922. Although brown (1966), Sandelin (1976) and Sameulson (1979) attached the credit to Wicksell for the discovery of Cobb Douglas functional form.

The Cobb Douglas production function has inborn characteristics of constant return to scale i.e. the coefficients of capital and labor when added together should be equal to one. But in the present study, as the model has been extended, this pre-supposition is ignored. i.e. the production process can be either constant return to scale, Increasing return to scale and decreasing return scale. The reason why we have selected the extended Cobb Douglas production function is its direct link to traditional micro and macro theories, which provides it with a robust design and high explanatory power. However its simple design makes it vulnerable for missing out different, potentially vital explanatory variables.

The traditional Cobb Douglas production function is as follow:

$$\mathbf{Y= A.\ K^{\alpha}L^{\beta}A>0,\ 0<\alpha,\ \beta<1,}$$

Where, Y= Output,, K=capital input, L=labor input and $\alpha+\beta=1$ (constant return to scale).

A,α andβ = Technological parameters.

The Cobb- Douglas production function limitsthe substitution between factor inputs hence the elasticity of substitution is always unity.

Its logarithmic form is as follows,

$$\mathbf{LnY = lnA+\alpha ln(K)+ \beta ln(L)}$$

The generalized or extended CobbDouglas production function can be written as follows.

$$\mathbf{Y = a\ X1\ b1\ X2\ b2\ \ldots\ Xnbn\ ,}$$

Here **Y** is the output level of thefirm.

X1 , ..., **Xn**are input variables, used in producing output.

b1, ...,bnare the respective elasticities of **X1** , ..., **Xn.**

The extended Cobb Douglas production function also lacks dynamic interaction functionality for example particularly found in VAR models, where all variables are treated endogenous within in a recursive system of interaction. This type of approach is more common in business cycles, so the extended model will explain the cross-sectional data in the present study.Average labor productivity had been used as a measure of efficiency until Farrell (1957) introduced a method to measure efficiency in his seminal paper.

Literature review

Varieties of studies are available on the issue of productivity both regarding developed and developing countries. Hsu and Chen (2000) examine the labor productivity of small and large manufacturing firms in Taiwan by focusing the export and foreign direct investment. The authors collect data for the year 1991 from manufacturing survey of Taiwan, using two stage switching regression to calculate the firm size effect on labor and estimating labor productivity for large and small firms. The variables under observation are labor productivity, capital intensity, quality of labor, training expenditure, welfare expenditure, monopoly power, research and development, export intensity, and foreign direct investment. The finding reveals that all selected variables have a positive effect on large and small scale enterprises. Labor productivity of SMEs can be increased by large trade intensity but it is not significant for large scale enterprises and SMEs having foreign direct investment (FDI) can enhance their labor productivity internally but it has a negative spillover on that of other small and large firms of the industry.

Zahid and Mokhtar (2007) estimated the technical efficiency levels of Malaysian manufacturing SMEs.. The Cobb-Douglas stochastic production frontier is applied.Theresults presented indicate that all - coefficients in the stochastic frontier production function are positive and significant. This indicates that inputs have a positive relationship, and are significant, to manufacturing SMEs' production levels. The average technical efficiency of overall manufacturing SMEs is 0.76 percent. It can be indicated that Malaysian manufacturing SMEs have approximately 24 percent of inefficiency in their production process

Admassie and Matambalya (2002) explain technical efficiency for small and medium scale enterprises, in Tanzania. The authors collect primary data from period 1999 to 2000, using Cobb-Douglas stochastic frontier production function. The finding reveals that in Tanzanian SMEs, there is a high level of technical inefficiency which reduces their output levels significantly. However adequate supply of inputs markets, credit facilities, infrastructure and training can raise the productivity of firms.

Majumder (2004) discusses the productivity growth in small manufacturing enterprises in Bangladesh. The author has studied the role of inputs, technological progress and learning by doing in enhancing productivity of SMEs from period 1994-1995 and 2000-2001, using Total Factor Productivity growth (TFPG) and Stochastic frontier Production function in its Translog form. The finding reveals that

technological improvement and technological diffusion is necessary for pure technical progress. The author suggests improvement of technology to enhance the productivity growth.

Dipa (2004) explains the determinants of the productivity in the SMEs in Bangladesh and emphasize the policies to foster productivity in SMEs. The author reiterates that technology, access to resources and inputs are important determinants of productivity. The author collect data from two latest surveys during the period 1994-1995, using capital labor ratio to define the technology. The finding shows that proper credit system, technology, land ownership, economic conditions of state, better working conditions, better wages are necessary for the development of the SMEs..

Taymaz (2005) explores the SMEs productivity in Turkey. The author writes that SMEs are playing a vital role in generating employment and production. The technical change, return to scale and technical efficiency are three main determinants of productivity. The author collected secondary data from state institute of statistic of Turkish SMEs having at least 25 employers during the period 1987-1997, using the Translog stochastic production frontier. The finding reveals that positive relation exists between entry size and entry firm efficiency, firms that are efficient tend to survive. The study supports passive learning, active learning and scale theories of productivity differentials. Policy recommendations are that firms by reducing cost increase efficiency, active learning, survive longer and grow faster.

Wengel and Rodriguez (2006) analyze the SME export performance in Indonesia after the crises. With the access and proper use of production inputs the SMEs can increase their productivity. The authors collect secondary data for more than 2000 industrial enterprises in Indonesia from central bureau statistical during the period from 1996 to 2000.The export share is the dependent variable and independent variables are size, number of export, total export, age, machinery, capital labor ratio, wage bill, average wage, import, interest paid, purchasing of industrial services research and development by the firm. The finding reveals that small firms have low export share as compare to the large firm and presence of foreign buyer/investor can increase exports. Credit and machinery have a positive and imported inputs have a negative effect, so small firm by using more domestic inputs like labor can increase their output being exported, new emerging firms are more export oriented.

Kumar and Basu (2008) present the perspective of productivity growth in Indian food industry. The authors collect secondary data during the period from 1988-1989 to 2004-2005 using log linear regression model and a data envelopment analysis technique. The findings reveals that Indian food industry is facing inefficiency due to low rate of technological progress which depends on mode of organization and various economic and institutional factors therefore it is necessary to encourage imports along with research and development.

Le and Harvie (2010) evaluates the technical efficiency performance of Vietnamese manufacturing SMEs. The authors collect cross sectional data over the period 2002 to 2007, using Translog Stochastic frontier production function approach to evaluate the technical efficiency. The independent variables are capital, labor, and material energy. The study reveals that SMEs in Vietnam operates at high level of technical efficiency. The coefficient for labor and other intermediate inputs are significant and the labor and material are important inputs in production. SMEs rely more on labor and material to increase their output. However capital input is insignificant, small and negative.

Khalil (2002), studies the cross section estimates of Jordanian manufacturing industry. The author uses the Translog function but focuses on its production side. The main determinants of output are capital, labor and material. The study reveals that Industry operates at slightly increasing returns. Capital and labor, capital and material and labor and material are all substitutes. The price elasticities of factor inputs show that capital and labor are more elastic than demand for material. Constant return to scale, Cobb - Douglas hypotheses are not satisfied with Jordanian manufacturing dataenot .

Although all the above mentioned studies have focused on the SMEs but they have not used the extended cobb Douglas production function in the form we have utilized. Especially we have included the female labor with male labor separately. And material categorized as local and imported so that their separate effects on ouput could be recorded. More so the impacts of sales tax, excise duty and advertisement have also been observed in addition.

Data and methodology

The empirical analysis in this paper is based oncross-sectional secondary data, regarding 3 digit, forty eight industries have been selected for the fiscal period 2005-2006. The latest available data (during the period 2005-2006) were collected from Census of manufacturing industry (CMI) through Federal Bureau of Statistics (FBS) published in 2010. Usually, it takes at least 5 years to collect, process and publish this type of data in Pakistan.

Table 2: **List of Variables used in the present Study**

Dependent variable	*Description of Variables*
Output	The output (in log) of the firm is proxies by total production at producer prices.
Explanatory Variables	
Labour	The labour input of the firm, includes production workers as well as non-production workers. Both production and non-production workers are further sub-divided into male and female workers which are included individually. (The log form of all variables is taken.)
Capital	The capital input of the firm, is calculated by addition/alteration during a year, plus depreciation during a year. (The log form of the capital is taken.)
Material	Two types of material have been taken for the present studyi.e. Locally produced material and imported material. Both materials are taken (in log) to analyze their affect individually.
Advertisement	Advertisement is an important expenditure, taken in log form in the model.
Excise Duty	Excise duty of the 3 digit SMEs is taken in log.
Sales tax	Sales tax of the 3 digit SMEs is taken in log.

The preferred measured of output in empirical studies is a value added variable as this includes intermediate input. So in the present study, the value added is not included rather output is taken at producer price.

One of the most important characteristics of Cobb Douglas production functional form is that, it is meant for only two factors of production, which confines its application to other factors of production or input. Due to its helplessness of its functional form to add more inputs, the present study has used the extended Cobb Douglas production function which incorporates more inputs than mere capital and labor including production workers (both male and female), non production workers (both male and female), local material imported material, capital , sales tax ,excise duty and advertisement. These inputs have been hypothesized according to the theory, but the main objective is to find out their relationship with output of SMEs, (negative or positive) and also find out the degree of responsiveness of output to the inputs. All variables are taken in log form to minimize the risk of heteroskedasticity. Autocorrelation may also be problem in regression model but in primary or cross sectional study it is not a serious problem [Greene (1992)]. Multicollinearity is very severe problem regarding Ordinary least square Method. If coefficient of correlation between X1 and X2 is in excess of 0.80, so there is severe problem of Multicollinearity [Gujarati (1995)].

Two models have been constructed to show the input output relationship of the SMEs.the first model takes the production workers and second model takes the non production workers whilst all the supporting variables are alike with minor difference. Both models are helpful to observe the productivity of all the factors of production involved especially with respect to labor.

The functional relationship of these variables with output (Y), is shown in the following mathematical models.

Model 1: Production workers

$$\ln Y = f(\ln LM, \ln LF, \ln ML, \ln MIMP, \ln K, \ln ST, \ln ED) \quad \text{.....(i)}$$

Its Econometric Equation is given as,

$$\ln \mathbf{Y} = \beta o + \beta_1 \ln \mathbf{LM} + \beta_2 \ln \mathbf{LF} + \beta_3 \ln \mathbf{ML} + \beta_4 \ln \mathbf{MIMP} + \beta_5 \ln \mathbf{K} + \beta_6 \ln \mathbf{ST} + \beta_7 \ln \mathbf{ED} + \mu \quad \text{.....(ii)}$$

Where, $\beta o > 0$, $\beta_1 > 0$, $\beta_3 \ldots\ldots \beta_7 > 0$.

Y= Output of the SMEs
LM= Male production workers
LF= Female production workers
ML= Local material
MIMP=Imported material
K=Capital
ED=Excise duty
ST=Sales tax
μ= Error term

Model 2:Non- Production workers

$$\ln Y = f(\ln LM, \ln LF, \ln ML, \ln MIMP, \ln K, \ln ADV) \quad \text{.....(iii)}$$

Its Econometric Equation is given as,

$$\ln \mathbf{Y} = \beta o + \beta_1 \ln \mathbf{LM} + \beta_2 \ln \mathbf{LF} + \beta_3 \ln \mathbf{ML} + \beta_4 \ln \mathbf{MIMP} + \beta_5 \ln \mathbf{K} + \beta_6 \ln \mathbf{ADV} \quad \text{.....(iv)}$$

where $\beta o_1 > 0$, $\beta_1 > 0$, $\beta_3 \ldots\ldots \beta_{67} > 0$

Y= output of the SMEs
LM=Male non production workers
LF= Female non production workers

ML= Local material
MIMP=Imported material
K=capital
ADV=Advertising expenditure
μ= Error term

The present study has utilized these models on the data of SMEs .Results have been taken using software Eviews -7

Table: 3Results of the Study

INDEPENDENT VARIABLES	(MODEL 1) (Production workers) Coefficients	(MODEL 2) (Non-Production workers) Coefficients
C	2.895885 (5.818212)*	2.273660 (4.981994)*
LOG(LM)	0.236282 (3.009366)*	0.034899 (0.438869)
LOG(LF)	-0.031763 (-0.870317)	-0.050258 (-1.060749)
LOG(ML)	0.434317 (6.857140)*	0.548224 (8.320226)*
LOG(MIMP)	0.191352 (3.989816)*	0.168082 (4.794604)*
LOG(K)	0.163585 (2.642752)*	0.151857 (3.375581)*
LOG(ST)	-0.049918 (-0.838196)	---------
LOG(ADV)	-------	0.112835 (2.799862)*
LOG(ED)	0.069565 (1.845897)	------
R-Square	0.974426	0.980810
Adjusted R-Square	0.968253	0.977520
White's test for hetroscedasticity	[0.418475]	[0.072261]
Observations	48	48

Note: The t-statistics (in parenthesis) significant at ,5% levels are indicated by *. P values are in [ ].All the estimations are carried out by Eview-s 7.

In model 1, the R-square is 97.44 percent, which represents that 97.44 percent variation in output has beenexplained by the independent variables. The adjusted R-square is 96.8 percent. The reason of high R-square is that almost most important variables have been incorporated in the model. The coefficients of capital LOG(K), local material LOG(ML), imported material LOG(MIMP),male labor LOG(LM), have shown positive association with Output, as well as they are statistically significant at 5 percent level. Female laborLOG(LF) and sales tax LOG(ST) shows negative relationship with output and both are statistically insignificant. This shows that an increase in sales tax LOG (ST) reduces the output of the firm, meaning that an increase in taxes reduced the revenue of the firm and therefore further investment of the firms suffers. The contribution of female labor does not play any role in the productivity of the SMEs in Pakistan.The reason behind the low productivity of female production workers might be that they are discriminated as compared to male labor i.e. their wages are low or having no job security. The data shows that there are many SMEs in Pakistan in which there is no participation of female labor worker. So all these facts and low participation show the low contribution and productivity of female workers in SMEs of Pakistan.

The coefficient of Excise Duty(ED) shows a positive relationship with output but statistically insignificant. The firms pay excise duty when they import raw material from abroad. It means that more the raw material is imported, more will be the excise duty and more will be the output of the SMEs but this positive relationship is insignificant.

In model 2, the R-square is 98.08 percent, which represents that 98.08 percent variation in output has been explained by the independent variables. The coefficients of capital LOG(K), local material LOG(ML), imported material LOG(MIMP), male labor LOG(LM), are showing positive association with Output, as well as they are statistically significant at 5 percent. Female labor LOG (LF) shows negative relationship with output and statistically insignificant. The coefficient of Advertisement LOG (ADV) shows a positive relationship with output but statistically not significant. This means an increase in advertisement expenditure result in an increase in the demand of output by the consumers and therefore the firms utilizes more inputs to increase in output, thus eventually increasing firm's profit.

It has been proved from the white tests for heteroskedasticity that there is absence of heteroskedasticity problem in the data .i.e. the data is homoskedastic in nature. Hence all the results are therefore reliable.

Conclusion

This study has analyzed the Input Output Relationship of Small and Medium Enterprises in Pakistan, using extended Cobb Douglas Production function. The results show that capital, male labor (both production and non production worker), local material, imported material have a positive and significant role in the productivity of small and medium enterprises. The female labor (both production and non-production worker) has negative relationship with output although insignificant. Sales tax also affects the productivity of SMEs. Excise duty and advertisement shows a positive relation with output in SMEs of Pakistan. The government should play an important role in women empowerment and job security so that they may also play an active role in the development of SMEs in Pakistan.

Whatever is astonishing is the role of women in SMEs is minor. As in Pakistan 52% of population consists of women. Not only their representation in generalemployment should be increased but also in SMEs.SMEs can be the best provider of the employment towomen. They should be well equipped for the jobs.So they should be trained properly in certain skills so that their productivityand numbershould be enhanced. In the present era when the voices are heard for women empowerment their role should be converted positive in SMEs.Certain quick measures are required to take

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