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Survival of Nigeria's Exports in Her Biggest Markets: Continuous and Discrete Time Estimations

Damilola Felix Arawomo
Nigerian Institute for Social and Economic Research, NISER

Abstract

Trade duration and its determinants have been largely overlooked in both theoretical and empirical literature, especially in the developing countries. It is in view of this, that this paper examined extent and drivers of export survival of Nigeria's products in her biggest markets (United State, Germany, France, China, and Japan). While the non-parametric Kaplan-Meier estimator was used to examine the extent of Nigeria's export survival in her major destinations, the Cox proportional hazards model and Prentice-Gloeckler were compared in estimating the determinants of survival. Results show that the survival rate of Nigeria's export has been low. 49.4% of Nigeria's export survives for more than one year, 37.8% survives for up to 10 years, and only 4.5% survives a 42 years period. As regards the determinants of export survival, language, initial export value, and exchange rate are the factors that promote the survival of Nigeria's export, while distance, GDP per capita, colonial ties, total export, competition, and tariff discourages it.

1. Introduction

Developing countries can enhance economic growth and have poverty reduced by expanding exports to the rich countries and to one another. However, most of the low-income countries, have found it very difficult to overcome the obstacles of expanding and diversifying their exports. A number of them have faced stagnant demand for the products they export. Brenton, Sabrowski and Uexkull (2010) maintained that successful export growth and diversification require not only entry into new export products and markets, but also the survival and growth of existing export flows. Export expansion can take place at least through three channels (Stibat et al. 2011): first, through expansion along the existing trade relationships (intensive margin); second, along the new-product and new-market margins (extensive margin) and third, along sustenance of extensive and intensive margins of trade.

Positive trade theory usually asks questions which address the "who, what, when, and why" of international trade. One question not often addressed is "how long?". When countries trade, how long do their trade relationships last? Are they exchanging products over long or short periods of time (Besedeˇ and Prusa, 2006)? New exporters tend to start small and focused on a single, usually neighboring country. Once they outlive their entry year they tend to expand their sales abroad and reach a larger number of destinations (Lawless, 2009). The occurrence of this process, however, is not guaranteed especially for developing country like Nigeria.

The dearth of literature on export survival must be emphasised. Majority of the available ones were on developed countries. For instance, Besedes and Prusa (2006a) employed survival analysis to study the duration of US imports. They found that the median duration of exporting a product to the US is very short, on average of two to four years. Chances of export survival increases, if a country is able to survive in the exporting market for the first few years. Such a country is likely able to export the product for a long period of time. The results hold across countries and industries and are robust to aggregation. Nitsch (2008) examined the duration of export in German at disaggregated product level. He found that survival probabilities are affected by exporter characteristics, product types and market structure. Besedes and Blyde (2010) analysed the drivers of export survival in Latin America. Their result showed that export relationships are in general short-lived but significantly different across regions.

Efforts have also been made in developing countries to assess export survival. For instance, Brenton *et al* (2009) analyzed the reasons for low survival rate of export flows in developing countries. The results confirmed the significance of a range of products as well as countryspecific factors in determining the survival of export flows. Kamuganga (2012) examined the effects of intra-regional trade cooperation on sustainability of Africa's exports (export survival) within Africa and to the rest of the world. Results suggest that regional trade cooperation (integration) initiatives in Africa have non-negligible effects in enhancing Africa's export survival. Fugazza and Molina (2011) explored the patterns of trade duration across regions. Result showed that the duration of trade increases with the region level of development, larger transaction.

It is in view of the above, that, this study examined the extent of export survival of Nigeria's products in her biggest markets (United State, Germany, France, China, and Japan). The drivers of Nigeria's export to these countries were also examined. The choice of these countries was not only

informed by the highest importing markets for Nigeria's total products[1], but consideration was given to highest importing markets for non-oil products. The dominance of the oil sector in Nigeria and efforts by the country to diversify to other products informed the choice of the major buyers. Empirical studies on export survival have been very scanty generally after the novel work of Besedes and Prusa (2006), moreover, only very few studies have been done in developing countries. The few available papers include Jun and Kangning (2012) for China, Kamuganga (2012) for selected African countries, Mohammed (2012) for manufacturing sector in Ghana, Cadot et al. (2013) for four selected African countries ((Malawi, Mali, Senegal and Tanzania). Despite the importance of export survival to Nigeria's efforts at diversifying her economy to non-oil products, efforts have not been made to examine the extent of export survival in Nigeria. This is the gap this paper seeks to fill.

After this introductory section, the magnitude, sectors and sources of Nigeria's export is presented in section two. The review of previous studies is done in the third section. Theoretical framework and methodology is in section four. Empirical analysis of the extent and determinants of export survival is done in section five and the last section addressed the concluding remarks and recommendations.

2. Magnitude, Sectors and Sources of Nigeria's Exports

It is important to examine the trend of Nigeria export in terms of aggregate, sectoral and destinations, especially her trade with major partner countries. Nigeria has grown her export substantially in the last couple of decades. The country has developed in terms of monetary values of export, number of products being exported and the number of partner countries. In terms of volume, Nigeria's export has increased from $1.22 billion in 1970 to $143.15 billion in 2012 as shown in Figure 1.

Figure 1: Nigeria's Total Exports of Goods (Billion $)
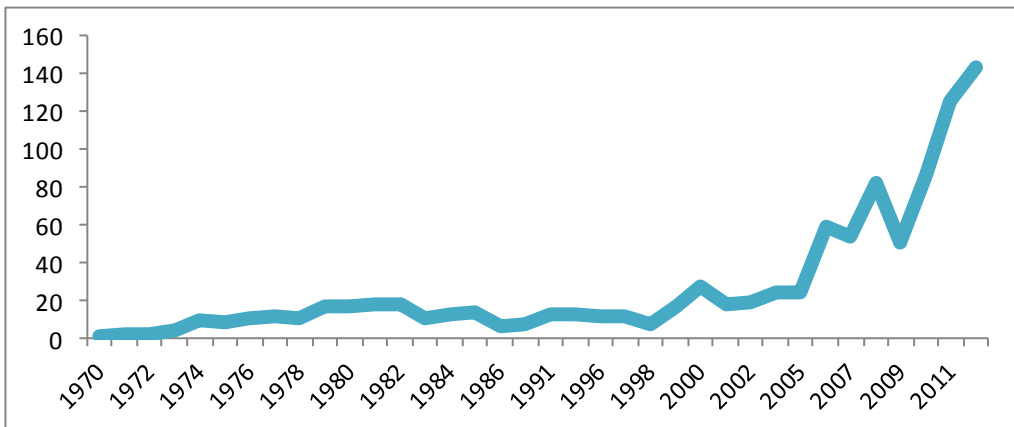
Fluctuations in Nigeria's export volume must be remarked, the instability in export is usually attributed to uncertainty of products prices. Sectorally, Nigeria's export of goods has been dominated by the mineral fuels since the discovery of oil in commercial quantity in Nigeria in the

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[1] The highest 10 importing markets of Nigeria's total products include: United States, India, Brazil, Netherlands, France, Spain, Equatorial Guinea, Canada, Italy, and South Africa.

1970s. Specifically, Table 1 showed that the proportion of Mineral fuel in Nigeria's export increased from 58.1 per cent in 1970 to 84.0 per cent in 2012. Aside mineral fuel products sector, another sector that exports significantly is the food and live animals. The sector's export value increased between 1970 and 2012, the however as a proportion of total export it declined from 19.1 per cent in 1970 to 4.77 per cent in 2012. Crude product is similar, although increasing in absolute terms, it however, its proportion declined from 13.9 per cent in 1970 to 7.6 per cent in 2012.

Table 1: Nigeria's Exports of Goods by Sector (Percentage of Total)

	1970	1975	1980	1985	1990	1995	2000	2006	2012
Food and live animals	19.121	4.405	1.951	2.074	1.414	1.344	0.431	1.871	4.778
Beverages and tobacco	0.000	0.000	0.002	0.000	0.006	0.060	0.000	0.002	0.208
Crude materials	13.998	1.196	0.322	0.133	0.610	1.791	0.476	0.362	7.672
Mineral fuels	58.143	93.306	97.064	96.642	96.632	95.580	98.868	96.447	84.039
Animal and vegetable	0.033	0.025	0.025	0.011	0.249	0.135	0.012	0.126	0.226
Chemicals	0.033	0.025	0.025	0.011	0.249	0.135	0.012	0.126	0.226
Manuf. goods (materials)	4.454	0.537	0.214	0.130	0.366	0.456	0.095	0.179	1.497
Machinery and transport	0.000	0.000	0.000	0.007	0.034	0.362	0.099	0.831	1.329
Miscellaneous manuf.	0.024	0.003	0.002	0.000	0.054	0.162	0.007	0.181	0.202
Commod. & transacts.	0.472	0.312	0.360	0.973	0.634	0.021	0.005	0.000	0.049

Source: World Integrated Trade Solution (WITS) Database (2014)

The performance of Nigeria manufacturing goods exports has been very poor since 1970; as a percentage of total export it decreased from 4.45 per cent in 1970 to 1.49 per cent in 2012. Chemical products export was also very low in the 1970s, however, as a proportion of total export, it increased from 0.03 per cent in 1970 to 0.22 in 2012.

In terms of export destinations, United States and the European countries have been the major trade partners of Nigeria since after Nigeria's independence. The major European countries that buy Nigeria's export include France, Spain, Germany, Italy, Netherlands, and United Kingdom. Other countries that buy Nigeria's export include Equatorial Guinea, Canada, South Africa, India, and Brazil.

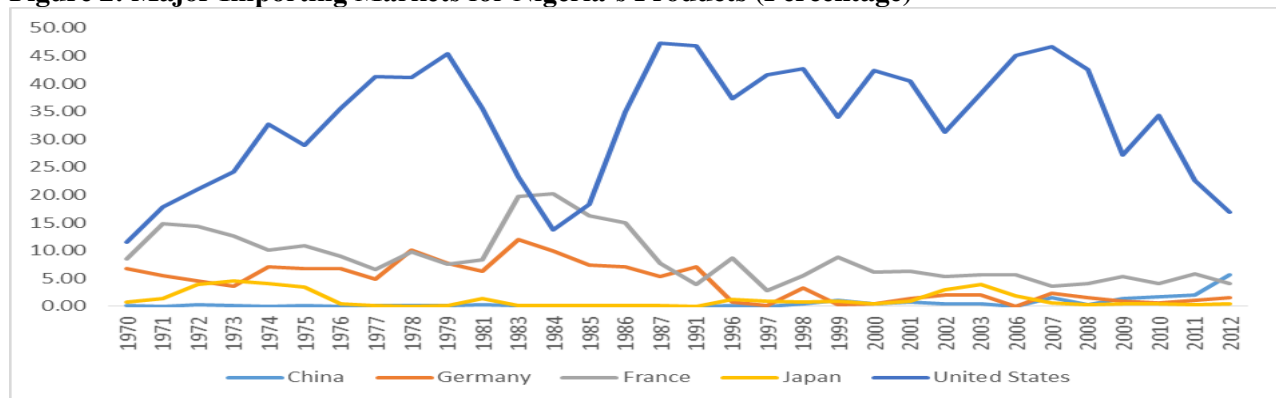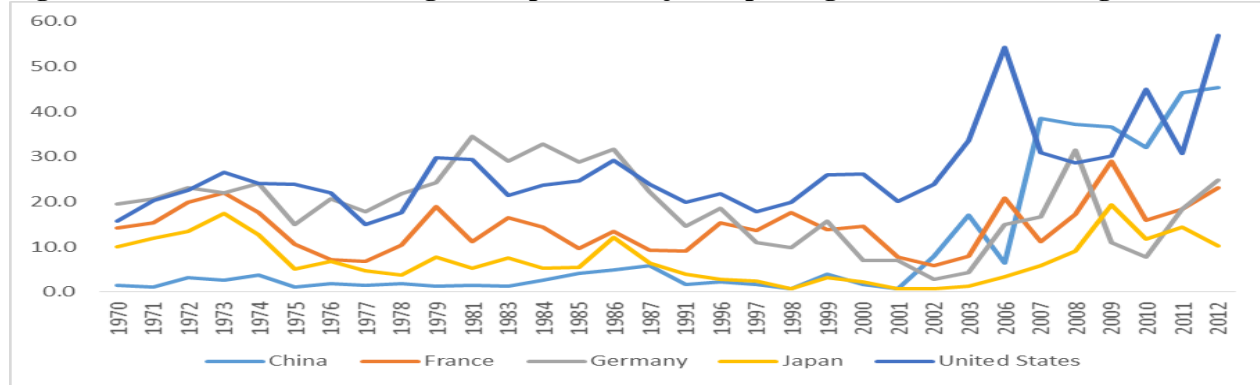**Figure 2: Major Importing Markets for Nigeria's Products (Percentage)**

Figure 3: Number of Products Nigeria Export to Major Importing Countries (Percentage of Total).

Source: World Integrated Trade Solution (WITS) Database (2014)

The dominance of United States among the buyers of Nigeria export is evident in Figure 2. Although the share of the country in Nigeria's exports declined to 16.9 in 2012, it was about 40 per cent between 1977 and 2008. Germany and France have been the other major buyers of Nigeria's exports since 1970. The two countries received quite substantial part of Nigeria's export between 1970 and 2012, except that that of Germany declined considerably from 1999 to 2012. For China, her trade relation with Nigeria got a boost in the last two decades. Nigeria's export to China remained below 1 per cent of Nigeria's export to the world between 1970 and 2012, except 1999 and 2009. Nigeria's export that was purchased in Japan also increase between 1970 and 2012, the share of total remained very small.

It is pertinent also to describe the number of products Nigeria exports to the various major importing countries. Presented in Figure 3 is the number of products Nigeria exported to the selected trade partners between the periods 1970 to 2012. Available data from COMTRADE showed that out of 1300 products tradeable in the 4-digit Standard International Trade Classification (SITC). The number of products Nigeria exported between 1970 and 2012 ranged between 73 and 410. In terms of country share, United States imported 15.8 per cent of Nigeria's products in 1970 this has increased to 57.0 per cent in 2012.

3.1 Methodology

3.1.1 Measurement of the Extent of Export Survival

The length of trade relationships can be examined using survival analysis techniques. Survival or duration methods were initially applied in medical and biological research to study the effect of certain independent variables on the occurrence of an event. Today duration models are also applied in labour economics, development economics and very recently in trade economics with the analysis of the duration of export activity. Hazard rate and hazard ratios are at the heart of this type of analysis. The hazard rate h(t) is the ratio of the probability of failure to the probability of survival. The non-parametric Kaplan-Meier estimator[2] will be used to estimate export survival and hazard for Nigeria.

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[2] For detailed analysis of Kaplan-Meier estimator (see Fugazza and Molina, 2011)

3.1.2 Model Specification and Estimation Techniques

Drawing from Rauch-Watson Model and Breton et al. (2004), the factors considered in examining the hazard rate of export duration include: Language, initial export value, and exchange rate, distance, GDP per capita, colonial ties, total export, competition, and tariff. There is a large family of survival models that can be used for continuous or discrete time cases. We use the semi-parametric Cox (1972) model. This type of model has the advantage that it does not require the specification of the distribution of the duration dependency and it is therefore appropriate to assess the impact of explanatory variables on the hazard rate. The hazard rate in the Cox model is given in equation (1)

$$h_i(t) = h_0(t)e^{\beta' x_i} \qquad (1)$$

where $h_0(t)$ is the baseline hazard function, which in the Cox model is assumed to be unknown and left unparametrized, x_i is a vector of covariates representing the characteristics of individual i, β is a vector of coefficients, accounting for the effect that those characteristics. By taking the natural logarithm, we obtain the additive log-linear model to be estimated:

$$\log\left(\frac{h_i(t)}{h_0(t)}\right) = \beta' x_i \qquad (2)$$

Table 2: Variable Sources and Definitions

Variables	Definition
Distance	ln of the trade value in first year of spell
Common Language	ln of the distance between most populated city in km
GDP Per capita	In US PPP for the 1970-2012 period
Total Export	ln of total exports of the exporter
Colony	dummy, 1 if exporter is a former colony of importer
Initial Value of Trade	ln of the trade value in first year of spell
Competition	Average number of countries that export product X, over the spell
Tariffs	Weighted applied tariff from the database
Exchange Rate	Exchange rate between exporter and importer

The estimates of the covariates in Cox models are obtained by the estimation of the partial likelihood. In our case since the data shows ties i.e. proper to non-continuous cases, the partial likelihood can only be approximated. As for the interpretation of the exponentiated coefficients, a value larger than one indicates a positive effect on the hazard rate, while a value between zero and one implies a negative effect on this latter. A value equal to one means the covariate does not have any effect on the hazard rate.

Brenton et al (2010) provided strong evidence for the failure of the proportional hazard assumption in trade data. This was based on the formal statistical testing procedure of the PH assumption within the Cox model is based on residuals derived by Schoenfeld (1982). This underscore the need to proceed to estimate a model that would address the issue of unobserved heterogeneity that is associated with the Cox model. As recommended by Brenton et al (2010), the alternative is Prentice-Gloeckler (1978), which is a discrete time equivalent of the continuous time

proportional hazards model. The Prentice Gloeckler model is an interesting complement to the Cox model as both estimators make no assumption about the shape of the baseline hazard. For suitably re-organized data in export flow-period format, its log-likelihood function is the same as the log-likelihood function for a generalized linear model of the binomial family with complementary log-log link (Brenton et al, 2010). If unobserved heterogeneity is assumed to take a multiplicative form, the hazard function can be expressed as:

$$\lambda_t(t) = \theta_i \lambda_0(t) \exp(z_i(t)'\beta)$$

θ_i is an unobserved random variable that is assumed to be independent of the $z_i(t)$, the vector of covariates for flow i. Maximum likelihood estimates of the parameter vector and baseline hazard can be obtained by conditioning the likelihood function on θi and then integrating over the distribution of θ. This approach requires specifying a distribution function for θ.

4. Empirical Analysis

4.1 Extent of Nigeria's Export Survival in Major Markets

The first objective of this study was to examine the extent of export survival of Nigeria's products in her biggest markets, which include: United State, Germany, France, China, and Japan. The result from the Kaplan-Meier estimator showed that the rate of export survival of Nigeria is low. For instance, 49.4% of Nigeria's export survives for more than one year. Moreover, 37.8% of the country's export survives for up to 10 years. The percentage of the country's export that survives a 20 years period is 26.2%. Only 15.2% of the exports survive 30 years period, while not more than 4.5% survive a 42 years period.

Figure 4: Survival Rates of Nigeria's Exports in Her Major Markets (%)
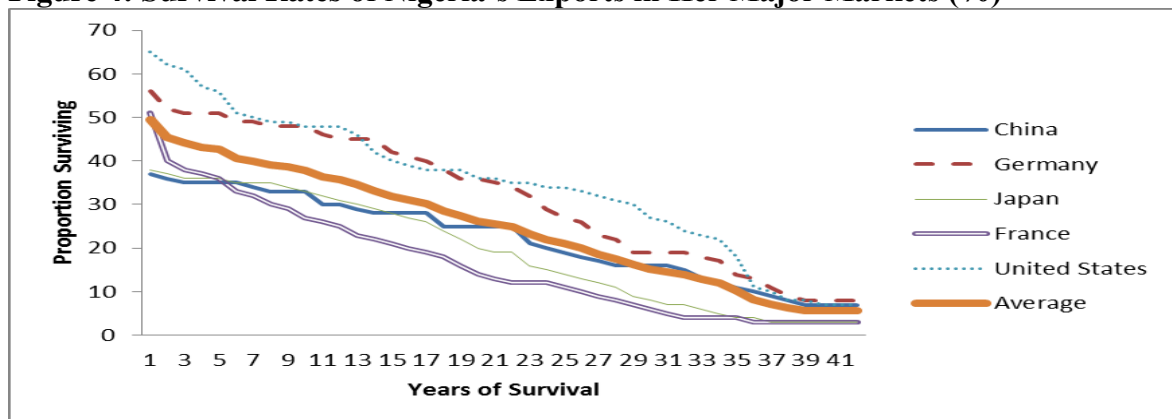
Source: Authors Computation

On individual country basis, Nigeria's exports survive in United States than the other countries. Specifically, Up to 65% of products Nigeria exports to United States survive more than one year. About 48% of the country's export survives United State market for ten years. As much as 36% of survive 20 years period, although, only 4% of them survives United States market 41 years.

Among Nigeria's highest trade partners, it is in China the Nigeria has the lowest survival rate for her exports. 37% of Nigeria's export survives the first year of trade relation. The country's export

6

survival rate after a decade is 33% but it declined to 7% in the 42 years period. The survival rate of Nigeria's export in Japan is also low, it is 38% in the first year, drops to 33% in the tenth year and 3% in the 42th year. Although 56 and 51 per cent of Nigeria's exports survives Germany and France markets respectively after the first year, while it drops to 48% in the 10th year in Germany, it reduced to 27% in France in the same period. There was further reduction in Nigeria's export in the survival in Germany and France to 8% and 3% respectively after a period of 42 years. That implies that Nigeria's export survive more in Germany than France.

4.2 Determinants of Nigeria's Export Survival in Major Markets

Table 3 presented the results of both the Cox (1972) PH Model and Prentice-Gloeckler estimated for the determinants of export survival in Nigeria. Despite the differences in the two methods that were used for estimation, the results were similarly. A value lower than one indicates that the effect of changes in the covariate on the hazard rate is negative (lower values of the covariate decrease the hazard rate). A value larger that one indicates that the effect of changes in the covariate on the hazard rate is positive (higher values of the covariate increase the hazard rate). The estimated coefficient of distance, usually used to proxy trade cost has the expected impact. Expressed differently, distance reduces the survival rate of Nigeria export with the trade partners. This negative impact of distance on Nigeria's export survival supports the findings of Jun and Kangning (2012).

The impact of common language on Nigeria's export survival is negative and significant. This implies that language reduces the hazards rate export of Nigeria, this supports the findings of Brenton (2010). UNCTAD (2011) however reported positive relationship between language and export hazards. For GDP per capita, the positive value indicates that it increases Nigeria's export hazard rate in major markets.

Table 3: Estimates of the Cox (1972) PH Model and the

		Cox (1972) PH		Prentice-Gloeckler	
Variables		Exp(b)	P-Value	Exp(b)	P-Value
Distance		1.5619	0.0007	1.7182	0.0000
Common Language		0.7018	0.0021	0.6717	0.0000
GDP Per capita		1.3071	0.0000	1.0412	0.0000
Total Export		1.4310	0.0000	1.0342	0.0000
Colony		1.8639	0.0081	1.2908	0.0000
Initial Value of Trade		0.9736	0.5921	0.8912	0.0000
Competition		1.9182	0.0000	1.7832	0.0000
Tariffs		1.0481	0.0000	1.1067	0.0001
Exchange Rate		0.0529	0.0000	0.1092	0.0004
Stratification by Product					
Log Likelihood		6,043			
No of Spells		4,0518			
No. of Failures		2,0672			
Gamma Variance	Exp(b)			0.398	
	P-Value			0.000	
LR Test	Chi2			45321	
	P-Value			0.001	

Colonial ties have positive impact on Nigeria's export hazard rate in the highest export markets. That is, it causes Nigeria's export hazard rate to increase. The fact that colonial ties increases the hazard rate of Nigeria's export is contrary to the previous findings of Besedes and Prusa (2006a) and Blyde (2008). This is plausible since Britain that colonise Nigeria is not among the highest trade partners. Total export is also found to increase Nigeria's export hazard rate, as indicated by the positive value of the impact of the variable. The result buttresses the fact that over 90 present of Nigeria's export is concentrated in single product, and hence may discourage the survival of other products.

Initial value of export has insignificant impact in the Cox (1972) PH Model, however, the variable have negative significant impact on export hazard rate in Nigeria based on the Prentice-Gloeckler model. This shows that initial value of export reduces the hazard rate of export. This is consistent with the Rauch-Watson Model which proposed that the length of a trade relationship is positively correlated with the initial amount of the transaction. Competition and tariff both have positive sign on Nigeria's export hazard rate. This result indicates that the quality of Nigeria's export is not high enough to enhance survival. Tariff is also found to discourage countries from continued patronage. Overvalued exchange rate is capable of discouraging export; our result shows negative value of the impact of exchange rate. Export survival of Nigeria is enhanced as Nigeria devalues her currency against dollar.

5. Conclusion Remarks and Recommendations

Trade duration (along with its determinants) has been most of the time overlooked in both theoretical and empirical literature, especially in the developing countries. This is in spite of the importance of the length of trade intensive margin. It is in view of this that the examine extent and drivers of export survival of Nigeria's products in her biggest markets (United State, Germany, France, China, and Japan) was examined. While the non-parametric Kaplan-Meier estimator was used to examine the extent of Nigeria's export survival in her major destinations, the Cox proportional hazards model and Prentice-Gloeckler were employed to estimate the determinants of export hazard rate in Nigeria.

Results show that the survival rate of Nigeria's export in the major markets has been low. Based on the average, 49.4% of Nigeria's export survives for more than one year in the selected countries, 37.8% survives for up to 10 years, and only 4.5% survives a 42 years period. It was also reported that Nigeria's export survive more in United States with 65% survival rate after a year and 7% after 42 years. The survival rate of Nigeria's export is lowest in Japan and China. As regards the determinants of export survival, Language, initial export value, and exchange rate are the factors that promote the survival of Nigeria's export, while distance, GDP per capita, colonial ties, total export, competition, and Tariff discourages it.

The results of this study throw up some policy variables that should be improved if the export of Nigeria is to survive more in international markets. Non competiveness of Nigeria's export suggests that the quality of products being exported be enhanced. For instance, farmers could be supported with improved seeds, storage facilities and others. Products with potential export should be given preferential access to inputs, credits, insurance. Tariff policies should be reviewed with special consideration to products with high export potentials.

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