Tourism Business Adaption to Survive the Coronavirus Disease-2019 Pandemic in Thailand

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Abstract. The tourism industry is a service sector playing a significant role in the Thai economy, accounting for 11 percent of the total revenue generated domestically before the coronavirus 2019 pandemic (COVID-19). Unfortunately, since some COVID-19 countermeasures like lockdowns and travel restrictions have drastically reduced the number of tourists, this revenue continuously diminishes. Consequently, many tourism-related businesses and activities could not survive through the circumstances. The present research aims to investigate the supporting and inhibiting factors of tourism business survival during the coronavirus pandemic, firstly, using the Cox proportional hazards model. Then, the Kaplan-Meier estimator is employed to estimate the businesses' survival probability of individual significant parameter across survival periods. The results reveal that the survivability of a tourism-related establishment mainly depends on firm's characteristics such as business type, location, fixed assets, and net income. Meanwhile, such business and employment strategies as social distancing practice, laying off part-time employees. and operating without working-hour reduction can ameliorate the business's survivability. Furthermore, domestic-tourist targeting enterprises appear to contribute to high survivability similar to the exporting and importing components in their supply chain. Among various government financial relief measures, the reduction of contribution of employers to the Social Security Fund is found to be a supporting factor for business survivability. However, some debt-relieving measures worsen the probability of business survival. Lastly, the survival probability paths over the studied period from the Kaplan-Meier estimation show that any business adaptation including government support should be promptly employed within the first six months or at the latest within a year of this epidemic event to increase the survivability.

Keywords: Business survival · Tourism · Coronavirus pandemic · Cox proportional hazards model, Thailand

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1 Introduction

The tourism sector in Thailand possesses a considerable potential for development into a global tourism hub. The top 10 visiting and earnings from tourism countries report by the United Nations World Tourism Organization (UNWTO) demonstrates the potential of Thailand's tourism industry to be more outstanding than other countries in the ASEAN region [1]. The tourism industry as a service sector had played a significant role in the Thai economy until the arrival of COVID-19 because its revenue in 2019 (2 trillion baht) accounts for 11 percent of the Thai GDP. Unfortunately, this revenue is likely to diminish (6.1 hundred billion baht) with the estimated foreign tourist numbers below five hundred thousand in 2020–2021 [2]. In Thailand, several enterprises are involved in the tourism industry, including hotel business, travel agencies, tour guides, transportation, food retail, beverage, souvenirs, entertainment, nature and rural tourism, etc. Therefore, the sustained expansion of the tourism industry will essentially contribute to the continuous growth of other business sectors. However, Thailand's tourism still faces a bunch of issues, most notably a decline in tourism revenue due to the coronavirus pandemic.

The announcement of the presence of the coronavirus pandemic in January 2020 triggered tremendous economic turmoil, particularly in developing countries, as well as the failure of numerous firms around the world [3]. Thailand's economy also has received a severe impact like other nations. The tourism sector especially has witnessed an unprecedented contraction since the implementation of complete country lockdown and travel restriction measures around the middle of 2020. Many business establishments have permanently closed since they could not overcome the economic contractions brought about by these radical measures [4]. However, some tourism-related enterprises can survive through the COVID crisis with their adaptation strategies and operational characteristics. In Thailand, the government has formulated several economic stimulus policies and countermeasures against the severe spread of the coronavirus to restore the economic health that has been devastated by the pandemic. The easing of the country's lockdown, the We Travel Together scheme, the Half-Half project, and the provision of extended public holidays have all been developed as part of its economic stimulus initiatives to encourage spending and domestic tourism. Besides, if the coronavirus pandemic scenario has subsided along with the recovery of the tourism sector, the government must promptly restructure the tourism sector in order to accommodate the new normal behavior of tourists. Especially, tourism entrepreneurs will have to adjust their business strategies to reflect the shifting traveler preferences around the globe, emphasizing health and hygiene, avoiding crowds, and concentrating more on niche travel than mass travel.

Therefore, a study of the surviving tourism entrepreneurs along with the failed ones during the coronavirus pandemic will serve as a guide for improving business competitiveness. Previous studies have demonstrated the significant effects of the coronavirus pandemic in several aspects, such as on society, the economy, and the environment. Furthermore, many studies suggest that financial performance [5], resilience strategies and innovation [6], and geographic location

[7] should be factors in assessing the coronavirus pandemic impact on the social enterprise. According to Shafi et al. [8], most companies were impacted by the crisis severely and were struggling with many challenges, including mounting debt, a tightened supply chain, declining demand, and profit loss. Likewise, Huynh et al. [9] found that the degree of the business downturn from the coronavirus impact differed among the different tourism enterprise types. Ma and Gao [10] explain that government policies can indirectly lessen the pandemic impact on SMEs. However, the direct influence of the pandemic on the market is the most noteworthy. Furthermore, Gregurec et al. [11] reveal that several countries have implemented lockdown measures and halted corporate operations to prevent the spread of coronavirus. Numerous enterprises are thus temporarily suspended or permanently shut down.

In this study, we focus on studying the probability of business failure given significant risk factors such as firm's characteristics, ongoing crisis-related business adaption, target customer, supply chain, employment, and government support policies. These factors are essential for developing and modifying appropriate policies to support the businesses during this crisis. To accomplish the goal, the Cox proportional hazards model [12] and the nonparametric Kaplan-Meier estimator [13] are used in the survival study of the Thai tourism-related enterprises. Overall, our results can provide specific guidance for tourism businesses and the government on methods for strengthening the survival probability of the businesses of interest and how to deal with the negative impact of the pandemic during the COVID-19 situation.

The remainder of this study is structured as follows: Sect. 2 gives details on the methodology, Sect. 3 describes the data used, Sect. 4 presents the empirical findings, and Sect. 5 provides the conclusion and policy implications.

2 Methodology

This section provides a background on the two-step approach used in the study. First, we discuss the theory underlying Cox proportional hazards modeling and survival analysis in general. The Cox proportional hazards model is considered to be particularly effective at identifying the risk factors affecting the probability of a Thai firm 's survival. Since we cannot directly interpret the coefficient estimates from this Cox model, hazard ratios (HR) of each coefficient are computed. Second, the firm's probability of surviving for the coming 12 months is then investigated, considering the influence of individual variables. The firm's survival path can be obtained and illustrated by using the nonparametric Kaplan-Meier estimator [12].

2.1 Survival and Hazard Functions

Let the survival time T be a random variable with cumulative distribution function $P(t) = \Pr(T \leq t)$, and probability density function $p(t) = dP(t)/dt$. The survival function is the complement of the distribution function, $S(t) =$

$\Pr(T > t) = 1 - P(t)$. And the relationship between $S(t)$ and $h(t)$ the hazard function, which estimates the sudden risk of failure at time t, is expressed by:

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr[(t \leq T < t + \Delta t) | T \geq t]}{\Delta t} = \frac{f(t)}{S(t)} \tag{1}$$

where $f(t) = d(S(t))/d(t)$ is the probability density of failure at time t. This implies that

$$h(t) = \frac{dS(t)/d(t)}{S(t)} = \frac{d}{dt}(-\log S(t)), \tag{2}$$

or equivalently,

$$S(t) = e^{-H(t)}, \tag{3}$$

where $H(t)$ is the cumulative hazard function. This function indicates the probability that an individual will experience an event (for example, death or bankruptcy) within a considered time period [14].

2.2 The Cox Proportional Hazards Model

Survival analysis typically addresses the relationship of the survival distribution with covariates. The simplest way to examine this relationship is the linear regression specification.

$$\log h_i(t) = \alpha(t) + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_k x_{ik}, \tag{4}$$

or, again equivalently,

$$h_i(t) = h_0(t) \exp(\beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_k x_{ik}), \tag{5}$$

where $h_i(t)$ is the conditional hazard function of continuous random variable. Briefly, the hazard function can be interpreted as the failure of business i and the survival time t. If business i could not survive during the crisis, h_i is given as 1, otherwise $h_i = 0$. k is the number of independent variables, β_i are the partial regression coefficients, x_i are the independent variable of individual observation i, $h_0(t)$ is the hazard baseline. If the value of β_i is greater than zero, or equivalently a hazard ratio greater than one, it indicates that the event's hazard increases, and the length of survival will decrease. we illustrate the concept in Fig. 1

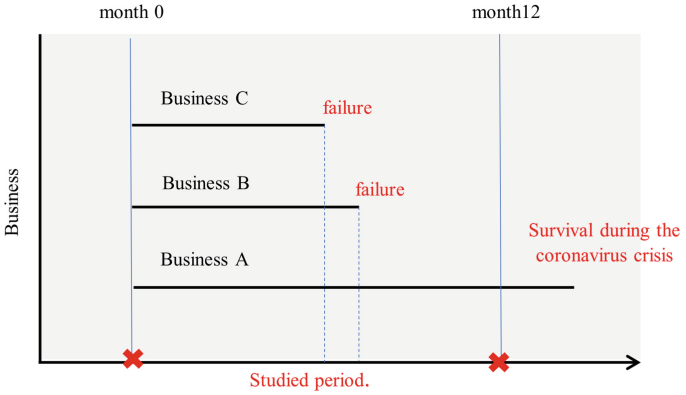

Fig. 1. The illustration of business survivability

2.3 Kaplan-Meier Estimator

The Kaplan-Meier estimation is one of the most popular methods of computing survival over time conditional on the predictor. Specifically, only one predictor is considered by the Kaplan-Meier estimate to construct the survival curve, which is defined as the probability of surviving over a specified period. This estimator is a nonparametric one with a few restrictions [15] and the properties that both the event of interest and the study period are clearly defined, and the survival probability of all businesses and the censored observations is the same. In our analysis, only significant factors obtained from the Cox regression are used to illustrate the survival probability predicting curve during this coronavirus crisis by the Kaplan-Meier estimator.

3 Data Specification

This study examines the survivability factors of Thai tourism enterprises during the coronavirus pandemic using a survey derived from part of the Asia Foundation's revisiting the pandemic project. The project gathered new information on the state of the Thai tourism enterprises during the coronavirus pandemic in December 2021. The survey also collects information on six different aspects of the Thai tourism business, including firm's characteristics, ongoing crisis-related business adaption, target customer, supply chain, employment, and government support policies. These aspects are considered independent variables in the study. Information concerning each part is displayed in Table 1. The survey samples include 400 Thai tourism-serving firms collected equally from Thailand's four major geographic regions: the North, Northeast, Central, and South. However, there are differences in the sample distribution per province within each area. To determine the economic survival probability of Thai tourism businesses, information related to the survival period is required to assess the possibility that the establishments will remain in operation economically if Thailand has another

year of the coronavirus crisis. The definitions of the variables used in this study are presented in Table 1. Note that the average is presented for continuous variables while corresponding percentages (%) are used for others. According to Table 1, we observe that percentage of non-survival businesses from this crisis is 33.5%, while the survival period average is 9.2 months.

Considering the independent variables, the majority 24.00% of the tourism-serving establishments are of the food and beverage type, and the least in number is the transportation type with 8.25%. Most of the firms surveyed, 42.25%, indicated earning net income between THB 1-5 million, while 36.75% had total fixed assets of THB 3-10 million, and 62.75% operated on Rent/Lease business premises. Furthermore, 93.50% of the businesses under study reported facing a business revenue loss by 54.53% as the result of the coronavirus pandemic.

In terms of business adaptation, more than 60% of the tourism-related firms currently operate as usual with regular working hours, while 41.00% operate with shortened working hours during the first wave of coronavirus in March 2020. For the business employment factor, we find that tourism businesses have an average of 44.97 persons for full-time employees and 11.75 persons for part-time employees. To survive this wave of crisis, 46.5% of the businesses laid off their employees. 23.25% reduced working hours to minimize the layoff of employees, and 24.75% continued doing everything as usual. If we look at the number of layoffs due to the coronavirus pandemic, the average is 10.26, 8.06, and 1.27 persons in the category of permanent employee, part-time employee, and expected laid-off employee in the next two months. respectively. Interestingly, less than half of the tourism businesses had logistics and supply chains components involving importing or exporting goods or services. In other words, most tourism-related establishments play a significant role in employment and the local economy of Thailand.

In the case of government support policies, the measure to reduce contributions to the Social Security Fund for employees and employers was most popularly participated by the tourism related businesses followed by the measures to stimulate domestic tourism by adding benefits for registrants of the "We travel together" scheme.

4 Empirical Results

4.1 Estimation Results of the Cox Proportional Hazards Model

Table 2 presents the obtained coefficients from the Cox regression model using the non-penalized method. Unfortunately, we cannot directly interpret the coefficients because each independent variable's effect on the business failure varies. Therefore, the exponential is used for converting these coefficients into hazard ratios. If the hazard ratio value is greater than 1, the factor will explicitly result in a lower survival probability for the business than the reference group. Contrarily, the hazard ratio value below 1 indicates that the factor increases the survival probability of the business compared with the reference group [16].

Table 1. Descriptive statistics

Variable	Description	Percentage
Dependent variable: Survival data		
Business failure	Business failure within 12 months	33.50
	Business survives more than 12 months	66.50
Economic survival duration	Number of month that business can operate	9.20
Independent variable: Fundamental business factors		
Types of business related to tourism sector	Hotel / accommodations	21.25
	Transportation	8.25
	Souvenir	20.50
	Food and beverage	24.00
	Travel agency / tour guide	17.50
	Other business in tourism sector	8.50
Total fixed assets	Total fixed assets less than THB 3 million	13.00
	Total fixed assets THB 3–10 million	36.75
	Total fixed assets THB 11–20 million	26.25
	Total fixed assets more than THB 20 million	24.00
Net income (Annual)	Net income less than THB 1 million	7.75
	Net income THB 1–5 million	42.25
	Net income THB 6–10 million	30.50
	Net income more than THB 10 million	19.50
Location of business	Central region	25.00
	Eastern region	25.00
	Northern region	25.00
	Southern region	25.00
Business premises	Does not have/ use a business premises	11.00
	Rent/Lease a business premises	62.75
	Own a business premises	26.25
Decreased revenue/income change	The percentage change in the business's revenue during the coronavirus pandemic. Decreased revenue change is presented by a positive value.	54.53*
Independent variable: Epidemic and business adaptation factors		
Perceiving the risks of the coronavirus impact	Perceiving the risks of the coronavirus impact of entrepreneur is divided into 5 levels of awareness.	3.31*
The current operation of a business	Open as usual and regular working hours	68.50
	Open with shortened working hours and days	25.00
	Not accepting customers but the employees are still working such as work from home and delivery.	4.00
	The firm is closed and has not yet reopened	2.50
The operation of a business during the first wave of the coronavirus pandemic in March 2020	Open as usual and regular working hours	26.25
	Open with shortened working hours and days	41.00
	Not accepting customers but the employees are still working such as work from home and delivery	32.75
Business model change from the coronavirus pandemic.	Operate while adapting to social distancing	74.00
	Move into new products and services that have high demand during the coronavirus pandemic	43.25
	Operate through online markets or social media	64.50
	Discussed with employees to reduce their salary to keep all employees	23.50
	No adaption	13.00

(*continued*)

Table 1. (*continued*)

Variable	Description	Percentage
Independent variable: Employment factors		
Number of employees	Full-time employees	44.97*
	Part-time employees	11.75*
Dismissal of employees	Number of laid-off permanent employees	10.26*
	Number of laid-off part time employees	8.06*
	Number of employees expected to be laid off in the next 2 months	1.27*
Labor Management	Reduced working hours to lower the unemployment rate	23.25
	Doing everything as usual	24.75
	Lay off employees (Part/All)	46.50
	Temporarily closed	5.50
Independent variable: Target market factor		
Target customer	Domestic tourists' ratio	62.31*
Change in the number of tourists	At the same level as before the coronavirus pandemic	0.50
	Less than 25% reduction	7.50
	Reduced by about 25–50%	46.50
	Decreased by more than 50%	43.00
	No domestic tourists	1.00
	Increased more than usual	1.50
Independent variable: Logistics and Supply Chain Factors		
Import/Export of goods and services	Import	15.25
	Export	7.75
	Import and export	12.00
	No import and export	65.00
Independent variable: government support policies		
Government support policies during the pandemic	Low-interest loan measures, Soft Loan, 2% interest, and a 6-month moratorium on debt.	11.75
	Tax deductible measure for businesses that still employ all employees.	11.75
	Measures to reduce contributions to the Social Security Fund for employees and employers	64.50
	Relaxation measure for personal and business tax filing	26.25
	Measures to reduce withholding tax rates from services	23.50
	Measures to extend the period of payment of income taxes (such as VAT) and excise taxes	19.00
	Measures to stimulate domestic tourism by adding benefits for registrants "We travel together"	57.25
	Not participating in any project	11.50

Note: The star (*) indicates the average value of continuous variable.

We present the estimated coefficients with their hazard ratios in Table 2. Our results reveal that the fundamental characteristics factors of a tourism business consisted of business type, total fixed assets, net profit (per year), business location, business premises (region), and percent change in revenue statistically significantly impacted the probability of business survival. The food and beverage

business type gets the most negative impact on business failure corresponding to the hazard ratio of 0.0944, indicating that the food and beverage business has the lowest risk of non-survival than other business types. Less total fixed assets businesses are less prone to failure than those with more. According to Table 2, findings show that total fixed assets of less than 3 million baht and between 3 to 10 million baht have a negative impact on the failure of a business, with hazard ratios of 0.2479 and 0.5862, respectively. On the other hand, lower annual net income businesses appear to have a higher possibility of failure. As expressed in Table 2, businesses with net incomes of less than 1 million baht and between 1 and 5 million baht have a failure possibility of 8.1390 and 3.1040 times, respectively, compared to more than those 10-million-baht net income businesses. Furthermore, businesses in the South have a negative impact on business failure corresponding to the hazard ratio of 0.4388, indicating a lower risk of non-survival than those in the Central region. Furthermore, a decrease in revenue of a business by 1% worsens the business's survival probability by 3.70%.

Concerning business strategies factors for surviving the pandemic, we find that if the perceived risks of the coronavirus impact increase 1 level, its non-survival probability increases by 2.0803 times, indicating accurate risk awareness of the business. Therefore, the government can employ this factor as an indicator to monitor high-risk businesses and then effectively provide them support or help. Moreover, adapting the business model to accommodate social distancing leads to an increase in the possibility of survivability by 59.62%.

We then discover that increasing the number of laid-off part-time employees ameliorates the business's survival probability. The higher number of laid-off results in survival probability increase by 5.55%, corresponding to the hazard ratio of 0.9450. Moreover, the regular operation using employees without working hours reduction also increases the business survival probability by 74.84%.

In terms of target market factors, we find a negative effect of the domestic visitors' proportion on business survivability as 1 level of domestic tourist ratio growth can increase a firm's possibility of survival by 30.87%. On the other hand, a decrease in the number of tourists by more than a quarter can severely worsen the business's survival probability with a hazard ratio of more than 9.8340 compared to a normal situation. Furthermore, the result shows that exporting and importing in business supply chain and logistics have a greater probability of surviving 92.33% (0.0767 hazard ratio) than those without these actions.

Lastly, we observe that two government-supporting policies are the key risk factors affecting the survival of Thai tourism-related enterprises. First, the debt-involving measures, comprised of Low-interest loans, Soft Loan, 2% interest, and a 6-month moratorium on debt measures, decisively worsen the probability of business survival, with a hazard ratio of 6.8636 compared to not participating in the scheme. As a result, these measures can slow down the business bankruptcy but might not help business to survive over the long term. On the contrary,

reduction of contributions to the Social Security Fund is a supporting factor of a business's survival by decisively increasing the probability of survivability by about 74.37% compared to not participating in this scheme.

Table 2. Results of the Cox regression model

Variable	Coefficient		Hazard ratio	SE	Z	MBF
Fundamental business factors						
Business type						
Hotel	-1.6857	**	0.1853	0.6793	-2.482	0.0460
Transportation	-0.6822		0.5055	0.7207	-0.947	0.6389
Souvenir	-1.9746	**	0.1388	0.8467	-2.332	0.0659
Food and beverage	-2.3597	***	0.0944	0.8287	-2.848	0.0174
Travel agency	-1.5809	**	0.2058	0.7072	-2.235	0.0822
Total fixed assets						
Less than 3 million baht	-1.3950	***	0.2479	0.2492	-5.597	0.0001
3-10 million baht	-0.5341	**	0.5862	0.1889	-2.827	0.0184
11-20 million baht	0.1468		1.1580	0.2059	0.713	0.7756
Net income (Annual)						
Less than 1 million baht	2.0970	***	8.1390	0.6327	3.314	0.0041
1-5 million baht	1.1330	**	3.1040	0.5545	2.043	0.1240
6-10 million baht	0.6272		1.8720	0.5321	1.179	0.4992
Business location (Region)						
Northern region	0.1030		1.1085	0.3958	0.260	0.9667
Eastern region	-0.0641		0.9379	0.4825	-0.133	0.9912
Southern region	-0.8238	*	0.4388	0.4066	-2.026	0.1284
Business premises						
Rent/Lease a business premises	1.3030	*	3.6810	0.6136	2.124	0.1049
Own a business premises	1.8060	**	6.0860	0.5696	3.171	0.0066
Decreased revenue/income change (%)	0.0361	***	1.0370	0.0103	3.493	0.0022
Epidemic and business adaptation factors						
Perceiving the risks of coronavirus impact (5 level)	0.7325	*	2.0803	0.3386	2.163	0.0963
The current operation of a business						
Open as usual and regular working hours	0.1358		1.1454	1.2465	0.109	0.9941
Open with shortened working hours and days	0.5955		1.8140	1.2522	0.476	0.8931
Not accepting customers but the employees are still working such as work from home and delivery.	0.7715		2.1630	1.4568	0.530	0.8692
The business operation during the first wave						
Open as usual and regular working hours	0.0361		1.0367	0.4863	0.074	0.9972
Open with shortened working hours and days	0.6362	*	1.8893	0.3150	2.020	0.1301
Business model change from the coronavirus pandemic						
Operate while adapting to social distancing	-0.5172	**	0.5962	0.1804	-2.866	0.0164
Move into new products and services that have high demand during the coronavirus pandemic	-0.1447		0.8653	0.1811	-0.799	0.7267
Operate through online markets or social media	-0.1280		0.8799	0.1832	-0.698	0.7834
Discussed with employees to reduce their salary to keep all employees	0.1338		1.1430	0.2134	0.627	0.8216

(*continued*)

Table 2. (*continued*)

Variable	Coefficient		Hazard ratio	SE	Z	MBF
Employment factors						
Number of employees						
Full-time employees	-0.0037		0.9963	0.0044	-0.838	0.7022
Part-time employees	0.0373	*	1.0380	0.0175	2.128	0.1032
Labor Management						
Reduced working hours to lower the unemployment rate	0.1129		1.1200	0.6731	0.168	0.9860
Doing everything as usual.	-1.3800	*	0.2516	0.7674	-1.798	0.1985
Lay off employees (Part/All)	-0.4284		0.6515	0.6384	-0.671	0.7984
Dismissal of employees						
Number of laid-off permanent employees.	0.0101		1.0101	0.0185	0.545	0.8615
Number of laid-off part time employees.	-0.0571	*	0.9445	0.0298	-1.913	0.1595
Number of employees expected to be laid off in the next 2 months.	0.0097		1.0097	0.0225	0.431	0.9113
Target market factor						
Target customer						
Domestic tourists' ratio	-0.3691	**	0.6913	0.1281	-2.881	0.0157
Change in the number of tourists						
Less than 25% reduction	1.6781		5.3555	1.2547	1.337	0.4089
Reduced by about 25-50%	2.2858	**	9.8340	1.0561	2.164	0.0961
Decreased by more than 50%	2.6165	**	13.6878	0.9768	2.679	0.0277
Logistics and Supply Chain Factors						
Import	-0.8983		0.4072	0.5523	-1.426	0.3314
Export	0.1855		1.2038	0.7406	0.251	0.9691
Import and export	-2.5682	**	0.0767	0.9537	-2.693	0.0266
Government supporting policies factor						
Low-interest loan measures, Soft Loan, 2% interest, and a 6-month moratorium on debt.	1.9262	***	6.8636	0.5292	3.640	0.0013
Tax deductible measure for businesses that still employ all employees.	-0.3166		0.7286	0.4756	-0.666	0.8013
Measures to reduce contributions to the Social Security Fund for employees and employers	-1.3616	***	0.2563	0.3937	-3.458	0.0025
Relaxation measure for personal and business tax filing	0.5853	.	1.7955	0.3338	1.453	0.3350
Measures to reduce withholding tax rates from services	-0.4701		0.6249	0.3526	-1.333	0.4112
Measures to extend the period of payment of income taxes (such as VAT) and excise taxes	-0.7115		0.4909	0.4460	-1.495	0.3601
Measures to stimulate domestic tourism by adding benefits for registrants "We travel together"	0.3892		1.4758	0.3881	1.003	0.6048
Not participating in any project	0.5341		1.7060	0.4749	1.125	0.5313

Note: The minimum Bayes factor (MBF) value provides the strength of evidence against the null hypothesis. It is the smallest possible Bayes factor for the point null hypothesis against the alternative within the specified class of alternatives [17]. ***, **, and * denote MBF, by 0.0001-0.01 MBF is decisive evidence, 0.01-0.1 is strong evidence, and 0.1-0.33 is moderate evidence rejecting the null hypothesis, respectively

4.2 Survival Path Analysis

This subsection presents an illustration of the survival probability over time. Following the previous parts, we employ the Kaplan-Meier estimator to evaluate

the impact of the various individual variables on the tourism business's survival. Only significant factors proposed by the Cox regression model are considered for the survival path analysis. We then plot the survival probability of the significant factor over the period as shown in Fig. 2.

The survival probability for each significant factor is illustrated in Figs. 2, 3, 4, 5 and 6. Figure 2 shows the survival curves for various types of tourism-serving establishments with varying total fixed assets, net income, locations, and types of business premises. It can be observed that the survival path in all variables has a stair-shaped downward slope in the first six months and a horizontal slope until the twelfth month. Moreover, we observe that the survival probability drops sharply after the sixth month, especially in total fixed assets of less than 3-million-baht businesses, a net income of less than 1 million baht businesses, businesses in the northern region, rent/lease business premises, and transportation and hotel business types. Then, the survival probability again sharply drops after the twelfth month, particularly in the travel agency business. These imply that the fundamental factors influence the survival probability of the tourism business in various categories only in the first six months. Thus, business adaptation and government support should be implemented during the first six months, particularly in the northern region. Furthermore, the risk of the crisis becomes stronger in businesses with low total fixed assets and worsens in low-income businesses indicating that small businesses are the ones most affected by the crisis.

Figure 3 illustrates the survival probability of current business operations and their adaptation. The survival probability of a temporarily closed business is apparently lower than the other labor employment strategies. We also find that reducing working hours and keeping regular working hours are the best helpers for businesses to survive through the next 12 months. Meanwhile, businesses' adaptation to social distancing and switching to high-demand products and services give the highest survival probabilities at at 78.2% and 72.4%, respectively.

The survival probabilities of the labor-management factors are depicted in Fig. 4. We discover that the temporary closure will cause the business not able to survive through the following year. Furthermore, reducing working hours can result in a dramatic decline of survival probability in month six and the subsequent stability through month 12, showing that employment adaptation should be taken within the first six months. Moreover, labor-management as usual should be continued if the business would like to survive beyond 12 months, considering the highest survival probability at 89.90%.

Figure 5 depicts the survival probabilities of various types of import/export of goods and services business from the Kaplan-Meier estimator. The overall result is in harmony with that obtained from the Cox regression model. Figure 5 shows that businesses having both exporting and importing components in their supply chain have the highest probability of surviving with a rate of 95.83%, implying that more distribution channels can increase the business survivability.

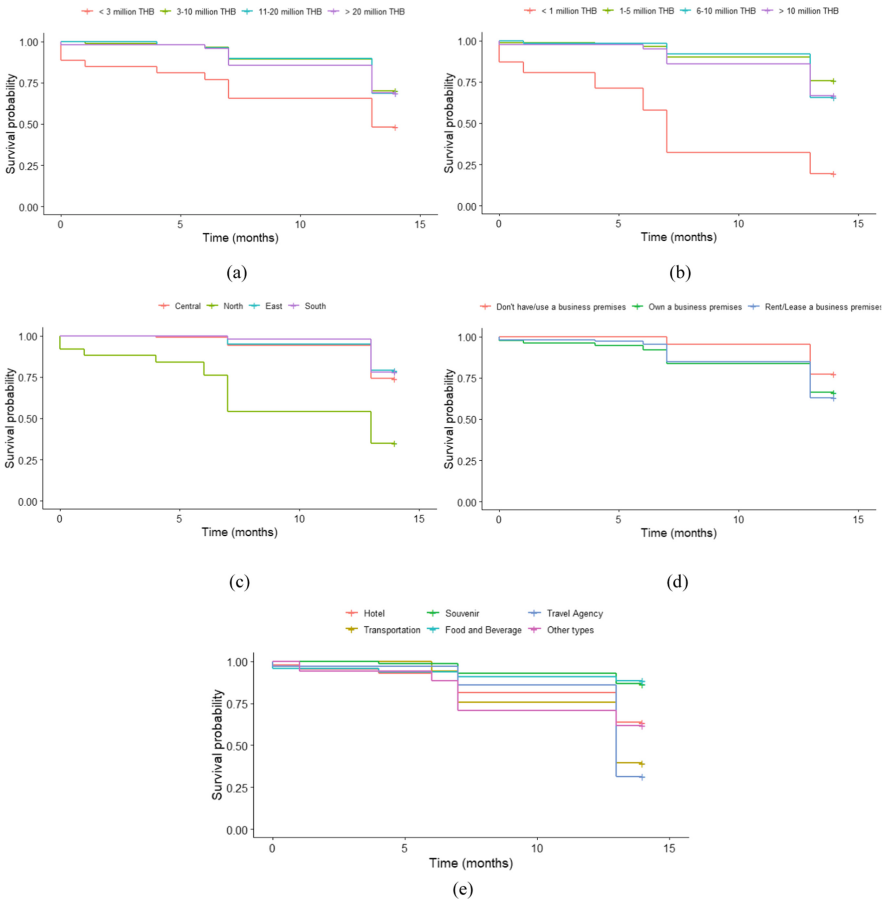

Fig. 2. Survival probability of tourism businesses in different total fixed assets(a), net income(b), regions(c), types of business premises (d), and business type (e)

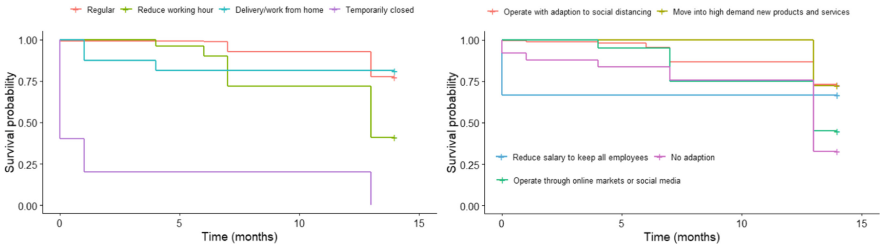

Fig. 3. Survival probability of tourism businesses in different current business operation (Left) and business adjustments (Right)

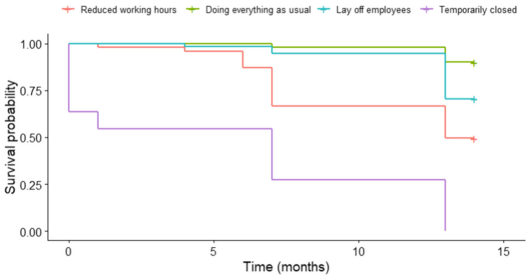

Fig. 4. Survival probability of tourism businesses in each labor management operation

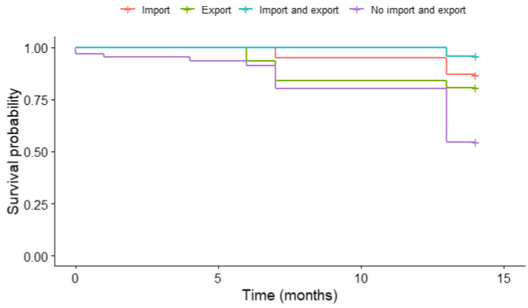

Fig. 5. Survival probability of tourism businesses in different types of import/export of goods and services

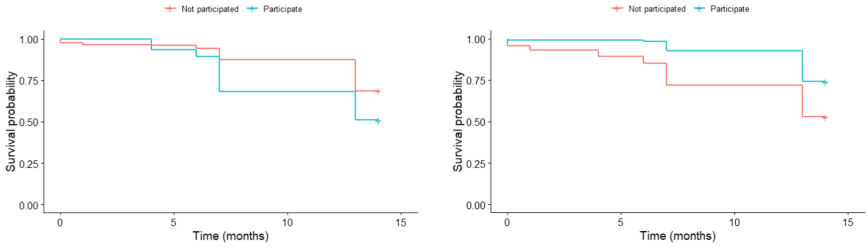

Fig. 6. Probability of survival of tourism businesses with participation in debt-related (Soft loan) measure (Left) and Social Security Fund contributions reduction measure (Right)

Unexpectedly, Fig. 6 reveals that those businesses participating in the debt-relieving measures have a survival probability after 12 months (51.1%) lower than their non-participant counterpart, indicating that while these financial relief measures, such as Low-interest loans, Soft Loan, 2% interest, and a 6-month moratorium on debt, help businesses to avoid bankruptcy in the short term, they might not help them to survive in the long run. Meanwhile, participating in the

Social Security Fund contribution reduction scheme can increase the probability of business survivability to 74.00%.

5 Conclusion

This research regards the presence of the coronavirus crisis as the major cause of aggravating business failure in Thailand, especially in the tourism sector. Since lockdowns and travel restrictions have drastically reduced the number of tourists, the tourism-related business establishments that rely heavily on tourists have seen a substantial decline in revenue [18]. Undeniably, a strong possibility that many businesses might collapse in the upcoming months or years provides a terrific opportunity to assess the resilience factors behind these companies. Thus, the key challenge in this research is to investigate the role of factors supporting and inhibiting the probability of tourism businesses surviving during the coronavirus pandemic. Our study focuses on six influencing factors comprising firm's characteristics, ongoing crisis-related business adaption, target customer, supply chain, employment, and government support policies. All data are obtained by interviewing 400 tourism businesses in Thailand. For the research methodology, we start with identifying the key risk factors of non-survival businesses using the Cox proportional hazards model. Then, we use the Kaplan-Meier estimator to estimate the businesses' survival probability of individual significant parameters across survival periods.

First, our regression findings reveal that the Food and Beverage business type has the lowest risk of non-survival because their products are an essential part of daily life demand all the time. The fewer total fixed assets, the lesser of failure, indicating high business adaptability from having the low sunk cost. Businesses in the Southern region have a lower risk of non-survival than those in the Central. Undoubtedly, lower annual net income businesses appear to have a high probability of failure just like a decrease in revenue can worsen the business's survival probability. These results imply that having less liquidity might not be sufficient for the operation in a crisis. In business strategy factors, we find that businesses can accurately perceive the risk of failure. Therefore, this business risk self-awareness can be used as an indicator to monitor high-risk businesses for effective provision of government support. Additionally, a business model with social distancing can increase the possibility of survivability. For employment, an increase in the number of laid-off part-time employees and operation without working hours' reduction ameliorate the business's survival probability. In terms of target market factors, we discover that domestic tourist ratio growth and having both exporting and importing in the business supply chain can increase a firm's possibility of survival. Lastly, the debt-relieving measures worsen the probability of business survival, implying that these policies only slow down the bankruptcy but do not help the company to survive. On the contrary, the contribution reduction measure applied to the Social Security Fund can decisively increase the probability of survivability.

Second, the individual factors survival path analysis produced by the Kaplan-Meier estimator is consistent with the Cox regression results. Moreover, in terms

of the survival probability path over the year, all variables exhibit a stair-shaped downward slope in the first six months, followed by a dramatic decline, and then a horizontal stability through month 12, before a sharp drop. Figures 2-6 depict that all significant factors have a heterogeneous influence on the survival probability of the tourism business during the first six months and have a severe effect after the sixth month through twelfth. Thus, any business adaptation including government support should be promptly implemented within the first six months or at the latest within a year.

Lastly, this research data has certain limitations. We use the firm owner perspective to extrapolate business failure events. Hence, the survival probability might not accurately reflect the firm's insolvency. In other words, extrapolation and occurred results might not coincide. Therefore, using the actual data of business failure due to the coronavirus pandemic is intriguing for further study.

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