IJEM
International Journal of Economics and Management
Journal homepage: http://www.ijem.upm.edu.my

The Export Survival of Malaysia's Processed Food

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ABSTRACT

Furthering future growth for the food processing industry in Malaysia faces multiple challenges, an area in which a recent trend shows the competitiveness of the exported processed food industry is declining. The sustainability of export flow is found to be a critical factor for long-term export growth. This paper provides empirical evidence on the survival pattern of Malaysia's processed food exports. The Kaplan-Meier technique is used in this paper to estimate the export survival time and rate of 128 processed food products at 31 export destinations for the period between 2000 and 2017. The findings show that food exporters face a high risk of failure in the initial years of exporting. At the aggregate level, the median survival time of processed food exports is two years, which means that 50% of export relationships face failure by the second year of exporting. The chances of export survival differ in terms of product groups and export destinations. This study also found that a higher initial export value increases the success rate of export survival.

JEL Classification: C41, F10, F14
Keywords: Export duration; Survival analysis; Export dynamic; Kaplan-Meier technique

Article history:
Received: 17 February 2020
Accepted: 24 August 2020

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INTRODUCTION

Sustaining exportation competitiveness is important for long-term economic growth, especially for a country that has a small and open economy like Malaysia. In an influential paper, Besedeš and Prusa (2011) showed that long-term trade growth hinges upon the sustainability of trade flow. This highlights the concept of export survival, which measures the ability of countries to sustain an export relationship over time as an important aspect of export competitiveness. Greater competitive pressure following increased regional integration and trade liberalisation underscores the importance of export survival for the long-term growth of the processed food industry. At present, studies on the export survival in Malaysia's processed food industry is limited. Export survival analysis, which is also known as export duration is critical to study to assist in formulating policies and strategies for targeted export promotion as well as mitigating risk involved in exporting. Therefore, this study aims to estimate the export survival of the processed food industry using the Kaplan-Meier technique. This study will be beneficial for exporters, policymakers, and financiers alike.

The food processing[1] industry plays an essential role in Malaysia, both in ensuring an adequate food supply and nutrition to the general population as well as a source of national income. The continuous rise of global food demand provides a vital impetus for growth in the processed food industry. Since the year 2000, processed food exports recorded a buoyant growth of 9.7% per annum. The importance of processed food exportation is considered in the increasing share of processed food in merchandise exports from 4.1% in 2000 to 9.0% in 2017. The export of processed food from Malaysia is concentrated in intermediate products, which accounted for 75% vis-à-vis consumer products at 25%. This contrasts with the world's export of processed food, which showed a concentration in products for household consumption.

At the domestic front, the industry was the third-highest contributor for the manufacturing sector at RM224 billion in terms of gross output and accounted for 11.9% of the manufacturing value added in 2017 (2011: 11.7%). The largest contributor in the food processing industry is palm oil manufacturing, which contributed 46.0% value-added and 64.8% gross output to the industry. The Economic Census 2016 reported that more than 97% of 8,500 companies involved in food processing were small-medium enterprises (SMEs) with a contribution of 49% to the industry value added (DOSM, 2017). More than 270 thousand workers are employed with RM7.3 billion in total salaries and wages. Generally, the food processing industry is domestic-oriented as reflected by its lower export intensity at 35% compared to an average of 53% for the manufacturing sector in 2015. Despite this, the number of firms involved in exporting increased almost three times from 475 firms in 2010 to 1,352 firms in 2015.

However, even with the positive growth, the industry faces various challenges like lower productivity vis-à-vis other manufacturing industries and weakening export competitiveness. In 2017, the average value added per worker of the food processing industry was RM119,081 (2015: RM111,392), which is lower than the average productivity of the manufacturing sector at RM132,758 (2015: RM121,330). In addition, Malaysia's market share at selected export markets has shown a plateauing or declining trend as in Appendix 1. Given the dominance of palm oil in processed foods exports, the declining trend is largely attributed to the depressing price of palm oil which reduced by 100% to RM1,900 at the end of 2018 from a high of RM3,800 in early 2011. The reduction in Malaysia's market share of processed food is most pronounced in China and North America. Moreover, the market share of processed food exports for household consumption has only increased marginally, indicating continuous weakness in export competitiveness for this product segment.

Theoretical literatures points to the firm heterogeneity model to explain export survival in the international market. The model suggests that productive firms that can afford the sunk costs and surpasses the productivity threshold are more likely to survive in the export market than less productive firms (Tybout, 1996; Melitz, 2003; Chaney, 2008). However, the firm heterogeneity model argues for longer duration of trade in line with sunk cost hysteresis (Baldwin, 1989; Roberts and Tybout, 1997; Besedes and Blyde, 2010). Another model that was highlighted to have explanatory power in explaining the trade relationship is the search-cost theory introduced by Rauch and Watson (2003). Besedeš and Prusa (2006b), who based their study on the model showed the trade relationship as starting with a large initial transaction or differentiated

[1] The American Society for Nutrition defines food processing as "the alteration of food from when they are harvested to better preserve them and feed consumers" (Weaver, C. M., Dwyer, J., Fulgoni, 2014).

products having a better chance to survive in the international market. Therefore, the contrasting findings in empirical literature on export survival where a short duration of exports are observed cannot be fully explained by the current theoretical model (Brenton et al. , 2010 ; Hess and Persson, 2011; Stirbat et al., 2015).

Empirical literature on export survival indicate that trade flow on average is short-lived mostly between one to three years (Besedeš and Prusa, 2006a; Nitsch, 2009; Hess and Persson, 2010; Brenton et al., 2010). Besedeš and Prusa (2011) showed that whether a country does better than others in long-run export growth depends more on its export survival rather than propensity to start new relationship. Using country-product combinations, Besedeš and Prusa (2006) uncovered a negative duration dependence where the probability of export failure decreases after it survives the first few years.

Various factors can affect export survival. The level of development in a particular region, product characteristics, size of exports, and cost incurred in exporting are among the factors that affects trade duration (Fugazza and Molina, 2011). Developed countries have more success in maintaining their export relationships compared to developing countries, of which developing countries tend to have a shorter export duration (Besedeš and Prusa 2011; Fugazza and Molina, 2011). From a regional perspective, the export survival rate of countries in Latin America is found to be lower than other parts of the world (Besedes and Blyde, 2010). The duration of exports among least developed countries (LDCs) is found to be mainly affected by their comparative advantages where the survival rates for products whose content do not reflect the countries' comparative advantage decreases overtime (Nicita, Shirotori and Tumurchudur, 2013).

From a product characteristic perspective, more sophisticated products are found to have greater staying power in the international market as the duration of exports increases with innovation (Chen, 2012). In addition, the difference between a new export and previous export basket play a significant role in determining survival rates (Goya and Zahler, 2017). Brenton et al. (2010) found that experience with exporting the same products to other markets or different products to the same market increases the chance of export survival. This supports the 'learning by exporting' hypothesis. Contrastingly, another study found that export diversification in both product and markets increase the chances of surviving in international markets (Volpe Martincus and Carballo, 2009)

Export survival for agri-food trade is associated with the importing country's development status, region it belongs to, product processing degree, exportation experience, and geographical space between the trading partner (Tian, Li, Yao and Huang, 2014). In the same study, China's newly established trade relationship was found to be brief and only if it reaches the four-year mark that it can be sustained and contribute to long-term export growth. An interesting finding from Dongwen Tian et al. (2014) is that the effect of learning by exporting in agri-food trade could not be supported as the likelihood to fail when the re-entering market is higher compared to the first time it enters market. According to the authors, once an agri-food trade relationship fails, exporters re-entering the market will face more difficulties to explore novel marketing strategies than before and trade related technical measures become increasingly stringent. In another study, the export survival of agricultural products also hinges on level of financial development (Jaud, Kukenova and Strieborny, 2015). Moreover, market integration influences the export survival rate positively for agriculture and food products (Bojnec and Ferto, 2012).

At the firm level, evidence in the United States shows that firms start and stop exporting at different productivity levels, with exporters exiting at a productivity level one-third below the productivity level at which they start exporting (Bernard et al., 2007). In Malaysia, new exporters were found to be more productive than surviving exporters and non-exporters, and firms that exited the export market were less productive than the surviving exporters (Dogan, Wong and Yap, 2011). In addition, the chances of firms to survive in the exports market is found to be positively associated with the ratio of sunk to fixed cost, more diversified products and firm network effects (Albornoz et al., 2016; Martuscelli and Varella, 2018).

METHODOLOGY

Most literature on export survival undertake analysis either through country-product pairing or at the firm level. Besedeš and Prusa, (2006) in their seminal paper on trade duration as well as Nitsch (2007) used country-product combinations at different levels of product aggregation. Past studies often used the non-

parametric techniques based on the Kaplan-Meier technique to investigate export survival rates (Besedeš and Prusa, 2006b; Nitsch, 2007; Brenton et al.; 2010; Tian et al., 2014; Fugazza and Molina, 2011). To estimate export duration or survival time, this study will use the Kaplan-Meier technique. According to Wooldridge (2002), survival or modern duration analysis puts a key emphasis on the hazard function. The hazard function allows for an approximation of the probability to exit the initial state and is used in this study to approximate the elasticity of the covariates for survival. The hazard function is given as follows:

$$h(t_i) = Pr\ (T = t_i \mid T \geq t_i = p(t_i)/(St_i - 1))\ \ where\ \ i = 1; 2; \ldots; n;$$

The survival function S_t is defined as the cumulative probability of surviving up to some point at time *t*, and T denotes time to failure event for a particular trade flow. The term T is a discrete random variable that takes values t_i, with a probability density function $p(t_i)$= Pr (T= t_i), I =1, 2, . . ., n, where $t_1 < t_2 < \ldots < t_n$. The survival function is defined as follows:

$$St = \Pr(T > t) = \sum p(t_i)$$

The survival and hazard functions are related through the following expression:

$$St = \prod[1 - h(ti)]$$

The survival and hazard functions can be estimated by assuming there is *n* independent observations denoted (t_i, c_i), i= 1, 2, . . ., *n*, where t_i is the survival time and c_i is the censoring indicator variable C of observation i. If failure occurs, c_i takes on a value of 1 and 0 otherwise. It is assumed there are m $\leq$ n recorded times of failure. The Kaplan-Meier (KM) product limit estimator of the survival and hazard functions are:

$$\hat{S}(t) = \frac{n_{i-}\ d_i}{n_i}$$

$$\hat{h}(t) = \frac{d_i}{n_i}$$

where t(1) < t(2) < ... < t(m) denotes the rank-ordered survival times. Whereas, n_i denotes the number of subjects at risk of failing at *t(i)*, and *di* is the number of observed failures.

The export survival analysis requires to first define a country-product pairing as an export trade relationship. In this study, export relationship is defined as the annual export of processed food products from Malaysia to another country. Next is to transform each annual export data into the duration of exports, which indicates the length of time that an export relationship exists without a break. Some export relationship may last without a break, known as single spells. However, some relationship may experience several breaks known as multiple spells. Survival analysis either treats multiple spells as several independent relationships or recognises the first spell of export duration as its sole survival function. Besedeš and Prusa (2006) found that the overall spell lengths distribution under the two scenarios are similar. For this study, multiple spells are treated as several independent export relationships.

DATA AND EMPIRICAL RESULTS

Data Description

This paper uses a panel dataset of 32 countries, including Malaysia and all its FTA partners (bilateral and regional) as well as other top 30 destinations for its processed food product exports spanning across all continents over a period of 18 years from 2000 to 2017. Exports data is obtained from the United Nations Commodity Trade Statistics Database (UN COMTRADE). The definition of processed food uses the standard product in Standard International Trade Classification (SITC- Revision 3) at level 5 and is individually correlated to the Broad Economic Category (BEC) category of processed food products. Specifically, the study analysed 128 products under certain product groups, namely processed meat products, processed fish, dairy products, preserved fruits, vegetables and nuts, flour and cereal, sugar and confectionary, beverage, coffee extracts, cocoa, tea and spices, other food preparations, as well as oils and fats.

Descriptive Statistics

The full sample contains 71,424 country-product pairings, of which 40,371 paired with zero value are subsequently dropped from the analysis. Thus, a total of 31,053 country-product pairs are used in the benchmark estimation. About 6.2% of the remaining data was right censored, while left censoring was ignored. The summary of the descriptive statistics for the survival analysis of processed food exports are as follows:

Table 1 Summary Statistics for Survival Analysis

Variable	No. of observations	Mean	Standard deviation	Min	Max
Benchmark: no cut-off limit for initial export value					
Country-product pairs (ijk)	31,053	-	-	11,000*	311,160*
Spells	47,638	1.847	1.039	1	6
Duration	6,210	4.800	5.600	1	18
Right Censored	1,950	0.062	0.163	0	1
Larger initial export value					
1) More than USD 25,000					
Country-product pairs (ijk)	23,127	-	-	11,000	311,160
Spells	33,692	1.457	0.759	1	6
Duration	4,435	11.630	6.325	1	18
Right Censored	1,781	0.077	0.251	0	1
2) More than USD 50,000					
Country-product pairs (ijk)	20,591	-	-	11,000	311,160
Spells	29,583	1.437	0.730	1	6
Duration (year)	3,877	11.586	6.242	1	18
Right Censored	1,434	0.069	0.255	0	1
3) More than USD 100,000					
Country-product pairs (ijk)	17,691	-	-	11,000*	311,160*
Spells	24,811	1.402	0.692	1	5
Duration	3,208	11.681	6.126	1	18
Right Censored	1, 247	0.070	0.256	0	1

Note: * Represents codes for the country-product pairings

Kaplan-Meier Survival Estimates

The event of interest in this study is an exit from the export market, which is defined as occurring in the year when there is no export value reported or when exports registered a zero value, this represents the benchmark estimation for this study. Between 2000 and 2017, exports of processed food products to 31 countries in the sample underwent multiple spells of up to six spells. In Table 2, the median survival time for aggregate processed food exports flow is two years, which means that 50% of export flow is estimated to fail by the second year. Similarly, the median export survival time or duration for processed food (excluding oils and fats) and oil and fats products also recorded a short duration of two years. However, cereals and flour products, other food preparations, and beverages showed a much longer median export survival time of 3, 6, and 7 years, respectively. The 75th percentile of survival time for aggregate processed food and processed food (excluding oils and fats) could not be estimated due to censoring. However, for oils and fats by the 10th year, 75% of export flow is estimated to fail. This means that only 25% of export relationships are expected to reach beyond 10 years duration. Figure 1 shows the export flow of the three product groups, namely cereals and flour, other food preparations, and beverage have better export duration compared with other product groups.

Table 2 Export Survival Time by Products

	Survival Time (Years)		
	25%	50%	75%
Processed Food	**1**	**2**	**.**[#]
Processed Food (excl. Oils and Fats)	**1**	**2**	**.**[#]
Meat Products	1	2	5
Dairy	1	2	8
Fish products	1	2	13
Cereals and flour	1	2	.[#]
Veg., fruits and nuts	1	2	7
Sugar and confectionary	1	2	13
Coffee, tea, cocoa and spices	1	3	.[#]
Other food preparations	1	6	.[#]
Beverage	2	7	.[#]
Oils and fats	**1**	**2**	**10**

Note: [#] Missing value is due to censoring. By the end of the study, 75% of the subjects in these groups have not experienced a failure, and the 75th percentile cannot be estimated.

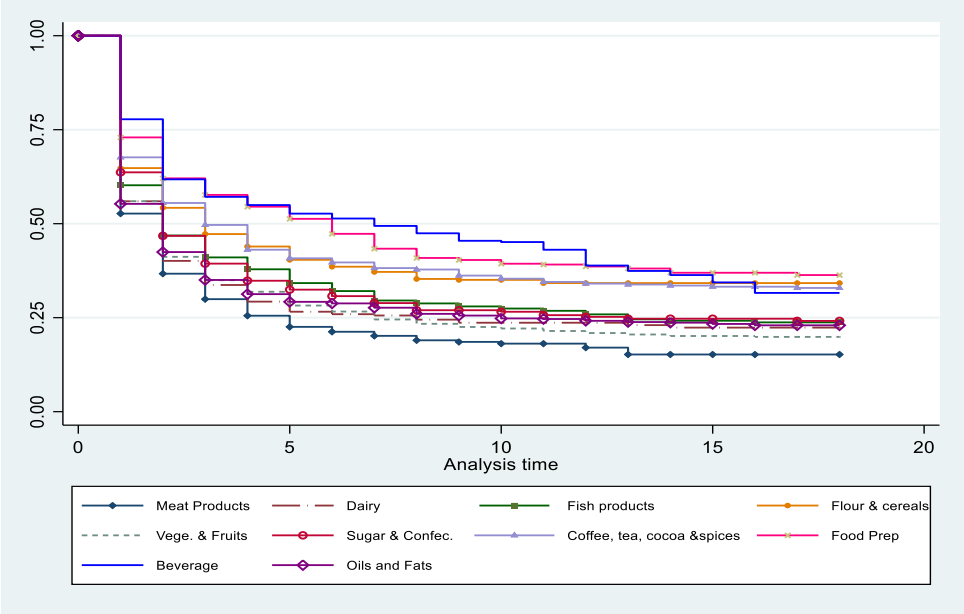

Figure 1 Kaplan-Meier Survival Estimate: Processed Food Export Survival by Product Groups

The survival rate of all processed food exports in the first year is 0.62 and 0.48 in the second year as shown in Table 3. This indicates that about 52% of export failure occurs after the second year. In the 5th year, 35% of bilateral export flow survived and in the 10th and 15th year, the survival rates reduced to 0.29 and 0.26, respectively. The products that exceeded the average survival rate of 0.62 in the first year are cereals and flour, sugar and confectionary, coffee, cocoa, tea and spices, other food preparations, and beverage products. Furthermore, the highest survival rate in the 15th year is other food preparations.

Table 3 Estimated Export Survival Rate by Products

	Median Duration (Years)	Estimate KM Survival Rate				
		1st	2nd	5th	10th	15th
Processed Food	**2**	**0.62**	**0.48**	**0.35**	**0.29**	**0.26**
Processed Food (excl. Oils and Fats)	**2**	**0.63**	**0.49**	**0.36**	**0.30**	**0.27**
Meat Products	2	0.53	0.37	0.23	0.18	0.15
Dairy	2	0.56	0.40	0.27	0.24	0.22
Fish products	2	0.60	0.47	0.34	0.27	0.24
Cereals and flour	3	0.65	0.54	0.40	0.35	0.34
Veg., fruits and nuts	2	0.56	0.41	0.28	0.22	0.20
Sugar and confectionary	2	0.64	0.47	0.32	0.27	0.23
Coffee, tea, cocoa and spices	2	0.68	0.56	0.41	0.36	0.33
Other food preparations	6	0.73	0.62	0.51	0.39	0.37
Beverage	7	0.78	0.62	0.53	0.45	0.34
Oils and fats	**2**	**0.55**	**0.42**	**0.29**	**0.25**	**0.23**

In terms of export destination, the exports of processed food have better survival time in the ASEAN and East Asia Pacific (EAP) regions. The median duration survival time for the ASEAN market is 4 years and 2 years in the EAP region. In both regions, the 75th percentile could not be estimated due to censoring since more than 25% did not experience failure. Table 4 shows that persistence of export survival time for processed food is the least in Africa and South America.

Table 4: Export Survival Time by Market Destination

	Survival Time (Years)		
	25%	50%	75%
ASEAN	**1**	**4**	**.**
Singapore	3	.#	.#
Indonesia	1	6	.#
Thailand	1	4	.#
Vietnam	1	2	.#
Philippines	1	5	.#
Brunei	2	5	.#
Myanmar	1	2	16
Cambodia	1	2	11
East Asia Pacific	**1**	**2**	**.**
Indian Sub-continent	**1**	**2**	**15**
North America	**1**	**2**	**7**
South America	**1**	**2**	**4**
Europe	**1**	**2**	**7**
Middle East	**1**	**2**	**9**
Africa	**1**	**2**	**5**

Note: # Missing value is due to censoring. By the end of the study, 25% of the subjects in these groups have not experienced a failure, and the 75th percentile cannot be estimated.

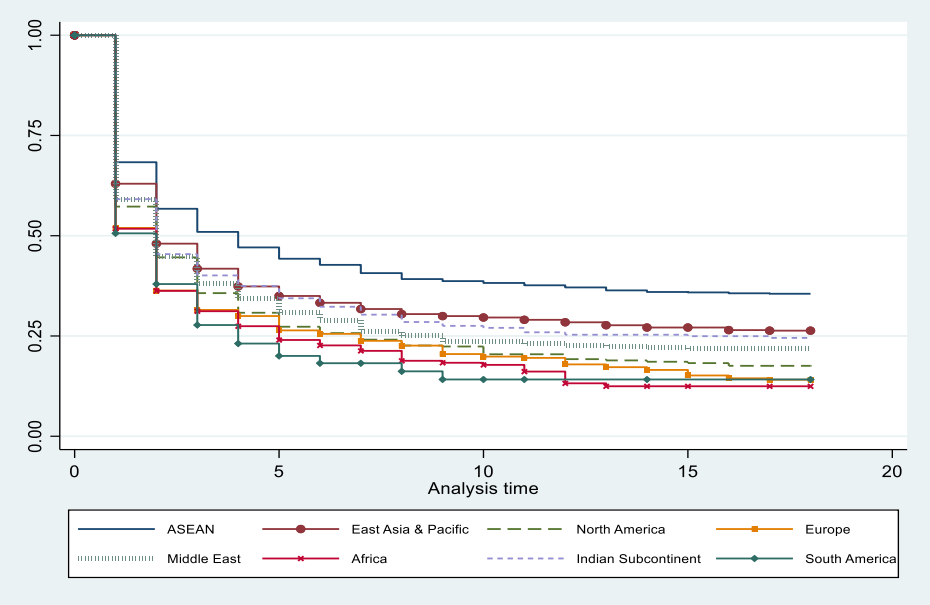

Figure 2 Kaplan-Meier Survival Estimate: Export Survival by Importer Region

The above estimation result is a benchmark case undertaken without setting any minimum limits for initial value of exports. According to the literature, a larger initial value of exports will increase the export survival time and rate. Therefore, to investigate the impact of a higher initial value of export, this study sets the initial export value at USD25000, USD50000 and USD100000. The results show that the median survival time for aggregate processed food increased to 3 years when the initial export value is set to the specified limit as shown in Table 5.

Table 5 Kaplan Meier Survival Rate for Higher Initial Export Value

	Median Duration (Years)	Estimate KM Survival Rate				
		1st	2nd	5th	10th	15th
Benchmark						
Processed Food	**2**	0.62	0.48	0.35	0.29	0.26
Processed Food (excl. Oils and Fats)	**2**	0.63	0.49	0.36	0.30	0.27
Oils and fats	**2**	0.55	0.42	0.29	0.25	0.23
Higher Initial Export Value						
1) More than USD25,000						
Processed Food	**3**	0.64	0.52	0.39	0.32	0.30
Processed Food (excl. Oils and Fats)	**3**	0.66	0.53	0.41	0.33	0.31
Oils and fats	**2**	0.57	0.45	0.32	0.27	0.26
2) More than USD50,000						
Processed Food	**3**	0.66	0.54	0.41	0.34	0.32
Processed Food (excl. Oils and Fats)	**3**	0.66	0.55	0.42	0.34	0.32
Oils and fats	**2**	0.60	0.48	0.35	0.31	0.30
3) More than USD100,000						
Processed Food	**3**	0.67	0.55	0.44	0.35	0.34
Processed Food (excl. Oils and Fats)	**4**	0.68	0.56	0.45	0.36	0.34
Oils and fats	**3**	0.60	0.50	0.40	0.34	0.32

Overall, the estimation results support the notion that a higher initial export value increases the chances of survival. The median survival time increased by one year as compared to the benchmark median survival time when the initial export value for processed food, excluding oils and fats was increased to USD25,000 and USD50,000. However, the median survival time remained unchanged for oils and fats products. For an initial value higher than USD100,000, the median survival time increased two years compared with the benchmark median survival time for processed food, excluding oils and fats. Meanwhile, the median survival time for oils and fats product group increased by one year compared with the benchmark when the initial export value was raised to USD100,000. This indicates that exports of oils and fats needs a much higher initial value of exports compared with non-oil processed food to improve its success in the international market.

CONCLUSION

In summary, the food processing industry faces multiple challenges in achieving future growth, specifically from the aspect productivity as well as export competitiveness. Given the importance of the industry to the manufacturing sector, it is imperative that these challenges be addressed for the industry to grow further in the long-term.

This study confirms previous literature findings that the median export duration is short, where firms face a high risk of exit in the early years of exporting. A higher initial value of exports was found to reduce the risk of exiting from the market indicating that bigger firms can sustain export growth in the long-term. Firms in certain industries, namely beverage, sugar and confectionary, coffee, tea, cocoa and spices, as well as other food preparations have a better chance at surviving in export markets compared with other industries. In terms of export destination, Malaysia's export of processed food fare better in the Asian market compared to other markets.

The findings from this study have important implications for Malaysian entrepreneurs and policy makers. The results can assist entrepreneurs in the food processing industry to assess the risk in exporting to the international market from the aspect of export destination and initial value of exports. Policy makers should enhance strategies that are targeted at improving access to foreign markets and providing export infrastructure to reduce firms' persistence cost in foreign markets. Government export assistance schemes for SMEs particularly should also be focused on supporting new exporters in their starting period up to at least two years as opposed to only being involved in the creation of new exporters.

An important limitation of the KM technique is that it is a univariate analysis, which does not allow for analysis of survival and other variables of interest. Therefore, further analysis should be undertaken using models like the Cox-Proportional Hazard Model and discrete time models to ascertain the determinants of export survival. Another limitation of this study is that this research is based on secondary data. Future research should be undertaken using primary data to give a more accurate assessment on entry and exit time of firms in export markets.

ACKNOWLEDGEMENT

This study was funded by the university's grant from University Putra Malaysia (GP-IPB/2017/9542300).

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