# The Effect of Fuel Subsidy Removal on Micro Enterprises in the Federal Capital Territory: The Survival Analysis Approach

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**ABSTRACT**: Fuel subsidy has aided MSMEs operations in Nigeria and the removal no doubt, has an impact on their survival. This study aims to investigate the effect of fuel subsidy removal on business survival outcome by employing survival analysis techniques. The questionnaire was administered to 150 MSMEs in the FCT, using Kobo Toolbox - an open source field data collection software and was analyzed using SPSS and R. The event of interest was the Negative Effect of Fuel Subsidy on Business ("Yes" implied "Dead", coded 1 whilst "No" implied "Alive" coded 0). The Case Processing Summary showed that 76% of the respondents are males, 27.3% businesses are in the education sector and lastly, about a quarter (25.3%) of the respondents use generator only as their source of power. Cox Regression showed that, as source of power improved, businesses were more likely to thrive.

**KEYWORDS**: Fuel Subsidy Removal, Survival Analysis, Cox Regression, Kaplan-Meier, Nano Enterprises, Micro Enterprises, Entrepreneurship

## I. INTRODUCTION

Survival data analysis, also known as time-to-event analysis, originated from medical research to study the time from treatment until death, hence the name [1]. However, its applications have since expanded to various fields, including engineering, banking, and manufacturing to mention a few. In this study however, it was applied in the field of entrepreneurship.

This research focuses on applying survival analysis on Micro Enterprises, a class of Micro, Small and Medium Enterprises (MSMEs) in the Federal Capital Territory (FCT) of Nigeria, particularly in the context of the recent removal of fuel subsidy. MSMEs, no doubt contribute remarkably to the economic growth and development of Nigeria, they represent a seedbed of entrepreneurial skills and innovation, contribute to job creation and are considered the backbone of the global economy [2]. The International Labour Organization (ILO) has disclosed that MSMEs contribute 48% of Nigeria's National Gross Domestic Product (GDP). In Nigeria, Micro Enterprises are generally referred to as enterprises with less than ten (<10) employees and assets including land and building of less than five million Naira (<N5,000,000)[3]. In this study however, focus will be on micro enterprises which make up 99% of MSMEs in Nigeria. However, it is worthy of note that the Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) in a collaboration survey with the National Bureau of Statistics (NBS) in 2021, amended the MSME classification. This was done through the introduction of Nano enterprises category as businesses with initial capital outlay of less than fifty thousand Naira (<N50,000), employee size of 1-3 and micro enterprises as having an employee size of 4-9[4]. In this study, nano and micro enterprises and Micro Enterprises might be used interchangeably.

Fuel subsidy removal has obviously hurt micro enterprises to the extent of interrupted supply chains, reduced consumer demand and cut cash flow. The outcome of all these is that businesses are unable to pay workers' salaries, shop rent, utility bills resulting in negative effects on households because micro enterprises in Nigeria are largely owned by sole proprietors accounting for 97.1%, while partnership accounted for 2.2% in terms of ownership status [5,6]. It is therefore within this context of business research, the utilization of survival analysis representing not just a valuable tool but an

imperative approach to uncovering essential insights that aims to enhance our understanding of the factors that influence the survival of nano and micro businesses, which are the backbone of the nation's economy.

## II. SIGNIFICANCE OF THE STUDY

Fuel subsidy removal continues to pose a challenge in all aspects of daily lives of citizens, contributing to a substantially low quality of life nationwide. Its negative impact manifests on the economic and business activities in the FCT resulting in an economic downturn. Literature, has however not scientifically examined the impact on nano and micro enterprises in the capital territory and this study aims to bridge the gap by applying survival analysis techniques to investigate the survival experiences of these businesses. This study as well, holds substantial significance in the field of entrepreneurship by contributing to a deeper understanding of business survival outcomes, which can inform more effective economic decision-making. The findings will also provide evidence-based recommendations for policies and strategies aimed at reducing the dearth rates of nano and micro businesses. In conclusion, the application of this tool in this context lays the groundwork for future research in business survival analysis.

## III. LITERATURE REVIEW

Entrepreneurship has become an important driving force of economic growth in various countries, and the academia has always maintained research enthusiasm for entrepreneurship [7]. Theoretical literature provides a foundational understanding of the uniqueness, methodologies, and theoretical/statistical models underpinning survival analysis and this review of literature delves into its broader applications in entrepreneurial research.

Robert J. Kauffman et al., [8] analyzed the business models of 130 Internet companies using non-parametric and semi-parametric Cox proportional hazards models of survival analysis to explore how business models affect the survival of companies. The results show that smaller Internet companies greatly reduce the possibility of interaction between customers, suppliers and trading brokers, and relying on advertising as a major source of revenue. In addition, interactive platforms for individuals and businesses have failed to adversely affect them. With the development of society and the increasing maturity of the Internet, the size of large companies will decrease and the weak will leave the market. The study also pointed out that the business model is the main dimension affecting the survival and development of Internet companies.

Yang Huan by using the survival analysis of half parametric method Cox proportional risk model for empirical analysis, study the construction enterprise mortality density dependence process and influencing factors, in 1989–2007 in Jiangsu province construction enterprises based on the research, the results show that the death of construction enterprises has a significant impact on the evolution of the industrial structure level [9]. The influence of population density on the mortality rate of construction enterprises is mainly manifested as increasing with the increase of the population density of enterprises, but this rising process is also restricted by the combination of organizational age. In addition, the size and external environment of the construction enterprise and environmental factors also affect the enterprise mortality rate. Yang Huan analyzed the factors affecting the flow of rural workers, combining statistics from Jilin Province, using female workers' survival analysis, etc.

Lai discussed the application of survival analysis in the loss of information customers, Studying the characteristics of information services [10]. The algorithm of survival time and customer loss definition conditions are studied, and using the user data of the National Science and Technology Books and Literature Center, the results show that the survival analysis method can well explain the living conditions of information customers and the factors affecting their survival, has a guiding role in customer information service management.

## IV. METHODOLOGY

The study employed survey research design and adopted questionnaire as the research instrument, hence a primary data source. The questionnaire was self-developed and in five (5) modules namely: Business Information, Business Status, Operation Status, Employment Information and Business Growth. It was administered to 150 MSMEs with the use of Kobo Toolbox, an open-source field data collection software by trained field interviewers. All questionnaires were retrieved representing 100% of the sample size. The descriptive statistics was used to describe the demographic characteristics of the entrepreneurs (age, sex and educational level) as well as the characteristics of the enterprises (form

of business, business sector, source of start-up capital and source of power), the variables were coded as seen in the table below

**Table 1 Demographic Characteristics of the Entrepreneurs and Characteristics of Enterprises**

| Variables | Codes | Descriptions |
|---|---|---|
| Form of business | 1-Sole Proprietorship<br>2-Partnership | What is the form of the Main Business of the Entrepreneur? |
| Age | 1- 26 - 35<br>2- 36 - 45<br>3- 46 and above | What is the Age Category of the Entrepreneur? |
| Sex | 1- Male<br>2- Female | What is the Gender of the Entrepreneur? |
| Educational Level | 1- No Education<br>2- Primary<br>3- SSS<br>4- Vocational<br>5- NCE/NDE/Nursing<br>6- Graduate<br>7- Post Graduate | What is the Highest Educational Level of the Entrepreneur? |
| Business Sector | 1- Accommodation and Food Services Activities<br>2- Wholesale and Retail Trade<br>3- Human Health and Social Work Activities<br>4- Administrative and Support Services Activities<br>5- Information and Communication Technology<br>6- Education<br>7- Other Services Activities | What sector best describes your business operations and/or activities? |
| Source of Start-Up Capital | 1- Contribution<br>2- Family<br>3- Grant<br>4- Cooperative<br>5- Loan | What is the Source of Business Start-Up Capital? |
| Power Source | 1- Generator Only<br>2- Electricity Only<br>3- Generator and Electricity<br>4- Generator and National Grid<br>5- Solar System and Electricity | What is the source of power for Businesses |
| Area of Assistance | 1- Financing<br>2- Regular Fuel at approved rate<br>3- Regular Power Supply<br>4- Spare Parts Availability<br>5- Reduction in interest rate<br>6- Security<br>7- Raw Materials<br>8- Others | What is the Priority Area of Assistance? |
| Major Government Policy (Fuel Subsidy) that Negatively Affected- **OUTCOME** | 0-Alive;1-Dead | Fuel Subsidy Removal Survival Outcome |

The Survival Analysis techniques employed were the Kaplan-Meier Estimator (used to estimate the survival function in dealing with censored data) and Cox Proportional-Hazards Model (widely used semi-parametric model that explores the impact of covariates on the hazard function). Finally, the Log-Rank Test was used to assess whether there are statistically

significant differences in survival probabilities between the groups. The software used for this study are the Statistical Package for Social Sciences (SPSS 27) and R.

## V. RESULTS

**Descriptive Statistics**

**Table 2 Demographic Characteristics of the Entrepreneurs**

| Sex | Frequency | Percent |
|---|---|---|
| Male | 114 | 76 |
| Female | 36 | 24 |
| Total | 150 | 100.0 |
| **Age** | **Frequency** | **Percent** |
| 26-35years | 64 | 42.7 |
| 36-45years | 69 | 46.0 |
| 46-above | 17 | 11.3 |
| Total | 150 | 100.0 |
| **Education Level** | **Frequency** | **Percent** |
| No Education | 2 | 1.3 |
| Primary | 1 | 0.7 |
| SSS | 41 | 27.3 |
| Vocational | 6 | 4.0 |
| NCE/NDE/Nursing | 29 | 19.3 |
| Graduate | 63 | 42.0 |
| Post-graduate | 8 | 5.3 |
| Total | 150 | 100.0 |

Table 2 depicts the demographic characteristics of the respondents (entrepreneurs). It revealed that 114 (76.0%) of the respondents are males while 36 (24.0%) are females. It also revealed that 64 (42.7%) of the respondent are of age 26-35 years, 69 (46.0%) are of age 36- 45 years, and age 46-above recorded the least with 17 (11.3%). It lastly revealed that 2 (1.3%) of the respondents have no any formal education, 63 (42.0%) are graduates and 8 (5.3%) of the respondents are post graduates.

**Table 3 Characteristics of Enterprises**

| Business Sector | Frequency | Percent |
|---|---|---|
| Accommodation and Food Services | 15 | 10.0 |
| Wholesale and Retail Trade | 39 | 26.0 |
| Human Health and Social Work Activities | 2 | 1.3 |
| Administrative and Support Services Activities | 7 | 4.7 |
| Information and Communication Technology | 10 | 6.7 |
| Education | 41 | 27.3 |
| Other Services | 36 | 24.0 |
| Total | 150 | 100.0 |
| **Source of Start-up Capital** | **Frequency** | **Percent** |
| Contribution | 65 | 43.3 |
| Family | 44 | 29.3 |
| Grant | 3 | 2.0 |
| Cooperative | 27 | 18.0 |
| Loan | 11 | 7.3 |
| Total | 150 | 100.0 |
| **Form of Business** | **Frequency** | **Percent** |
| Sole Proprietorship | 107 | 71.3 |
| Partnership | 43 | 28.7 |
| Total | 150 | 100.0 |

| Source of Power | Frequency | Percent |
|---|---|---|
| Generator | 38 | 25.3 |
| Electricity | 34 | 22.7 |
| Generator and Electricity | 30 | 20.0 |
| Generator and National grid | 45 | 30.0 |
| Solar system and Electricity | 3 | 2.0 |
| Total | 150 | 100.0 |

Table 3 depicts the characteristics of enterprises. The table shows that 27.3% businesses are in the education sector, 26.0% are into wholesale and retail trade and the least, which is 1.3% are into human health activities. The table also shows that majority got their start-up capital from contribution accounting for 43.3% of the respondents, 29.3% got theirs from family and 2.0% from grant. The table lastly shows that about a quarter (25.3%) of the respondents use generator only as their source of power, 22.7% use electricity only and 2.0% of the respondents use solar system and electricity as their source of power (zero fuel).

**Table 4 Priority Area of Assistance**

| Priority area of assistance | Frequency | Percent |
|---|---|---|
| Financing | 57 | 38.0 |
| Spare Parts Availability | 3 | 2.0 |
| Regular Fuel Supply at approved rate | 39 | 26.0 |
| Regular Power Supply | 22 | 14.7 |
| Reduction in Interest Rate | 8 | 5.3 |
| Security Raw Materials | 4 | 2.7 |
| Others, Specify... | 17 | 11.3 |
| Total | 150 | 100.0 |

Table 4 depicts the priority area of assistance needed by the respondents. The table revealed that asides Financing, Regular Fuel Supply at approved rate was the major area that entrepreneurs needed assistance from the government. It accounted for over a quarter (26.0%) of the respondents' concerns.

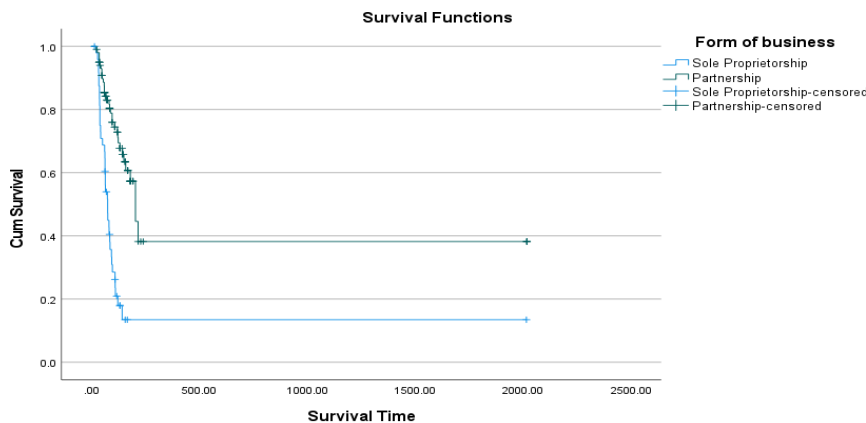**Figure 1 Survival Functions Curve of Form of Business**

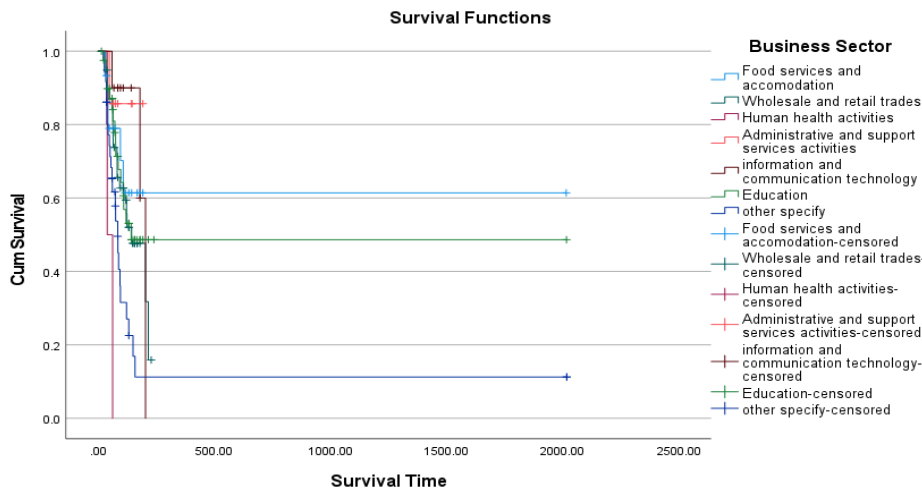**Figure 2 Survival Functions Curve of Business Sector**



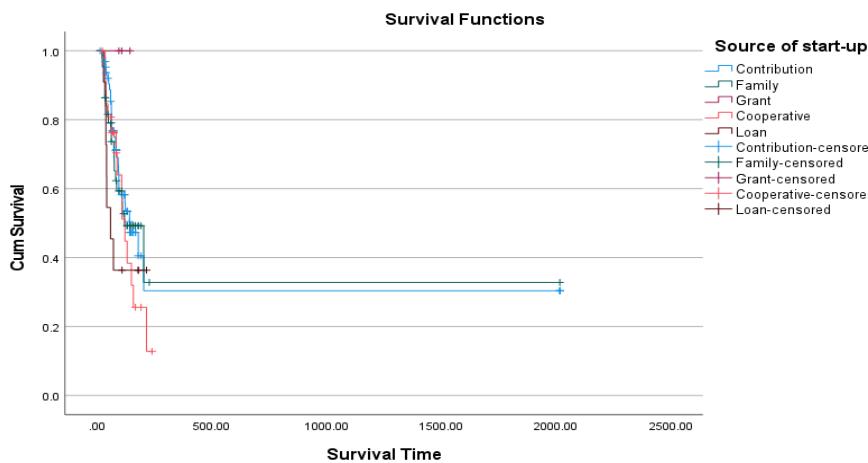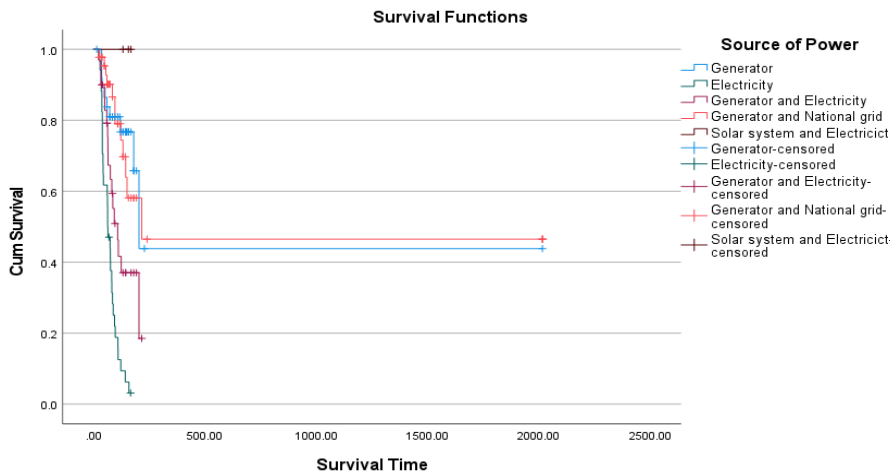**Figure 3 Survival Functions Curve of Source of Start-up**



**Figure 4 Survival Functions Curve for Source of Power**



Figures 1-4 shows the Kaplan-Meier survival rate or survival function curve, it displays the estimated survival probability for the business sector, source of start-up capital, form of business and source of power on the effect of fuel subsidy

removal on nano and micro businesses in Federal Capital Territory (FCT). Partnership under form of business survived better; Food services and accommodation survived the best in the category of business sector; those who had grant as their source of start-up had a stable certainty of survival whilst those who had from cooperative didn't survive well compared to those who took business loan; businesses using solar and electricity only (zero fuel) sure had the best and stable certainty of surviving the effect of fuel subsidy. Each vertical step in the curve indicates one or more events (i.e., dead, in this study 'negatively affected by fuel subsidy'), and right-censored businesses are indicated by a vertical mark in the curve at the censoring time.

**Table 5 Log Rank (Mantel-Cox) Overall Comparison**

| Variables | Chi-Square | Df | Sig. |
|---|---|---|---|
| Business Sector | 23.014 | 6 | .001 |
| Source of Start-up Capital | 4.215 | 4 | .378 |
| Form of business | 34.775 | 1 | .000 |
| Source of Power | 59.346 | 4 | .000 |

Table 5 presents the results of statistical tests used to examine the equality of survival distributions for the different levels of the variables in the study and compares their overall survival experiences. Since the p-value for Source of Start-up Capital is 0.378 which is greater than the level of significance (0.05), the null hypothesis is accepted. It is assumed that all levels of Source of Start-up Capital have the same distribution curve and there exists no significant difference in survival experiences. All the levels of the Business Sector are statistically significantly different in their survival experiences of the Effect of Fuel Subsidy Removal on micro businesses in the case study. The same situation applies to Form of Business and Source of Power.

**Table 6 Correlation Matrix of Predictor Variables**

| | Business Sector | Source of start-up | Form of business | Source of Power |
|---|---|---|---|---|
| Business Sector | 1 | .021 | .048 | -.018 |
| Source of start-up | .021 | 1 | .065 | -.038 |
| Form of business | .048 | .065 | 1 | .232 |
| Source of Power | -.018 | -.038 | .232 | 1 |

Table 6 shows the Correlation Matrix for the predictor variables to be used in Cox Regression, with the maximum correlation coefficient as 0.232, it shows that there is overall, a negligible association between the variables.

**Table 7 Cox Regression**

| | B | SE | Wald | df | Sig. | Exp(B) | 95.0% CI for Exp(B) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Business Sector | 0.118 | 0.057 | 4.337 | 1 | .037 | 1.125 | 1.007 | 1.257 |
| Source of start-up | 0.153 | 0.089 | 2.979 | 1 | .084 | 1.165 | .979 | 1.386 |
| Form of business | -1.505 | 0.259 | 33.821 | 1 | .000 | .222 | .134 | .369 |
| Source of Power | -.095 | 0.107 | .795 | 1 | .373 | .909 | .737 | 1.121 |

a. Degree of freedom reduced because of constant or linearly dependent covariates
b. Constant or Linearly Dependent Covariates Registration with CAC = 3 - Form of business;

Table 7 shows the information on the predictor variables included in the Cox Regression Model. The variables with positive coefficients i.e B values (Business Sector and Source of Start-Up Capital) are associated with increased hazard and decreased survival times. i.e as the predictor increased, the hazard of the event increased and the predicted survival duration decreased. The variables with negative coefficients i.e B values (Form of Business and Source of Power) are associated with decreased hazard and increased survival times. This implies that as source of power eased, businesses were more likely to thrive. Similarly, the more businesses were in partnerships, the higher their chances of surviving the fuel subsidy. For the first two variables, their hazard ratios [exp (B)] are greater than one (1.125, 1.165 respectively)

which implies that survival (no negative impact of fuel subsidy removal) was worse in one of the groups of each of Business Sector and Source of Start-up Capital.

## VI. CONCLUSION AND FUTURE WORK

The effective application of survival analysis techniques on the Effect of Fuel Subsidy Removal on Nano and Micro Businesses has shed knowledgeable light on the major factors affecting business survival outcomes in the FCT. Some of the risk factors in the study revealed significant impacts on the survival probabilities. Business Sector and Source of Start-Up Capital emerged as major factors with worse prognosis on Nano and Micro Businesses survival outcomes in the Federal Capital Territory. Based on the results and finding of this study, it is recommended that further research be carried out on the effect of fuel subsidy removal on the survival of nano and micro enterprises in other parts of the country, as well as on small and medium scale enterprises.

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