Productivity of MSEs: DEA Approach

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Abstract- Any production unit inspires efficiency, because it leads to profitability. The purpose of the study was to evaluate relative Efficiency and TFP of MSEs operating in three sample Towns in Buno Bedelle and Ilu Aba Bor Zones during the year 2013 and 2014. Three input variables - Plant Asset, intermediate variables and number of employee, and one output variable – Net Sales, were selected. Output-orientation DEA BCC-model was used to measure the relative technical efficiency and DEA-MPI to measure the productivity changes over time. The results revealed the average TE score of 0.492, which implies that the sample MSEs on average technically inefficient. It also indicates that the major source of inefficiency during the study period on average comes from pure technical inefficiency which meant primarily due to managerial inefficiency in selecting optimal selection of resource allocation. The study also reveals that the average TFP change is 0.836 during the year2014 which implies productivity regress. Technical efficiency regress takes the most contributions to the loss of TFP. Regression in Technical efficiency indicates a great potential for the MSEs to increase productivity through effective utilization of resources and filling knowledge dispersion among managers through different capacity building mechanism.

Index Terms- Data Envelopment Analysis, relative efficiency and Total productivity index

I. Introduction

Efficiency leads production units to profitability, for this reason they inspire efficient production. However, efficient production can be achieved only through minimizing resource utilization and maximizing returns. Aubyn *et al.*, (2009), defined efficiency as a comparison between inputs used in a certain activity and produced outputs. An output-oriented measure of efficiency compares observed output with the maximum output possible given level of input whereas input-oriented measure of efficiency compares the observed input with the minimum level of inputs that could produce the observed level of output (Wheelock and Wilson, 1995).

Currently, entrepreneurship is growing all over the globe as a possibility for productive employment, means of helping youth, and women to assert themselves in the planet of work, and a way of improving both their economic and social status (Heilbrunn, S. *et al.*, 2011). MSEs have large potential to create such opportunities for low skilled and less educated workers (Raj, R., 2007). In addition, MSEs are the engine of economies for any country, especially for developing countries, because they use more of the resource what the country own and less of what it lacks, and they also provide backward linkages for medium and large enterprises through supply of goods, services, information and knowledge (Charoenrat, T. *et al*, 2013).

In Ethiopia, like in most developing countries, MSEs play a crucial role in providing productive employment; earning opportunities for the large number of the populations; activating computation by fairly distributing income - which in turn enhance productivity; and then alleviating poverty which has been stimulating economic growth of the country (CSA, 1997, FeMTI MSE strategy, 1997).

In response to the sector's socioeconomic role and its potential contribution to the country's economic development, the Ethiopian government designated small businesses as a priority sector in terms of policy formulation, direct support from own resources and in mobilization of external resources (FeMTI MSE strategy, 1997). To accomplish these policies and to achieve the planned development goal, the government established various responsible bodies in all regions of the country to give immediate response for the sector easily.

Even though the government of Ethiopia works hard to enjoy by the crucial role the sector played in employment and economic development, the progress achieved by sector is more debatable, especially in terms of transforming their capital to the next scale of enterprises (i.e. micro to small, small to medium and large enterprises).

A survey study conducted on four towns of study area by Tekalign, M. *et al*. (2013), for instance, reveals that from 2004 to 2012 only 44.24 percent transformed from Micro enterprises to Small and 3.54 percent transformed from Micro enterprises to Medium & Large scale enterprises. This is what motivates the author to conduct this research to evaluate productivity of manufacturing MSEs operating in these zones. Thus, the aim of this paper is to measure the relative technical efficiency and total factor productivity of MSEs currently on working in sampled towns using Data Envelopment Analysis approach.

1.1. STATEMENT OF THE PROBLEM

Ethiopian Government plan to steer the economy of the nation on a rapid growth path toward becoming a middle income country by 2025. This goal is expected to be accomplished by strengthening MSEs in a manner that unleashes the full growth potential of the sector into medium and large scale enterprises. To fulfill this development plan, the government established MSEs coordinating body at regional level to give immediate support and solution for problem faced by the sector (Entrepreneurship Development Programme in Ethiopia, 2012).

Accordingly, MSEs' development Agencies are set up in all regions, even sub branch offices at zone/district level. Further, the government also arranges the size of support to MSEs based up on the growth stage of the enterprises - providing large support for enterprises in the higher stage to be successful in their business activity. In response, MSEs have been on the forefront in employment creations, poverty reductions, explosions of entrepreneurships and thus, economic development concurrently in the country (CSA, 2003; MoTI, 1997; GTP, 2010).

Despite the MSEs are playing initiative role in the country's economy in terms of the aforementioned factors of economic development, the sector is not achieving the expected level of growth and transformation in their capital to the next level of enterprises as planned. Surprisingly, some of them were failed to run their business at lower growth stage. Between the year 2003 and 2010, 1,765 (52%) of MSEs were failed to run their businesses in the study area by leaving 1,664 workforces unemployment (Tekalign, M. *et al.*, 2013).

Different researchers tried to shows the reasons of MSEs' failure, such as financial constraints, lack of fair support, lack of infrastructures, marketing problems, etc. (Brahne, T., 2014; Tekalign, M. *et al.*, 2013) and recommended as technology up-grading can be a solution to help MSEs to overcome these problems (Raj, R., 2007). However, advancing technology is proved very costly for developing countries like Ethiopia because of limited capital they possesses to help the sector. Therefore, the alternative way through which the MSEs operating in developing country could solve these problems is by improving their technical efficiency. Thus, this paper aims to evaluate the relative efficiency and productivity of MSEs operating in selected towns using DEA.

1.2. RESEARCH QUESTION

This study going to answer these questions: Are the sampled manufacturing MSEs technically efficient? If not, what are the necessary changes to be undertaken to bring the sector into relatively competent firm? Is there any change in TFP in manufacturing working in sample towns during the past two years?

1.3. OBJECTIVE OF THE STUDY

The main objective of the study is to evaluate technical efficiency of manufacturing MSEs operating in study area. The targeted specific objectives are:

1. To evaluate the relative efficiency and productivity of sample MSEs
2. To determine factor contributing for total factor productivity regress
3. To identify necessary enhancement for inept MSEs to become efficient.

1.4. SIGNIFICANCE OF THE STUDY

The study assess the manufacturing MSEs' relative technical efficiency and the sources of inefficiency that will provide a helpful insight to various government bodies with making decision related to the sector, management and employees of MSEs to take corrective measures to improve their internal efficiency and productivity and it also help the entrepreneurs and general society to help growth of the sector to enhance the general economic growth of the nation. That means, once the concerned body knows the source of inefficiency and factors affecting productivity; s/he can develop the necessary strategy to solve the inefficiency problem in the future. In addition, evaluating relative efficiency and TFP of manufacturing MSEs rectify the gap in literature about the sector.

1.5. DEFINITION OF TERMS AND CONCEPTS

For more clarity and understanding, it is better to have definitions of terms and concepts as used in this paper. These terms and concepts are derived from MoFED, and GTP, 2010 and stated as follows:

An enterprise can be defined as an undertaking engaged in production and/or distribution of goods & services for commercial benefits, beyond household consumption at the household level.

An enterprise can be defined as "*Micro Enterprise*" when the numbers of its employees (including the owner or family) are not greater than 5 and total asset is ≤ 100,000 Ethiopian Birr for industrial sector and ≤ 50,000 Ethiopian Birr for service sector. In a similar manner, an enterprise defined as "*Small Enterprise*" when the numbers of its employees (including the owner or family) are 6-30 and total asset is 100,001—1,500,000 Ethiopian Birr for industrial sector and 50, 0001—500,000 Ethiopian Birr for service sector.

II. METHODOLOGY

2.1. RESEARCH DESIGN

This study is a quantitative research approach. It tries to describe the relative technical efficiency of manufacturing MSEs using DEA. DEA approach is selected because it doesn't restrict weights or prices of inputs and outputs while specification of their functional relationships and also its ability to identify source of inefficiency, and showing required improvements.

2.2. SOURCE OF DATA AND COLLECTION METHOD

In this paper, two years quantitative panel data would be used because by nature DEA requires balanced panel data to measure TFP. Both primary and secondary sources of data were used. Primary data were collected through unstructured interviews; while secondary data were collected from periodic report prepared by sampled towns' woreda MSEs' agencies and the firm level financial performance, especially, cost components and gross sales of the sectors. Primary data were collected to support collecting and to strength secondary data analysis rather than analyzing separately.

2.3. SAMPLING AND SAMPLING TECHNIQUES

This study focuses on the manufacturing MSEs that have an ample potential to occupy higher employment opportunity and also have a highest potential to bring sustainable development in developing countries like Ethiopia. The study purposively select Bedelle, Yayo, and Bure as a sample area by assuming the sector is densely populated thereof. However, based on availability techniques, 23 MSEs were furnished for analysis to measure the relative technical efficiency and productivity change of the sector.

2.4. METHOD OF DATA ANALYSIS

The study employed DEA output-oriented – BCC model which assumes variable return to scale (VRS) to evaluate relative efficiency of MSEs. An output-oriented VRS measure of efficiency compares observed output with the maximum output possible given level of input assuming firms are not operating at optimal scale efficiency due to many reasons such as government regulations, imperfect competition and financial restrictions (Coelli *et al*., 2005; Cooper *et al*., 2006; Amornkitvikai, 2011). Ethiopian government provide limited support for MSEs, even its amount and type is based on the usefulness and growth stage of an enterprise, so, the only way through which MSEs improving their growth and transformation to the next level of the growth is maximizing output from given input. Therefore, output-orientated could be an appropriate choice to evaluate their technical efficiency. The study used the DEAP version2.1 software tool to compute the technical efficiency and productivity scores.

2.5. SELECTION OF VARIABLES

Measuring efficiency of DMU requires selection of appropriate input and output variables. Based on prior studies in MSEs' literature and the major cost components that Manufacturing MSEs in Ethiopia have been incurred, three input variables – (1) ***Capital*** – measured by the value of fixed assets of MSEs at the beginning of the survey year. (2) ***Intermediate Variables*** – real value of inputs such as raw materials and energy. Raw materials include expenditure on imported and domestic intermediate goods. Similarly, energy input includes expenditure on fuel, electricity, and wood and charcoal used for production. (3) ***Labor*** – the number of workers in the enterprises including owners. This is used because MSEs employed by owners and sometimes by relatives or family members. Thus, many of the time, MSEs pay zero cost for labor or very minimum cost and one output variable – (1) ***Net Sales*** - value of annual sales income of the enterprises. This variable selected because many of MSEs produce their product or services when ordered not for stock.

2.6. BCC-DEA MODEL SPECIFICATION

Theoretically, efficiency is determined by dividing the weighted sum of output by weighted sum of inputs. Assume that there are *n* MSEs, each with *m* inputs and *s* output, the relative technical efficiency score of a test MSE *p* is obtained by solving the following model proposed by Banker *et al*., (1984):

$$\max \mathrm{Ep} = \sum_{r=1}^{s} \mathrm{uyp} - up$$

Subject to:

$$\sum_{j=1}^{m} vxp = 1$$

$$\sum_{r=1}^{s} uyi - \sum_{j=1}^{m} vxi - up < 0$$

Ur, $V_j \geq \varepsilon$, Up – free in sign

The dual form of this linear programming is expressed as:

$$min\theta - \varepsilon \left[\sum_{j=1}^{m} Sj^{-} + \sum_{r=1}^{s} \boldsymbol{Sr}^{+} \right]$$

Subject to:

$$\sum_{j=1}^{m} \mu xi + Sj^{-} = \theta pxp, \qquad i = 1, \ldots, n$$

$$\sum_{r=1}^{s} \mu yi - Sr^{+} = yrp, \qquad r = 1, \ldots, s$$

$$\sum_{j=1}^{m} \mu = 1, j = 1, \ldots m$$

$$\mu j, S^{+}, S^{-} \geq 0 \;\; j = 1, \ldots m$$

A decision making unit is BCC-efficient if and only if $\theta^* = 1$and all slacks ($\boldsymbol{Sj}^{-}$&$\boldsymbol{Sr}^{+}$) are zero. The envelopment surface in BCC mode1 is variable returns to scale and this is the result of the presence of the convexity constraint ($\sum_{j=1}^{m} \mu = 1$) in the dual and, equivalently, the presence of ***up*** which is an unconstrained variable, in the primal problem.

2.7. MALMQUIST PRODUCTIVITY INDEX

The Malmquist productivity index used to measure the productivity trends of DMUs over the given period of time and decomposed it to technical efficiency change and technological changes, according to the following equation (for detail see, Fare et al., 1985)

$$Mt + 1(x_{t+1}, y_{t+1}, x_{t,} y_t) = \sqrt{\frac{Dt(x_{t+1}, y_{t+1})}{Dt(x_t, y_t)} \frac{Dt+1(x_{t+1}, y_{t+1})}{Dt+1(x_t, y_t)}}$$

This decomposed into:

$$\mathbf{M_{t+1}} (x_{t+1}, y_{t+1}, x_t, y_t) = \frac{\mathbf{Dt+1}\,(x_{t+1}, y_{t+1})}{\mathbf{Dt}\,(x_t, y_t)} \sqrt{\left[\frac{\mathbf{Dt}\,(x_{t+1}, y_{t+1})}{\mathbf{Dt+1}\,(x_{t+1}, y_{t+1})} * \frac{\mathbf{Dt}\,(x_t, y_t)}{\mathbf{Dt+1}\,(x_t, y_t)} \right]}$$

= Technical efficiency change (Tech)* Technological change (Techch)

III. RESULTS AND DISCUSSIONS

The efficiency measures computed in this study are relative in nature. That means, technical efficiency of the MSEs is not assessed in an absolute manner, but it is compared with the best practice MSEs in the sample. The source of inefficiency can be decided by comparing the relative sizes of pure technical efficiency and scale efficiency measures. If pure technical efficiency is greater than scale efficiency, then inefficiency is caused highly by scale inefficiency.

As revealed in table 3.1, in the year 2013, five MSEs are TE, ten MSEs are PTE and six MSEs are SE. Enterprises that are efficient both in PTE and SE are those operating on most productive scale size (MPSS). In contrast, the remaining MSEs are technically inefficient. That means, out of the total of 23 MSEs, 18(78%) are technically inefficient during the 2013.

Furthermore, it also reveals that the annual average TE of 0.529. This reflects that averagely, the sampled MSEs are technically inefficient. By decomposing technical efficiency into PTE and SE, the results revealed that the annual average PTE was 0.633 and average SE was 0.0.848. Thus, the source of technical inefficiency during the period is PT inefficiency which implies management inefficiency in allocating resources optimally.

Moreover, from the technically inefficient MSEs, nine of them are experiencing increasing return to scale (i.e. they operates at the declining portion of long-run average cost curve). This implies that an increase in the amount of employed inputs is most likely to contribute to a greater proportional increase in their production output. Hence, these enterprises can enhance their efficiency gain by increasing their scale of operations/resource allocation. In contrast, seven MSEs are experiencing decreasing return-to-scale (i.e. operates at the rising portion of long-run average cost curve). This implies that they have supra-optimal scale size and thus, downsizing their inputs is needed for achieving efficiency gains. And the remaining MSEs operating on constant return to scale or operating on most productive scale size.

Table3.1: BCC Model Relative Efficiency Summary

2013					2014			
Firm	**TE**	**PTE**	**SE**	**Types of Scale**	**TE**	**PTE**	**SE**	**Types of Scale**
1	0.833	1.000	0.833	IRS	0.643	0.999	0.644	IRS
2	1.000	1.000	1.000	-	1.000	1.000	1.000	-
3	1.000	1.000	1.000	-	1.000	1.000	1.000	-
4	0.749	0.863	0.868	DRS	0.653	0.685	0.953	IRS
5	0.824	1.000	0.824	IRS	0.360	0.423	0.851	DRS
6	0.812	1.000	0.812	IRS	0.773	0.797	0.969	DRS
7	1.000	1.000	1.000	-	0.316	0.409	0.772	IRS
8	0.102	1.000	0.102	IRS	0.165	1.000	0.165	IRS
9	1.000	1.000	1.000	-	1.000	1.000	1.000	-
10	0.313	0.487	0.644	DRS	0.301	0.479	0.628	DRS
11	0.445	0.514	0.866	DRS	0.558	0.699	0.798	DRS
12	0.594	0.658	0.903	DRS	0.988	1.000	0.988	DRS
13	0.161	0.172	0.937	IRS	0.104	0.107	0.973	IRS
14	0.187	0.207	0.906	DRS	0.132	0.146	0.898	DRS
15	0.206	0.219	0.940	IRS	0.146	0.146	1.000	-
16	0.183	0.183	1.000	-	0.102	0.117	0.869	DRS
17	1.000	1.000	1.000	-	1.000	1.000	1.000	-
18	0.207	0.240	0.863	IRS	0.082	0.0892	0.889	DRS
19	0.291	0.292	0.999	-	0.239	0.255	0.935	IRS
20	0.173	0.247	0.698	DRS	0.223	0.301	0.740	DRS
21	0.130	0.199	0.652	DRS	0.136	0.180	0.753	DRS
22	0.681	1.000	0.681	IRS	0.247	0.392	0.629	IRS
23	0.283	0.288	0.983	IRS	0.271	0.320	0.848	DRS
Mean	**0.529**	**0.633**	**0.848**		**0.454**	**0.546**	**0.839**	

Source: Author computation 2016

Note:

- ✓ *TE =Technical efficiency from CRS DEA*
- ✓ *PTE= Pure technical efficiency*
- ✓ *SE= Scale efficiency = TE/PTE*
- ✓ *Irs – increasing return to scale*
- ✓ *Drs – decreasing return to scale*

In the year 2014, the four MSEs were technically efficient, whereas 5 MSEs and 6 MSEs were scale efficient and pure technical efficient respectively. That means, 19(83%), 17(74%) and 18(78%) MSEs are technically, pure technically and scale inefficient respectively with the average technical efficiency score of 0.454, average pure technical efficiency of 0.546 and average scale efficiency of 0.839. From this one can understand that even if the number of both relatively technically efficient and scale efficient Enterprises remain constant during the study period, the number of pure technical efficient entity shows detrimental. In addition the average efficiency score of the sector were decreased during the year 2013 when compared with the year 2014 (from 52.9% to 45.4%).

Moreover, out of the relatively technically inefficient MSEs, seven of them are experiencing increasing return-to-scale. This means an increase in the amount of employed inputs is likely to contribute to a greater proportional increase in their production output. In other words, these MSEs are lie below the optimal scale of operations (operating at sub-optimal scale size) and therefore, they would improve their TE by expanding the scale of operations. Hence, these enterprises can enhance their efficiency gain by increasing their scale of operations/resource allocation.

In addition, eleven MSEs are experiencing decreasing return to scale. This implies that they have supra-optimal scale size (i.e. operates at the rising portion of long-run average cost curve) and thus, downsizing their inputs is needed for achieving efficiency gains.

Despites, five MSEs are found to be operating at most productive scale size (MPSS) and experiencing constant return to scale (CRS). This means, these enterprises are operate at a flatter portion of long-run average cost curve. In other word, the relatively efficient MSEs are operating on the most productive scale size and experiencing constant return to scale (CRS). Further, when we come to the source of inefficiency, the results revealed that pure technical inefficiency takes the higher contribution (36.8%) than scale inefficiency (34.2%).

Table3.2: Average Annual TE, PTE and SE

	2013	2014	Average
Technical Efficiency	0.529	0.454	**0.492**
Pure Technical Efficiency	0.633	0.546	**0.590**
Scale Efficiency	0.848	0.590	**0.719**

Source: Authors calculations, 2016

Table 3.2 describes the average estimates of TE and VRS components of TE of MSEs by year. The average annual TE for MSEs during the study period were 0.529 in the year 2013 and 0.454 in the year 2014 with an overall mean over the two years equal to 0.492. This implies that the average MSEs in the sample could have reduced the level for inefficiency approximately 50.8% to produce the same level of output. Similarly, the average PTE score was 0.633 in the year 2013, and 0.546 in the year 2014, with an overall mean over the two years equal to 0.590. This indicates that the PTE during the study period ranges between 36.7% and 45.4% and to be PTE in every year of the study, on average the MSEs had reduce their level of inefficiency by 41%.

Furthermore, the average SE ranges between 0.848 in the year 2013 and 0.839 in the year 2014, with an overall mean over both period equal to 0.719. This implies to be SE in each year of the study period, MSEs' scale inefficiency had reduced on average by 16.2%.

Finally, when compared overall annual mean efficiency of PTE with that of SE, there is indication which SE contributes more towards efficiency during both years of study and therefore, the source of inefficiency is attributed to pure technical inefficiency (managerial inefficiency) rather than scale inefficiency. These results are against to Soetanto and Ricky (2011) which stated that technical efficiency scores obtained under VRS (PTE) are higher than scale efficiency (SE) and thus, the cause of inefficiency is scale inefficiency rather than pure technical inefficiency.

3.1. POTENTIAL IMPROVEMENT SUMMARY

The potential improvement is calculated for each variable as percentage of the movement from the actual value. Zhu (2000) argued that in DEA, if the DMU's all input and output slacks are equal to zero, then DMU is defined to be Constant Return to Scale efficient, otherwise; the DMU is defined to be Constant Return to Scale inefficient and could improve its efficiency by either reducing its input levels or increasing its output levels. Input slacks represent the input excess used that are required to reduce and the output slack represents the output which is under produced by the DMUs (Collie, 1996). Technically inefficient MSEs become relatively efficient either by decreasing their excess level of inputs without changing their outputs or increases further the level of outputs without altering their level of inputs.

Table3.3. Potential Improvement summary

Variable	Original value (in million birr)	Potential Improvement	
		Amount (in million birr)	Percentage
Net Sales	3,521.86	2,716.186	77.12
Capital	8,580.51	-1,276	14.87
Labor	253.00	-65.000	25.69
Intermediate Inputs	2,218.52	-255.240	11.51

Source: Author computation, 2016

Table 3.3 shows the amount and percentage of potential improvement for each input and/or output variables during the study period. This is achieved by aggregating the potential improvement per each variable per year together and dividing the aggregate by total actual value for each variable. As shown in the table, the potential improvement needed for the input variables are; Capital should reduced on average by 1,276(14.87%), Labor should reduced on average by 65(25.69%) and Intermediate Inputs should reduced on average by 255.240(11.51%), whereas for the output variable, Net Sales should increased further on average by 2,716.186 (77.12%) to reach the target output level.

3.2. MALMQUIST INDEX SUMMARY OF FIRM MEANS

The Malmquist index evaluates the productivity changes over time. In the non-parametric framework, it is measured as the product of recovery and innovation terms, both coming from the DEA technologies. The recovery term relates to the degree that a DMU attains for improving its efficiency, while the innovation term reflects the change in the efficient frontiers surrounding the DMU between the two time periods (Cooper, *et al*, 2004).

Table3.4 shows Malmquist Productivity Index Summary of Firm Means. The MPI evaluates the productivity changes over time which is measured as the product of technical efficiency change (Tech) and technological change (Techch). The findings of the average TFP change and its components of MSEs during the study period reveals that Tech of 5(22%) MSEs increased, whereas that of 14(61%) MSEs declined. It also revealed that in 16(70%) MSEs technological progress has been observed. In contrast, in 6(26%) MSEs the result shows technology deterioration during the period. Moreover, the results also show that, on average, the TFP change is 0.836 which is less than unity; and indicates a 16.4% regress from 2013 to 2014. The loss in TFP has been mostly due to technical efficiency regress.

Furthermore, the mean technical efficiency change of MSEs is equal to 0.810 implying averagely, technical efficiency decline by 19% during the study period. Decline in technical efficiency is due to PTE regress averagely by 19.5%. Nevertheless, the average technological change of sector is 1.032 implying the technological progress of 3.2% during the study period

Table3.4: Malmquist Index Summary of Firm Means

Firm	Tech	Techch	Pech	Sech	Tfpch
1	0.771	1.107	0.999	0.773	0.854
2	1.000	1.001	1.000	1.000	1.001
3	1.000	1.234	1.000	1.000	1.234
4	0.872	1.010	0.794	1.098	0.881
5	0.437	1.219	0.423	1.032	0.532
6	0.951	1.137	0.797	1.193	1.081
7	0.316	1.000	0.409	0.772	0.316
8	1.613	1.010	1.000	1.613	1.629
9	1.000	1.018	1.000	1.000	1.018
10	0.961	0.905	0.985	0.976	0.870
11	1.254	0.838	1.361	0.922	1.052
12	1.663	0.732	1.520	1.094	1.218
13	0.648	1.331	0.625	1.038	0.863
14	0.704	0.948	0.709	0.992	0.667
15	0.712	1.196	0.669	1.064	0.852
16	0.556	1.338	0.640	0.869	0.744
17	1.000	0.677	1.000	1.000	0.677
18	0.395	1.063	0.383	1.031	0.420
19	0.819	1.010	0.875	0.935	0.827
20	1.291	1.157	1.217	1.060	1.493
21	1.048	1.172	0.908	1.155	1.229
22	0.363	1.003	0.392	0.924	0.364
23	0.958	0.953	1.111	0.862	0.913
Mean	**0.810**	**1.032**	**0.805**	**1.006**	**0.836**

Source: Author computation 2016
[Note that all Malmquist index averages are geometric means]

IV. CONCLUSIONS

In current dynamic and competitive world issue, measurement is the way of managing the situations and achieving improvement for success. Such conditions necessitate the detail understanding of technical efficiency of DMUs. Thus, it is helpful to compute technical and productive efficiency of MSEs which entertain moderate competition when compared to other sectors working in Ethiopia since they are large in number and employing non-educated labor forces to more professional entrepreneurs. Therefore, the aim of this paper is to investigate the relative TE of MSEs operating in Buno Bedelle and Ilu Aba Bor Zones using DEA. By applying data availability technique 23 MSEs observed from three purposively selected towns of the zones for the two years study period, 2013 and 2014. After reviewing previous MSEs' literatures in different country and based on local MSEs' cost components three input variables and one output variables were selected for the study. The input variables are capital, intermediate variables and number of employees, whereas the output variable is net sales.

The results show a substantial level of dispersion of TE between entities within the sample during the study period. The estimated results revealed that only 4 MSEs are technically efficient in both years under investigation. It is also found that the annual average TE of 0.529 during the year 2013 and 0.454 during the year 2014. This indicates that the overall level of technical inefficiency in sample MSEs operating in sample towns, ranges from a minimum 47.1% to a maximum 54.6%. Furthermore, it is also found that the average PTE was 0.633 in the year 2013 and 0.546 in the year 2014, whereas the average SE scores was 0.848 in year 2013 and 0.839 in the year 2014. This implies that deviation of management efficiency in allocating resource optimally ranges from 36.7% to 45.4% and deviation of actual scale of production from the most productive scale size range between 17.6% and 14.9% during the study period.

Moreover, out of 46 observations, the results of 16(35%) observations show increasing return-to-scale, hence, can enhance their efficiency gain by increasing their scale of operations/resource allocation. In contrast, the results of 18(39%) observations show decreasing return-to-scale, means they are working at a increasing portion of long-run average cost curve (i.e. they have supra-optimal scale size). So, these MSEs can improve their efficiency score by downsizing their scale size.

When we estimate the annual average efficiency scores of MSEs, the overall mean TE of sample MSEs over the study period was 0.492 which indicates the MSEs could have increase their output on average by 50.8% by using the same level of inputs. This implies that sample MSEs on average relatively technically inefficient. Further, the overall mean PTE and SE were 0.554 and 0.838 respectively. Hence, the source of technical inefficiency among sample MSEs, on average, is due to PT inefficiency.

Based on the MPI, the findings of the two years average TFP change and its components of MSEs reveal that in 14 (37%) MSEs decrease in annual TE and in 5(22%) MSEs, progress in annual TE has been observed. It also revealed that in 16(70%)

MSEs technological progress has been observed. In contrast, the results of 6(26%) MSEs show deterioration in technology during the relevant period. In addition, the results also show that, on average, the TFP change is 0.836 which is less than unity; and it indicates a 16.4% regress over the two years. The loss in TFP has been mostly due to technical efficiency regress in the sample firms.

As described in the results of average changes in all sampled MSEs' TFP and its components by year, the average annual TE of MSE is equal to 0.810 implying averagely, TE decline by 19% during the study period. This decline in TE is the result of PTE regress averagely by 19.5% and proceeding in scale efficiency averagely by 0.6%. Nevertheless, the average technological change of sector is 1.032. This implies that technological progress of 3.2% during the study period. Regression in Technical efficiency indicates a great potential for the MSEs to increase productivity through effective utilization of resources and filling knowledge dispersion among managers through different capacity building mechanism.

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