International Journal of Business and Management Invention
ISSN (Online): 2319 – 8028, ISSN (Print): 2319 – 801X
www.ijbmi.org || Volume 6 Issue 6 || June. 2017 || PP—22-28

An investigation on elasticity of inputs and returns to scale of enterprises in the Mekong River Delta, Vietnam

La Xuan Dao[1], Tu Van Binh[2]
[1](*University of Economics and Law, National University, Vietnam)*
[2](*University of Economics Ho Chi Minh City and CFVG, Vietnam)*

Abstract: *To find out elasticity of input factors and returns to scale (RTS) of enterprises in Vietnam, the production function is concerned, which 8,168 enterprises located in Long An province and Can Tho City (belong to the Mekong River Delta) are surveyed by the General Statistics Office of Vietnam in 2013, are taken into account. Based on using Translog production function, in which independent variables are labor, human capital, and physical capital. While the sales output value is deployed as the dependent variable. Findings shown that there is an existing elasticity of substitution between capital and labor. RTS of firms is the increasing, which firms with advantages of technology, capital and size, e.g. the joint stock company and the 100% foreign capital company are found a larger RTS. With what found and mentioned above, policies of the government toward enterprises should be clarified. In addition, the collective, private company, private limited company are Vietnamese pure companies need supports with respect to technology knowledge, management skills, market comprehension to face with their competitors, particularly companies with foreign elements.*
Keywords: *Elasticity, Enterprises, the Mekong River Delta*

I. INTRODUCTION

With positive changes in policies of Vietnam's economy, firms seemly have more chances to enter market. However this is not at all for enterprises with differences in financial capacity and size. With a quick growth of Vietnam's economy, the financial market had been busier. Of course, interesting business and entering potential for enterprises in general can cause more severe competition. In addition, due to the global crisis, a number of enterprises in Vietnam are bankruptcy, plus with the crisis of local financial market and real estate bubble-breaking led to the collapse of a series of business (Nha & Quan, 2014). Of which reasons can be small production scales of Vietnamese enterprises, poorness to mobilize and save capital, weak management skills low qualified workers, limited technology application. Consequences make a low contribution to competition and not meet demands of export and local markets of enterprises, particularly for Vietnamese enterprises.

Although there are many papers with arguments on Vietnamese enterprises, this paper is going to fill a gap of investing on elasticity of inputs, returns to scale of enterprises, in that comparison between Vietnamese firms and firms with 100% foreign capital. Database considered are based on the survey of Vietnam General Statistics Office (GSO) conducted on enterprises located in Vietnam. Although every two years the survey is carried out, the survey of 2013 is considered in this paper. Two provinces in the Mekong River Delta (MRD) are representative, such as Long An province and Can Tho City. There are three input factors recruited in approach as total employment, working capital and physical capital. In addition, the output factor is a measure of the total output sales values also concerned in the study.

II. ENTERPRISES AND ITS CONTRIBUTION

Small and medium size enterprises (SMEs) in Vietnam occupy the majority and mainly in the economy. They play an important role of creating jobs, increasing income for workers, which contributing to mobilize social resources for development investment, poverty reduction. Therefore, annually enterprises generate more than half a million new jobs, which is using 51% of social workers and contributes over 40% of GDP of the government. In addition, the amount of taxes and fees that SMEs were privately submitted to the government has increased by 18.4 times after 10 years. The contribution was a big support for spending on social services and other development programs. Thus, 40% have created opportunities for people to invest in the most effective in mobilizing the funds are distributed, located in the residential.

Achievements of local enterprises are a positively representative signal to the country's economy through employment generation, income enhancement, and the national budget growth. Shifting from the rigidities of a centrally- planned economy to market-oriented economy, Vietnamese enterprises are promoted and have more chances to address market needs of both local and foreign markets. In terms of opened door policies, the market entrance of Vietnamese enterprises is stimulated. Consequently, the labor market demand is

increased, which the vast number of labor accounting for 85% of total corporate workforce are employed in local enterprises (GSO1). In addition, annually, the Vietnamese enterprises recruit around half of million labors, use 51% of social labor force, and contribute to more than 40% to GDP.

There is an increase in amount of enterprises for recent years, in which the service sector accounts for the highest share of 67,8% in total, next as the sector of construction and industry occupies 21.8%. In general, Vietnamese enterprises are in process to be restructured to response to the global recession. However, still many enterprises are backward technology compared with regional countries, e.g. Thailand, Indonesia, Singapore, so it causes a weak jump toward the competitive market. Although, the government currently pays more attention to local enterprises through the restructuring programs (mainly focused on state owned enterprises), implications are still questionable. In addition, programs of improving dynamic finance system, human resource enhancement though advanced trainings, science and technology transfer are taken into account. Unluckily thousands of enterprises do not maintain their market place. Evidently, 43.000 enterprises have been broken in 2010, 53.000 enterprises in 2011, 54.000 enterprises in 20122. Innovative programs to enterprises with a low efficiency are extremely considered. However, detailed actions are ambiguous. To contribute into positive development policies to Vietnamese enterprises, this paper is going to find out how input factors impact on the enterprise performance. Its findings are helpful and will be a good reference for policy decision makers through recommendations. However, a large limitation of this paper is data used in this paper just providing economic indicators related to labor, working capital and physical capital (defined in next section). Information related to others factor are not offered, such as business sector, export situation, market place, etc. In addition, data limited to find out what can affect technical efficiency is not presented.

III. EMPIRICAL MODEL

Candidates of Cobb-Douglas and Translog production frontier function are considered and tested. Testing these candidates are based on (Coelli, et al., 2005), which a generalized likelihood ratio test is deployed. The likelihood ratio *LR* test is twice differences in the log-likelihood value for unrestricted and restricted function an defined as

$$LR = -2\,(R - U)$$

Where, R is restricted log of likelihood of Cobb-Douglas production function, *U* is unrestricted log of likelihood of Translog production function. The *LR* has approximately λ^2 distribution with degree of freedom equal to the number of parameters assumed to be equal to zero in the null hypothesis. The critical value of *LR* is drawn from Kode & Palm (1986).

In terms of finding out effects of inputs on the output growth of firms, Liu & Li (2012) used stochastic frontier production function, in which independent variables are labor, human capital, and physical capital. In constructing physical capital, they use the real total fixed assets as a proxy variable. The dependent variable of which is defined as the industrial sales output value, measured as the total value of industrial products. Liu & Li found that labor has the largest share in production, but its contribution to the input growth effect is the lowest. To investigate relationship between inputs, e.g. physical capital and employment and real GDP enrolled as the country's output level, Arazmuradov et al. (2014) also use stochastic frontier production function. Additionally, Seo et al. (2010) also used stochastic frontier production function, with the number of employees as an independent variable, and find out total factor productivity through stochastic frontier analysis with a time varying inefficiency model.

Therefore, application of frontier production function is considered in many papers, which the output measured in sales output value is recruited as the dependent variable, inputs measured in quantity or value play as independent variables. Applied stochastic frontier production function as an extent application in this paper, which three exploratory variables are recruited. The total annual capital of the firm is a proxy of working capital (K), total fixed asset and long term investment are a proxy of physical capital (P) (Liu & Li, 2012), the employees are a proxy of number of labors employed in the enterprise (Arazmuradov et al., 2014; Seo et al., 2010).

The general frontier production for enterprises considered in the study is as below

$$Y_i = f(W_i, P, L_i)\tau_i\varphi_i \qquad (1)$$

Where $i = 1, 2, \ldots, N$ enterprises, *Yi* is average sales output value of the enterprise (Liu & Li, 2012) (measured in billion VND) for the *ith* firm. *K*, *P* and *L* are already defined above, in which *K* and *P* are working capital and physical capital respectively, measured by billion VND on average, and L is the number of employees measured in average. The efficiency measure is τ_i, with $0 < \tau_i < 1$ and φ_i captures the stochastic nature of the frontier.

[1] Vietnam General Statistics Office (GSO)

[2] http://songmoi.vn/kinh-te-kinh-doanh/%E2%80%98doanh-nghiep-ngung-hoat-dong-pha-san-da-tro-thanh-dich-roi%E2%80%99

With adoption through studies of Mastromarco (2008), Seo et al. (2010), and Arazmuradov et al. (2014), the model of Translog production function is considered as below

$$LnY = \beta_0 + \beta_L LnL + \beta_K LnK + \beta_P LnP + {}^1\!/_2\,\beta_{LL} LnLLnL + {}^1\!/_2\,\beta_{KK} LnKLnK + {}^1\!/_2\,\beta_{PP} LnPLnP + \beta_{LK} LnLLnK + \beta_{LP} LnLLnP + \beta_{KP} LnKLnP \quad (2)$$

Where $\beta_{KP} = \beta_{PK}$, $\beta_{KL} = \beta_{LK}$, $\beta_{PL} = \beta_{LP}$, the translog production function is no homothetic and imposes to no restrictions on technology of production. Continuously, if the sum of $\beta_K, \beta_P, \beta_L$ is constant and the sum of $\beta_{KP}, \beta_{PK}, \beta_{PL}$ is zero, the production function becomes homogeneous of degree. Once $\beta_{KP} = \beta_{KL} = \beta_{PL} = 0$ is happened, the Translog production function is reduced to Cobb_Douglas (Kim, 1992). As previously stated, the application of theTranslog and Cobb-Douglas production function is tested.

With the existing of Translog production function, the degree of returns to scale is measured by sum of the derivative of the dependent variable based on each independent variable. As presented in (2), the returns to scale (RTS) is $\sum \frac{\partial Y}{\partial X_i}$ (where Y is the average sales output value, Xi is inputs used in the function, e.g. labor (L), working capital (K) and physical capital (P), which RTS is depended on the input levels and technology index (Berndt, 1973).

$$RTS = \sum \frac{\partial LnY}{\partial LnX_i} \quad (3)$$

Where X_i is input factors (K, P, L)

Three levels of RTS can be happened. RTS > 1 means the increasing RTS, which an increase in the scale of production give rise to certain benefits to the producers; RTS < 1 means the decreasing RTS, which there is a limit to the scale of production due to the economies of scale are exhausted and diseconomies; RTS = 1 offers the constant RTS, it occurs if a given percentage change in all inputs results in an equal percentage in output

As considered previously, three inputs deployed in the production function, they are concerned substitutable or/and production elasticity in each input. Finding out elasticity of input factors is concerned by the previous papers. Such Griffin & Gregory (1976) deployed the Translog production function with four inputs, e.g. equipment, labor, material and capital, and presented elasticity of substitution. Findings confirm an existing elasticity of substitution between capital and labor

According to (Helali & Kalai, 2015), the Translog production function is much more flexible than that of Cobb-Douglas. In addition, it confirms hypotheses of the input substitutability and the production homogeneity in relationship among them. Although two candidates of Translog and Cobb-Douglas are going to test, the Translog production function is expected in this paper, due to exploration expectation on elasticity of inputs.

Based on (2), production elasticity with respect to each input is as the following

$\sigma_{Yi} = \frac{\partial LnY}{\partial Ln X_i}$ where $i = K, P, L$ as input factors *(3)*

Calculating elasticity of substitution between input factors, e.g. X_i and X_j is based on (Allen, 1938) as the following

$$\theta_{ij} = \frac{1}{X_i X_j}\left(X_i . \frac{\partial Y}{\partial X_i} + X_j \frac{\partial Y}{\partial X_j}\right)\frac{|H_{ij}|}{|H|} \quad (4)$$

Where H is the Hessian matrix combined with the production function and H_{ij} as the association among two input factors of *H*. In terms of a combination between two inputs, e.g. *P* and *L*. Likely, the combination between other two inputs can be carried out.

$$|H| = 2\frac{\partial^2 Y}{\partial P . \partial L} . \frac{\partial Y}{\partial P} . \frac{\partial Y}{\partial L} - \frac{\partial^2 Y}{\partial P^2} . \frac{\partial^2 Y}{\partial L^2} - \frac{\partial^2 Y}{\partial L^2} . \left(\frac{\partial Y}{\partial P}\right)$$

and

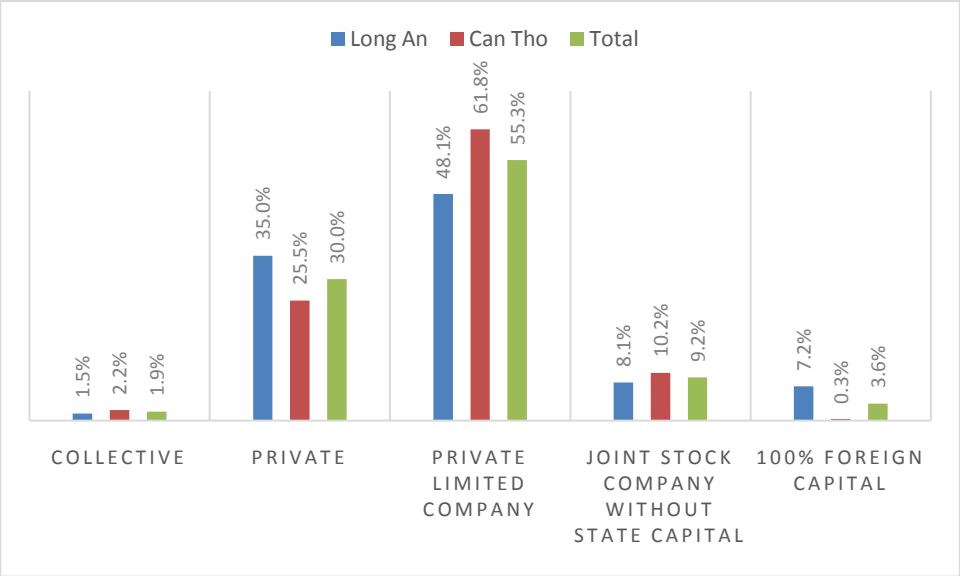
$$|H_{ij}| = \frac{\partial Y}{\partial P} . \frac{\partial Y}{\partial L} = \sigma_{YP} . \sigma_{YL} \frac{Y^2}{P . L}$$

As argued by (Helali & Kalai, 2015), the definition of substitution elasticity as an elasticity of the ratio of two inputs, e.g. the physical capital (P) to labor relative compared with the marginal rate of substitution between input factors. This method is interpreted as the impact of change of the relative prices of two factors on the ratio of demands for composed of the production function and the equation of the production elasticity in relation to the labor ratio.

IV. DATA AND ITS DESCRIPTION

Database used are under GSO, who every two years has conducted a survey on enterprises located in Vietnam. There are many provinces in nationwide to be enrolled in the survey, but two provinces (e.g. Long An and Can Tho) representing the MRD are considered in this study, in which Long An province is taken into account, because of the high share of enterprises and located at border with Ho Chi Minh City. Can Tho city is considered, due to the heart and the economic centre of the MRD. Accordingly, the final sample of the study is 8,168 enterprises as a sufficient sample, in which Long An province accounts for 47.7% and Can Tho City accounts for 52.3%. Types of firms by province is depicted in figure 1, which the private limited company, in total, occupies 55.3%, next as the private company with 30%, while joint stock company without state capital and 100% foreign capital company occupy lower shares of 9.2% and 3.6% respectively.Accordingly, the limited private enterprise is limited liability, legal protection for its shareholders but that has restrictions on its ownership, while the private company is a company with the private ownership, it may develop shareholders, but its shares are not issued through an public offering. The shares of business are less liquid and the values are difficult to determine.

Figure 1: Type of firm located in Long An and Can Tho



Source: GSO in 2013

As resulted in table 1, enterprises located in Long An province is a larger size than that in Can Tho City. The reason can be Long An is nearby and around 30 km far away from Ho Chi Minh city. Otherwise, Can Tho City is far away from Ho Chi Minh City about 200 km, it can make disadvantages of transportation costs. In addition, it is not surprised joint stock company and 100% foreign capital company have larger sizes of labor and financial capacity.

Table 1: Sample distribution by stakeholders

Content	Output sales (million VND*)	Labor (person)	Working capital (million VND)	Physical capital (million VND)
Province				
Long An province	45,011.02	61.18	35,805.55	38,498.12
Can Tho City	27,493.91	20.33	16,541.92	17,902.65
Economic sectors				
Collective	10,844.56	16.64	11,781.15	15,497.93
Private	13,170.66	9.44	6,039.02	6,519.19
Private limited company	25,125.55	23.49	18,107.95	19,440.53
Joint stock company	98,742.77	68.73	91,612.49	100,208.70
100% foreign capital company	241,783.50	478.87	146,666.10	152,315.30
Total	**35,913.98**	**39.80**	**25,808.18**	**27,718.78**

Source: GSO in 2003
(1 USD = 21,100 VND in December 2013)*

V. EMPIRICAL ANALYSIS

To test two candidates of the production function, the production function of Translog frontier and Cobb-Douglas frontier are estimated. Its results are depicted in table 2, in which the last row of table presents the log-likelihood is -15580.63 and -15610.04 of the Translog frontier production function and the Cobb-Douglas frontier production function, respectively. The likelihood statistics for testing the null hypothesis that the Cobb-Douglas is an adequate of data equal λ = -2(-15610.04 - (-15580.63)) = 58.82. This value exceeds the critical value (upper 1% with two degrees of freedom) of 8.273 (Kode & Palm, 1986). As a result, the null hypothesis is rejected, meaning that the Translog frontier production function is appropriate and preferred. Continuously, calculation of elasticity, returns to scales coming are based on the Translog production function.

Table 2: Estimate results of stochastic production function

	Translog frontier production		Cobb-Douglas frontier production	
Coefficient	Estimate	P-Value	Estimate	P-Value
Constant	-0.469	0.000	2.975	0.000
LnL	0.477	0.000	0.651	0.000
LnK	-0.165	0.480	0.103	0.067
LnP	0.398	0.092	0.442	0.000
LnLLnL	-0.054	0.017		
LnKLnK	0.167	0.003		
LnALnP	0.211	0.000		
LnLLnK	0.118	0.021		
LnLLnP	-0.085	0.097		
LnKLnP	-0.175	0.000		
/lnsigma2	0.713	0.000	0.734	0.000
/ilgtgamma	0.910	0.000	0.885	0.000
sigma_v	1.428		1.443	
sigma_u	1.576		1.556	
sigma2	4.524		4.505	
lambda	1.104		1.078	
Observation	7,964		7,964	
Log-Likelihood	-15,580.63		-15,610.04	

At depicted in table 2, the first-order coefficients of inputs, e.g. labor (L) and physical capital (P) are significant at 1% and 10%, respectively. An appearance of the capital coefficient without significance means there is not enough evidence to concluded an existing impact of working capital on output sales value. This can be that the knowledge and the use of capital is not indicated clearly for enterprises, particularly for SMEs in Vietnam. With signs of labor and physical capital are positive, this is consistent with the actual situation. Once there is an increasing in labor or/and physical capital impacting on the sales output value of firm. As a result, a 1% increase in labor input makes an raise of 4.0% in the sales of firm. This is consistent with (Arazmuradov, et al., 2014), which (Arazmuradov, et al., 2014) confirmed that an increase of 1% in physical capital makes an increase of 4.77% in the sales of firm.

In addition, the estimated coefficients of interaction among input factors are presented and significant, e.g. between the labor and the working capital, the labor and the physical capital, and the working capital and the physical capital. To identify elasticity of inputs, functions of (3) and (4) are deployed to consider. Elasticities estimated is depicted in table 3 considering the own substitution elasticity and the estimated cross substitution elasticities. As resulted, the own substitution elasticity expected to be negative is appropriate, e.g. σ_{LL} and σ_{KK}. However, σ_{PP} is positive, explained due to physical capital invested as outdated technology. This is also a main reason that SMEs in Vietnam lost its leading market.

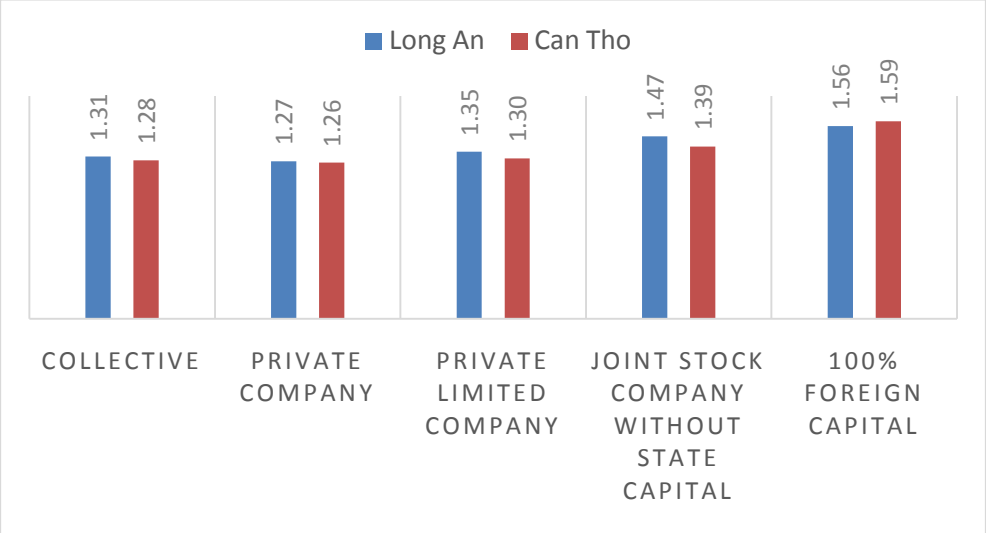
In terms of the cross substitution elasticity are positive for σ_{LK}, this means labor and working capital are substitute. So the demand of labor increases if the price of capital is raised. Unlikely, two inputs of labor and physical capital (σ_{LP}) and two inputs of working capital and physical capital (σ_{KP}) are complements, in which σ_{LP} is found more substituable than σ_{KP}. As a result, the demand of the physical capital is decreased if the price of capital as the price of labor are increased.

Table 3: Allen elasticity of substitution

Elasticity	Value	Elasticity	Value
σ_{LK}	0.863	σ_{LL}	-4.494
σ_{LP}	-1.098	σ_{KK}	-0.128
σ_{KP}	-0.052	σ_{PP}	0.002

Estimating RTS is based on the function (3), which RTS of economic sectors by two provinces are stated in figure. In general, RTS of economic sectors is greater than 1 as the increasing RTS. It means that an increase in the scale of production give rise to certain benefits to the producers. Returns to scale, in general, is larger than 1, indicating a positive increasing return to scale and the companies with 100% foreign capital play the leading one of the increasing RTS. This is not surprising, due to technology advantages of foreign companies. Next as joint stock companies is positioned as the second leading of RTS>1. As a result, firms with the small size and the limited capital building as collective and private companies have a lower RTS than private the limited company, the joint stock company without state capital, and the company with 100% foreign capital.

Figure 7: Returns to scale of enterprises by regions



VI. CONCLUSION

In terms of finding out effects of inputs on the output growth of firms, Liu & Li (2012) used stochastic frontier production function, in which independent variables are labor, human capital, and physical capital. Physical capital is based on the measure of the real total fixed assets and long investment. While the sales output value is deployed as the dependent variable. Based on testing the likelihood of Translog and Cobb-Douglas production function, Translog production function is preferred and estimated on database under GSO with the sufficient of 8,168 enterprises, in which Long An province accounts for 47.7% and Can Tho City accounts for 52.3%. The finding consistent with (Griffin & Gregory, 1976) is that there is an existing elasticity of substitution between capital and labor.In general, RTS of firms in the survey of 2013 are the increasing RTS, which firms with advantages of technology, capital and size, e.g. the joint stock company and the 100% foreign capital company are found a larger RTS. With what found and mentioned above, policies of the government toward enterprises should be clarified, because the MRD, mostly products are agricultural, so a policy of the government should be classified. In addition, the collective, private company, private limited company are Vietnamese pure companies need supports with respect to technology knowledge, management skills, market comprehension to face with their competitors, particularly companies with foreign elements.

To avoid risks of the enterprise's investment toward assets and long term investments, the government needs good controls to macroeconomic stability, and considers more capacity building program to improve skilled labors to meet technological development. In additions, market restructure must be concentrated to facilitate local enterprises to stable development.

REFERENCES

[1]. Aigner, D. J. & Lovell, C. A. K., 1977. Formulation and estimation of stochastic frontier production function model. Journal of Economics, Volume 6, pp. 21-37.

[2]. Allen, R., 1938. Mathematical Analysis for Economist. Macillan: London.

[3]. Arazmuradov, A., Martini, G. & Scotti, D., 2014. Determinants of total factor productivity in former Soviet Union economics: A stochastic frontier approach. Economic System, Volume 38, pp. 115-135.

[4]. Battese, G. E. & Coelli, T. J., 1988. Prediction of firm-level technical efficiencies with a generalized frontier production fuction and panel data. Journal of Economics, Volume 38, pp. 387-399.

[5]. Battese, G. E. & Coelli, T. J., 1995. A model for technical inefficiency effects in a stochastic frontier production function for panel data. Empirical Economics, 20(2), pp. 325-332.

[6]. Berndt, E. R., 1973. The Translog function and the substitution of equipment, structures, and labor in U.S. manufacturing 1929-68. Journal of Econometrics, Volume 1, pp. 81-114.

[7]. Charoenrat, T., Harvie, C. & Amornkitvikai, Y., 2013. Thai manufacturing small and medium sized enterprise technical efficiency: Evidence from firm-level industrial census data. Journal of Asian Economics, Volume 27, pp. 42-56.

[8]. Coelli, T. J., Rao, D. P., O'Donnell, C. J. & Battese, G. E., 2005. An introduction to efficiency and productivity analysis. Second Edition ed. The United States Of America: Springer Science+Business Meida, Inc..

[9]. Griffin, J. M. & Gregory, P. R., 1976. An intercountry translog model of energy substitution responses. The American Economic Review, 66(5), pp. 845-857.

[10]. Helali, K. & Kalai, M., 2015. Estimate of the elasticities of substitution of the CES and translog production function in Tunisia. International Journal of Economics and Business Research, 9(3), pp. 245-253.

[11]. Kim, Y. H., 1992. The Translog Production Function and Variable Returns to Scale. The Review of Economics and Statistics, 74(3), pp. 546-552.

[12]. Kode, D. A. & Palm, F. C., 1986. Wald criteria for Jointly testing equality and inequality restrictions. Econometrica, 54(5), pp. 1243-1248.

[13]. Kokkinou, A., 2010. Estimating technical inefficiency: an empirical approach to EU industries. Regional Science Inquiry Journal, II(2), pp. 95-104.

[14]. Liu, T. & Li, K.-W., 2012. Analyzing China's productivity growth: Evidence from manufacturing industries. Economic Systems, Volume 36, pp. 531-551.

[15]. Mastromarco, C., 2008. Foreign capital and efficiency in developing countries. Bulletin of Economic Research , 60(4), pp. 327-427.

[16]. Mastromarco, C. & Ghosh, S., 2009. Foreign capital, human capital, and efficiency: a stochastic frontier analysis for developing countries. World Development, 37(2), pp. 489-502.

[17]. Nha, P. X. & Quan, L., 2014. Response of Vietnamese private enterprises' leader under global financial crisis: From theatrical to empirical approach. Canadian Centre of Science and Education, 10(9), pp. 26-39.

[18]. Page, J. M., 1984. Firm size and technical efficiency. Journal of Development Economics, Volume 16, pp. 129-152.

[19]. Seo, D., Featherstone, A. M., Weisman, D. L. & Gao, Y., 2010. Market consolidation and productivity growth in U.S. wireline telecommunications: Stochastic frontier analysis vs. Malmquist idex. Review of Industrial Organization, Volume 36, pp. 271-294.

[20]. Tong, C. S. P., 1999. Production efficiency and its spatial disparity across China's TVEs- a stochastic production frontier approach. Journal of Asian Economics, Volume 10, pp. 415-430.