International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:02, Issue:04

IS EFFICIENCY SCORES FOR APPAREL AS A LABOR–INTENSIVE INDUSTRY VARY IN RELATION TO FIRM'S SIZE AND LOCATION?

Ibrahim Mosaad Elatroush

Assistant professor at Department of Economics, Tanta University, Tanta, Egypt

ABSTRACT

The aim of this paper is to examine whether efficiency scores for an Egyptian apparel industry, as an example of a labor–intensive industry, vary corresponding to firms' sizes and their location. Efficiency scores are predicted via an eight–year pooled data for a representative sample of 349 firms with different sizes and at various locations in which they are principally concentrated in four regions. Efficiency scores are estimated through stochastic frontier (SF) technique using a maximum likelihood estimates (MLEs) for both Cobb–Douglas and Translog production functions. Results disclose that a sort of great variation for firms' efficiency scores owing to their sizes and across regions. Moreover, results show that the impact of time–varying technique for efficiency score is clear in some firms, different sizes, and indistinct for other firms.

Keywords: Apparel firms, technical efficiency, sizes, regions, Cobb–Douglas & Translog production functions

JEL classification: C23; C51; D24; L67

I. INTRODUCTION

The importance of the Egyptian apparel industry is rendered to its ability to generate strong links between industry and upstream industries such as yarn, other fibres, and textiles industries. The main advantage of the apparel industry is that it offers more value added compared to the textile industry in which it is characterized by high rates of returns and high rates of turnover. It is also does not involve intensive investments. As a labor–intensive industry, it plays a major role in eliminating unemployment rates. In 2007–08, industry exports amounted to 2.2 billion US$ and 3 billion US$ in 2010. The U.S. market absorbed the average between 30% to 40% of total exports whereas the EU market accounted for 38% of total industry exports. A total of 5000 enterprises are operated in the Egyptian textile and apparel industry and the number of workers in the apparel sector is 30 %, 300,000, of total employment in the textile and apparel sector. The

ISSN: 2455-8834

Volume:02, Issue:04

value–added for the apparel industry amounted to 32% of the textile and apparel sector value–added and investments are 14% of the textile and apparel sector investments (CAPMAS, several issues). The industry receives yearly investments from 3.5 to 4 billion U.S $ and is considered among highly paid industries in the manufacturing sector.

Egyptian apparel manufacturing firms has its own characteristics in which its firms are primarily spread across lower Egypt governorates. The illustrative sample are spread in main four regions. Each region has its outstanding socioeconomic and infrastructural features. However, the ratio of 47% of total sample are only concentrated in the greater Cairo region, which incorporates Cairo, Giza, and Qalyubia governorates. Easy access to factors of production and other infrastructural facilities is not evenly distributed over country. Regions may differ owing to type of machinery, labor force, industry's concentration, etc. Social and economic infrastructure such as their access to markets, doing business indicators, and variations in infrastructure services may have an impact on production process.

The aim of the paper is to examine is there any impact for differences in firms' sizes and their location on efficiency scores. The remainder of the paper is arranged as follows: Section II involves the literature review; section III deals with the employed model; section IV provides a brief description for collected data; section V handles the obtained results and an analysis of these results; section VI shows conclusions; and finally, section VII displays references.

II. LITERATURE REVIEW

Literature has witnessed wide–range of papers especially the topics about the role of SMEs in stimulating and promoting economic growth and derives innovation. Bell et al., (2004) stated that SMEs are considered as a driver for enhancing economic growth, employment, innovation, and wealth creation. Moreover, Ayyagari et al., (2003) regarded that SMEs also play a chief role on economic performance in developed countries where high levels of education, low inflation rates and high levels of financial intermediary development are evident. However, Wonget et al., (2005) viewed that despite in some economies, the performance of SMEs might be not important, their positive contribution in terms of facilitating change, and enhancing competition are worth consideration. Additionally, Wennekers et al. (2005), illustrate that several studies have shown that the innovative advantage has moved from large corporations to small enterprises. Wagner and Hansen (2005) stated that companies of different sizes require different types of innovation. Laforet (2008) claimed that SMEs enterprises need to be more creative to develop new products to maintain their competitive advantage. Lazear (2004) referred to the role of the owner's skills and accumulated knowledge as crucial factors for the success of SMEs. Laki (1998, 2001) and Lengyel (2002) reached a similar conclusion but they emphasized the entrepreneurs' social capital—the network of social connections they had created—beside

ISSN: 2455-8834

Volume:02, Issue:04

education and experience in the case of Hungarian SMEs and in some other Central and Eastern Europe countries are vital for SMEs. Relating to easy access to finance for SMEs, Pissarides et al. (2003) and EBRD (2002) emphasized the decisive role of financial constraints that SMEs face especially for developing countries.

Bourell et al. (2009) specified that even though technical barriers exist, as in most technology areas, most barriers tend to be non-technical and instead were more focused on human-centric issues. Such barriers are primarily focused on; lack of an appropriate training programs, lack of education, lack of resources, cultural and performance issues, and trusted interests that facilitate innovation.

The Egyptian apparel private firms are considered divergent owing to the following reasons; the weakness of institutional framework and legislations aimed at fighting antitrust arrangements emerged from wrong privatization policies. After the initiation of the privatization program at the end of 1990s, oligopolistic provisions were spread and followed by prices increment. Thus, the paper aims to investigate if firms' size and location have an impact on efficiency scores during the period from 2001 to 2008.

III. THE MODEL

The most well-known tools for assessing efficiency scores via SF are Cobb–Douglas and Translog (transcendental logarithmic) production functions. The Cobb-Douglas production function in a stochastic frontier form is used for estimation (Cobb & Douglas, 1928). The time varying inefficiency effects method, proposed by (Battese & Coelli,1992), is employed in the model. The model is defined as:

$$Y_{it} = f(x_{it}) \quad (1)$$

$$Y_{it} = \beta_0 + \sum \beta x_{it} + \varepsilon_{it} \quad (2)$$

The compound error term is:

$$\varepsilon_{it} = v_{it} - u_{it} \quad (3)$$

ε_{it} including inefficiency term with error term based upon the study of (Good, Nadiri, Röller, & Sickles, 1993) where u_{it} is the inefficiency term and is defined as:

$$u_{it} = \eta_t u_i \quad for\ i = 1, 2, \ldots, 349\ ; \quad t = 1, 2\ldots, 8 \quad (4)$$

ISSN: 2455-8834

Volume:02, Issue:04

$$\eta_t = \{\exp[-\delta(t-T)]\} \tag{5}$$

The term Translog production function was proposed by Christiansen, Jorgensn and Lau in their papers published in 1971 and 1973, which dealt with the problems of strong separability and homogeneity of the Cobb–Douglas and constant elasticity of substitution (CES) production functions and their implications for the production frontier. Allen and Hall (1997) stated that the Translog production functions represent in fact a flexible functional form for the production functions. Klacek, et al., (2007) viewed that one of the main advantages of the respective production function is that it does not assume rigid grounds such as: perfect or "smooth" substitution between production factors or perfect competition on the production factors market. Also, the concept of the Translog production function permits to pass from a linear relationship between the output and the production factors, which are considered, to a nonlinear one. Because of its properties, the Translog production function can be used for the second order approximation of the linear–homogenous production, for the estimation of the production frontier, or for the measurement of the total factor productivity dynamics.

The large number of parameters that estimated to Translog production function in some cases arise the occurrence of an extended collinearity is favoured. In fact, the number of the parameters practically explodes as the number of production factors increase. Thus, both techniques are employed in the paper to avoid the collinearity problem arises in some firms. The Translog function has the following form:

$$Y_{it} = B_0 + \sum B x_{it} + \varepsilon_{it} \tag{6}$$

$$\begin{aligned} \ln Y_{it} &= \beta_0 + \beta_l \ln l_{it} + \beta_m \ln m_{it} + \beta_k \ln k_{it} + \beta_t t + \beta_{ll} \ln l_{2it}^2 + \beta_{mm} \ln m_{it}^2 \\ &+ \beta_{kk} \ln k_{it}^2 + \beta_{tt} t^2 + \beta_{kl} \ln k_{it} \ln l_{it} + \beta_{km} \ln k_{it} \ln m_{it} + \beta_{lm} \ln l_{it} \ln m_{it} \\ &+ \beta_{lt} t \ln l_{it} + \beta_{mt} t \ln m_{it} + \beta_{kt} t \ln k_{it} + \varepsilon_{it} \end{aligned} \tag{7}$$

Where; $\varepsilon_{it} = v_{it} - u_{it}$ (8)

The u_{it} is assumed to be defined by:

$$u_{it} = \eta_t u_i \quad \text{for } i = 1, 2, \ldots, 349; \quad t = 1, 2\ldots,8 \tag{9}$$

Where ;

ISSN: 2455-8834

Volume:02, Issue:04

$$\eta_t = \{\exp[-\delta(t-T)]\} \quad (10)$$

Output (Y_{it}) is the natural logarithm of the total value of the net sales for i firm, t year in Egyptian pounds (2001 constant prices). Inputs (X_{it}) are the natural logarithm of the total value of the factors of production for i firm, t year at constant prices. Inputs are categorized into three main groups in which labor services (L_{it}) are the natural logarithm of the total annual salary paid for all labor categories at constant prices (x_1). Materials (M_{it}) are the natural logarithm of the cost of total purchased raw materials during the year (x_2) and capital services (K_{it}) show the natural logarithm of the expenditure on operating costs such as electricity, water and utilities, maintenance, repairs of capital goods, rents of buildings and machinery upgrading, etc., as a proxy of capital during the year (x_3).

ε_{it} is the compound error term, including v_{it}—the two-sided "noise" component of the error term and u_{it} as the inefficiency term. The v_{it} is assumed to be independently and identically distributed (*iid*) as $N(0, \sigma^2_v)$ and u_{it} is also assumed to be *iid* and non-negative random variables as $N^+(0, \sigma^2_u)$. Both v_{it} and u_{it} are distributed independently of each other and regressors. Inefficiency term is included in the error term following Good methodology. δ is a parameter that determines the behavior of technical efficiency (TE) over time. Battese and Coelli (1992) confirmed that if $\delta > 0$, TE rises at a decreasing rate. If $\delta < 0$, TE declines at an increasing rate. If $\delta = 0$, TE remains the same. Then maximum-likelihood estimates of parameters and efficiency scores are obtained through LIMDEP software version 9 (Greene, 2010).

IV. DATA DESCRIPTION

Data cover the period from 2001 to 2008 with a sample of 349 private firms related to all apparel manufacturing activities. These activities involve thousands of products such as shirts, polo shirts, t–shirts, trousers, denim, blouses, dresses, suits, blazers, pajamas, …., etc. The sample is representative in which it comprises various activities, different firms' sizes; small, medium, large, and extra–large sized firms at different regions.

Apparel manufacturing firms are principally spread at key four regions as follows:

1- Greater Cairo region, which includes all firm located in Cairo, Giza, and Qalyubia governorates. The sample of this region encompasses the sum of 200 firms in which the number of large and extra–large manufacturing firms is 70 firms with 560 observations. These firms comprise all industry activities and most of them are fully integrated in which they have upstream and downstream production process. In other words, these firms are managing and controlling the processes of manufacturing fabrics as a raw material or industry input such as

ISSN: 2455-8834

Volume:02, Issue:04

spinning yarn, weaving, and dyeing. Then fabrics are used as an industry input in producing various sorts of apparel. The small and medium sized enterprises (SMEs) comprise 95 firm with 760 observations and 35 firms are dropped from the sample owing to they are providing wrong information about their activity to official data collectors and then total firms for the region become 165.

2- Delta region: the region consists of all apparel firms situate in three governorates: Gharbia, Dakahlia, and Sharqia. The sample size of apparel firms in the region was 76 firms which are divided into 25 large and extra–large sized firms with 200 observations, and 51 SMEs with the number of 408 observations. The most of raw material manufacturing firms are placed in this region.

3- Alexandria region, which includes apparel firms that are placed in Alexandria governorate. This region has 93 firms with 15 large and extra–large sized firms, and 78 SMEs apparel firms. All apparel manufacturing firms are spread across the governorate and the total number of observations are 744.

4- Finally, the Suez Canal region entails 15 firms lies in Ismailia and Port Said governorates. The total number of firms are 15 firms with 120 observations. All apparel firms in this region are large and extra–large sized firms.

Raw data are obtained through the Egyptian Central Agency of Population Mobilization and Statics [CAPMAS] (2014) for an eight–year panel covering the period from 2001 to 2008. Raw data involve industries' inputs and outputs at current prices, then prices are deflated to achieve constant prices using 2001 as base year. Separate deflators are used for outputs, labor, capital, and raw materials and the sample covers 2,792 observations.

V. EMPIRICAL RESULTS

The Cobb-Douglas and the Translog production functions are utilized to estimate inputs coefficients and efficiency scores for apparel private firms as a labor–intensive industry from 2001 to 2008. Both techniques are utilized, Cobb–Douglas and Translog, to benefit from the advantages of them and avoid the drawbacks of each and to determine if there are any changes in results because of using both techniques. Primarily, the efficiency is projected for the whole sample of firms at different sizes and within all regions, then efficiency scores are estimated for whole SMEs and for whole large and extra–large firms too. Afterwards, firms are classified regarding regions that they belong in which each region is divided into two subgroups; the first is related to SMEs, and the second is for large and extra–large sized to examine if there is any distinction between firms owing to sizes or / and location.

Apparel Industry Efficiency Estimation for All Firms' Sizes and all Regions

ISSN: 2455-8834

Volume:02, Issue:04

Here, table 1 displays summary statistics for the whole private apparel firms sample. In table 2, the estimation of the production function for the whole sample also is obtained through the Cobb–Douglas production function. However, table 3 exhibits projected efficiency for the sample via the Translog production function. Then the analysis of tables results will be followed.

Table 1: Apparel Private Firms Summary Statistics for all observations (2,792 Obs)

Variable	Mean	Min	Max	Std. Dev.
Output	5.9493	4.1202	8.3709	0.7828
Labor	5.1405	3.4335	7.9878	0.7194
Materials	5.6327	3.1030	8.3811	0.8516
Capital	4.7942	3.0212	7.8590	0.8666
Year	3.5000	0.0000	7.0000	2.2918
Year * Year	17.5000	0.0000	49.0000	16.6808
Labor * Labor	26.9423	11.7892	63.8043	7.8572
Materials * Materials	32.4525	9.6287	70.2429	9.8874
Capital * Capital	23.7355	9.1276	61.7641	8.9454
Capital * Labor	25.1875	11.3472	55.1959	8.1478
Capital * Materials	27.5912	9.5956	63.4072	8.9676
Labor * Materials	29.4475	11.929	65.9225	8.4244
Labor * Year	17.9249	0.0000	49.8047	12.0265
Materials * Year	19.5813	0.0000	56.0268	13.1532
Capital * Year	16.6805	0.0000	52.1127	11.3784

Table 2 provides the estimated MLEs (maximum likelihood estimates) for the whole sample, an eight–year panel with 349 firm with a sum of 2792 observations, of the private apparel manufacturing firms. The Cobb–Douglas production function is employed in table 2. The dependent variable is the output of net yearly sales per firm evaluated in Egyptian pound at 2001 constant prices. Regressors are labor, raw materials, and capital. Results expose that inputs coefficients are highly significant. As a traditional industry, most firms follow a labor–intensive technique. Eta indicator is highly significant indicating that, in general, efficiency scores vary across time. Variance parameters for the compound error are also highly significant. TE mean is 56% with the minimum of 27% and the maximum of 99%. For the industry, the efficiency scores are varied whether for firms within the same governorate and across governorates. Figures 1 and 2 show efficiency scores for the whole private firms via histogram and Kernel density function and they are principally concentrated in the area lies between 30% to 80%.

On the other hand, table 3 exhibits efficiency scores via the Translog technique. It is noticeable that by using the Translog technique 180 firms are removed among them the all 165 firms that

ISSN: 2455-8834

Volume:02, Issue:04

belong to Greater Cairo region in which their efficiency and performance are poor. All coefficients are highly significant except materials, year, and the intersection between labor and time and between materials and time. The more interesting feature from employing the Translog technique is that average TE score has been raised from 56% to 86% after using the technique and the minimum efficiency scores have been also raised from 27% to 51%. This is maybe attributed to the exclusion of poorly inefficient firms. Figures 3 and 4 confirmed the changes in efficiency scores after employing the Translog technique.

Table 2: MLE Cobb-Douglas Production Function Time Varying Estimates for Apparel Firms (2792Obs)

Variable	Coefficient	Standard error	*P* value
Constant β_0	2.7924	0.0374	0.0000
Labor β_1	0.2791	0.0093	0.0000
Materials β_2	0.3027	0.0049	0.0000
Capital β_3	0.1175	0.0072	0.0000
Year β_4	0.0217	0.0026	0.0008
Variance parameters for compound error			
Lambda (λ)	3.7874	0.0221	0.0000
Sigma (u)	0.6347	0.0245	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0195	0.0045	0.0000
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.5578	0.2729	0.9853	0.1618

ISSN: 2455-8834

Volume:02, Issue:04

Table 3: MLE Translog Production Function Time Varying Estimates for Apparel Firms Total observations (2792) Cases 1352 Obs Missing1440Obs

Variable	Coefficient	Standard error	*P* value
Constant β_0	1.1784	0.3663	0.0013
Labor β_1	0.3356	0.1489	0.0242
Materials β_2	0.0938	0.0956	0.3262
Capital β_3	0.4591	0.1268	0.0003
Year β_4	0.0036	0.0198	0.8574
Year * Year β_5	0.0017	0.0009	0.0701
Labor * Labor β_6	0.0892	0.0282	0.0016
Materials * Materials β_7	0.1634	0.0104	0.0000
Capital * Capital β_8	0.1279	0.0264	0.0000
Capital * Labor β_9	- 0.0816	0.0483	0.0911
Capital * Materials β_{10}	-0.2001	0.0241	0.0000
Labor * Materials β_{11}	-0.0947	0.0273	0.0005
Labor * Year β_{12}	-0.0069	0.0075	0.3594
Materials * Year β_{13}	-0.0047	0.0045	0.3008
Capital * Year β_{14}	0.0147	0.0066	0.0247
Variance parameters for compound error			
Lambda	0. 8684	0.0576	0.0000
Sigma (u)	0.1456	0.0008	0.0000
Eta parameter for time varying inefficiency			
Eta	0. 0659	0. 0180	0.0003
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0. 8558	0.5084	0.9945	0.0691

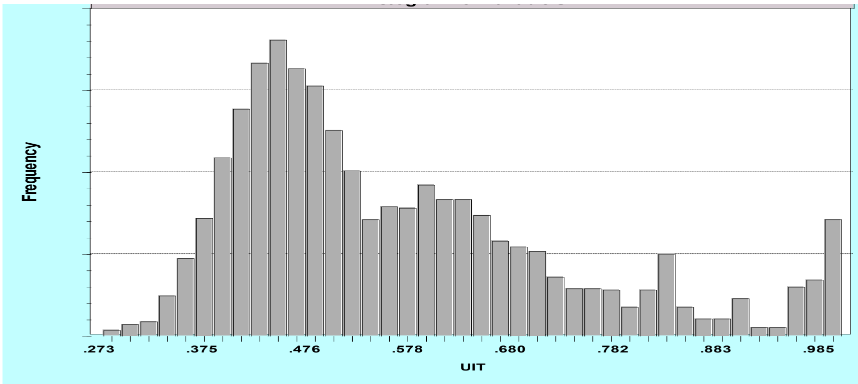

Figure 1. Efficiency scores histogram for all firms at all regions Cobb–Douglas technique

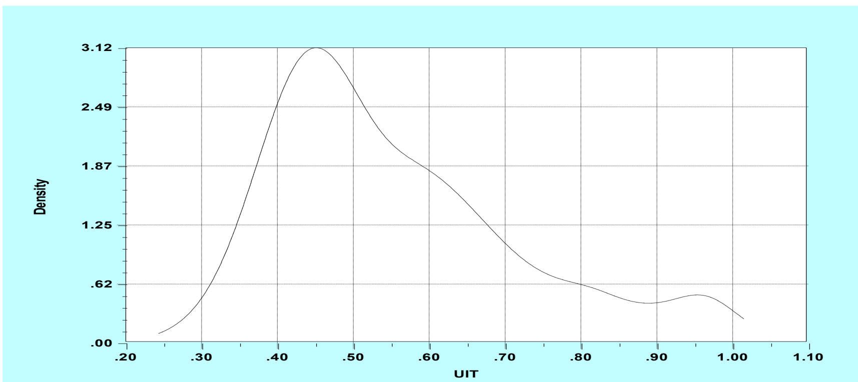

Figure 2. Kernel density function efficiency estimates for all firms, all regions via Cobb-Douglas

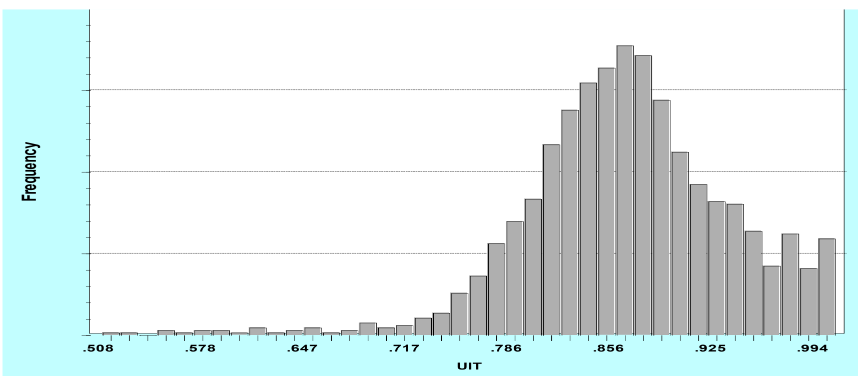

Figure 3. Efficiency scores for all firms at all region histogram via Translog technique

ISSN: 2455-8834

Volume:02, Issue:04

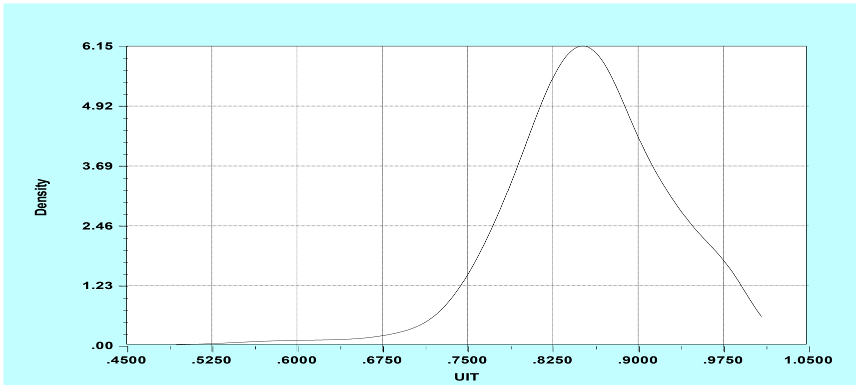

Figure 4. Kernel density function efficiency estimates for all firms, all regions via Translog technique

Efficiency Estimates for Apparel SMEs

Tables 4 and 5 display efficiency scores for all SMEs, 224 firms and 1792 observations, via the Cobb–Douglas and the Translog production techniques. Results of table 4 show that the coefficients of labor, materials, and capital are highly significant. The variance parameters for the compound error are also significant, and the eta coefficient for time–varying is also significant implying that efficiency scores for SMEs vary from year to another. TE mean for SMEs is 51% with the minimum of 26% for the lowest inefficient firm and the maximum of 99% the firm that is closely efficient. Figures 5 and 6 display efficiency scores for all SMEs via histogram and kernel density function. They reveal that most firms are mainly concentrated in the range from 30% to 60% level of efficiency and this may be attributed to the weight of greater Cairo firms, which represent 42% of total SMEs and they have low efficiency scores.

Table 5 for the Translog technique exposes that all SMEs for greater Cairo region have been missed, 760 observations for 95 firms, when employing the technique, therefore the mean TE is raised up from 51% to 89% and the minimum TE is scaled up from 37% to 55%. The variance parameters for the compound error are highly significant and the eta is also significant. The coefficients of materials and labor variables are insignificant and this may be ascribed to most SMEs are suffering from difficulties of accessing to finance relative to large and extra–large sized firms in which affect their availability to buy raw materials at lower prices and benefit from economies of scale like large firms. Moreover, labor at large firms mostly have more proficiency in which they can do specific tasks and benefit from learning by doing whereas in SMEs worker can do most of the production tasks Therefore, this may affect worker's productivity and causes productivity slowdown. All other coefficients are highly significant. Figures 7 and 8 reveals that efficiency scores seen at histogram and Kernel density function via the Translog technique and

ISSN: 2455-8834

Volume:02, Issue:04

they are totally improved as in the Cobb–Douglas owing to excluding greater Cairo firms of lower efficiency scores in which efficiency scores for firms are mainly concentrated in the area lies between 80% to 99% efficiency level.

Efficiency Estimates for All Apparel Large and Extra–Large Sized Firms

The sample of large and extra–large firms covers 125 firms for all regions with 1000 observations. Results of table 6 show that inputs coefficients are highly significant. The variance parameters for the compound error are highly significant and the eta is significant at 90% level of confidence telling that efficiency scores vary across time. This variation for large and extra–large firms is much sluggish than SMEs. Mean TE is 67% with the minimum of 37% and the maximum of 98%. However, the Translog technique is not applicable for large and extra–large firms owing to higher collinearity rates among intersection and product of variables and this is considered one of main drawbacks for the Translog technique. This is maybe due to greater Cairo region represents 56% of large firms. Figures 9 and 10 show efficiency scores are concentrated in the range 40%:80%

Table 4: MLE for Cobb-Douglas Function Time Varying Estimates for SMEs Apparel Firms (1792Obs)

Variable	Coefficient	Standard error	*P* value
Constant β_0	3.1806	0.0527	0.0000
Labor β_1	0.2467	0.1168	0.0000
Materials β_2	0.2670	0.0062	0.0000
Capital β_3	0.1075	0.0090	0.0000
Year β_4	0.0196	0.0039	0.0000
Variance parameters for compound error			
Lambda	4.5290	0.0273	0.0000
Sigma (u)	0.7157	0.0496	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0182	0.0056	0.0011
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.5085	0.2569	0.9874	0.1517

ISSN: 2455-8834

Volume:02, Issue:04

Table 5: MLE Translog Production Function Time Varying Estimates for Apparel Firms Total observations (1792) Cases 1032 Obs Missing760 Obs (all missing Obs belong to Greater Cairo region)

Variable	Coefficient	Standard error	*P* value
Constant β_0	1.5541	0.3966	0.0001
Labor β_1	0.2519	0.1768	0.1542
Materials β_2	0.0830	0.0978	0.3963
Capital β_3	0.3692	0.1322	0.0052
Year β_4	- 0.2151	0.2036	0.2908
Year * Year β_5	0.0035	0.0012	0.0046
Labor * Labor β_6	0.1574	0.0353	0.0000
Materials * Materials β_7	0.2273	0.1802	0.0000
Capital * Capital β_8	0.1752	0.0307	0.0000
Capital * Labor β_9	- 0.1012	0.0569	0.0754
Capital * Materials β_{10}	-0.2481	0.0322	0.0000
Labor * Materials β_{11}	-0.1860	0.3070	0.0000
Labor * Year β_{12}	-0.0136	0.0850	0.1090
Materials * Year β_{13}	0.0030	0.0058	0.6100
Capital * Year β_{14}	0.0154	0.0076	0.0433
Variance parameters for compound error			
Lambda	0.8482	0.0579	0.0000
Sigma (u)	0.1269	0. 0005	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0467	0.0213	0.0281
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0. 8856	0. 5462	0.9930	0.0604

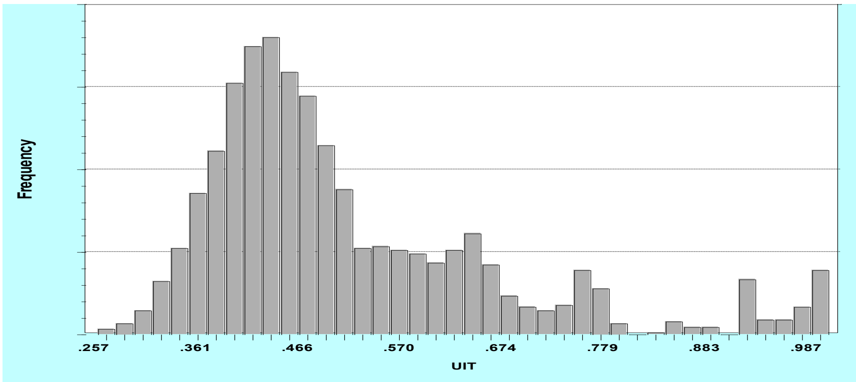

Figure 5. Efficiency scores for all SMEs at all regions histogram Cobb–Douglas technique

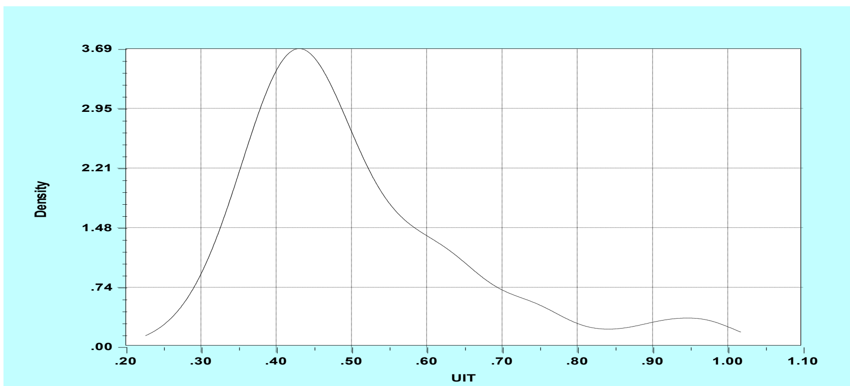

Figure 6. Kernel density function efficiency estimates for SMEs at all regions via Cobb-Douglas

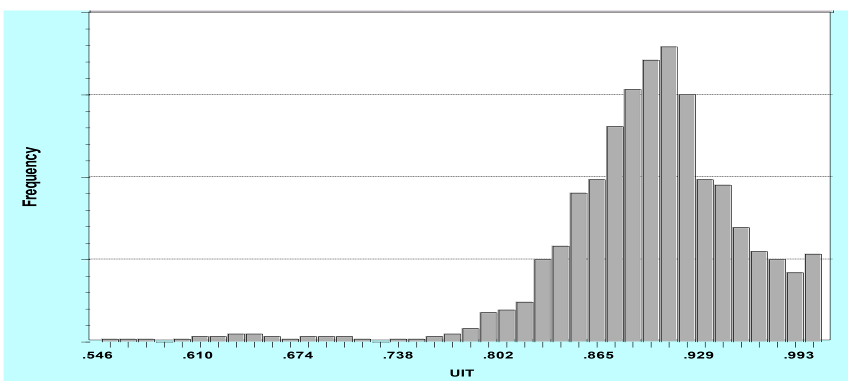

Figure 7. Efficiency scores for all SMEs at all regions histogram via Translog technique

ISSN: 2455-8834

Volume:02, Issue:04

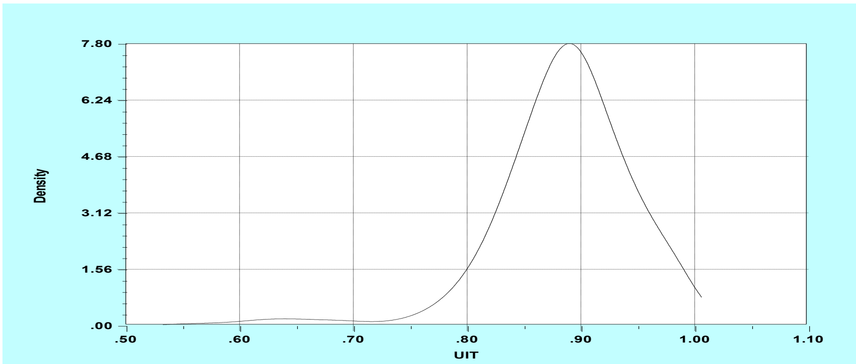

Figure 8. Kernel density function efficiency estimates for all SMEs at all regions via Translog technique

Table 6: MLE for Cobb-Douglas Function Time Varying Estimates for Large & Extra-Large Apparel Firms (1000Obs)

Variable	Coefficient	Standard error	*P* value
Constant β_0	2.3986	0.0631	0.0000
Labor β_1	0.3080	0.0172	0.0000
Materials β_2	0.3254	0.0093	0.0000
Capital β_3	0.1302	0.1429	0.0000
Year β_4	0.0234	0.0044	0.0000
Variance parameters for compound error			
Lambda	2.4846	0.0453	0.0000
Sigma (u)	0.4489	0.0139	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0213	0.0125	0.0879
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.6674	0.3744	0.9764	0.1464

ISSN: 2455-8834

Volume:02, Issue:04

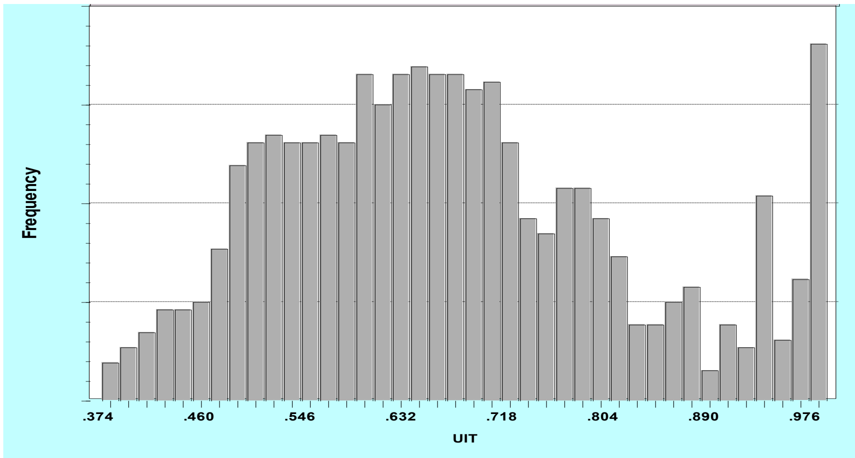

Figure 9. Efficiency scores for all large& Extra–large firms, all regions histogram Cobb-Douglas technique

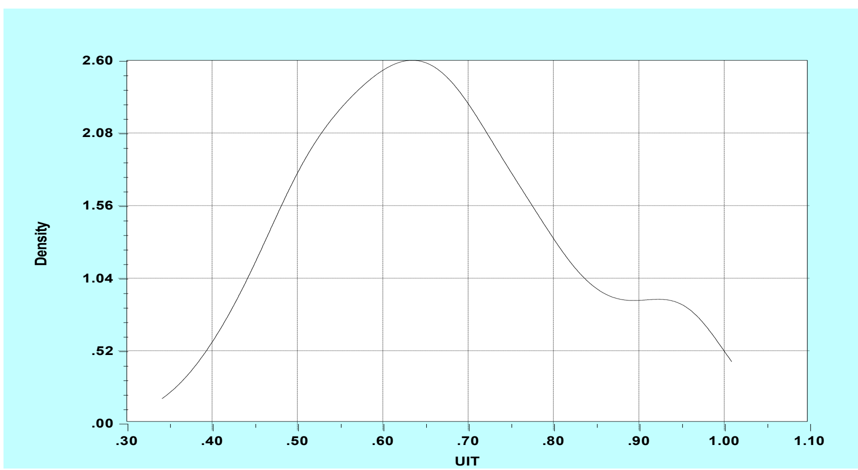

Figure 10. Kernel density function efficiency estimates for all large & Extra–large firms, all regions via Translog technique

ISSN: 2455-8834

Volume:02, Issue:04

Efficiency Estimates for Greater Cairo SMEs

The region SMEs consists of 95 firms spread across it with 760 observations, Results of table 7 show that all factors of production coefficients are highly significant and the variance parameters for the compound error are also significant. Alternatively, the eta coefficient is highly insignificant in which efficiency scores do not vary over time. TE mean is 26% which is considered the lowest across regions. The minimum efficiency score is 10% and the maximum level is 98%. Figures 11 and 12 exhibit histogram and Kernel density for the efficiency scores for the region firms. Efficiency scores in the figures display that most of firms are primarily concentrated in the area lies between 10% to 35%. The Translog production function cannot be obtained for the region firms since the product of each factor of production has higher levels of collinearity and this is done for labor, raw materials, and capital in which the regressesors are collinear. This is also considered among the drawbacks of the Translog technique.

Efficiency Estimates for Greater Cairo Large and Extra–Large Sized Firms

Greater Cairo region in the sample incorporates 70 large and extra–large apparel firms located in Cairo, Giza and Qalyubia governorates. Results of table 8 demonstrate that labor, raw materials, and capital coefficients are highly significant when applying the Cobb–Douglas production function technique. The variance parameters for the compound error are also highly significant. However, the eta coefficient for the region is insignificant suggesting that efficiency scores for large and extra–large firms also do not change across time. Furthermore, TE scores for the region are considered the lowest compared with large and extra–large firms at other regions. Mean TE is 31% with the minimum of 10% and the maximum of 98%. This lowest efficiency score can also clearly be observed in the figures13 and 14. The histogram and Kernel density function for efficiency scores confirm that too many of the region firms are mainly focused on the area between 10% to 40% indicating that most of firms are highly inefficient. This is maybe ascribed to most of the firms are not export oriented in which they did not obtain the gains form international trade. There is also no doubt that gains from trade emerged from international competitiveness enable inefficient firms to modernize their products and therefore enhance their efficiency scores because of competing with rivals. The Translog technique for large and extra–large firms in the region cannot be achieved since the product of the regressors are also collinear.

ISSN: 2455-8834

Volume:02, Issue:04

Table 7: MLE for Cobb-Douglas Function Time Varying Estimates for SMEs Apparel Firms at Greater Cairo Region (760Obs)

Variable	Coefficient	Standard error	P value
Constant β_0	5.8466	0.0951	0.0000
Labor β_1	0.0909	0.0189	0.0000
Materials β_2	0.1015	0.0894	0.0000
Capital β_3	0.0645	0.1174	0.0000
Year β_4	0.0005	0.0064	0.9324
Variance parameters for compound error			
Lambda	12.3863	0.0177	0.0000
Sigma (u)	1.5576	0.8401	0.0637
Eta parameter for time varying inefficiency			
Eta	0.0006	0.0044	0.8847
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.2591	0.0991	0.9846	0.1659

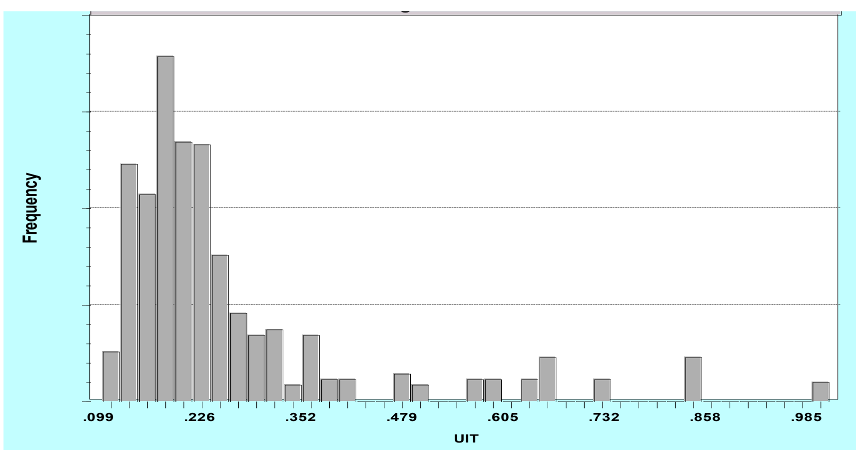

Figure 11. Histogram for Efficiency scores about SMEs at Greater Cairo via Cobb-Douglas technique

ISSN: 2455-8834

Volume:02, Issue:04

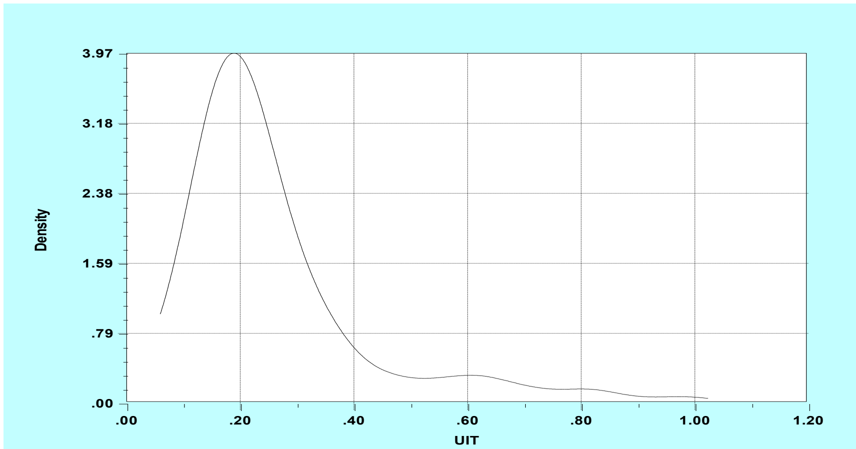

Figure 12. Kernel density function efficiency estimates for SMEs at Greater Cairo region via Cobb – Douglas technique

Table 8: MLE for Cobb-Douglas Function Time Varying Estimates for Large & Extra–Large Firms at Greater Cairo Region (560Obs)

Variable	Coefficient	Standard error	*P* value
Constant β_0	5.7623	0.1091	0.0000
Labor β_1	0.1105	0.0183	0.0000
Materials β_2	0.1457	0.0105	0.0000
Capital β_3	0.0578	0.0130	0.0000
Year β_4	-0.0068	0.0045	0.1271
Variance parameters for compound error			
Lambda	13.3652	0.0163	0.0000
Sigma (u)	1.4403	0.6701	0.0316
Eta parameter for time varying inefficiency			
Eta	-0.0051	0.0036	0.1487
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.3117	0.1015	0.9821	0. 1998

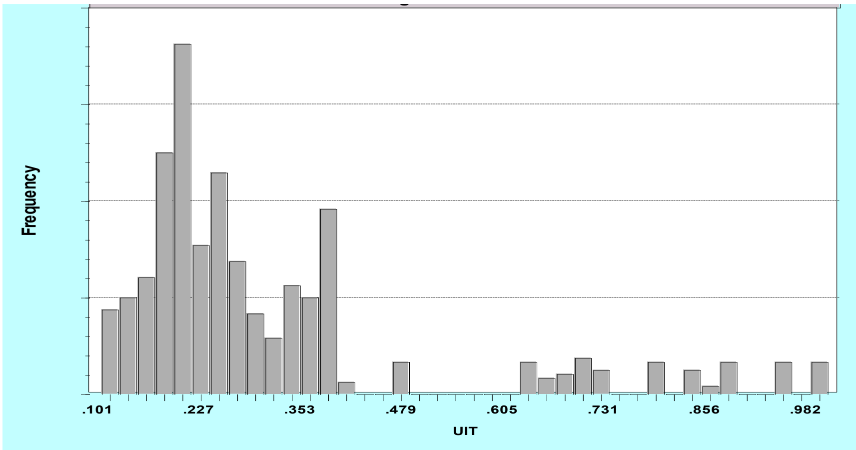

Figure 13. Histogram for Efficiency scores about Large & Extra-large firms at Greater Cairo via Cobb-Douglas technique

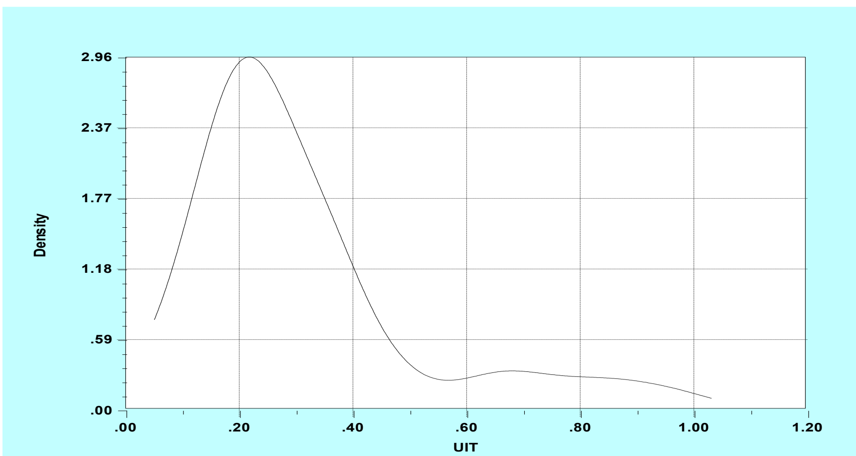

Figure14. Kernel density function efficiency estimates for large & Extra–Large firms at Greater Cairo region via Cobb–Douglas technique

Efficiency Estimates for Delta Region SMEs

The sample of SMEs at Delta region includes 51 firms with 408 observations. Table 9 exhibits the Cobb–Douglas production function results in which the regressors coefficients are highly significant. Moreover, the variance parameters for the compound error are also highly significant. The eta parameter for time varying inefficiency is also significant with positive coefficient suggesting that efficiency scores have increased form year to another and are not

ISSN: 2455-8834

Volume:02, Issue:04

constant. The average efficiency score is 58% with the minimum efficiency score of 10% and the maximum of 98%. Histogram in figure 15 and Kernel density function in figure 16 display efficiency scores graphically. Both diagrams show that efficiency scores for SMEs for Delta region are primarily spread within the area lies between 34% to 80%.

The Translog production function is utilized also for measuring efficiency score for SMEs at Delta region. Results in table 10 confirm that both labor and capital coefficients are insignificant and their product plus their intersection. On the other hand, raw materials coefficient and its product coefficient is significant. This is maybe attributed to the fact that the region, especially Gharbia governorate, has the privilege of producing raw materials at economies of scales. Both the variance parameters for the compound error is highly significant whereas the eta is insignificant meaning that efficiency scores do not vary across time. TE mean for the Translog technique is raised to be 78% and the minimum is also raised to be 46% with the maximum of 99%. Figures 17 and 18 approve this increase in which efficiency scores cover the area from 60% to 90% instead of the area from 34% to 80% as in the Cobb–Douglas technique.

Efficiency Estimates for Delta Region Large and Extra–Large Sized Apparel Firms

The sample of firms in the region incorporates 25 firms with 200 observations. Table 11 displays MLE via the Cobb–Douglas production function. Results show that inputs coefficients are significant, the variance parameters for the compound error is highly significant whereas the eta is insignificant. TE mean is 61% with the minimum of 20% and the maximum of 96%. Figures 19 and 20 depict efficiency scores through histogram and Kernel density function.

Table 12 shows the Translog technique results. Results reveal that the regressors coefficients, their product, and their intersections are insignificant. TE mean is slightly increase relative to the Cobb–Douglas model. The technical efficiency average is 65% with the minimum of 10% and the maximum of 97%. Figures 21 and 22 portray efficiency score via histogram and Kernel density function.

ISSN: 2455-8834

Volume:02, Issue:04

Table 9: MLE for Cobb-Douglas Function Time Varying Estimates for SMEs Apparel Firms at Delta Region (408Obs)

Variable	Coefficient	Standard error	*P* value
Constant β_0	2.4465	0.1801	0.0000
Labor β_1	0.2307	0.3379	0.0000
Materials β_2	0.3510	0.1662	0.0000
Capital β_3	0.1670	0.0242	0.0000
Year β_4	0.0297	0.0010	0.0029
Variance parameters for compound error			
Lambda	3.9410	0.0720	0.0000
Sigma (u)	0.5421	0.0511	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0340	0.0158	0.0317
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.5781	0.3353	0.9791	0. 1376

Table 10: MLE Translog Production Function Time Varying Estimates for SMEs Apparel Firms at Delta Region Total observations (408) Cases 408 Obs Missing zero Obs

Variable	Coefficient	Standard error	*P* value
Constant β_0	3.9888	1.0861	0.0002
Labor β_1	-0.2433	0.5668	0.6678
Materials β_2	-0.3734	0.2273	0.1005
Capital β_3	0.5633	0.4052	0.1645
Year β_4	- 0.0251	0.0274	0.3598
Year * Year β_5	0.0033	0.0022	0.1314
Labor * Labor β_6	0.0717	0.1265	0.5711
Materials * Materials β_7	0.2547	0.0384	0.0000
Capital * Capital β_8	0.1355	0.0909	0.1360
Capital * Labor β_9	0.0428	0.2085	0.8372
Capital * Materials β_{10}	-0.3368	0.0638	0.0000
Labor * Materials β_{11}	-0.0809	0.0777	0.2978
Labor * Year β_{12}	0.0017	0.0176	0.9211
Materials * Year β_{13}	0.0009	0.0115	0.9384
Capital * Year β_{14}	0.0019	0.0176	0.9134

ISSN: 2455-8834

Volume:02, Issue:04

Variance parameters for compound error			
Lambda	1.8402	0.0993	0.0000
Sigma (u)	0.2484	0. 0044	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0406	0.0334	0.2238
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0. 7800	0.4593	0.9912	0.0931

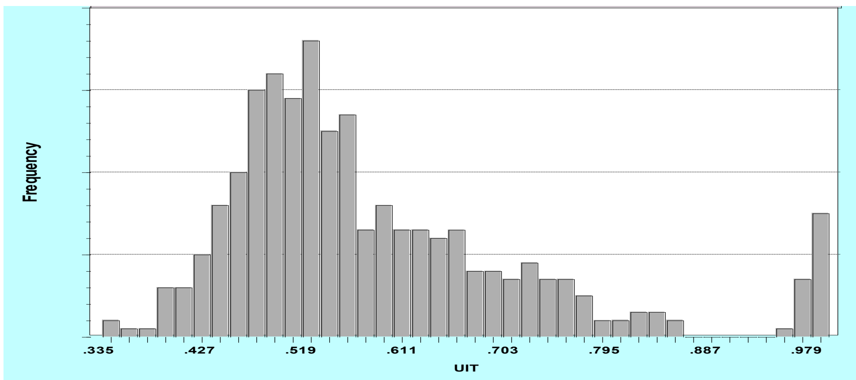

Figure 15. Histogram for Efficiency scores about SMEs at Delta region via Cobb-Douglas technique

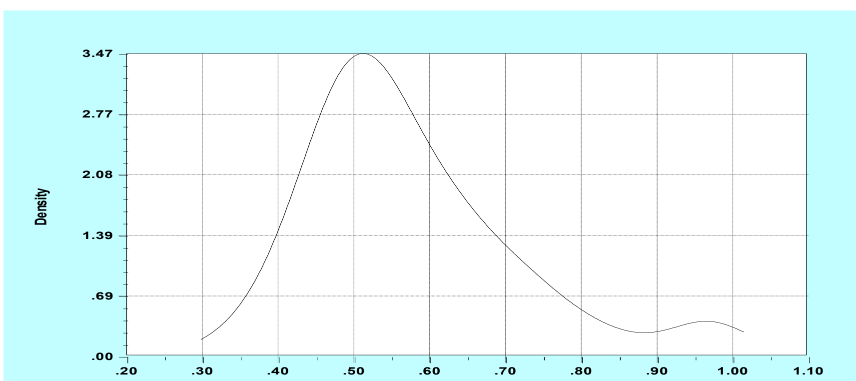

Figure 16. Kernel density function efficiency estimates for SMEs at Delta via Cobb–Douglas technique

ISSN: 2455-8834

Volume:02, Issue:04

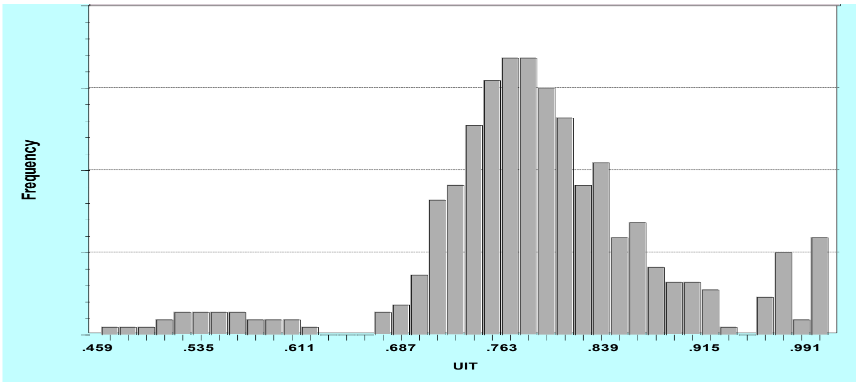

Figure 17. Histogram for Efficiency scores about SMEs at Delta region via Translog technique

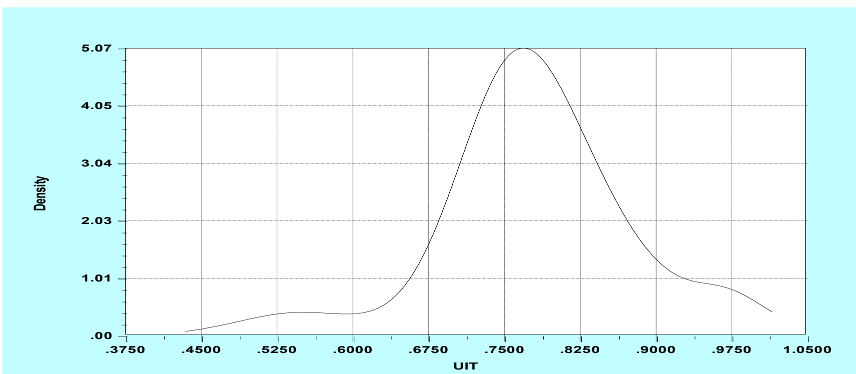

Figure 16. Kernel density function efficiency estimates for SMEs at Delta via Translog technique

ISSN: 2455-8834

Volume:02, Issue:04

Table 11: MLE for Cobb-Douglas Function Time Varying Estimates for Large & Extra -– Large Apparel Firms at Delta Region (200Obs)

Variable	Coefficient	Standard error	*P* value
Constant β_0	4.9924	0. 3813	0.0000
Labor β_1	0.1254	0.0489	0.0103
Materials β_2	0.0773	0.0276	0.0051
Capital β_3	0.1442	0.0648	0.0261
Year β_4	0.0153	0.0094	0.1029
Variance parameters for compound error			
Lambda	3.6790	0.0767	0.0000
Sigma (u)	0.6133	0.0766	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0216	0.0199	0.2793
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.6125	0.1962	0.9569	0. 2052

Table 12: MLE Translog Production Function Time Varying Estimates for Large & Extra– large Apparel Firms Total observations (200) Cases 200 Obs Missing zero Obs

Variable	Coefficient	Standard error	*P* value
Constant β_0	6.6700	6.1361	0.2770
Labor β_1	0.2365	1.3231	0.8582
Materials β_2	-1.4908	1.1867	0.2090
Capital β_3	0.9143	2.3387	0.6958
Year β_4	0.2989	0.6786	0.6596
Year * Year β_5	-0.0003	0.0176	0.9874
Labor * Labor β_6	-0.1748	0.3056	0.5673
Materials * Materials β_7	0.6831	0.1186	0.5646
Capital * Capital β_8	-0.0532	0.1301	0.6828
Capital * Labor β_9	0.0805	0.4584	0.8607
Capital * Materials β_{10}	-0.1051	0.6383	0.8692
Labor * Materials β_{11}	0.2476	0. 4137	0.5494
Labor * Year β_{12}	-0.0399	0.4827	0.4088
Materials * Year β_{13}	-0.0074	09790	0.9400
Capital * Year β_{14}	0.0033	0.0206	0.8737

ISSN: 2455-8834

Volume:02, Issue:04

Variance parameters for compound error			
Lambda	2.7736	0.2166	0.0000
Sigma (u)	0.4251	0.0588	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0983	0.1398	0.4820
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0. 6491	0.1042	0.9691	0.2044

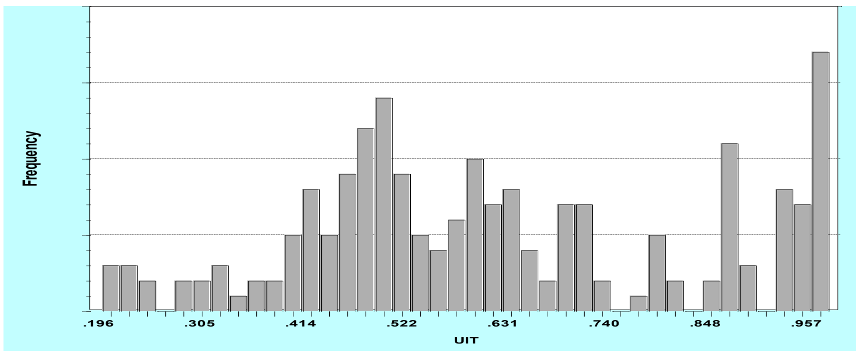

Figure 19. Histogram for Efficiency scores about Large & Extra–Large firms at Delta region by Cobb-Douglas technique

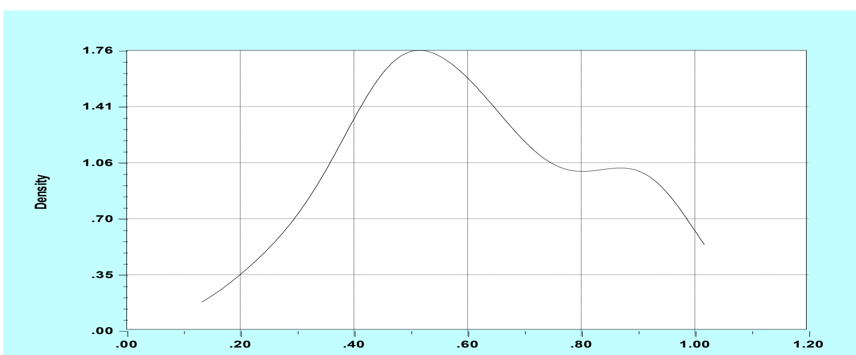

Figure 20. Kernel density function efficiency estimates for Large & Extra–large firms at Delta region by Cobb–Douglas technique

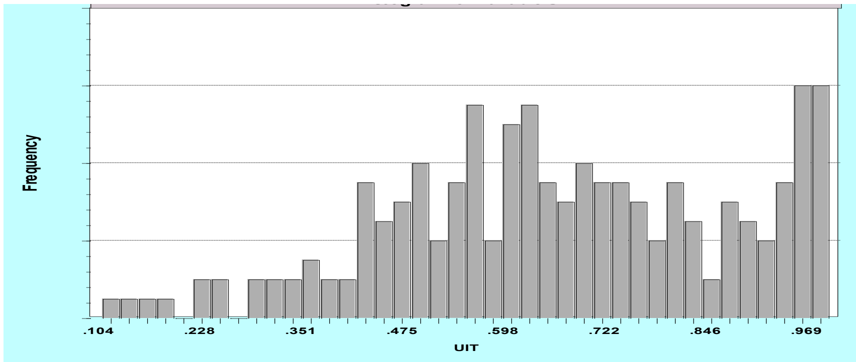

Figure 21. Histogram for efficiency scores about Large& Extra–large firms at Delta by Translog technique

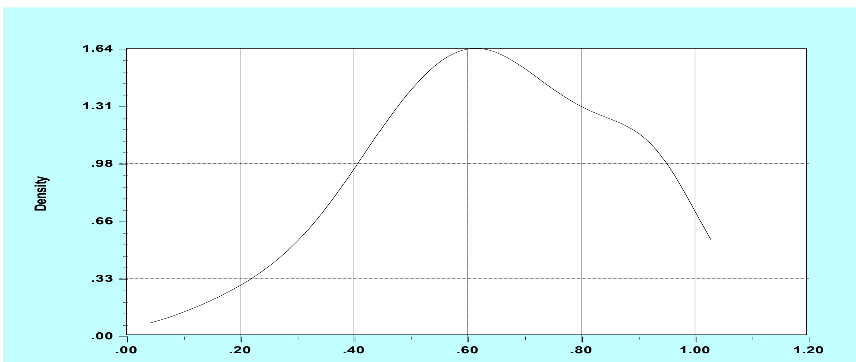

Figure 22. Kernel density function efficiency estimates for Large &Extra–Large firms at Delta region by Translog technique

Efficiency Estimates for Alexandria Region SMEs

The Alexandria region covers a sample of 78 SMEs with 624 observations. Table 13 denotes the Cobb–Douglas production function results in which factors of production coefficients are highly significant. Additionally, the variance parameters for the compound error are also highly significant. The eta parameter for the time–varying inefficiency is insignificant indicating that efficiency scores are constant across time and does not change from year to another. TE mean is 92%, which is considered the highest average efficiency score among regions and among SMEs with the minimum efficiency score of 79% and the maximum of 99% with the lowest standard deviation too. Figures 23 and 24 depict histogram and Kernel density function for efficiency scores graphically. Both diagrams display that efficiency scores for SMEs for Alexandria region

ISSN: 2455-8834

Volume:02, Issue:04

are primarily spread within the area lies between 82% to 97%, which is considered also the highest among regions.

The Translog production function is employed also for projecting efficiency scores for SMEs at Alexandria region. Table 14 results affirm that both raw materials and capital coefficients are insignificant whereas their product are significant. The intersection between raw materials and capital is also insignificant and the intersection between materials and time is also insignificant. On the other hand, labor factor coefficient, its product coefficient is significant, its intersection with capital is significant, and its intersection with time and with raw materials is also significant. The variance parameter for the inefficiency error is highly significant whereas the lambda for noise error is insignificant. The eta parameter for time–varying inefficiency is also insignificant meaning that efficiency scores do not vary across time. The average efficiency score for the Translog technique has a slight raise form 92% for the Cobb–Douglas technique to 95% at the Translog. The minimum also has a slight increase from 79% to 81% with the maximum of 99% and standard deviation has a slight decline but is still the lowest among regions. Figures 25 and 26 approve the shape of both histogram and Kernel density function as in the Cobb–Douglas Technique.

Efficiency Estimates for Alexandria Large and Extra–Large Sized Apparel Firms

The sample of the firms in the region incorporate 15 firms with 120 observations. Table 15 displays MLE via the Cobb–Douglas production function. Results show that inputs coefficients are highly significant, the variance parameters for the compound error is highly significant for the inefficiency error and slightly insignificant for the noise error. Eta parameter for time–varying inefficiency is also insignificant. TE mean is 85% with the minimum of 66% and the maximum of 99% which is also considered the highest among large and Extra–large firms. Figures 27 and 28 portray efficiency scores via histogram and Kernel density function for the region. Translog technique isn't applicable for the region.

ISSN: 2455-8834

Volume:02, Issue:04

Table 13: MLE for Cobb-Douglas Function Time Varying Estimates for SMEs Apparel Firms at Alexandria Region (624Obs)

Variable	Coefficient	Standard error	*P* value
Constant β_0	0.7039	0.1160	0.0000
Labor β_1	0.3593	0.0280	0.0000
Materials β_2	0.4323	0.1147	0.0000
Capital β_3	0.1868	0.0189	0.0000
Year β_4	0.0277	0.0054	0.0000
Variance parameters for compound error			
Lambda	0.4299	0.1874	0.0218
Sigma (u)	0.0728	0.0011	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0845	0.0832	0.3102
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.9218	0.7852	0.9919	0. 0376

Table 14: MLE Translog Production Function Time Varying Estimates for SMEs Apparel Firms Total observations (624) Cases 624 Obs Missing zero Obs

Variable	Coefficient	Standard error	*P* value
Constant β_0	0.7565	0.7236	0.3022
Labor β_1	0.6050	0.2862	0.0345
Materials β_2	0.1505	0.2055	0.4637
Capital β_3	0.2015	0.1892	0.2869
Year β_4	-0.0065	0.0336	0.8471
Year * Year β_5	0.0036	0.0018	0.0488
Labor * Labor β_6	0.2279	0.0510	0.0000
Materials * Materials β_7	0.2230	0.0342	0.0000
Capital * Capital β_8	0.1203	0.0602	0.0456
Capital * Labor β_9	-0.1483	0.0849	0.0806
Capital * Materials β_{10}	-0.0911	0.0661	0.1677
Labor * Materials β_{11}	-0.3312	0.0479	0.0000
Labor * Year β_{12}	-0.0318	0.0108	0.0031
Materials * Year β_{13}	0.0108	0.0095	0.2542
Capital * Year β_{14}	0.0232	0.0103	0.0239

ISSN: 2455-8834

Volume:02, Issue:04

Variance parameters for compound error			
Lambda	0.3389	0.2752	0.2181
Sigma (u)	0.0505	0.0010	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0829	0.1512	0.5833
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0. 9462	0. 8101	0.9936	0.0248

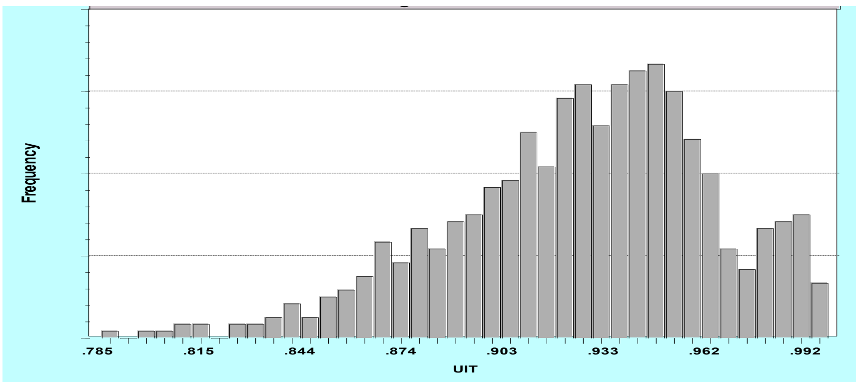

Figure 23. Histogram for Efficiency scores about SMEs at Alexandria by Cobb-Douglas technique

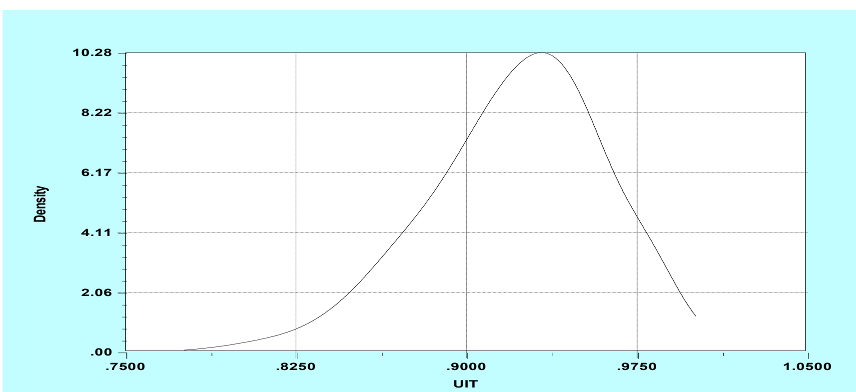

Figure 24. Kernel density function estimates for SMEs at Alexandria by Cobb–Douglas technique

ISSN: 2455-8834

Volume:02, Issue:04

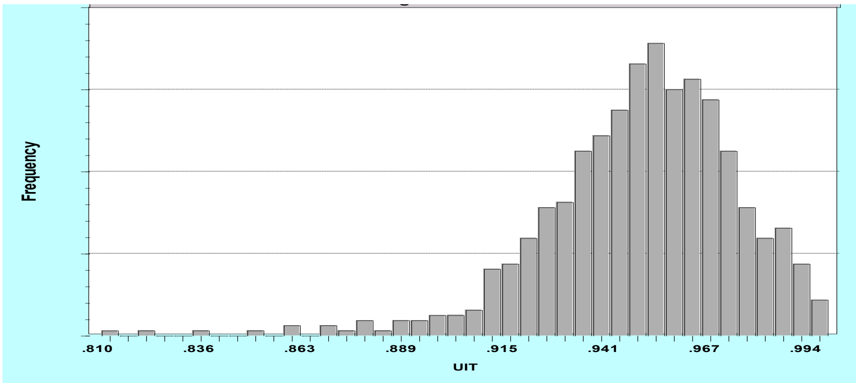

Figure 25. Histogram for efficiency scores about SMEs at Alexandria by Translog technique

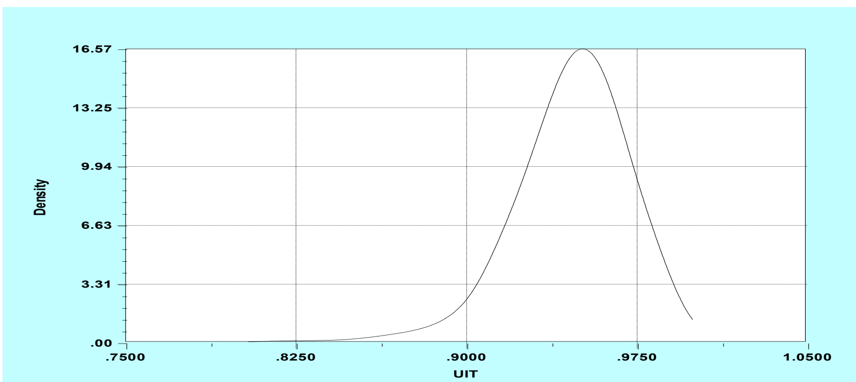

Figure 26. Kernel density function efficiency estimates for SMEs at Alexandria by Translog Technique

ISSN: 2455-8834

Volume:02, Issue:04

Table 15: MLE for Cobb-Douglas Function Time Varying Estimates for Large & Extra–Large Apparel Firms at Alexandria Region (120Obs)

Variable	Coefficient	Standard error	*P* value
Constant β_0	1.0965	0.2209	0.0000
Labor β_1	0.3540	0.0409	0.0000
Materials β_2	0.3564	0.0317	0.0000
Capital β_3	0.2201	0.0348	0.0000
Year β_4	0.0581	0.0289	0.0445
Variance parameters for compound error			
Lambda	0.6893	0.4267	0.1062
Sigma (u)	0.1165	0.0046	0.0000
Eta parameter for time varying inefficiency			
Eta	0.1273	0.2011	0.5268
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.8545	0.6579	0.9851	0. 0840

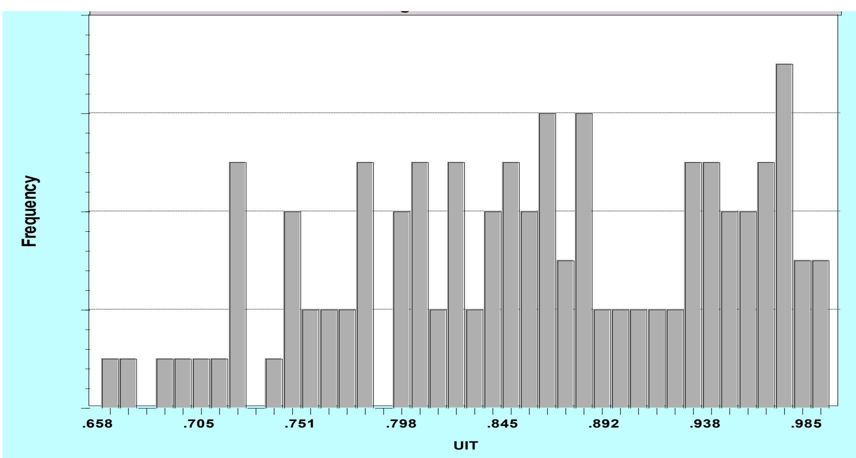

Figure 27. Histogram for Efficiency scores about Large & Extra–Large firms at Alexandria region by Cobb-Douglas technique

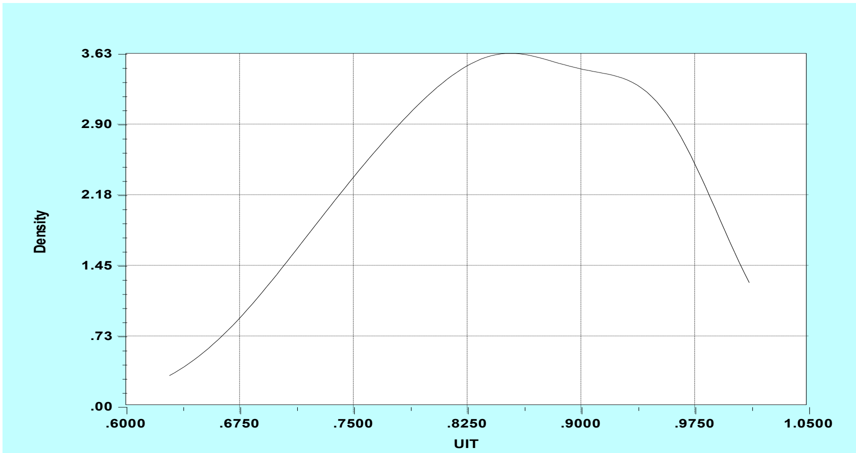

Figure 28. Kernel density function efficiency estimates for Large & Extra–Large firms at Alexandria region by Cobb–Douglas technique

Efficiency Estimates for Alexandria Large and Extra–Large Sized Apparel Firms

The Suez Canal region combines a sample of 15 large and extra–large sized firms with 120 observations. Table 16 signifies the Cobb–Douglas production function results. Results reveal that the regressors coefficients are significant in which labor coefficient is significant at 99% level of confidence, raw materials coefficient is highly significant, and capital coefficient is significant at 95% level of confidence. In addition, the variance parameter for the noise error is insignificant whereas the inefficiency error is highly significant. The eta parameter for the time–varying inefficiency is highly insignificant suggesting that efficiency scores are constant and don't change across time. Average efficiency scores 82%, the minimum efficiency score is 56% and the maximum is 97%. Figures 29 and 30 depict histogram and Kernel density function for efficiency scores graphically. Both diagrams display that efficiency scores for Suez Canal large and extra–large firms are spread randomly between 66% to 97. The Translog production function for the region is not available owing to the collinearity between the product of the factors of production and between their intersections.

ISSN: 2455-8834

Volume:02, Issue:04

Table 16: MLE for Cobb-Douglas Function Time Varying Estimates for Large & Extra–Large Apparel Firms at Suez Canal Region (120Obs)

Variable	Coefficient	Standard error	*P* value
Constant β_0	1.1260	0.7235	0.1196
Labor β_1	0.3480	0.1277	0.0064
Materials β_2	0.4147	0.0439	0.0000
Capital β_3	0.1860	0.0942	0.0484
Year β_4	0.4945	0.0600	0.4099
Variance parameters for compound error			
Lambda	0.9146	0.8170	0.2629
Sigma (u)	0.2131	0.0380	0.0000
Eta parameter for time varying inefficiency			
Eta	0.0521	0.3192	0.8704
Estimated efficiencies			
Mean	Min	Max	Std. Dev.
0.8178	0.5566	0.9733	0.1054

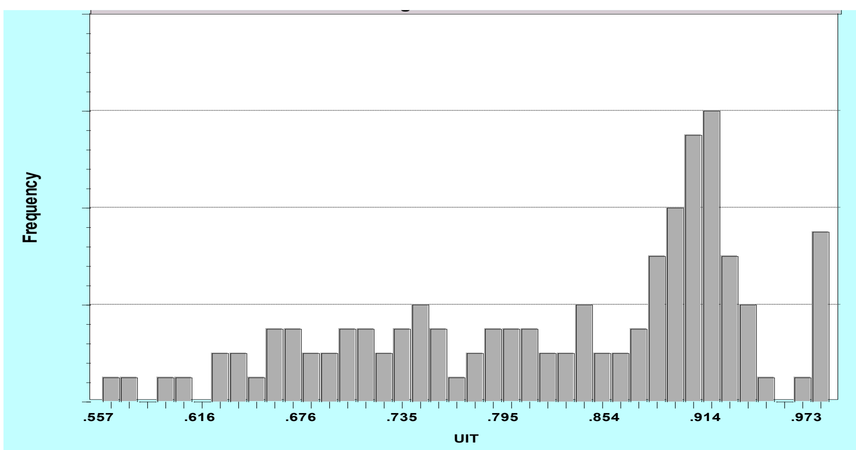

Figure 29. Histogram for Efficiency scores about Large & Extra–Large firms at Suez Canal region by Cobb-Douglas technique

ISSN: 2455-8834

Volume:02, Issue:04

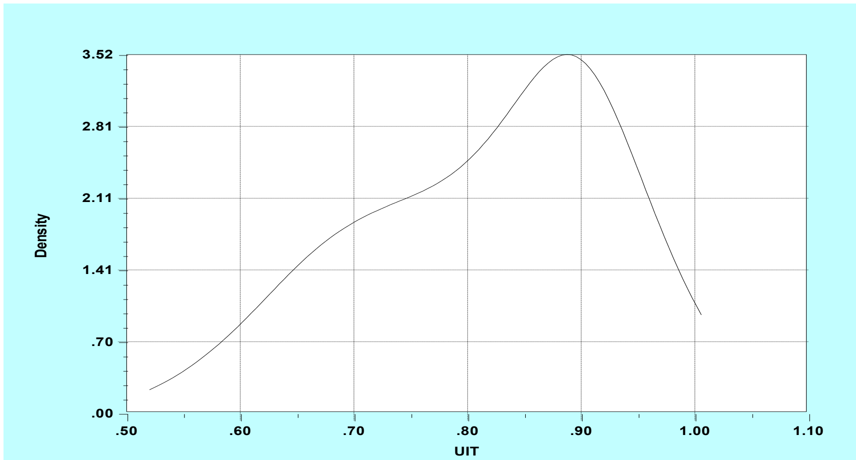

Figure 30. Kernel density function efficiency estimates for Large & Extra–Large firms at Suez Canal region by Cobb–Douglas technique

VI. CONCLUSIONS

The two well–known techniques, the Cobb-Douglas and the Translog production functions with time–varying technique, are utilized for predicting technical efficiency scores for a sample of manufactured apparel private firms. Egyptian apparel industry is chosen as an example of labor–intensive industries. Efficiency scores are firstly predicted for all firms in the sample then the whole sample are divided into subgroups; the first covers the SMEs and the second incorporates large and extra–large sized firms. Then the whole sample are distributed into four regions in which each region has two subsets; one includes the SMEs, and the other encompasses the large and extra–large sized firms. The methodology behind using this classification is to detect or to answer the question about: Is efficiency scores can differ regarding firm's size and its location and relative to the utilized technique used for measurement and across time?

Empirical results show that the average technical efficiency scores have wide–range across regions. This variation is due to the utilized technique (Cobb–Douglas or Translog), and relative to the firms' sizes. Alternatively, time–varying technique has an impact on efficiency scores for firms at some regions and therefore efficiency scores can vary for year to another. On the other hand, time–varying hasn't any impact on efficiency scores for other firms at other regions in which efficiency scores cannot change across time. Upcoming paper will deal with measuring the performance of Egyptian apparel industry for both public and private sectors via total factor productivity (TFP) using Date Envelopment Analysis (DEA).

ISSN: 2455-8834

Volume:02, Issue:04

VII. REFERENCES

Allen C., Hall S. (1997), Macroeconomic Modelling in a Changing World, John Willey & Sons, New York.

Ayyagari, M., Beck, T., & Demirguc-Kunt, A. (2003). Small and Medium Enterprises across the Globe: A New Database. World Bank Policy, Research Working Paper 3127. Washington DC: World Bank.

Battese, G., & Coelli, T. (1992). Frontier production functions, technical efficiency, and panel data: With application to paddy farmers in India. Journal of Productivity Analysis, 3, 153-169.

Bell, J., Crick, D., & Young, S. (2004). Small firm internationalization and business strategy: an exploratory study of 'knowledge-intensive' and 'traditional' manufacturing firms in the UK. International Small Business Journal, 22 (1), 23–26.

Bourell, D., Leu, M., & Rosen, D. (2009). Roadmap for additive manufacturing identifying the future of freeform processing. In: The Roadmap for Additive Manufacturing (RAM) Workshop Washington, DC, USA: The University of Texas at Austin, Laboratory for Freeform Fabrication, Advanced Manufacturing Center.

Central Agency for Population Mobilization and Statistics [CAPMAS]. (2014). Annual industrial statistics bulletin: Several issues. Retrieved from http://www.capmas.gov.eg

Christiansen, L., Jorgensen, D., & Lau, L. (1971). Conjugate duality and the transcendental logarithmic production function. Econometrica, (39), 255-256

Christiansen, L., Jorgensen, D., & Lau, L. (1973). Transcendental logarithmic production frontier. Review of Economics and Statistics, (55), 28-45.

Cobb, C. W., & Douglas, P. H. (1928). A theory of production. American Economic Review, 18, 139-165.

Elatroush, I., & Montes-Rojas, G. (2011). Technical efficiency estimation via metafrontier technique with factors that affect supply chain operation. International Journal of Business and Economics, 10(2), 117-138.

European Bank for Reconstruction and Development (EBRD) (2002) Transition Report (London, EBRD).

Good, D., Nadiri, M., Röller, L. H., & Sickles, R. C. (1993). Efficiency and productivity growth comparisons of European and U.S. air carriers: A first look at the data. The Journal of Productivity Analysis, 4, 115-125.

ISSN: 2455-8834

Volume:02, Issue:04

Greene, W. (2010). LIMDEP Econometric Software Inc. [computer software]. Retrieved from http://www.limdep.com

Laforet, S. (2008). Size, strategic, and market orientation affects on innovation. Journal of Business Research, 61(7), 753–764.

Klacek J., Vosvrda M., & Schlosser S. (2007), "KLE Production Function and Total Factor Productivity, Statistika, 4.

Laki, M. (1998) Kisvallalkoza´s a szocializmus utan [Small Ventures After Socialism] (Budapest, Kozgazdasagi Szemle Foundation).

Laki, M. (2001) 'Az u´jonnan alapıtott maganvallalatok teljesıtmenye' ['Economic Performance of the Newly-Established Private Firms'], Kozgazdasagi Szemle, XLVIII, 11, 965–79.

Lazear, E. (2004) Balanced Skills and Entrepreneurship. American Economic Review, 94, (2), 208– 211.

Lengyel, G. (2002) Social Capital and Entrepreneurial Success. Hungarian Small Enterprises between 1993 and 1996, in Bonnell, V. & Gold, T.B. (eds) (2002) The New Entrepreneurs of Europe and Asia. Patterns of Business Development in Russia, Eastern Europe and China (Armonk, NY & London, Sharpe).

Pissarides, F., Singer, M. & Svejnar, J. (2003) Objectives and Constraints of Entrepreneurs: Evidence from Small and Medium Size Enterprises in Russia and Bulgaria. Journal of Comparative Economics, 31, 503–31.

Wagner, E., & Hansen, E. (2005). Innovation in large versus small companies: insights from the US wood products industry. Management Decision, 43(5), 837–850.

Wennekers, S., Van Stel, A., Thurik, R., & Reynolds, P. (2005). Nascent entrepreneurship and the level of economic development. Small Business Economics, 24(3), 293–309.

Wong, P., Ho, Y., & Autio, E. (2005). Entrepreneurship, innovation and economic growth: evidence from GEM data. Small Business Economics, 24(3), 335–350.

