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An Econometric Analysis of Production Behavior of Micro Enterprises in Assam: A Case Study in Dibrugarh District

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I. INTRODUCTION

Production Can Be Defined As Any Use Of Resources That Converts Or Transforms A Commodity Into Different Commodity Over Time And Or Space. In General Any Activity That Creates Value Is Production. In Broad Sense, Production Includes Not Only Manufacturing , But The Principles Of Production Are Also Applicable To The Whole Range Of An Organization's Activities, Irrespective Of Whether The Organization Is Goods-Oriented Or Service Oriented, Profit Oriented Or Not For Profit(Boruah, 2008). Production Function Shows The Maximum Amount Of Output Can Be Produced With A Given Level Of Inputs. Production Implies Transformation Of Inputs. The Word Production Encompasses Not Only Physical Changes In Matter It Also Embraces Rendering Of Services Such As Transporting, Financing, Wholesaling And Retailing.

Production Is The Combined Result Of Various Factors Of Production I.E. Land, Labour, Capital And Technology. Statistically A Production Function Can Be Expressed As:

$Q = F (X_1 , X_2, X_3, X_4,\ldots\ldots\ldots\ldots\ldots\ldots.., X_n) + Ɛ$

Where, Q Is The Quantity Of Output.

$X_1 , X_2, X_3, X_4,\ldots\ldots\ldots\ldots\ldots\ldots.., X_n$ Represents Quantities Of Various Types Of Inputs.

Ɛ Is The Random Error .

In Traditional Economics The General Form Of Production Function Is Given As:

$Q = F (X_1 , X_2, X_3, X_4,\ldots\ldots\ldots\ldots\ldots\ldots.., X_n, \Lambda, \Upsilon) + Ɛ$

Where Λ Refers To Returns To Scale I.E. Long Run Analysis Of The Laws Of Production And The ϒ The Efficiency Parameter Refers To Organizational Aspect Of Production.

Production Function Mainly Depends On The Quantities Of Resources Employed And The Technology Adopted By The Firm.

The Inputs Are Divided Into Two Components I.E. Labour And Capital. The Concept Plays An Important Role In Both Microeconomics As Well As Macroeconomics. At The Macro Level It Has Been Combined With Marginal Productivity Theory To Explain The Prices Of The Various Factors Of Production And The Extent To Which These Factors Are Utilized. At The Micro Level It Is Used To Analyze The Degree To Which Substitution Between The Various Factors Of Production Is Possible And The Extent To Which Firms Experience Decreasing Or Increasing Returns To Scale (Thomas 1990).

Industrialization Is Regarded As A Vital Ingredient For Economic Upliftment Of Any Nation. Most Prominently Micro And Small Enterprises Play A Significant Role In The Economic Development Of Developing Countries. In Developing Countries Small Scale Industries Are Especially Important In The Context Of Employment Opportunities, Equitable Distribution Of National Income, Balanced Regional Development And Development Of Rural And Semi-Urban Areas (Rahman, 2006).

In India As Per Micro, Small And Medium Enterprise Development Act (Msmed) Of 2006. Enterprises Engaged In Manufacture Or Production, Processing Or Preservation Of Goods Whose Investment In Plant And Machinery (Original Cost Excluding Land And Building And The Items Specified By The Ministry Of Small Scale Industries Vide Its Notification No. S.O. 1722(E) Dated 5th October 2006) As Specified Below:

Table 1 Number Of Investment Of Msmes In Plant And Machinery

Classification	Number Of Investment In Plant And Machinery (In Rs)
Micro Enterprise	Upto Rs. 25 Lakh
Small Enterprise	Above Rs. 25 Lakh And Upto Rs. 5 Crore
Medium Enterprise	Above Rs. 5 Crore And Upto Rs. 10 Crore

Source: Ministry Of Micro, Small And Medium Enterprises (Msmes), 2006.

Enterprises Engaged In Providing Of Services And Whose Investment In Equipment (Original Cost Excluding Land And Building And Furniture Fittings And Other Items Not Directly Relate To The Service Rendered As Notified Under The Msmed Act, 2006) Are Specified As:

Table 2 Investment In Equipment Of Msmes

Classification	Investment In Equipment (In Rs)
Micro Enterprise	Upto Rs. 10 Lakh
Small Enterprise	Above Rs.10 Lakh And Upto Rs. 2 Crore
Medium Enterprise	Above Rs. 2 Crore And Upto Rs. 5 Crore

Source: Ministry Of Micro, Small And Medium Enterprises (Msmes), 2006.

In India There Are 2672188 Units Of Msmes Till June 2001. According To Ministry Of Msmes Report 2006-07 The Sector Contributed 5.94% In Total Gdp Of The Country. The Current 5 Year Plan (2007-12) Estimates That The Sector Accounts For About 45% Of The Manufacturing Output And Around 40% Of The Total Export Of The Country (Estimations Are In Terms Of Value). Distribution Of Working Enterprises And Employment By Sector In India Is Depicted In The Table Below:

Table 3 Distribution Of Working Enterprises And Employment Of Msmes

Enterprises	No. Of Enterprises (In Lakh)	Employment (In Lakh)
Micro Enterprises	14.85	65.34
Small Enterprises	0.76	23.43
Medium Enterprises	0.03	4.32

Source: 4th All India Census Report (2006-07) Ministry Of Micro, Small And Medium Enterprises.

Assam Being A State Of India Is Industrially Backward By Indian Standards As It Has A Few Agro-Based And Mineral-Based Industries. In Assam During 2010-2011, There Are 26887 Number Of Working Msme In Different District Which Provides Employment To 284933 Person With Production And Fixed Investment Of 12708.79 And 7941.84 Crore. Dibrugarh District Occupies A Leading Position In Concentration Of Medium And Large Scale Industries Among The Different Districts Of Assam. The Medium And Large Scale Operating Industries Are Oil Industry, Tea Industry, Fertilizer Corporation Of India And Assam Petro-Chemical Limited. Small Scale And Msmes In The District Also Occupies An Important Place. Total Number Of Registered Ssi/Msmes In Dibrugarh District Under The Directorate Of Industries And Commerce In 31st December 2008 Is 5429.

Objectives Of The Study

1. To Examine The Production Behavior Of Micro Enterprises In Dibrugarh District.
2. To Analyze The Impact Of Labour Supply In Total Productivity Of The Sample Units.

Hypothesis

The Elasticity Of Substitution In Micro Enterprises Is Not Constant In Nature.

II. RESEARCH METHODOLOGY

The Proposed Research Work Will Be Carried Out By Using Both Primary And Secondary Data. The Study Covers Only The Registered Micro Enterprises During 2006-07 To 2011-12 Under District Industrial And Commercial Centre (Dicc), Dibrugarh. According To Dicc, Dibrugarh There Are 1370 Registered Micro Enterprises During The Period 1st April 2006 To 25th May 2012. As The Micro Enterprises Are Spread Over The Entire District, So The Sample Are Taken From All The 7 Revenue Circles Of The District I.E. Dibrugarh East, Dibrugarh West, Chabua, Tegakhat, Naharkatiya, Tingkhong And Moran. For The Study The Micro Enterprises Are Classified Into 10 Different Categories And From Each Category 10% Are Randomly Selected As Samples. It Is 137 Sample Units. The Sample Size Are Taken As Follows:

Table 4 Classification And Sample Size Of Micro Enterprises In Dibrugarh District

Sl. No.	Type Of Industry	No. Of Unit	*Sample Size (%)
1	Agro Based	200	20
2	Food Based	135	13.5
3	Weaving & Textile	142	14.2
4	Forest Based	137	13.7
5	Engineering Based	165	16.5
6	Construction Based	70	7.0
7	Electronic & Electrical	92	9.2
8	Services	197	19.7
9	Repairing	93	9.3
10	Others	139	13.9
	Total	1370	137

Source: District Industry And Commercial Centre, Dibrugarh

* Sample Size Compiled By The Researcher (10%)

In The Study To Analyze The Production Function Constant Elasticity Of Substitution (Ces) And Variable Elasticity Of Substitution (Ves) Production Function Is Used. The Variable Output In The Study Is Taken As Gross Value Added. Capital Is Measured By Perpetual Inventory Method, Which Measures The Relationship Between The Capital Stock At A Point Of Time And Investments Up To That Point And Labour Is Measured As The Number Of Persons Employed During A Year. To Study The Impact Of Labour Supply On Productivity, Regression Splines Are Used.

Analysis Of Production Function Of Micro Enterprises In Dibrugarh District Of Assam

Constant Elasticity Of Substitution (Ces) Production Function:

The Constant Elasticity Of Substitution (Ces) Production Function Assumes Constant Elasticity Of Substitution. The Ces Production Function Is Developed By Economist Solow, Kmenta, Minhas, Arrow And Chenery. Kmenta (1967) Has Postulated The Ces Production Function Which Can Be Estimated By Using Ols Technique Is Of The Form –

$Q= A[\Delta k^{-P} + (1-\Delta)L^{-\Delta}]^{N/P}$

$\text{Log } Q = \text{Log } A + N\delta \text{ Log } K + N(1- \Delta)\text{Log } L – (1/2)N\delta\rho(1- \Delta) (\text{Log } K – \text{Log } L)^2 + \mathcal{E}_i$

This Can Be Written As,

$\text{Log } Q = A_0 + A_1 \text{ Log } K + A_2 \text{ Log } L + A_3 (\text{Log } K – \text{Log } L)^2 + \mathcal{E}_i$

Where,

Q = Output, L = Labour, K = Capital, A = Efficiency Parameter, Δ = Distribution Parameter, $(1 – \Delta)$ = Labour Intensity Coefficient, P = Substitution Parameter.

Elasticity Of Substitution (Σ) In Ces Production Function Is = 1/1 + P

The Ces Production Function Exhibits Three Returns To Scale:

Q = 1, Constant Returns To Scale

Q > 1, Increasing Returns To Scale

Q < 1, Decreasing Returns To Scale

Variable Elasticity Of Substitution (Ves) Production Function:

Revankar Have Given A Ves Production Function I.E.

$V = \Gamma k^{\alpha(1- \Delta\rho)} [L +(P – 1)K]^{A\delta\rho}$

Where A,Δ,P, And Γ Are Parameters.

$\Gamma>0$, $A> 0$, $0< \Delta <1$, $0\leq \Delta\rho\leq1$, $L/K> (1-P)/1 – \Delta\rho$

Taking Log On Both Sides, The Equation Transforms Into,

$\text{Log } V = \text{Log } \Gamma + A \text{ Log } K + A\delta\rho \text{ Log } L + A\delta\rho^2 \text{ Log } K$ (Considering $\text{Log } \Gamma = A_0$, A=1 Constant Returns To Scale)

The Elasticity Of Substitution Σ For Ves (Revankar) Is

$\Sigma = \Sigma (K, L) = 1 + (1 – P/ 1 – \Delta\rho) K/L$

Thus We Have Taken $B = (1 – P/ 1 – \Delta\rho)$. The Elasticity Of Substitution Varies Linearly With The Capital Labour Ratio. We Assume $\Delta > 0$ In The Empirically Relevant Range Of K/L. It Requires That $L/K > (1 – P/ 1 – \Delta\rho)$.

Satis Hoffman (1968), Revankar (1971), Lu And Fletcher And Christenson, Jorgenson And Liu (1973), Have Developed Variable Elasticity Of Substitution (Ves) Production Function In Which Elasticity Of Substitution Is A Linear Function Of The Capital Labour Ratio K/L.

Lu And Fletcher Ves Production Function Is –

$$\text{Log } Q/L = \text{Log } A + B \text{ Log } W + Y \text{ Log } K/L + U$$

The General Form Of Ves Production Function Can Be Derived As:

$$Q/L = \Gamma [V\sigma^{-P} + Y\ K/L^{-Y(1+P)}(1-\Delta)\ L^{-P}]^{-1/P} + U$$

Where,

Γ = Efficiency Parameter, Δ = Distribution Parameter, Y = Intensity Parameter And P = Substitution Parameter.

Thus, Σ Can Be Obtained As

$$\Sigma = B / 1- Y (1+ Wl/Rk)$$

Where, W = Wage Rate, R = Rate Of Return On Capital.

Christenson, Jorgenson And Liu In 1973 Have Developed The Ves Production Function As

$$\text{Log } Q = B_0 + B_k \text{ Log } K + B_l \text{ Log } L + B_{kk} (\text{Log } K)^2 + B_{ll} (\text{Log } L)^2 + B_{lk} (\text{Log } K) (\text{Log } L) + U$$

The Function Is Used To Test Whether Elasticity Of Substitution Is Constant Or Not. To Fulfilled The Condition It Is Required To Test Whether The Identity Is True Or Not.

$$B_{kk} = B_{ll} = 1/2\ B_{lk}$$

Estimated Ces Production Function:

The Estimated Ces Production Function Is Depicted In The Table Below:

$$Q= A[\ \Delta k^{-P} + (1-\Delta)L^{-\Delta}]^{N/P}$$

$$\text{Log } Q = A_0 + A_1 \text{ Log } K + A_2 \text{ Log } L + A_3 (\text{Log } K - \text{Log } L)^2 + \varepsilon_i$$

Table 5 Estimated Results Of Ces Production Function

Parameter	**Estimated Value**	**P-Value**
A_0	1.324	0.003
$\text{Logk}(A_1)$	-2.811	0.005
$\text{Logl}(A_2)$	1.752	0.002
$(\text{Log } K - \text{Log } L)^2\ A_3$	2.179	0.004
Rts	-4.563	-
R^2	0.88	-
Adjusted R^2	0.84	-
F	12.921	0.01

Source: Calculated By The Researcher

The Above Table Provides The Estimates Of The Coefficients Of Ces Production Function. In The Model It Is Observed That 84 Percent Of Variation In Output Is Explained By The Regresor, The Model Fit The Data Well.

The Ces Function Is Also Subjected To Some Limitations That The Value Of The Elasticity Of Substitution Is Constant, Although Not Necessarily Unity. When $\Sigma > 1$,An Increasing Share Of National Income Goes To Capital As The Capital-Labor Ratio Increases. If $\Sigma < 1$, Then Capital's Share Declines As This Ratio Increases. When $\Sigma = 1$, Income Shares Are Unaffected By Changes In The Capital-Labor Ratio. But Elasticity Of Substitution Always Does Not Remain Constant When The Capital/Labor Ratio Varies Due To Changes In The Factor Price Ratio. In The Study The Elasticity Of Substitution Is $(\Sigma) = 0.87$, Is Less Than 1. It Represents That The Proportionate Change In Capital Labor Ratio Is Less Than The Proportionate Change In Their Prices, The Elasticity Is Relatively Inelastic.

Estimated Ves Production Function For Micro Enterprises In Dibrugarh District:

The Estimated Ves Production Function Is:

$$V = \Gamma k^{\alpha(1-\Delta\rho)} [L + (P-1)K]^{A\delta\rho}$$

Where A,Δ,P, And Γ Are Parameters.

$\Gamma>0$, $A> 0$, $0< \Delta <1$, $0\leq \Delta\rho\leq 1$, $L/K> (1-P)/1 - \Delta\rho$

$$\text{Log } V = \text{Log } \Gamma + A \text{ Log } K + A\delta\rho \text{ Log } L + A\delta\rho^2 \text{ Log } K$$ (Considering $\text{Log } \Gamma = A_0$, A=1 Constant Returns To Scale)

Table 6 Estimated Results Of Ves Production Function

Parameter	**Estimated Value**	**Se**
Log Γ (A_0)	3.46	53568.2
Δ	-0.62	21572.116
P	-2.44	10755.8
R^2	0.62	-
Adjusted R^2	0.51	-

Source: Calculated By The Researcher

From The Table It Is Observed That The Estimated Ves Production Function That The Value Of R^2 And Adjusted R^2 Are High But The Value Of The Capital Coefficient Is Found To Be Insignificant Due To Multicolinearity Problem Because Of Higher Standard Error (Se) Of Different Coefficient. In Ves Model, If The Elasticity Of Substitution Is Less Than 1, Which Indicates That Elasticity Of Substitution Increases As The Industry Gets More Labour Intensive And Vice Versa. But In The Present Analysis The Condition, L/K> (1-P)/1 – Δρ, Associated With The Ves Model Forwarded By Ravenkar Is Not Satisfied. So The Model Cannot Be Considered As A Reliable For Micro Enterprises In The District.

Lu And Fletcher Fitted Ves Production Function Is

Log Q/L = 1.565^{**} + 0.081 Log W - 0.588^{**} Log K/L

** Indicates Significant At 1% Level Of Significance

R^2 = 0.689 Adjusted R^2 = 0.681 F = -6.721^{**}

Christenson, Jorgenson And Lu Estimated Ves Production Function Is

Log Q = 31.06 -1.21 Log K + 0.20 Log L

+ 0.071^{**} $(\text{Log K})^2$ - 0.02 $(\text{Logl})^2$ +0.03 (Log K) (Log L)

** Indicates Significant At 1% Level Of Significance

R^2 = 0.821 Adjusted R^2 = 0.810 F = -11.502^{**}

From The Analysis It Is Observed That All The Production Function Shows Higher Goodness Of Fit. The Ves Production Function Shows Higher R^2 And Adjusted R^2 But Some Coefficients Are Insignificant. Therefore The Elasticity Of Substitution Is Not Variable In The Sample Units Of Dibrugarh District. On The Other Hand Ces Production Function Is Significant And Fit The Data Well Therefore The Elasticity Of Substitution Of Micro Enterprises In The District Can Be Considered As Constant.

Analysis Of Total Factor Productivity (Tfp) In Micro Enterprises In Dibrugarh District Of Assam

Total Factor Productivity Measures The Overall Productive Efficiency Of A Firm. It Is The Ratio Of Output To The Weighted Combination Of Inputs. Total Factor Productivity Shows The Productive Growth Of The Factors Of Production. To Measure Productivity Indexes Two Types Of Output Measures Are Used I.E. Real Value Added And Gross Value Added. Industrial Productivity Is Calculated When Labour And Capital Are Used As Inputs Is Appropriate Using Real Value Added Method And When Intermediate Goods Are Used As Inputs In Production Process Gross Value Added Method Is Appropriate. There Are Various Methods Of Measuring Total Factor Productivity. In The Study Kendrick Index (1984) Is Used For Measuring Total Factor Productivity.

Kendrick Index $(A_{t)} = O_t / W_0 l_t + R_0 K_t$

Where 0 Represents Base Year And T Represents Time Period. W_0 And R_0 Are The Factor Shares Of Labour And Capital. Income Shares Are Used As Weights To Measure Kendrick Index. To Estimate Tfp Factor Shares Of Labour And Capital Are Taken From Ces Production Function. This Estimation Results Are Shown In The Following Table.

Table 7 Total Factor Productivity Of Sample Units In Dibrugarh District Of Assam

Type Of Industry	**Tfp (In Lakhs) (Gross Value Added)**
Agro Based	0.27
Food Based	0.24
Weaving & Textile	0.11
Forest Based	0.14
Engineering Based	0.26
Construction Based	0.63
Electronic & Electrical	0.41
Services	0.52

Repairing	0.31
Others	0.17
Average	0.31

Source: Calculated From Field Survey

It Is Observed From The Table That Total Factor Productivity Of The Sample Units In The District Is 0.31. The Construction Based Enterprises In The District Are Found With Highest Total Factor Productivity And Lowest For Weaving And Textile Industries.

Determinants Of Total Factor Productivity (Tfp) In The Sample Units In Dibrugarh District Of Assam

The Determinants Of Total Factor Productivity Of Micro Enterprises In Dibrugarh District Is Investigated By Using A Regression Analysis. Determinants Of Tfp Can Be A Number Of Factors. Romer (1990),Grossman And Helpman (1991) And Aghion And Howitt (1998) Emphasized The Role Of Technology, Lucas (1988) And Other Tries To Show The Role Of Externalities, Economics Of Scale, Various Complimentaries In Describing Tfp. The Linear Multiple Regression For Estimating Determinants Of Tfp Is

$Tfp = \alpha + Bci + B_1 Pc + B_2 S + B_3 Ql + Ɛ$

Where, α Is The Intercept Term, Ci Is The Capital Intensity Measured In Terms Of Capital Labour Ratio, Pc Is The Cost Of Production Measured In Terms Of The Summation Of Fixed Cost And Variable Cost, S Is The Value Of Sales, Ql Is The Quality Of Labour In Terms Of Labourers Educational Level And Ɛ Is The Error Term.

From The Regression Analysis It Is Found That The R^2 And Adjusted R^2 Are High. The F Statistic Is Significant And The Model Fits The Data Well The Analysis Is Found To Be Significant.

Table 8 Estimated Regression Equation For Estimating Determinants Of Tfp Of Micro Enterprises In Dibrugarh District

Variable	**Coefficient**	**T**
A	- 4.3	- 0.69
B	4.23	14.11*
B_1	0.687	0.389*
B_2	1.389	3.21*
B_3	3.082	16.23*
F = 23.54* *Significant At 5 Percent Level Of Significance, R^2 = 0.871 Adjusted R^2 = 0.706		

Source: Calculated By The Researcher

From The Coefficient Table, F Statistic And All Variables Are Significant Except The Intercept Term α. The Coefficient Of B Is 4.23 Indicating That With The Increase In Capital Intensity The Total Factor Productivity Will Also Increase. With The Increase In The Cost Of Production The Enterprises Total Factor Productivity Decreases, And Coefficient B_3 Is Found To Be Significant For Quality Of Labour Variable.

Spline Functions

In Recent Years Spline Functions Are Used In Various Economics And Statistics Research. The Genesis Of Spline Function Is From Mathematics Of Interpolation And Engineering. Spline Functions Have Been Used In Problems Related To Economics Studies By Various Researcher, Mcgee And Carlton (1970), Poirier (1973, 1976), Barth, Kraft And Kraft (1976), Buse And Lim In (1977) Used Spline Functions As A Special Case Of Restricted Least Squares. In A Scattered Observation A Linear Regression Would Be A Poor Fit, So In That Case A Series Of Linear Regression Can Be Fitted I.E. Piece-Wise Linear Regression. Piece-Wise Linear Regression Is Shown In The Diagram Below:

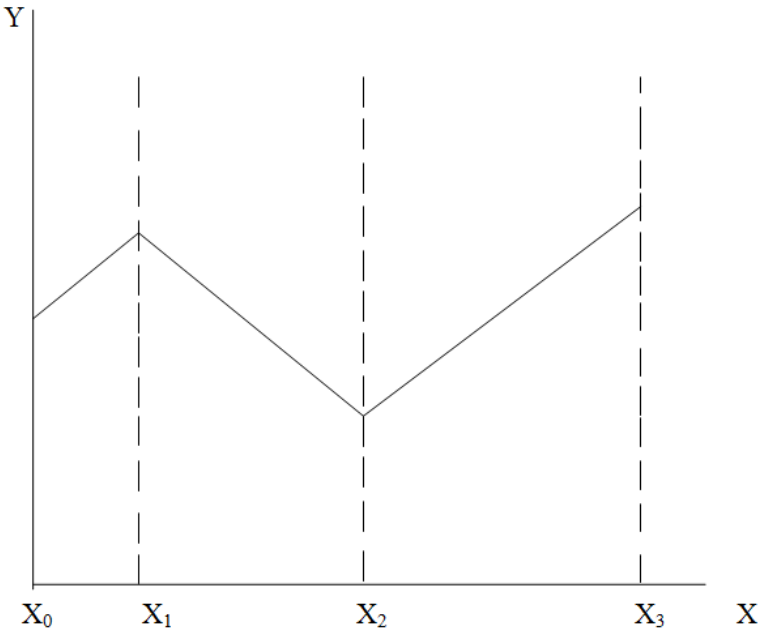

Fig: 2.3 Piece-Wise Linear Regression

Piece-Wise Linear Regression Suffers From Some Limitations. Piece-Wise Linear Regression Function Is Continuous But It Derivatives Are Not As A Result Of Which Economic Applications Results May Be Discontinuous Resulting In Shifts In Elasticity, Marginals Etc. So, Curvilinear Relationship May Provide A Better Fit To The Data As Against Linear Segments Which Is Given By Spline Functions. Spline Functions Overcome This Disadvantage Of Piece-Wise Linear Regression By Fitting A Piece-Wise Polynomial Regression. Mostly Cubic Polynomial Is Use As It Is More Convenient. The Cubic Spline Is Shown In The Diagram Below. Where X-Axis Has Been Divided Into Three Segments By The Points Or Knots X_0, X_1, X_2 And X_3.

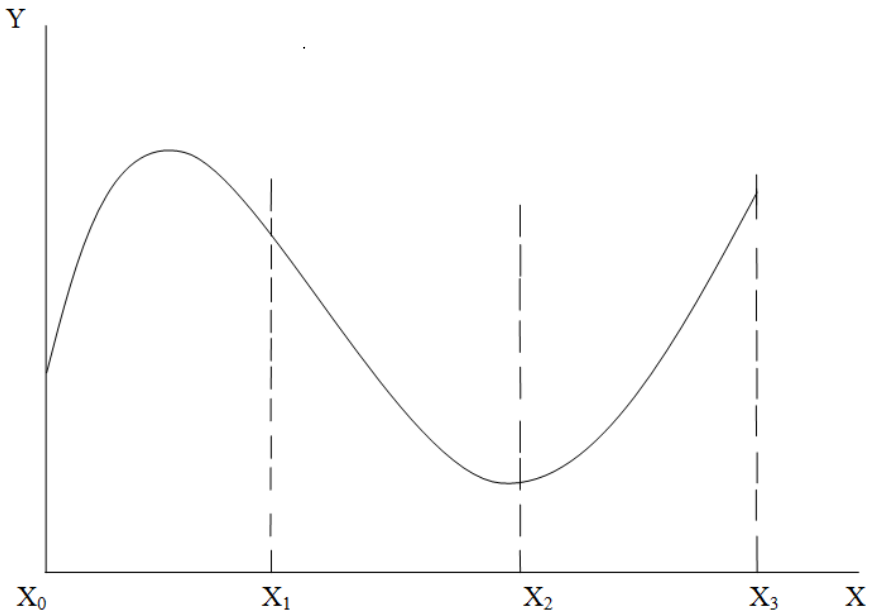

Fig: 2.4 Piece-Wise Polynomial Regression.

The Intervals Between The Knots Are Taken Equal For Convenience. While Fitting Spline Function More Than Four Knots And Three Intervals Can Be Taken. If The Numbers Of Intervals Are More Than Greater Number Of Composite Variables Will Be Required To Fit The Curve And Loss Of Degrees Of Freedom Will Be Greater. The Regression Line Will Be (Suits, Mason And Chan, 1978)

$Y = [A_1 + B_1 (X-X_0) + C_1 (X-X_0)^2 + D_1 (X-X_0)^3] D_1 + [A_2 + B_2 (X-X_1) + C_2 (X-X_1)^2 + D_2 (X-X_0)^3]D_2 + [A_3 + B_3 (X-X_2) + C_3 (X-X_2)^2 + D_3 (X-X_2)^3]D_3 + U$ …… (1)

D_i Is A Dummy Variables Of I^{th} Interval. The Equation 1is Discontinuous At The Knots, If Constraints Are Applied To The Coefficients The Function Will Become Continuous. The Constraints Are

$A_2 = A_1 + B_1 (X_1 – X_0) + C_1 (X_1 – X_0)^2 + D_1 (X_1 – X_0)^3$

$B_2 = B_1 + 2c_1 (X_1 – X_0) + 3d_1 (X_1 – X_0)^2$

$C_2 = C_1 + 3d_1 (X_1 – X_0)$

$A_3 = A_2 + B_2 (X_2 – X_1) + C_2 (X_2 – X_1)^2 + D_2 (X_2 – X_1)^3$

$B_3 = B_2 + 2c_2 (X_2 – X_1) + 3d_2 (X_2 – X_1)^2$

$C_3 = C_2 + 3d_2 (X_2 – X_1)$…….….. (2)

In Order To Consider Equal Intervals Let $(X_1 – X_0) = (X_2 – X_1) = (X_3 – X_2) = W$ And Substituting Into Equation (2) And Putting The Constraints In Equation (1) Equates The Slopes Of Left And Right Branches At The Knots(Suits, Mason And Chan, 1978).

$Y = A_1 + B_1 (X-X_0) + C_1 [(X-X_0)^2 D_1 (W + X – X_1)^2 D_2 + (2 W + X – X_2)^2 D_3] + D_1 \{(X-X_0)^3 D_1 + [W^3 + 3w (X – X_1)^2 + 3w (X – X_1)^3] D_2 + [7w^2 + 9w^2 (X – X_2) + 3w (X – X_2)^2]D_3\} + D_2 \{ (X – X_1)^3 D_2 + [W^3 + W^2 (X – X_2) + 3w (X – X_2)^2]D_3\} + D_3 (X- X_2)^3 D_3$..... (3)

In Equation (3) The Spline Function Can Be Fit By Using A Multiple Regression Of Y On Five Composite Variables. However The Above Equation Can Be Simplified Which Can Be Used As A Generalization To A Large Number Of Intervals. To Do This A Set Of Dummy Variables Need To Be Constructed Under Certain Conditions D_1^* And D_2^*, $D_1^* = 1$, If And Only If X Is Greater Than Equal To X_i , Otherwise $D_1^* = 0$. D_1^* Has The Value 0 Until X Reaches X_1 And Thereafter Equal To 1. D_2^* Is Equal To 0 Until X Reaches X_2 And Is Thereafter Equal To 1. The Generalized Spline Function Is

$Y = A_1 + B_1 (X-X_0) + C_1 (X-X_0)^2 + D_1 (X-X_0)^3 + (D_2 – D_1) (X – X_1)^3 d_1^* + (D_3 – D_2)(X – X_2)^3 D_2^*$.....(4)

Equation (4) Is A Multiple Regression On Five Composite Variables, The Regression Equation Yield The Values Of A_1, B_1, C_1, And D_1, And The Values Of D_2 And D_3 Can Be Calculated From The Coefficients. Spline Functions With More Than Three Intervals Can Also Be Derived. Spline Functions With More -Than One Independent Variable Can Also Be Incorporated. To Study The Impact Of Labour Supply On Productivity Regression Splines Are Used.

In The Study Samples Are Taken From The Registered Micro Enterprises Of Dibrugarh District From The Year 2006-2012. Over This Period Labour Supply Varied From A High Of 16.0 To A Low Of Nearly 1.0. This Range Of Labour Supply Is Divided Into Three Segments By Knots I.E. 1.11, 6.11, 11.11 And 16.11 With Uniform Interval Equal To 5.0. In The Regression Spline Function Composite Variables Are Generated And Represented By X_1, ……, X_5. This Can Be Expressed In The Equation,

$P = A_1 + B_1 (X-X_0) + C_1 (X-X_0)^2 + D_1 (X-X_0)^3 + (D_2 – D_1) (X – X_1)^3 d_1^* + (D_3 – D_2)(X – X_2)^3 D_2^*$.

$P = 34.14 – 56.65x_1 + 87.21x_2 - 1549.98x_3 + 6287.44x_4 – 5112.79x_5$

$R^2 = 0.88$, $F = 89.7$ And D. W. = 1.19

It Is Observed In The Study That R^2 Is Highly Significant And There Is A Positive Impact Of Labour Supply In Productivity.

III. CONCLUSION

In The Study The Elasticity Of Substitution Of Micro Enterprises In The District Is Constant In Nature. It Is Observed That With The Increase In Capital Intensity The Total Factor Productivity Of The Micro Enterprises In The District Will Also Increase And With The Increase In The Cost Of Production The Enterprises Total Factor Productivity Decreases.

REFERENCES

[1]. Ahmed, J.U.D. (2014) Micro, Small And Medium Enterprises (Msmes) In India: Institutional Framework, Problems And Policies, New Century Publications, New Delhi.

[2]. Boruah, P. (2008) Production Behaviour Of O.N.G.C., Eastern Region: An Econometric Analysis, Published Ph.D Thesis, Department Of Statistics, Dibrugarh University, Assam.

[3]. Gujarati, D. N. (2004) Basic Econometrics, Tata Mc Graw – Hill Publishing Company Limited, New Delhi.

[4]. Khreisat, M. A. (2011) Production Function Estimations And Policy Implications, Colorado State University, Department Of Economics, Fort Collins, Colorado.

[5]. Ko, M. And Bryson, K. M. (2004) The Productivity Impact Of Information Technology In The Healthcare Industry: An Empirical Study Using A Regression Spline Based Approach, Information And Software Technology, Elsevier, 65-73.

[6]. Revankar, N. S. (1971) A Class Of Variable Elasticity Of Substitution Production Functions, Econometrica, Vol.39, No. 1, January.
[7]. Sharma, A. K. (1976) Management Problems Of The Small Scale Enterprises In Assam, Omson Publication.
[8]. Sivayya, K.V. And Das, V.B.M. (1987) Indian Industrial Economy, S. Chand And Company Ltd, New Delhi.
[9]. Suits, D. B. Mason, A. And Chan, L. (1978) Spline Functions Fitted By Standard Regression Methods, The Review Of Economics And Statistics, Vol. 60, 132-139.
[10]. Thomas, D. (1990) Intra - Household Resource Allocation: An Inferential Approach, University Of Wisconsin , Journal Of Human Resources, P. 635-664.
[11]. Zellner, A. Ryu, H. (1998) Alternative Functional Forms For Production, Cost And Returns To Scale Functions, Journal Of Applied Econometrics, P. 101-127.

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