

**An Efficiency Analysis of Female Hair Dressers in Empangeni, South Africa:  
The Role of Infrastructure**

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**Introduction**

Much has been written about the important role that SMMEs can play in the development process of an economy including job creation and poverty alleviation. The importance of SMMEs on economic growth has been recognised by many researchers (Chimucheka and Mandipata, 2015, Varbane and Mets, 2015, Nani, 2016, Fatoki and Garwe, 2010) who all maintain the view that SMMEs represent an important economic tool and a major driver for economic growth, job opportunities and poverty alleviation. Swart (2011) affirms that South African SMMEs employ roughly 80% of the national labour force while contributing 30% to the national Gross Domestic Product. SMMEs are regarded as the crucial drivers of the economic development, as well as important tool in solving the socio- economic problems such as unemployment rate and poverty (Echezona, 2015). Kongolo (2010) asserted that South African SMMEs account for roughly 91% of all business units that are currently operating in South Africa, whereas Swart (2011) further comment that South African SMMEs employ approximately 80% of national workforce in the country and also add an estimated 30% to the national GDP.

Hair salons are no exceptional as they contribute towards economic growth. Despite their economic relevance, there is very limited information concerning service industries, Hair salon is one of these service industries and Onsongo & Muturi (2015) agree that hair salons do contribute to the GDP of the country and also create job opportunities. Empirically like most small businesses, most of hair salons are faced with a myriad of economic challenges that inhibit their growth and productivity (Amoakoh, 2016). Due to this background the objective of this study is particularly measuring the efficiency and determines whether infrastructure has any contribution to the performance of hair dressing industries.

**Overview of Female entrepreneurship in South Africa**

The level of South African females participating in entrepreneurship remains the problem and there is still gender imbalance. Chimucheka and Mandipaka (2015) agrees with the fact that gender stereotyping remains the big challenge that hinder the success of female entrepreneurship, especially in the environment where man are dominated. The author further argue that this problem of gender imbalance remain the big problem in South African. Ascher (2012) alluded that women face additional challenges besides the risks that all entrepreneurs

are facing, women face additional problems of being a woman in a male-dominated society. The core difficulty lies with the lack of support, the negative socio-cultural attitudes and sex discrimination. The author further stated that although women entrepreneurs operate in the same environment as men entrepreneurs, there are gender biases implanted in society, which limit women from active economic participation and access to business and development services. Women are less likely to participate in entrepreneurship activities compared to men due to the challenges that they are facing (GEM, 2016/2017). The report further revealed there are many challenges that are face by women in becoming entrepreneurs. Some of these obstacles are: higher levels of domestic responsibility, lower levels of education (particularly in developing countries), fewer business-orientated networks in their communities, lack of capital and assets; lower status in society and a culturally-induced lack of forcefulness and confidence in their ability to succeed in business.

The increased gender gap in terms of entrepreneurial activity in South Africa is cause for concern in the current economic climate. Since there is high unemployment rate amongst women which in the second quarter of 2018 was 29, 5% compared with 25,3% amongst men, according to the official definition of unemployment. According to the expanded definition, the rate of unemployment amongst women was 7, 5 percentage points higher than that of males. In 2019 the unemployment rate rose to 31.1% in Q1 (Statistic South Africa, 2019).

Ascher (2012) suggests that in order to alleviate gender bias, policy-makers should perceive female entrepreneurs as a special group that deserves special attention, as well as promoting equal opportunities and they need to be empowered. VÉRAS (2015) defines women's empowerment as their ability to make strategic life choices, where this ability had been denied previously. Women are still economically and socially disadvantaged in many countries. The challenges that women are facing prevent women from partaking and recognising as well as acting on entrepreneurial opportunities. Gem 2016 revealed that Male entrepreneurs in South Africa were 3.7 times more likely to be motivated by opportunity-rather than necessity, while women entrepreneurs were 2.6 times more likely to be motivated by opportunity rather than necessity.

### Empirical Literature

This section provides an empirical review of literature conducted on the SMMEs performance. The section is important because it allows the researcher to synthesize existing empirical work on the subject so that relevant research methods can be adopted in the subsequent chapters.

There are few studies focusing on hair salon, the study by Onsongo & Muturi (2015) for example which its focus was on the factors influencing the Growth of Hair Salon Enterprises. The objective of this study was to determine the influence of entrepreneur's characteristics on the growth of hair salon businesses in Kenya. In this study self-administered questionnaires and interview schedules were used for data collection. With the sample size of 94. The data was analysed using statistical package for social scientists (SPSS) version 19 and Microsoft Office Excel 2013. The descriptive statistics (mean, mode, median, and standard deviation), inferential statistics (correlation analysis and simple linear regression) and ANOVA were also used to analyse data. The t-test was used to test the study hypothesis at 0.05 confidence level. Reliability test gave a Cronbach alpha of 0.954 and a value of 0.893 based on standardized items. The results revealed that there is a strong correlation between the entrepreneur's experience and the growth of a business. The study recommended that the government should provide thorough training and other support services for the small enterprises to grow, provide an enabling environment for small

initiatives. Further, there should be information centres in every county and sub-county where Small businesses obtain support.

Amoakoh (2016) applied the relationship marketing model for hair salons in the Free State province. The study applied both qualitative and quantitative research method. The quantitative phase used survey data collection method, to collect data from 145 respondents, randomly selected owner/managers of hair salons and customers from Bloemfontein in the Free State Province of South Africa. These responses were supported with personal interview (i.e. qualitative) to improve generalizability of research finding. This study develops and presents relationship marketing framework that provides support for hair salons competitiveness and growth. The empirical findings show evidence of lack of awareness and importance of relationship marketing activities in the hair salons for competitiveness. Despite the lack of awareness, a positive relationship between relationship marketing framework and hair salon competitiveness and growth was found. The relationship marketing model adopted would provide strategic support and adequate information on small business performance which would prove useful for their marketing planning.

Other studies focus on measuring the influence of private and public finance on the performance of SMMEs, such study is the study by Rambe (2017) which is focusing on afro hair salons. This study examines the combined influence of public and private funding on the growth and profitability of small, micro and medium enterprises (SMMEs) in the beauty and cosmetology industry. The study drew on a quantitative approach and survey research design, in which 150 structured questionnaires were administered to Afro hair salon SMMEs in the Mangaung Metropolitan Area, which covers Bloemfontein, Botshabelo and Thaba Nchu. The combined influence of private and public finance on performance was established using correlational analysis to reveal the significance and size of these relationships. The findings suggest that there is a weak relationship between the both sources of funding and firm performance. Furthermore, the study revealed that most SMMEs depend on private funding, especially loans from Matshonis (i.e. individual private lenders located in former townships), community or group savings, and family and friends than public funding. The study recommends multiple interventions that broaden access to public funding, improve SMME owner/managers awareness of public funding institutions and improve financial inclusion in funding options available for SMMEs.

A study by Halkos and Tzeremes (2010) on the efficiency analysis on the performance of SMEs owned by foreigners. This paper uses both Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH) models in order to determine different performance levels in a sample of 353 foreign equities operating in the Greek manufacturing sector. Convex and non-convex models are used alongside with bootstrap techniques in order to determine the effect of foreign ownership on SMEs' performance. The study illustrates how the recent developments in efficiency analysis and statistical inference can be applied when evaluating performance issues. The analysis among the foreign equities indicates that the levels of foreign ownership have a positive effect on SMEs' performance.

Battacharyya (2010) Measuring organizational performance and organizational excellence of SMEs. The purpose of this paper is to propose a conceptual framework for measuring organizational performance and organizational excellence, which could be used by small and medium enterprises. Altogether, seven variables are proposed in the overall and work unit level for measuring organizational performance and organizational excellence. The proposed model for evaluating organizational performance and organizational excellence was taken through a round of pre-testing using relevant statistical analyses, in order to validate the hypothesized relationships. Excellence is redefined as the ability or capacity of one

performance variable to affect or influence the other performance variables in an organization. Total correlation is suggested for measuring different excellences and equations are suggested for calculating overall organizational performance and overall organizational excellence.

### Methodology

The analysis was based on a cross sectional data set comprising N hairdressers in Empangeni. Questionnaires were distributed to the sample of 35 hairdressers who were selected using a multi-step sampling procedure. The participants were 20 hairdressers from formally designed structures and 15 from the roadside.

### Model specification

A SFA was used to measure technical efficiency of hairdressers in this study. Unlike the DEA which is an alternative method, the SFA method is able to separate technical inefficiency from random noise and affords us an opportunity to conduct relevant hypotheses tests related, for example, to the presence of technical inefficiency and the corresponding effect of infrastructure on the estimated levels of technical inefficiency. The general specification of a stochastic frontier model takes the following form.

$$y_i = \beta_0 + \beta_1 l_i + \beta_2 k_i + (v_i - u_i) \quad (1)$$

$$v_i \sim N(0, \sigma_v^2) \quad i = 1, \dots, 35$$

where subscript  $i$  denotes cross sectional unit,  $y$  is the logarithm of output measured as the average number of clients served per day,  $l$  is the logarithm of labour proxied by the number of labour hours per day and  $k$  is the logarithm of capital proxied by the estimated value of capital items used by hairdresser  $i$ . Parameter  $u_i$  is the non-negative inefficiency component which, by assumption, follows a truncated-normal distribution and it measures the shortfall of actual output from the potential output level.

$$y_i = \beta_0 + \beta_1 l_i + \beta_2 k_i + \beta_3 l_i^2 + \beta_4 k_i^2 + \beta_5 l_i * k_i + (v_i - u_i) \quad (2)$$

$$v_i \sim N(0, \sigma_v^2) \quad i = 1, \dots, 35$$

To determine the more appropriate functional form between equation (1) and equation (2), we tested the following null hypothesis,

$$H_0: \beta_3 = \dots, = \beta_5 = 0$$

Against the alternative,

$$H_a: \beta_3 \neq \dots, \neq \beta_5 \neq 0$$

Failure to reject the null hypothesis would be evidence in favour of a Cobb-Douglas and vice versa. Also important to test was the presence of technical inefficiencies. . To achieve this, we computed the likelihood ratio (LR) test statistic recommended by Kumbhakar, Wang and Horncastle (2015)<sup>1</sup>. The LR test statistic is given by,

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<sup>1</sup> We could alternatively use the statistic  $\sigma^2 = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}$  to determine the extent to which output varies due to technical inefficiency. The weakness of this statistic is explained in Kumbhakar, Wang and Horncastle (2015).

$$-2[L(H_0) - L(H_1)]$$

where  $L(H_0)$  and  $L(H_1)$  denote the log-likelihood values derived from restricted ordinary least squares regression model and the SFA respectively with one restriction. The null hypothesis of no technical inefficiencies is rejected only if the LR statistic exceeds the critical values for the mixed distribution tabulated in Kodde and Palm (1986). A significant LR test statistic would indicate presence of technical inefficiencies.

It is important to note at this stage that equations 1 and 2 are essentially there to compute technical inefficiency scores. In other words, these two equations estimate the frontier level of output and define technical inefficiency as the gap between observed output level and the computed frontier level represented by the best practice in the sample. There is often an interest in efficiency analyses to link the computed technical inefficiency scores with other factors which are presumed to have a significant influence on the decision making unit's level of technical inefficiency. In this case, we are interested in testing the hypothesis that hairdressers with formal structures in terms of buildings are more efficient than roadside hairdressers with informal structures controlling for age, education and nationality. The estimated technical inefficiency model takes the following form.

$$u_i = \alpha_0 + \alpha_1 \text{infr}_i + \alpha_2 \text{age}_i + \alpha_3 \text{edu}_i + \alpha_4 \text{nat}_i + w_i \quad (3)$$

$$\text{infr} = \begin{cases} 1 = \text{formal structure} \\ 0 = \text{roadside} \end{cases}$$

where *infra* is a dummy variable that treats roadside hairdressers without formal structures as the baseline group, *age* captures the number of the hairdresser's years since birth, *edu* is education measured by the number of years spent in education while *nat* represents nationality dummy of the hairdressers taking the value 1 for locals and 0 for foreign nationals. There is a commonly held but hardly tested hypothesis that foreign nationals are hardworking and more efficient than locals hence the sign and significance of  $\alpha_4$  will determine the validity of this assertion as far as the hairdressers in the sample are concerned. The parameter of interest is  $\alpha_1$  which we expect to be negative if the hypothesis that hairdressers with formal structures are more efficient than roadside hairdressers is true otherwise  $\alpha_1$  will be either positive if the opposite is true or insignificant if the two groups are not statistically different in terms of technical inefficiency levels.

Intuitively,  $\alpha_1$  can either be positive or negative. It takes a negative sign when roadside hairdressers are more inefficient than hairdressers in formal structures. Efficiency of roadside hairdressers can be hampered by an environment that might not be desirable to the clients and an environment that may not be conducive and convenient to the hairdressers. From a client perspective, there is a possibility that clients might prefer being served in formal structures out of reasons related to preference or privacy. In this case, hairdressers will have fewer clients per day than their counterparts operating in formally structured salons. Consequently, they are inhibited from reaching their potential output level.

From the perspective of the hairdresser, operating by the roadside might also affect productivity when viewed in terms of unfavourable weather conditions. An example could be unexpected wind and rain that make it impossible for the hairdresser to continue operating during working hours. Similarly, hot or cold weather might have a miniscule impact at best on a hairdresser operating in a formally structured salon due to air conditioners that create artificial temperatures conducive for work.

However, there is no certainty that roadside hairdressers will always operate inefficiently when compared with their counterparts working in formal structures. For instance, unfavourable conditions might motivate roadside hairdressers to work hard and rationalise their operations in order to maintain a competitive edge that attracts customers irrespective of the unwelcoming conditions. In other words, there are cases in which customers are aware of the undesirability of being serviced in an open space but still choose a particular hairdresser for reasons related to quality and the ability of the hairdresser to provide a service in a way that surpasses those operating in formal structures. Put differently, operating by the roadside might force roadside hairdressers to improve the quality of their service delivery in order to survive the competition of formally structured salons. Viewed this way,  $\alpha_1$  can either be negative or positive depending on the outcome of the empirical test.

Note here that the dependent variable in equation 3 is technical inefficiency so a negative slope parameter signals a positive marginal effect on technical efficiency while a negative dummy coefficient on *infra* signals a higher mean level of technical efficiency for hairdressers with formal structures than roadside hairdressers. In other words, a significantly negative  $\alpha_1$  would mean that hairdressers with formal structures are, on average, less inefficient than roadside hairdressers. Age attempts to capture the hypothesis that young workers are more efficient than old workers hence  $\alpha_2$  is expected to be positive which would imply that the older one gets, the more inefficient (less efficient) he/she becomes. Education is expected to have a positive effect on technical efficiency as it allows one to have the necessary skills required to operate efficiently. The frontier and technical inefficiency parameters were simultaneously estimated using the maximum likelihood technique to avoid the bias associated with the two step approach (Schmidt and Wang, 2002).

### Results and Discussion

Table 4.1 reports descriptive statistics. Out of 35 hairdressers, 57 per cent operated in formal structures (20 hairdressers) and 65 per cent were locals. A typical hairdresser in the sample operates for 9 hours per day serving 10 clients with capital equipment worth 1903 Rands. There is also evidence that a typical hairdresser in the sample has an average of 14 years spend in education and is 37 years old.

Table 4.1: Summary Statistics

Variable	Description	Obs.	Mean	Std. Dev.
y	log clients	35	10.428	2.747
l	log labour hours	35	8.971	1.014
k	log capital	35	1903	987.0
infra	Dummy	35	0.571	0.502
nationality	Dummy	35	0.657	0.481
edu	years spend in education	35	14.257	1.899
age	years since birth	35	37.331	5.378

From descriptive statistics, it is standard to first provide results from the diagnostic tests particularly those related to functional form of the frontier specification and the presence of technical inefficiency. Table 4.2 reports these results and it shows three important results. Firstly, it shows that the null hypothesis of a Cobb Douglas being the preferred specification could not be rejected. Secondly, the null hypothesis of constant returns to scale could not be rejected suggesting that doubling the inputs will double the output for these hairdressers. Thirdly and most importantly, the null hypothesis of no inefficiencies is rejected at 5 per cent level indicating that a stochastic frontier model was more appropriate over a standard linear regression with normal errors.

Table 4.2: Functional Form tests

Test	Null hypothesis	p-value (Chi2)
Functional form	$H_0: \beta_3 = \dots = \beta_5 = 0$	0.7466 (0.10)
Constant returns to scale	$H_0: \beta_1 + \beta_2 = 1$	0.3261 (0.96)
Technical inefficiencies	$u_i = 0$	0.041 (LR statistics = 28.34 & the 5% critical value for LR = 2.706)

In summary, Table 4.2 provides a greenlight for us to proceed with a stochastic frontier model that assumes a Cobb Douglas specification with constant returns to scale. Having imposed the constant returns to scale constraint, evidence shows from Table 4.3 that labour and capital enter with expected signs. Both have positive signs indicating that labour and capital are relevant determinants of output of these hairdressers. Although both enter positively and significantly at 1 percent level, it is labour that turns out to have a more sizeable effect on output of these hairdressers relative to capital which is not surprising since hairdressing is generally labour intensive. According to the results, an increase in labour hours by 1 per cent is associated with a 0.8 per cent increase in output holding capital constant. On the other hand, a 1 per cent increase in capital is estimated to raise output by 0.2 per cent holding labour hours constant.

Table 4.3: SFA – Infrastructure and technical efficiency

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Stoc. frontier normal/truncated-normal model   Number of obs   =       35
                                                Wald chi2(1)    =      108.15
Log likelihood = 28.340472                    Prob > chi2     =       0.0000
    
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( 1) [logoutput]loglabour\_hrs + [logoutput]logcapital = 1

	logoutput	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
logoutput						
loglabour_hrs		.7892514	.0758928	10.40	0.000	.6405042 .9379986
logcapital		.2107486	.0758928	2.78	0.005	.0620014 .3594958
_cons		-.7943852	.3765678	-2.11	0.035	-1.532444 -.0563259
mu						
infra		-.1116187	.0501655	-2.23	0.026	-.2099413 -.0132962
nationality		.0383032	.0550903	0.70	0.487	-.0696718 .1462781
edu		-.0275498	.013482	-2.04	0.041	-.0539741 -.0011255
age		.0067493	.0026612	2.54	0.011	.0015335 .0119652
_cons		.5511002	.1676292	3.29	0.001	.222553 .8796473

Technical inefficiency results are reported on the lower part of Table 4.2. The dummy variable of interest, *infra*, is negative and statistically significant at 5 per cent level indicating that hairdressers operating in formal structures are less inefficient relative to hairdressers operating by the roadside. In more technical sense, the average technical inefficiency score of hairdressers operating in formally structured salons is lower by 11.2 per cent when compared with the average inefficiency score of roadside hairdressers holding constant age, education and nationality. This result is supportive of the hypothesis that hairdressers with formally structured salons are more efficient than hairdressers operating by the roadside.

The nationality dummy is positive but statistically insignificant. The insignificance of this dummy variable indicates that locals and foreign national hairdressers are not statistically different in terms of technical efficiency. Education is positive and statistically significant at 5 per cent level indicating that hairdressers that spend more years in education are less inefficient than hairdressers that spend less number of years in education. Put differently, an additional year in education reduces technical inefficiency by 2.7 per cent holding other

regressors constant. Age enters with a positive effect that is significant at 5 per cent level. The result on age supports the view that young hairdressers are more efficient than old hairdressers. As the hairdresser gets older by 1 year, technical inefficiency increases by 0.7 per cent holding other explanatory variables constant.

Table 4.4 provides descriptive statistics of technical efficiency scores by groups. Technical inefficiency levels are computed using the  $TE = \exp(-u)$  formula and we sought to infer the mean efficiency levels of different groups in the sample. The first column of the table indicates the group in question while the second column shows the corresponding average efficiency level. The third column labelled shortfall indicates the extent to which observed output is short of potential output level. For instance, the second row reveals that hairdressers operating under formally structured salons have an average efficiency level of 61.6 per cent. Since the maximum output level is 1, it follows that hairdressers operating in formally structured salons can still increase their output level by 38.4 per cent with given inputs and the prevailing technology. For roadside hairdressers, the average efficiency level is relatively lower, 55.3 per cent. Relative to hairdressers operating in formally structured salons, roadside hairdressers have a bigger room for pushing towards the output frontier level as observed output falls short of potential output level by almost 45 per cent. If we compare the mean efficiency level of those operating in formally structured salons with that of roadside hairdressers, we observe from Table 4.4 that the mean level of the latter is lower by about 7 percentage points. This observation suggests that policy measures that place roadside hairdressers in formal structures have the potential to raise their efficiency levels by 7 percentage points.

Table 4.4: Technical Efficiency Scores

Group	Mean	Shortfall	Std. Dev.	Max
Formally Structured Salons	0.616	0.384	0.028	0.656
Roadside Hairdressers	0.553	0.447	0.014	0.583
Formally structured salons (foreign nationals)	0.622	0.378	0.037	0.656
Formally structured salons (locals)	0.607	0.393	0.014	0.614
Roadside hairdressers (foreign nationals)	0.597	0.403	0.015	0.625
Roadside hairdressers (locals)	0.590	0.410	0.023	0.628
Youth (age < 35)	0.632	0.368	0.013	0.642
Adult (age > 34)	0.601	0.399	0.035	0.656

With respect to other groups, we observe that efficiency difference is not quite significant (only 2 percentage points) between locals and foreign national hairdressers operating in formally structured salons. Although the difference is miniscule, the average efficiency level of foreign national hairdressers is slightly higher. The difference is even smaller when we group the hairdressers into locals and foreign nationals operating by the roadside. For age, we divided the hairdressers into two groups namely youths and adults following the youth definition applied in South Africa (i.e. from 15 years to 34 years – youth, above 34 – adult). Note here that this new categorization is only for descriptive statistics otherwise the initial age variable was continuous in the inefficiency regression. With the youth-adult categorization, we find that youths are more efficient than adults in the hairdressing industry (for this sample) by about 3 percentage points on average.

#### Concluding Remarks

In this paper, we have sought to establish the importance of infrastructure as a source of technical efficiency for hairdressers in Empangeni of South Africa. Using a sample of 35 hairdressers and a stochastic frontier analysis that assumes a Cobb Douglas technology, we found that output measured by the number of clients served per day increases with capital

equipment and the number of labour hours. Importantly, we found that output is more enhanced by increasing labour hours per day than capital which reflects the labour intensity of hairdressing industry. The estimated stochastic frontier model indicated that the hairdressers in Empangeni area are technically inefficient operating on average more than 30 percent below their potential output level. We took a further step to determine some of the important sources of this inefficiency and observed that infrastructure has a huge bearing on efficiency levels. In particular, we observed that hairdressers operating in formally structured salons are more efficient than hairdressers operating by the roadside by almost 11 per cent on average. This finding implies that policy measures that place roadside hairdressers into formal structures can potentially improve efficiency levels of roadside hairdressers. These policy measures might include efforts to build government infrastructure with low and affordable rentals that incentivize roadside hairdressers to operate under formal structures. Education also correlates positively with technical efficiency.

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