A TIMELY APPROACH TO ESTIMATE THE DEFAULT DISTANCE OF THAI LISTED FIRMS IN THE STOCK EXCHANGE OF THAILAND

By

Paniti Mongkonpathumrat

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Department of Economics

University of Virginia

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Advisor: Leland E. Farmer

Abstract

This paper is organized to present a timely model that can evaluate the risk of default for Thai companies listed in The Stock Exchange of Thailand (SET). The model derives the daily default distance as the measurement of the risk of default of companies listed in SET over time. Nine of the twelve default companies have their default distances below two at least two quarters before they default. The default distance in financials and property industry is particularly low in general due to their business nature. In conclusion, if the default distance of a specific listed company falls below two and the median of its sector with a decreasing trend, it means the company is running into the risk of default. With this model, investors and regulators can track the default distance daily. The investors can make a better decision on investment on that company and the Bank of Thailand, as a regulator, can formulate an appropriate policy sooner.

Contents

1 Introduction

The risk of default may be the biggest fear in a time of crisis. Recently, the default of Thai Airways, the national airline, in 2020 has led to a massive concern of the big wave of default in Thailand in the age of Covid-19 pandemic. In this paper, I am interested in creating a timely model that can track the daily default distances to determine the risk of default of Thai companies listed in The Stock Exchange of Thailand (SET).

I use the Black-Scholes-Merton (BSM) model to estimate the risk of default. The BSM model is a mathematical model for pricing an options contract (Hayes 2021). However, the concept of the call option is the same as the concept of default. Investors exercise a call option if the asset's market price (S) exceeds the strike price (K), or else the value of the option is zero since investors do not exercise the option. As a result, the value of that call option is the greater between S-K and 0. With the same concept, the shareholders of a firm with a firm value (V) and an amount of debt (D) will own the difference between the firm value and its debt (V-D) in the case of no default. However, if the firm's value is less than the value of its debt, the firm will default, and the shareholders will get nothing. As a result, the shareholders will receive the greater between V-D and 0. According to Merton (1974), I can apply this concept of the BSM model to create an adjusted model that calculates the default distance (DD), measuring the risk of default.

I adjusted model to be able to derive the default distance daily. Instead of using book values, I utilize the market cap as the measurement of the equity part of the firm value in the model. Although book values can accurately represent the firm value and the debt, the listed companies announce these numbers quarterly. With the market cap, calculated by the number of

outstanding shares multiplied by the stock price, the model can instead derive the default distance daily due to the frequency of the stock price.

I find some criteria for the default distances in the default cases indicating that a company has financial difficulty. For at least two quarters before the event of default, a default company usually has the default distance below two. The distance usually has a decreasing trend or stays low closer to two for a few years. Compared to its sector, the default distance is generally lower than the sector median distances. With these criteria, investors and regulators can notice the risk of default for each listed company sooner.

This model is a conservative approach when applied to Thai listed companies. Although it can reflect the financial difficulty and reasonably determine all the default cases, the model gives many warning signals to those companies that never default. The main reason is that stock price is an essential element in my model, and it fluctuates over time in the inefficient market of Thailand. Therefore, we should interpret the model with the context of each company, its sector, and the market.

2 Literature review

Although there are several ways to estimate the probability of default, I applied the Merton model to Thai companies because it is easy to interpret and compatible with the nature of Thai business. In Bandyopadhyay (2006), the author uses logistic regression to estimate the probability of default in India. In Altman (1968), the author uses discriminant analysis to model the credit risk. A couple of other ways to estimate the credit risk are Loss Given Default and Migration Risk (Dar and Anuradha 2017). However, the Merton model can give a financial explanation which is essential, especially for regulators such as the Bank of Thailand. In a

working paper of the Bank of Canada, Chang and Orosi (2016) also applies this model with equity option to study the probability of default. This model is composed of two parts: initial distance and the growth of that distance (Zieliński 2013). The central part of this model is the initial distance, and the second part is just the growth that compatible with the initial distance. Therefore, I can choose parameters that represent the firm value and the debt and correspond to the nature of Thai listed companies especially in the event of default.

Instead of calculating the probability of default, I used just the default distance to measure the risk of default. On the one hand, Bharath and Shumway (2008) suggests that the probability of default calculated by taking the minus default distance into cumulative distribution function of normal distribution is helpful for forecasting defaults. On the other hand, it requires the impractical assumption of the normal or lognormal distribution of assets to calculate that probability from the distance to default (Crosbie and Bohn 2003). Since the goal of the model is to send a warning signal when a company faces the risk of default, the default distance is enough to achieve the goal.

The existing literature on applying the Black-Scholes-Merton model to estimate the probability of default is broad. Still, the literature on adjusting with a high-frequency factor such as stock price is much narrower. In my model, I use the market cap to measure the equity part instead of book values generally used in previous literature. For example, in Dar, Anuradha, and Qadir (2019), the authors apply the Black-Scholes-Merton model to estimate the yearly probability of default of Jammu and Kashmir Bank, Indian Overseas Bank, Bank of Baroda, and Canara Bank from 2012 to 2016 by using book values. They use the book value of assets (total equity + debt) to measure the firm value. Although this market value of the firm's equity is volatile, this variable has a higher frequency than book values.

Instead of using the face value of the debt and the expected continuously compounded return on the value of the firm, I use the book value of current debts and the expected return on the stock price by CAPM. In practice, a firm will default if they cannot repay even just the current portion of the debt. Therefore, it is not practical to use the total debt in the model. Since the data of current debt is rarely provided, Zieliński (2013) uses the short-term debt plus half of the long-term debt instead of the total debt to make the model more practical. However, because of the data provided by the Bank of Thailand, I can use the current debt, mainly composed of the short-term debts and the current portion of long-term debts, in my model. I call the sum of this current debt and the firm's market cap that *implied asset value*. Since the number of shares outstanding and the debts are stable over time, the volatile part of the implied asset value mainly comes from the stock price. Therefore, it is reasonable to use the expected return on the stock price by CAPM to measure the expected continuously compounded return on the firm's value.

3 Model

$$\mathrm{DD} = \frac{\ln\left(\frac{V}{D}\right)+\left(r-\frac{1}{2}\sigma_V^2\right)T}{\sigma_V\sqrt{T}} \quad (1)\ \text{(Kenton 2020)}$$

Based on Merton's model (1), I use the implied asset value (A), the sum of the current debts and the firm's market cap, to replace the company's assets (V). As a result, I must use the volatility of these implied asset values (σ_A) instead of the volatility of stock returns (σ_V). I change the total debts (D) to the current debts (D_B) and use the expected return on the stock price by CAPM (μ_s) instead of risk-free interest rate (r) with the time period of one year ($T = 1$). Consequently, I get the following formula (2) for estimating the distance to default.

$$\mathrm{DD} = \frac{\ln\left(\frac{A}{D_B}\right)+\left(\mu_s-\frac{1}{2}\sigma_A^2\right)}{\sigma_A} \quad (2)$$

4 Background

Although the default can happen across several types of debts, it is most important to focus on the bond market due to cross default. The cross default is a provision in a bond contract that forces this unpaid bond to default if the borrower defaults on another bonds. Generally, in Thailand, cross-default is determined in the bond contract, but it does not appear in the other types of debts, such as the bill of exchange and promissory note (ThaiBMA 2017). This condition might exaggerate the effect of the default. Therefore, the default in the corporate bond market of Thailand has a significant effect on the country's financial market.

In Thailand, the corporate bond market is still mainly dominated by large issuers due to the small market size and the regulation. According to ThaiBMA (n.d.1), The Thai corporate bond market significantly developed after the Asian financial crisis in 1997. It grew from 3% of GDP in 1997 to around 25% of GDP in 2020. However, it is still tiny compared to the stock market and bank loan at 86% and 107% of GDP, respectively. In terms of regulation, according to the Bank of International Settlements' report, *Bond market regulation and supervision in Asia*, Thailand releases a new law which is more issuer-friendly for large borrowers in the bond market, but not for small borrowers (Eschweiler 2006). With this regulation, the Thai corporate bond market was reasonably secure after 1997.

It is rarer to find default in Thai listed companies, especially those listed in SET, due to Thai law. Typically, the trustee is a person who declares default when the conditions of the debentures that are deemed to be an agreement between the debenture issuer and the debenture holder are met. Although in practice, the default immediately occurs when the trustee declares it, it is a very long and unclear process of declaring an official default by Thai law (The Asian Development Bank 2012). Thai law is open for these practically defaulted companies to

negotiate with debenture holders and announce restructured on their debt. The companies can also submit the rehabilitation plan to reorganize the company instead of getting default and delisted immediately (Dharmniti 2020). Therefore, I count these kinds of companies as the default samples.

5 Methodology and Data

The Bank of Thailand provides the data of the daily closed stock price and the daily stock beta of 623 listed companies in SET from Jan 3, 2005, to Feb 10, 2021, and the number of share outstanding of these listed companies in SET from Mar 31, 2005, to Dec 31, 2020. With these two data sets, I can calculate the market cap of these companies daily. The Bank of Thailand also provides the daily one-year government bond yield from Jan 3, 2005, to Jan 11, 2021, the daily stock beta of these listed companies in SET from Jan 3, 2005, to Feb 10, 2021, and the daily SET index from Jan 4, 2005, to Feb 10, 2021. I use the one-year government bond yield and the one-year return on the SET index as the risk-free rate and market rate. With these three data sets, I can calculate the expected return by CAPM. Lastly, the Bank of Thailand provides the book value of current debts of these listed companies from Mar 31, 2005, to Dec 31, 2020. I sum up the current debts with the market cap and use it as implied asset value. Then, I calculate the volatility by the standard deviation of the log return of this implied asset value. lastly, I plug these data into formula (2) to create the default distance. As a result, only 555 companies have enough data to calculate their default distances.

It is difficult to collect all the companies that could be considered as default. In this paper, I, therefore, consider companies that had been in the process of either restructuring or reorganization as default. According to ThaiBMA (n.d.2), only nine companies listed in SET are restructured. According to efinanceThai (2020), only five listed companies in SET that can

complete the rehabilitation plan and comes back to the market during 2015-2020, and another 14 companies are still in the process of reorganization during the same period. Pace Development Corporation PCL. (PACE) and Apex Development PCL. (APEX) had been in both processes. As a result, there are 26 companies considered as default, and only 12 companies have enough data provided by the Bank of Thailand to calculate the default distances (Table 1). Therefore, I created a panel data table of defaults distances from May 2, 2007, to Jan 11, 2021, of 555 listed companies, 12 of which are the default cases.

Table 1: The listed companies in SET that used to reorganize or restructure and have enough data provided by the Bank of Thailand to calculate the default distances

Ticker	Company name	Announcement Date	Restructuring	Reorganization
PACE	Pace Development Corporation PCL.	June 29, 2020	✓	✓
PPPM	PP Prime PCL.	Feb 28, 2020	✓	
MIDA	Mida Assets PCL.	Apr 22, 2020	✓	
NUSA	Nusasiri PCL.	Apr 23, 2020	✓	
PSL	Precious Shipping PCL.	May 20, 2020	✓	
CWT	Chai Watana Tannery Group PCL.	May 25, 2020	✓	
CGD	Country Group Development PCL.	June 16, 2020	✓	
JCK	JCK International PCL.	Sep 11, 2020	✓	
BIG	Big Camera Corporation PCL.	Apr 25, 2008		✓
PK	Patkol PCL.	Oct 20, 2009		✓
THAI	Thai Airways International PCL.	Sep 14, 2020		✓
NOK	Nok Airlines PCL.	July 30, 2020		✓

Resource: ThaiBMA (n.d.2), efinanceThai (2020), Thai Airways International Public Co., Ltd. (2021), Big Camera Corporation PCL. (2015), Patkol PCL. (n.d.), and Nok Airlines PCL. (2020)

Since I have only 12 default companies, I focus more on these companies to find the criteria to determine the high probability of default. In this paper, I identify the date that the default distance of each company gets below the cutoff as the *warning date*, and I call the date that the company announces the event of restructuring or reorganization as the *default date*. I first look at the warning dates of each defaulting company in history, with the graph showing the movement of the default distance. This first step aims to find a low enough threshold for which the default distance can be interpreted as a high risk of default. Next, I find the time horizon between the latest warning date and the default date to evaluate how well the cutoff can send a warning signal early before the event of default.

To make the usage of the model more robust at the sector level, I compare the default distance of these default companies with the median default distance of their sector at every time point. Since there are just a small number of companies in each sector with some outliers, it is more reasonable to use the median instead of the mean. I also investigate the percentile of each company's distance in its sector.

Lastly, I show some examples of big companies that invest a considerable amount of money in their projects and verify how well the model can reflect those events and their financial situation.

6 Result

According to the summary statistics, the defaults distances from May 2, 2007, to Jan 11, 2021, of 555 listed companies range from -7.44 to 77.79. The data has a mean of 6.92, a median of 4.93, and a standard deviation of 6.80. The kurtosis is 11.79, exceeding three, so the default distance of these 555 listed companies has more mass in its tails than a normal random variable.

The mean and median of the default distance are different across the industry. In particular, the medians and the means in financials and property industry are lower than the other industries.

Table 2: The summary statistics of the default distances from May 2, 2007 to Jan 11, 2021 of all the listed companies and each industry

Industry	The number of companies	Mean	Median	s.d.	Kurtosis
All companies	555	6.92	4.93	6.80	11.79
Agro & Food	49	7.45	5.30	7.56	8.45
Consumer Products	36	8.98	5.98	8.86	4.85
Financials	57	4.85	3.08	7.14	36.88
Industrials	84	6.38	4.23	6.66	9.61
Property & Construction	137	5.65	4.11	5.71	22.19
Resources	53	7.16	6.02	4.74	1.50
Services	102	8.96	6.99	7.43	4.88
Technology	37	6.89	5.20	5.26	2.10

Default company

After considering the nine companies that default, I noticed that the model sends a default signal when the default distance gets below two. However, the sign did not always lead to the actual event of default, but it reflects the company's financial difficulty. Thai Airways International Public Co., Ltd. or THAI is a vital case worth looking at. Although this company is operating the Thai national airline, it was in financial difficulty even before the pandemic. From 2015 to 2019, THAI had a loss before tax of 14.12, 1.42, 2.90, 11.61, and 11.04 billion THB, respectively (Thai Airways International Public Co., Ltd. 2020). This fact reflects in the graph below. We can see that the default distance increased in 2016 and stays above two until 2018. Although it moves above the cutoff a couple of times in the middle of 2019, they are just a few

days, and the distance never goes beyond 2.21 since then. When the pandemic happened in 2020, the default distance quickly decreases from its peak of 1.21 on January 17 to -1.50 on March 17. The distance remains negative until the Central Bankruptcy Court finally orders the company to go under a court-supervised business rehabilitation on September 14, 2020 (Thai Airways International Public Co., Ltd. 2021). In the other default cases, we can also see that their default distances get below the cutoff two before the events of default, as summarized in Table 3.

Figure 1

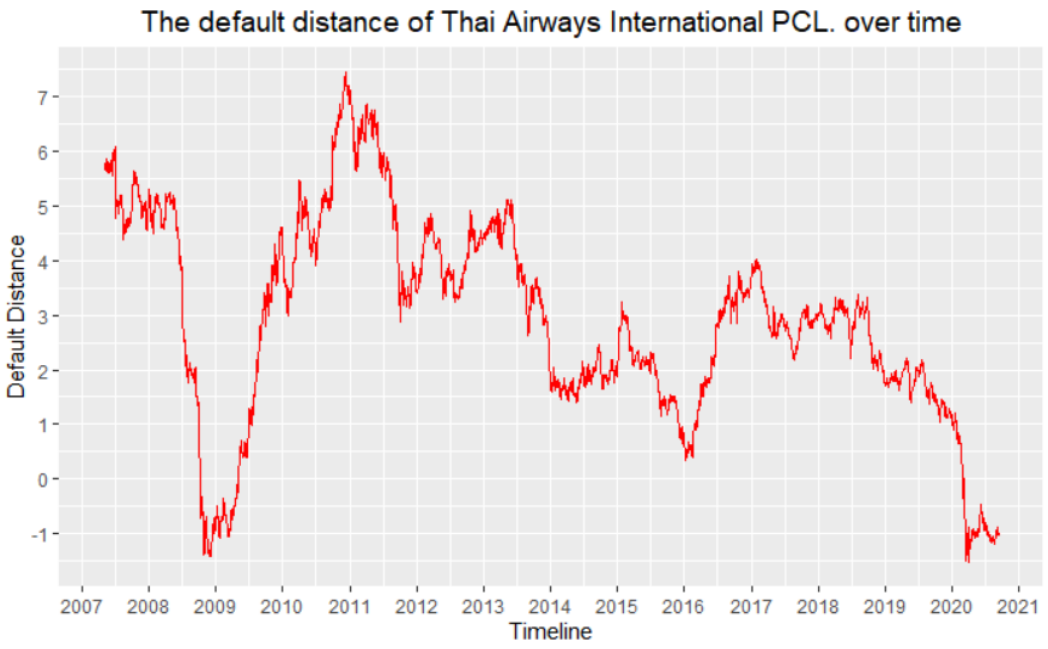


Table 3

Company ticker	The latest warning date	Default date	Time horizon (days)
PACE	July 27, 2017	June 29, 2020	1,069
MIDA	Nov 9, 2017	Apr 22, 2020	896
PK	Nov 8, 2007	Oct 20, 2009	713
JCK	Apr 1, 2019	Sep 11, 2020	530
PPPM	Dec 11, 2018	Feb 28, 2020	445
CGD	Apr 1, 2019	June 16, 2020	443
THAI	Aug 2, 2019	Sep 14, 2020	410
NOK	Jan 2, 2020	July 30, 2020	211
CWT	Nov 19, 2019	May 25, 2020	189
PSL	Feb 21, 2020	May 20, 2020	90
NUSA	Feb 2, 2020	Apr 23, 2020	82
BIG	Apr 24, 2008	Apr 25, 2008	1*

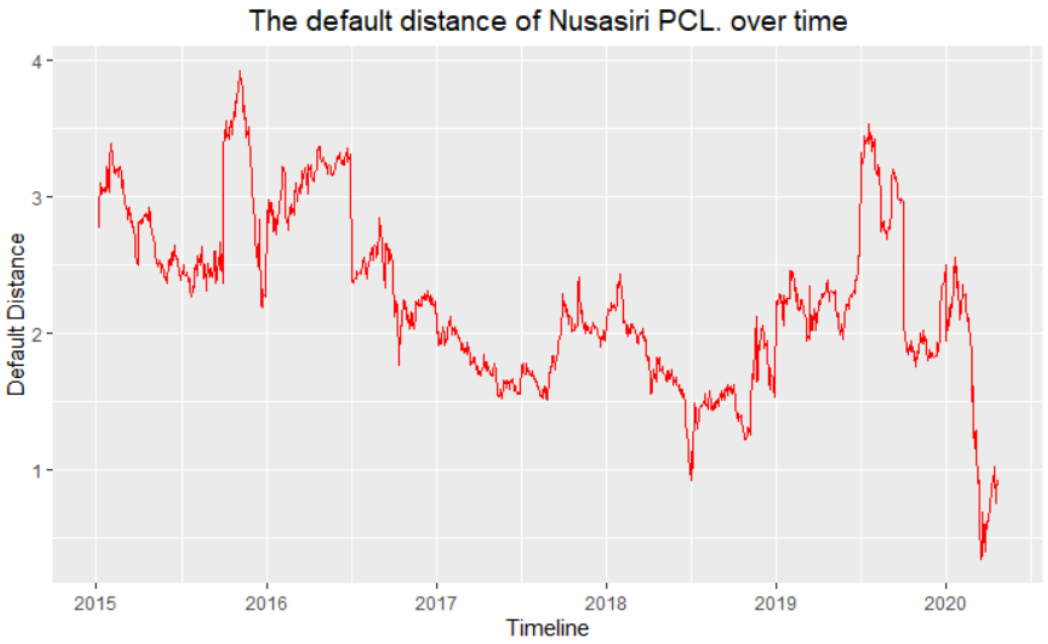
Resource: ThaiBMA (n.d.2), Thai Airways International Public Co., Ltd. (2021), Big Camera Corporation PCL. (2015), Patkol PCL. (n.d.), and Nok Airlines PCL. (2020)

* BIG's default distance fluctuates around two just right before the default date. The previous warning signal should be Nov 7, 2007 which results to 171 days of time horizon.

The latest warning date, as presented in Table 3, is not enough to justify the default. The model requires users to look back in history to interpret the model more precisely. For example, Nusasiri Public Company Limited or NUSA has the latest warning date on Feb 2, 2020 which is 82 days before the company defaults (Table 3). However, NUSA's the default distance shows that the company has financial difficulty since late 2016. Its default distance falls sharply from 2.97 on Sep 30, 2019, to 1.96 within four days before it eventually fell below the cutoff again on Feb 2, 2020. On the one hand, the distance increases to 2.55 at the beginning of 2020. On the other hand, from late 2019 to early 2020, it fluctuates between 1.94 and 2.55, which is still low. Besides, without the special event in the 3rd quarter of 2019, we can see a decreasing trend from the beginning of 2019. As a result, the latest warning date may be too close to the default date

due to the volatility and possible special events. Therefore, the model also needs previous warning dates to justify the risk of default.

Figure 2



Besides a fixed cutoff at two, the model also considers the trend of the distance to default for interpretation. We can see that THAI has a decreasing trend from 2017. PP Prime Public Company Limited (PPPM) and Mida Assets Public Company Limited (MIDA) are also obvious examples. For PPPM, its default distance collapses in the second half of 2015, and it shows an obvious decreasing trend from 2017 to 2020. The company eventually defaults on Feb 28, 2020 (ThaiBMA n.d.2). For MIDA, its default distance goes below the cutoff since late 2015. Although the distance exceeds the threshold a few times in quarter three of 2016, the first half of 2017, and late 2017, it just reached 2.5 once on Jan 30, 2017. After that, we can also see a decreasing trend until it fell sharply in 2020 and finally defaults on Apr 22, 2020 (ThaiBMA n.d.2). Another interesting case worth mentioning is Patkol PCL. or PK. Although PK's default

distance has an increasing trend from the beginning of 2009 until the Bankruptcy Court approves the rehabilitation process on Oct 20, 2009 (Patkol PCL. n.d.), the default distance has been negative for a year during that period. Moreover, the explanation of this increasing trend might be the expectation that the company can complete the rehabilitation plan that reflects on the stock price. Due to the size of the stock and its volatility, arbitrage might also be another explanation. From Aug 27, 2009, to Oct 19, 2009, the stock price increases from 0.28 Baht to 1.00 Baht. Compared to its peak at 4.18 at the end of 2006, this price is relatively low, and we can see that it is volatile. Therefore, it is crucial to consider both the level of the default distance and its trend together before taking any actions.

Figure 3

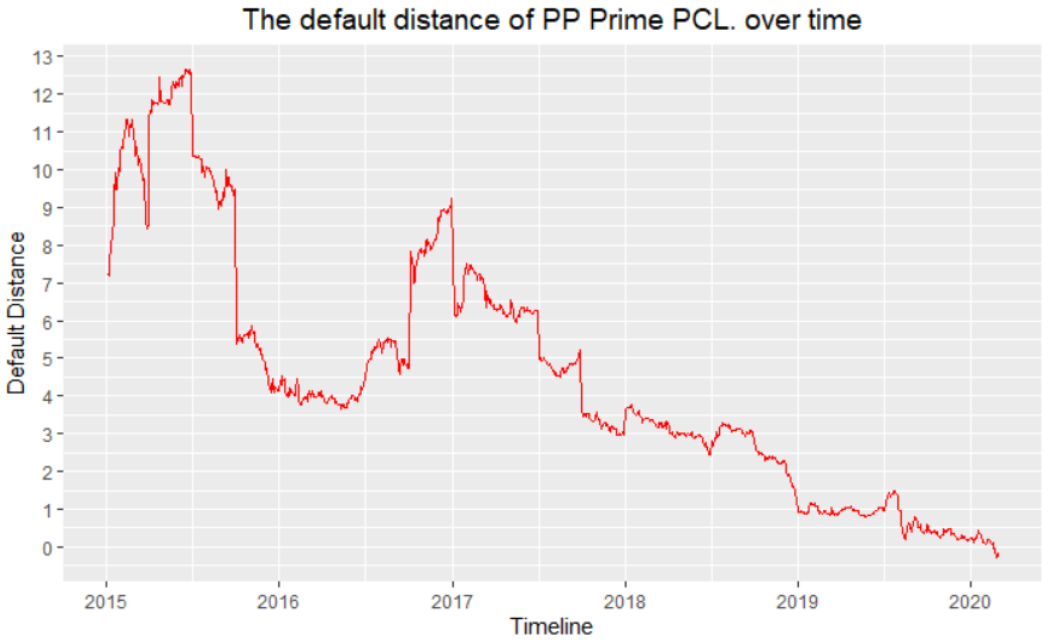


Figure 4

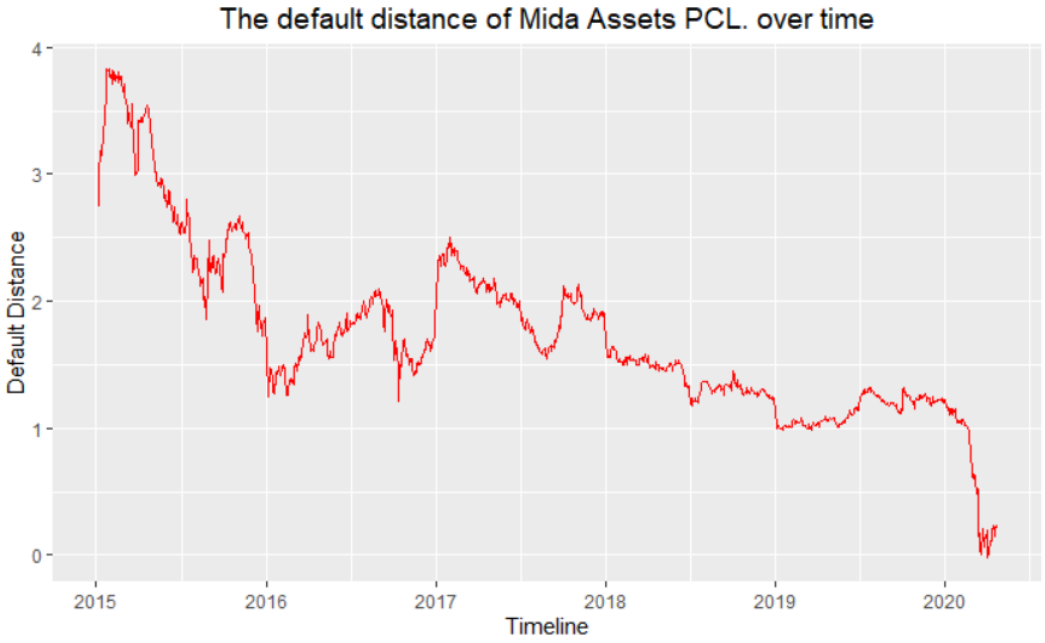
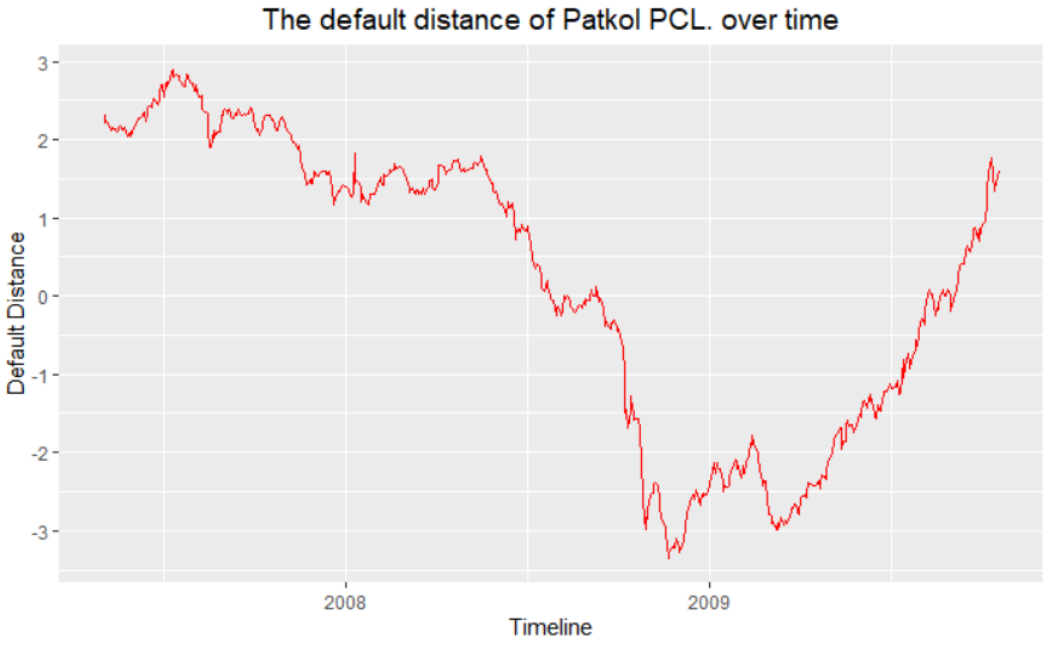


Figure 5



Since each industry has different nature in financing and operating, we need to consider the company's industry and sector to interpret the model. According to the data provided, the companies in the dataset are from 8 industries and 27 sectors. Without considering 2020 when the pandemic happens, the ranges of median default distances are different across industries, as shown in Table 4. For example, the property and construction industry has its median default distance moving between 2.93 and 5.79 between 2015-2019, while the median of the service industry never goes below 6.45 in the same period. Also, during the Covid-19 crisis, the median of the service industry drops to 4.78, while the median of the property and construction industry drops even more to 1.31. The main reason is that property companies in Thailand require a considerable investment in each project, and they usually finance their projects with interest-bearing debts, including bonds and loans. On the other hand, companies in the service industry have a low debt-to-equity ratio (D/E ratio). A considerable part of their debts is usually trade-account payables that generally do not incur interest payments. Therefore, it is helpful to consider the company's default distance and the median default distance of its sector. However, since some sectors have just a few companies, it is sometimes more appropriate to compare the default distance with its industry. Let consider Country Group Development Public Company Limited or CGD as an example. CGD is a property development company, and there are 53 companies in this sector, so that I can compare the company with its sector median. CGD's distance to default decreases sharply from 3.06 to 1.43 in the last quarter of 2015, creating a big gap between the company's distance and the sector median until the middle of 2018, and it happens again after the first quarter of 2019 until the company defaults on June 16, 2020 (ThaiBMA n.d.2). In term of the percentile, we can see that CGD default distance usually stay low, 15th-30th percentile, relatively to the property development sector from 2016. For the other

default companies, their default distances are typically low or at least lower than the medians of their sectors. Also, they tend to diverge from the medians as the time approaches the default date.

Table 4: The range of median DD between 2015-2019 and the minimum of median DD in 2020 of each industry

Industry	Range of median DD between 2015-2019	Minimum of median DD in 2020
Financials	1.73 - 4.52	1.20
Property & Construction	2.93 - 5.79	1.31
Technology	3.02 - 7.43	2.29
Industrials	3.52 - 6.10	3.06
Agro & Food	3.97 - 6.67	3.21
Resources	4.21 - 6.86	3.30
Consumer Products	4.66 - 9.90	4.27
Services	6.46 - 8.33	4.78

Table 5: The industry and sector of each default company

Company ticker	Industry	Sector
NUSA	Property & Construction	Property Development
CGD		
JCK		
PACE		
THAI	Services	Transportation & Logistics
NOK		
PSL		
MIDA		Commerce
BIG		
PPPM	Agro & Food	Agribusiness
CWT	Industrials	Automotive
PK		Industrial Materials & Machinery

Figure 6

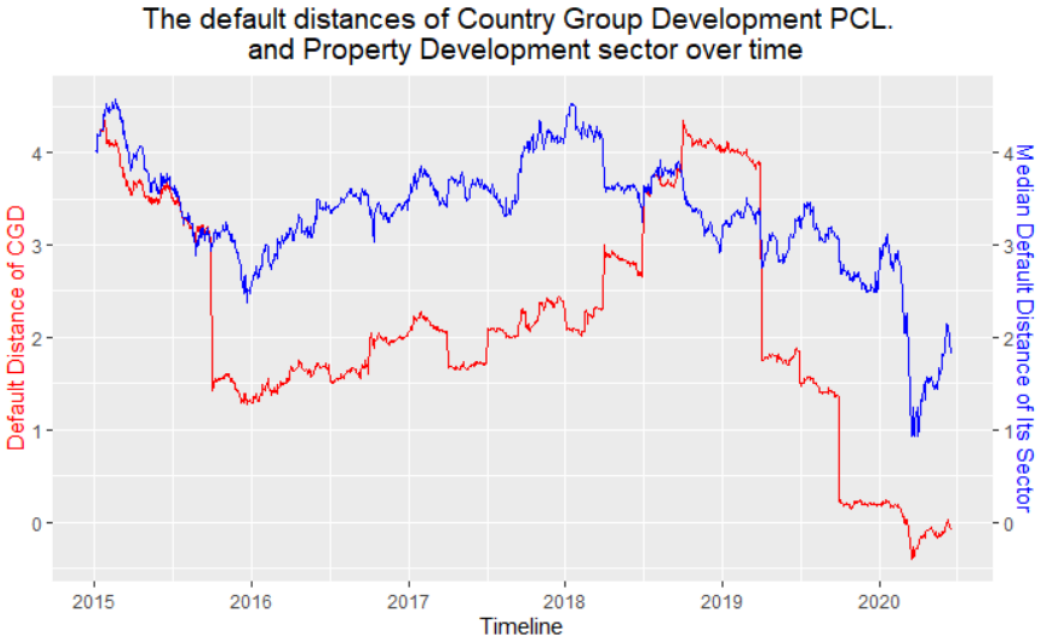
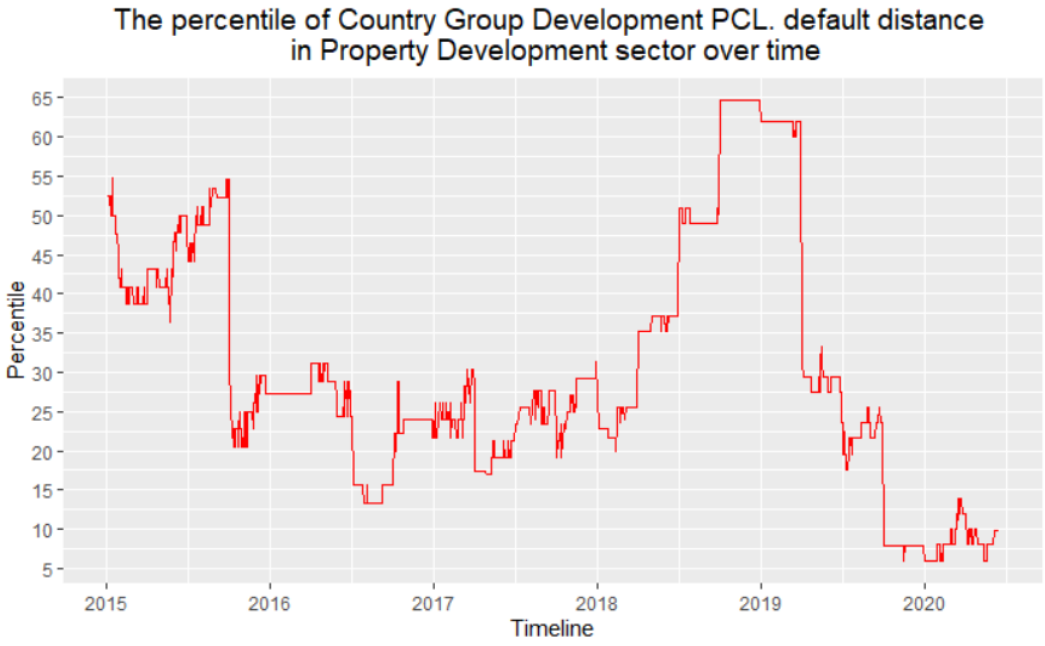


Figure 7



If the model uses only the cutoff criteria, it will lead to lots of theoretically false signals. Theoretically, the company should undoubtedly default if the default distance in the original Merton model is zero (Dar, Anuradha, and Qadir 2019). However, it is more practical to consider the default distance with its history, trend, and industry factor. Based on the available data of 543 non-default companies, the model with the solid cutoff of two sends 3,020 false signals of 278 companies from 2007 to 2020. As shown in Figure 8 and 9, the number of signals increases during every crisis, The Great Recession during 2007-2009, the severe flooding in 2011, and the Covid-19 pandemic in 2020, reflecting the dire financial situations during those periods. A part of these theoretically false signals stems from the usage of stock price. Since the stock price reflects all the market information, it can fluctuate by either good or bad news. As a result, the model can send the warning just from the panic of stock investors even though some of the company does not get a real impact from the situation. Therefore, it is essential to look at the other factors and interpret the default distance in the sense of probability.

Figure 8

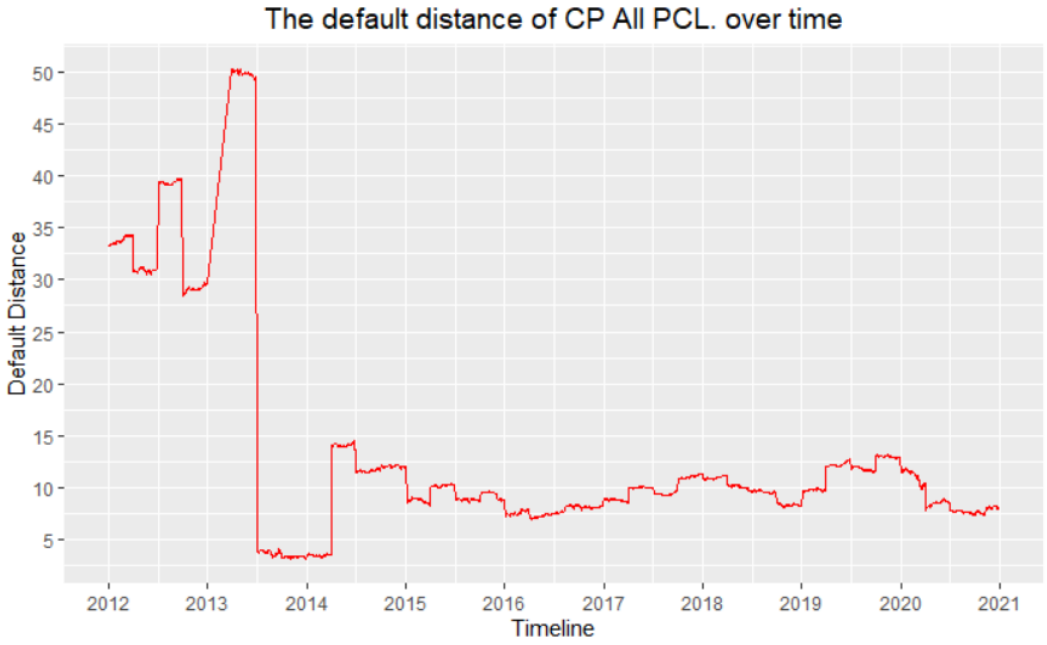
Figure 9

Non-default company

In this section, I show a couple of examples that illustrate that the model can also reflect the financial situation and the financial difficulty well for companies that never default.

Firstly, CP All PCL. or CPALL, the operator of 7-Eleven convenience stores in Thailand, is the largest listed company in the commerce sector with a market cap of around 559 billion baht (The Stock Exchange of Thailand 2021). In the last decade, the company has two significant events that affect the company's balance sheet. First, CPALL buys Makro cash-and-carry stores in Thailand with 188.88 billion baht (US$6.6 billion) in 2013 (Bangkok Post 2013). This event clearly reflects on the default distance of the company. However, with the strong financial situation and reputation, the default distance is still over the cutoff of two. The second event is when CPALL buys Tesco in 2020 (Arunmas, Apisitniran and Polkuamdee 2020). Together with the impact of Covid-19, the default distance decreases but still moves far from the cutoff.

Figure 8



Secondly, Minor International PCL. or MINT is a Thai hospitality and leisure company operating hotels in 55 countries and restaurants in 26 countries worldwide (Minor International PCL n.d.). It is also the largest hotel company listed in the Thai stock market (BuffetCode 2018). However, MINT creates a massive debt in 2018 to acquire 8.6% of the shares of NH Hotel Group with 192 million euros (RYT9 2018). As a result, the default distance falls in 2018 from around ten at the beginning of the year to around six at the end of the year. This weaker-than-usual financial situation also reflects on the default distance in 2020. We can see that the default distance of this largest hotel company fell below the median to around 2. On the one hand, the pandemic affects hospitality and leisure companies more than any other companies in the sector. On the other hand, the graph looks worse than its closest peer, Central Plaza Hotel PCL. or CENTEL. The default distances of CENTEL also decrease when the pandemic happens, but it just falls to around 4, reflecting a stronger financial situation.

Figure 9

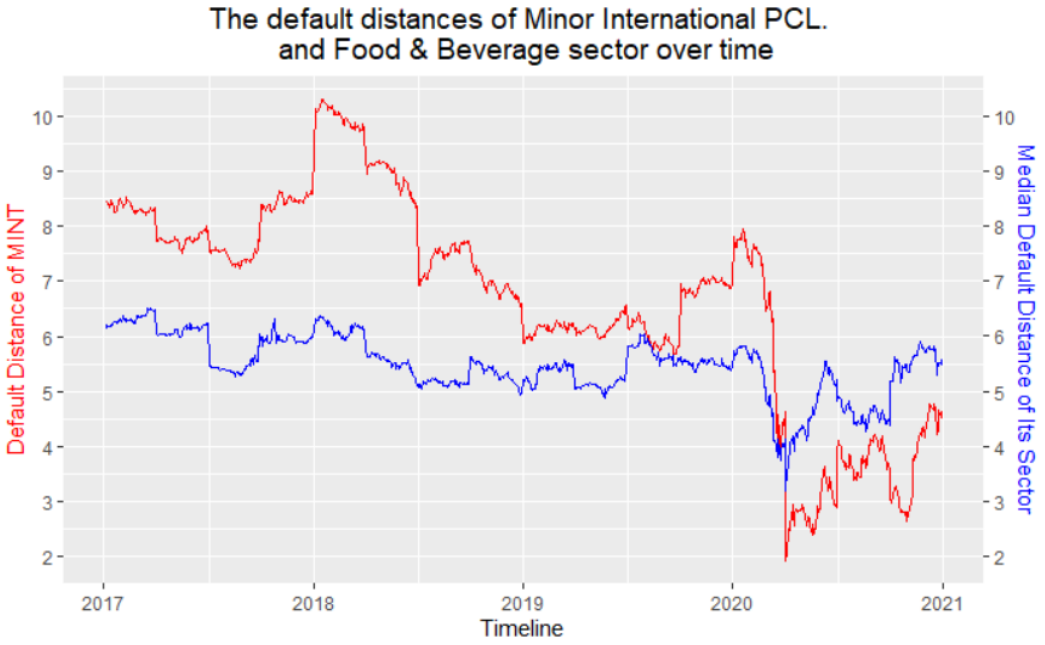
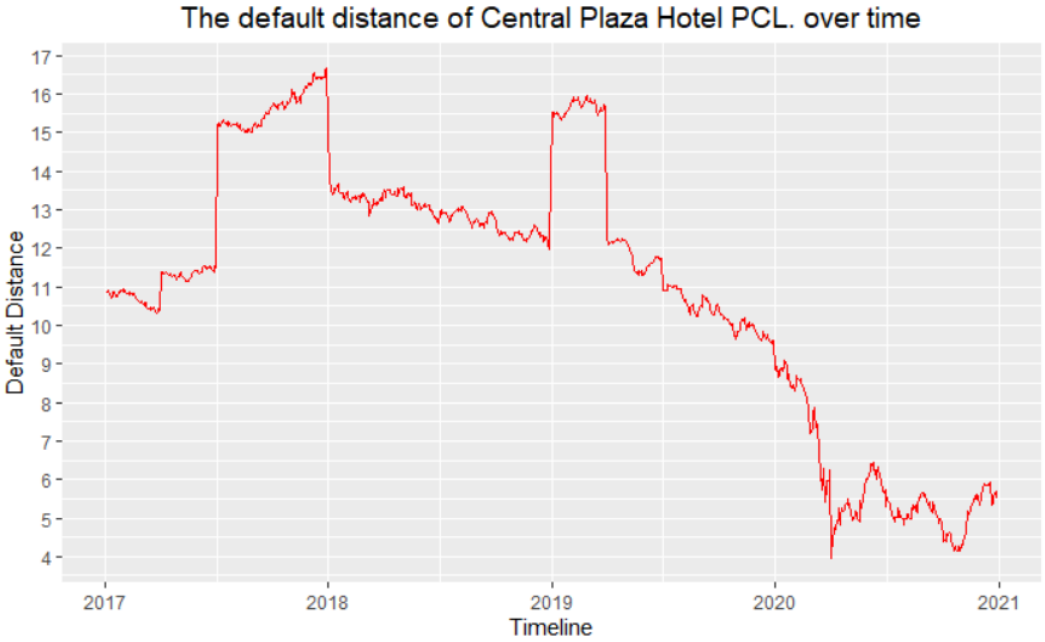


Figure 10



7 Conclusion

Since the model is based on the probability of default model of Merton, it is crucial to consider the default distance with the context of the company itself, its industry, and the market to evaluate the company's risk of default. In the Bank of Thailand aspect, the advantage of the model is that they can use the model to estimate the risk of default daily. As a result, the Bank of Thailand can reduce the recognition lag and cope with the possible default sooner.

Although the model works well to reflect the financial difficulty of Thai listed companies with the cutoff of two, the trend, and the comparison to the sector, some limitations still exist due to the assumption of the original model and the incompleteness of data. Theoretically, the firm can default only at time T, and its assets must follow lognormal distribution (Dar, Anuradha, and Qadir 2019). However, applying skew Brownian motion in Zhu and He (2017) instead of geometric Brownian motion in the PD model could be an alternative to evaluate the default distance. Another limitation is the data collection in Thailand. The data is usually inconsistent and restricted due to legal issues.

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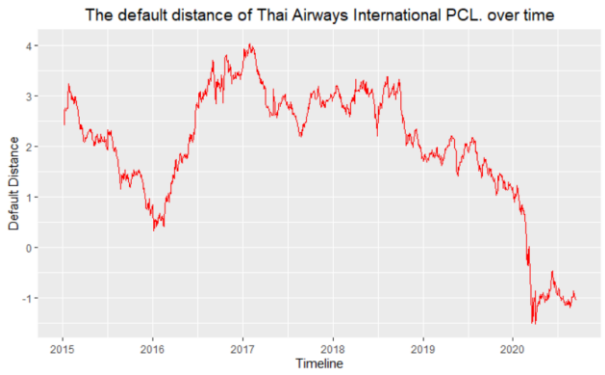
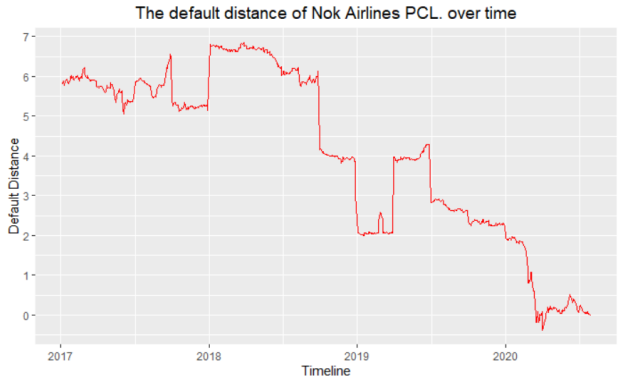
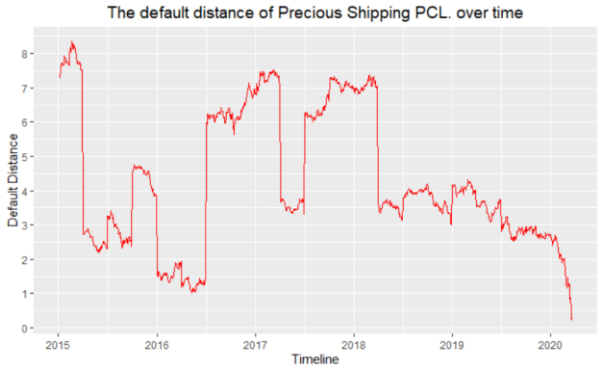
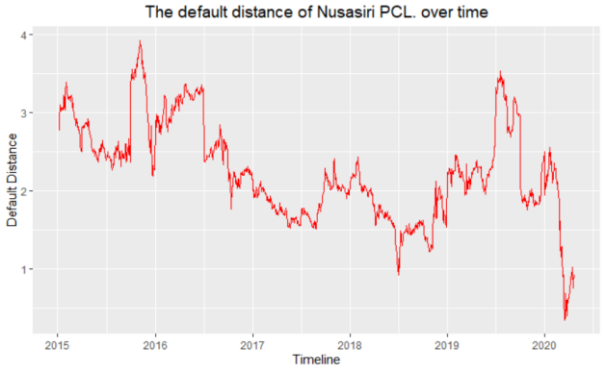
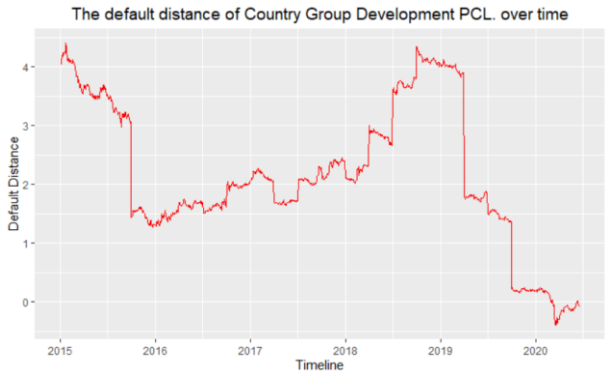
Appendix 1: The default distance of 12 default companies over time

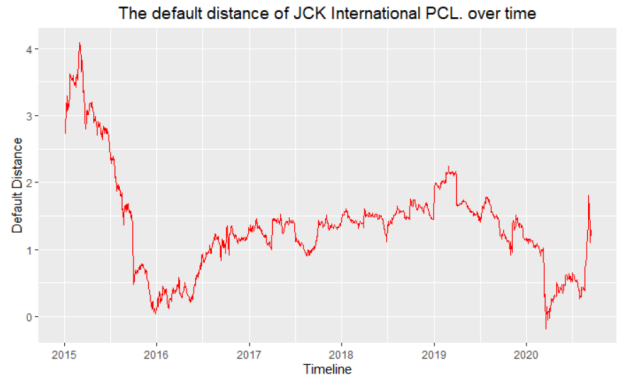


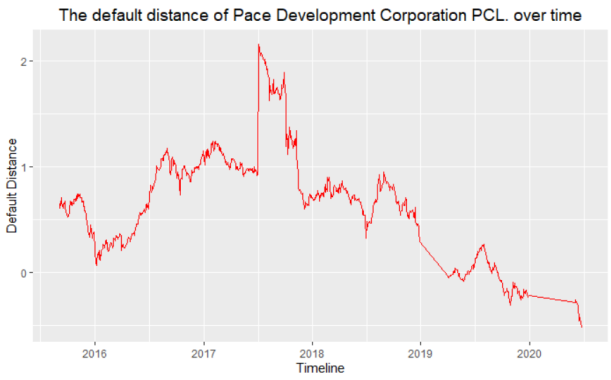











The default distance of Pace Development Corporation PCL. over time
Default Distance
Timeline
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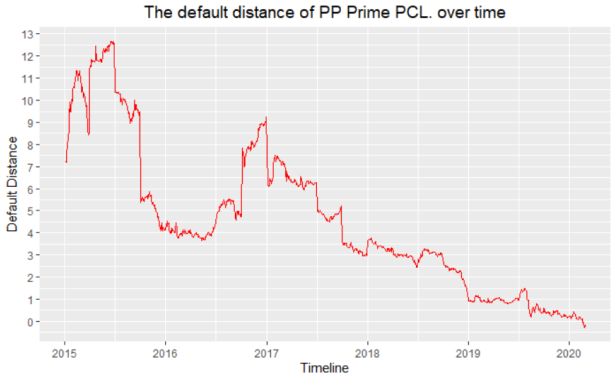
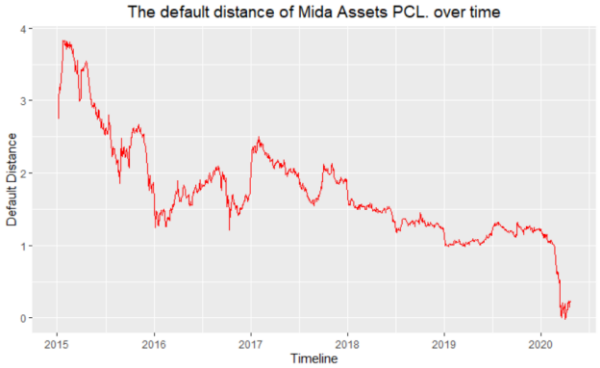
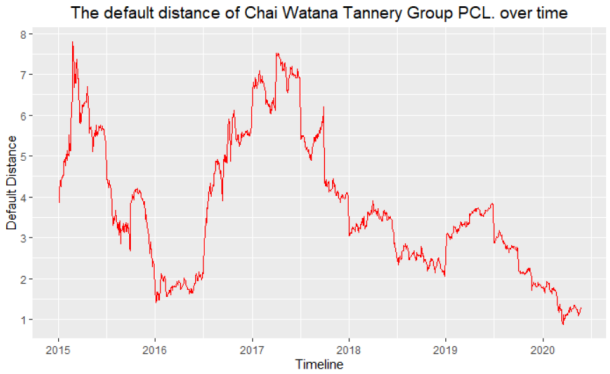
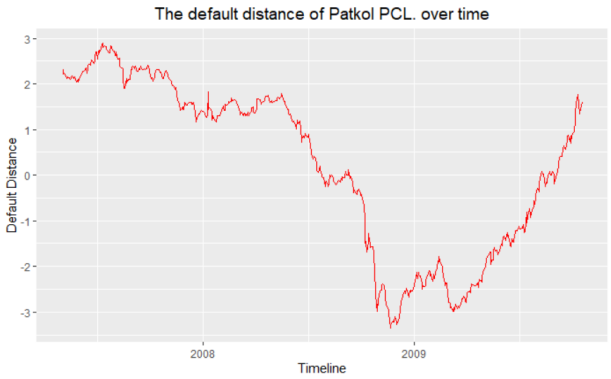
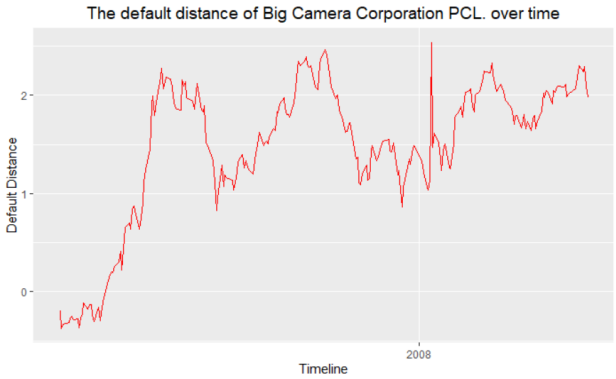
2017
2018
2019
2020


The default distance of PP Prime PCL. over time
Default Distance
Timeline
2015
2016
2017
2018
2019
2020

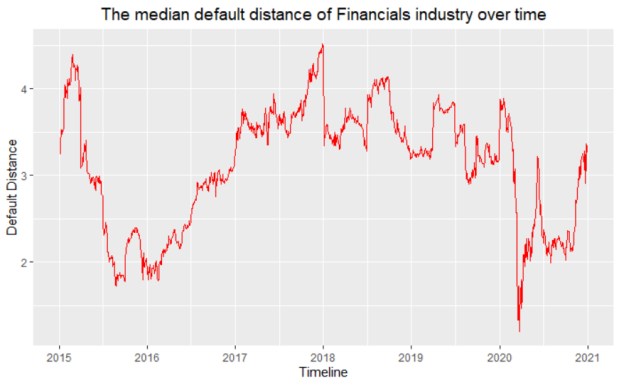

The default distance of Mida Assets PCL. over time
Default Distance
Timeline
2015
2016
2017
2018
2019
2020

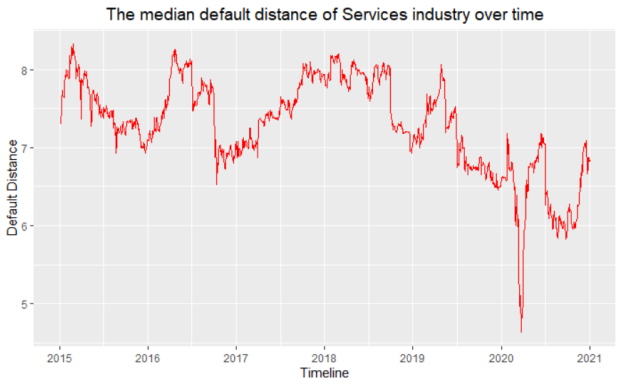

The default distance of Chai Watana Tannery Group PCL. over time
Default Distance
Timeline
2015
2016
2017
2018
2019
2020

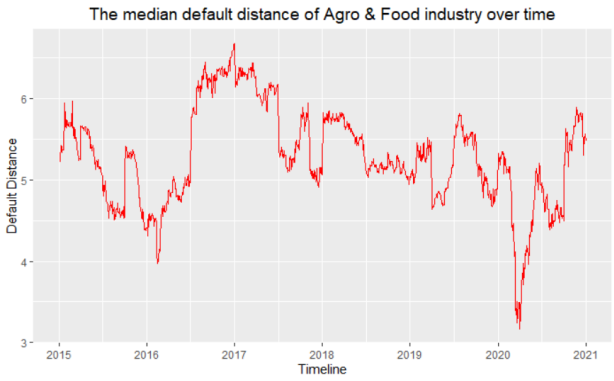

The default distance of Patkol PCL. over time
Default Distance
Timeline
2008
2009

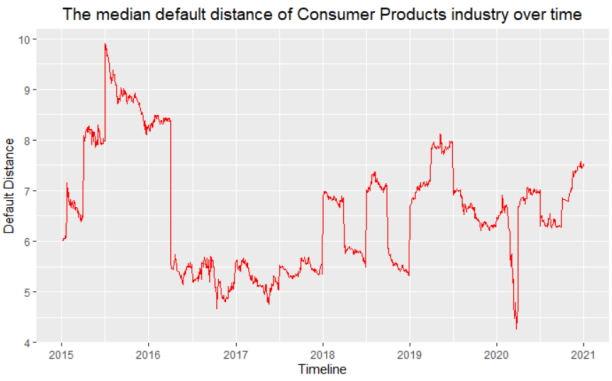

The default distance of Big Camera Corporation PCL. over time
Default Distance
Timeline
2008

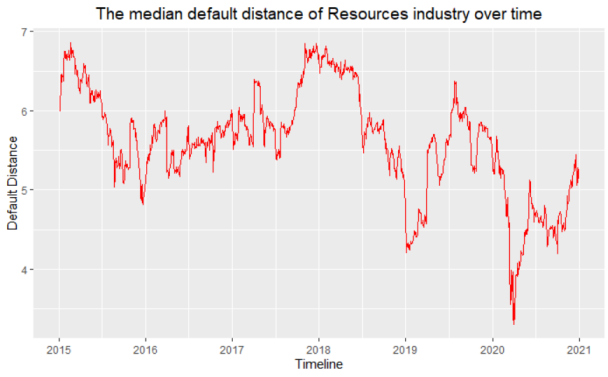
Appendix 2: The median default distance of each industry over time

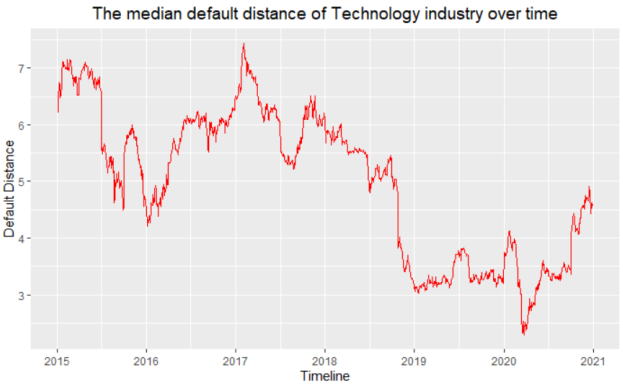


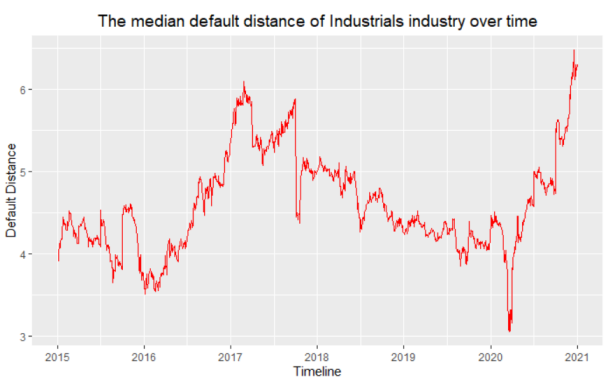


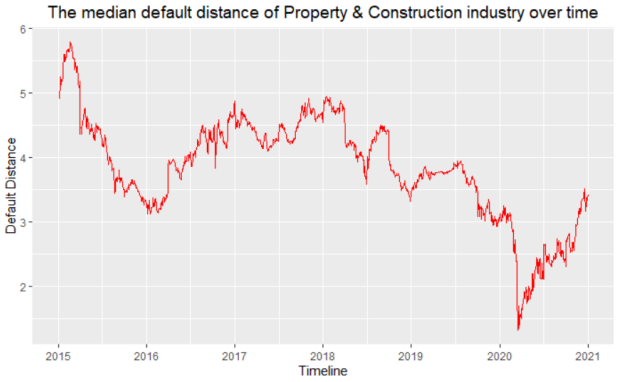




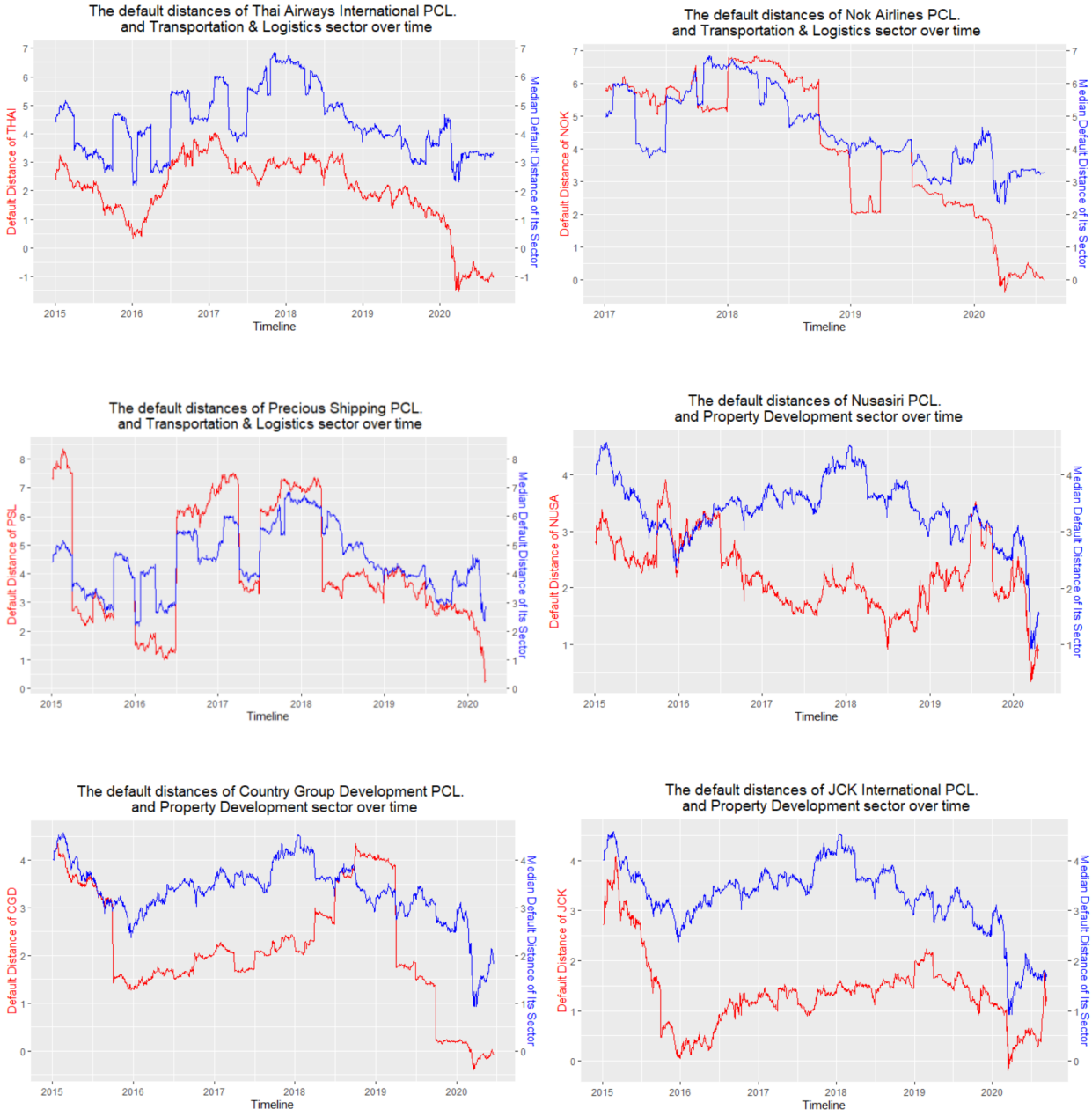


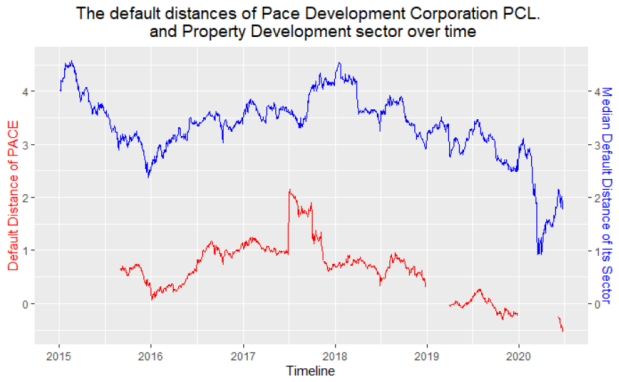


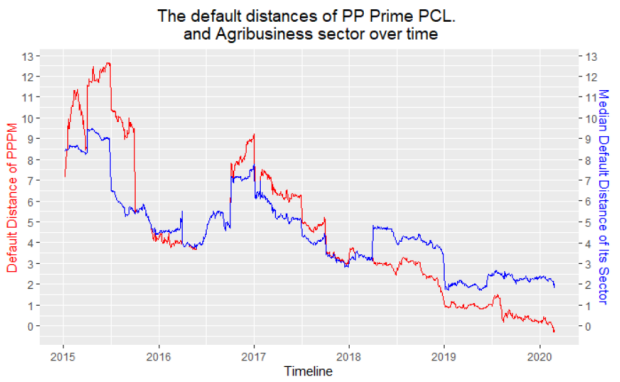

The median default distance of Industrials industry over time
Default Distance
6
5
4
3
2015
2016
2017
2018
2019
2020
2021
Timeline

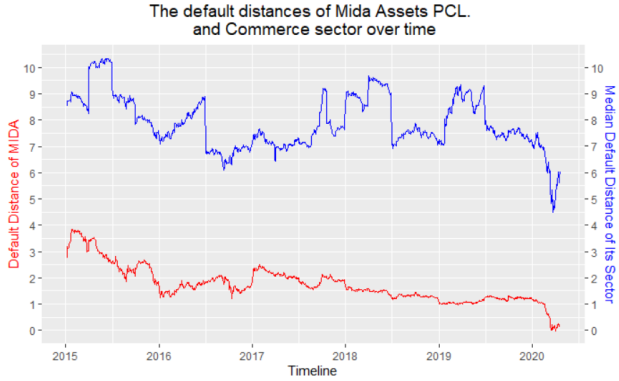

The median default distance of Property & Construction industry over time
Default Distance
6
5
4
3
2
2015
2016
2017
2018
2019
2020
2021
Timeline

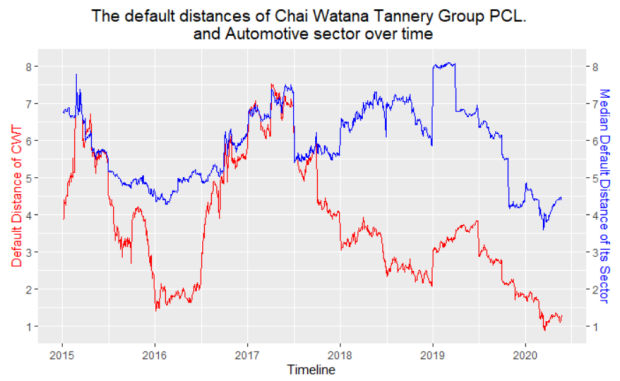
Appendix 3: The default distance of 12 default companies with sector's median default distance over time

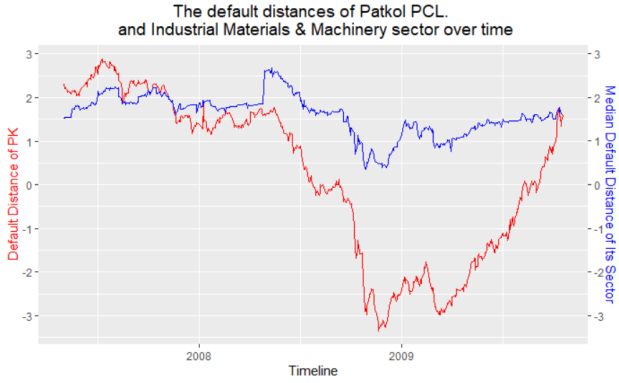


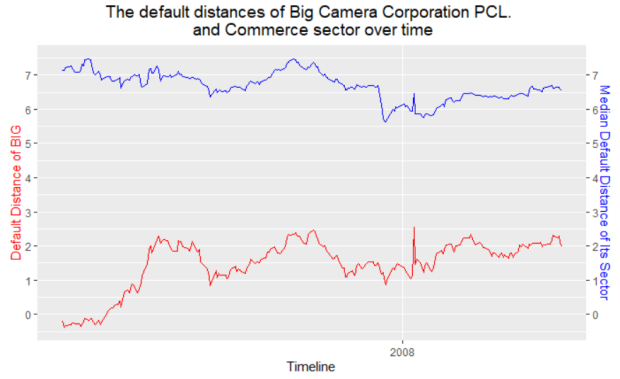

The default distances of Pace Development Corporation PCL.
and Property Development sector over time
Default Distance of PACE
Median Default Distance of Its Sector
Timeline


The default distances of PP Prime PCL.
and Agribusiness sector over time
Default Distance of PPPM
Median Default Distance of Its Sector
Timeline

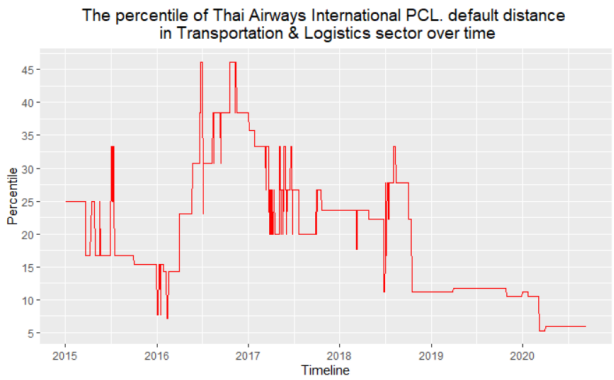

The default distances of Mida Assets PCL.
and Commerce sector over time
Default Distance of MIDA
Median Default Distance of Its Sector
Timeline

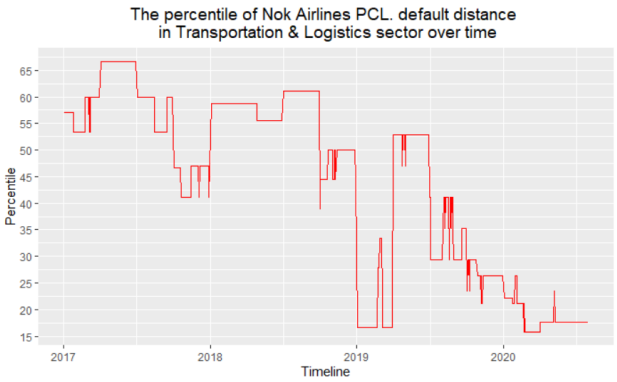

The default distances of Chai Watana Tannery Group PCL.
and Automotive sector over time
Default Distance of CWT
Median Default Distance of Its Sector
Timeline

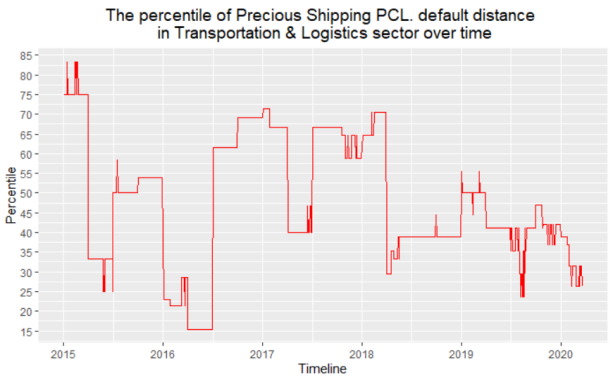

The default distances of Patkol PCL.
and Industrial Materials & Machinery sector over time
Default Distance of PK
Median Default Distance of Its Sector
Timeline

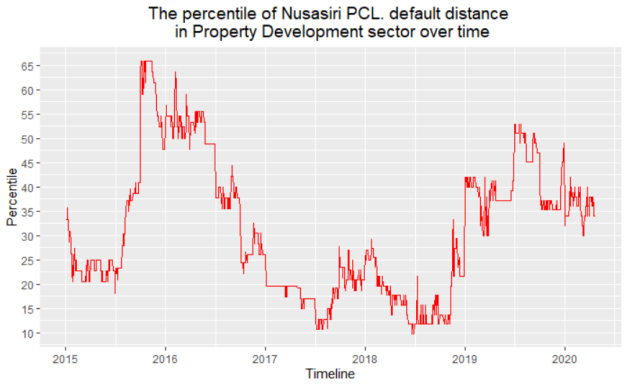

The default distances of Big Camera Corporation PCL.
and Commerce sector over time
Default Distance of BIG
Median Default Distance of Its Sector
Timeline

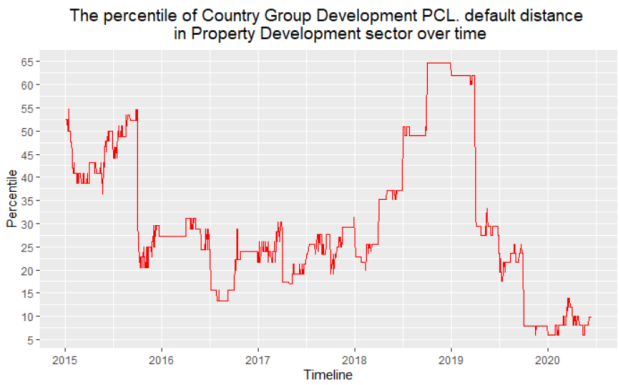
Appendix 4: The percentile of the default distance of 12 default companies over time

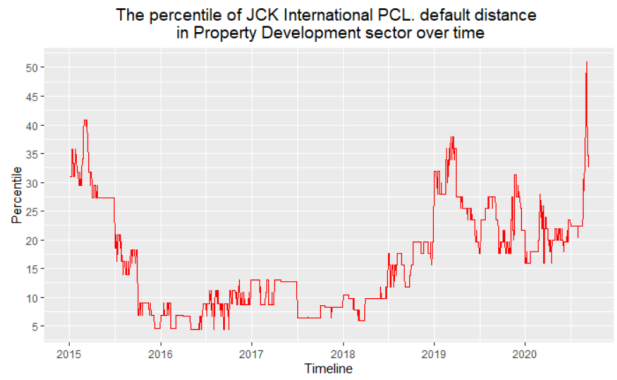


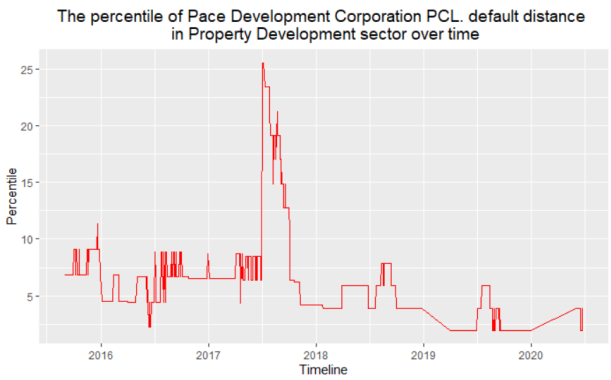


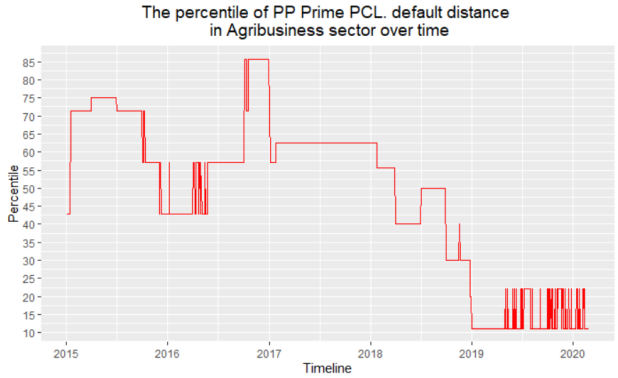


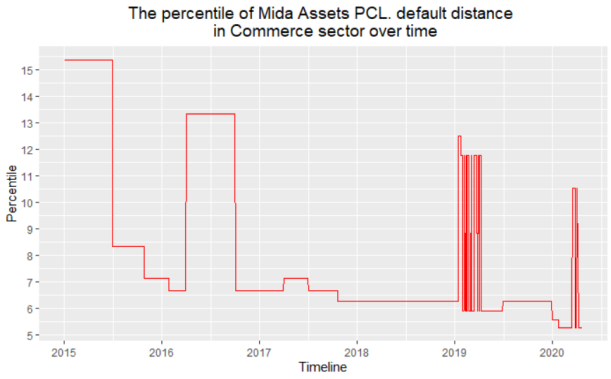


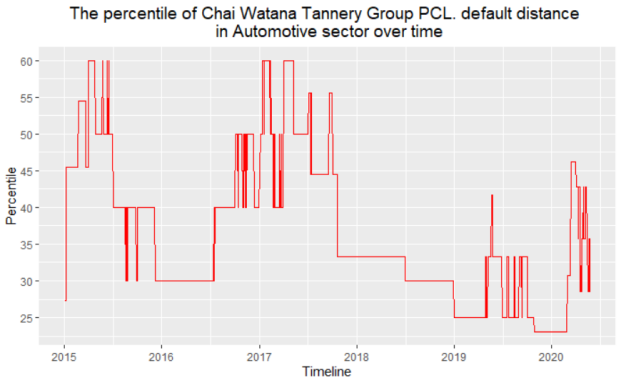


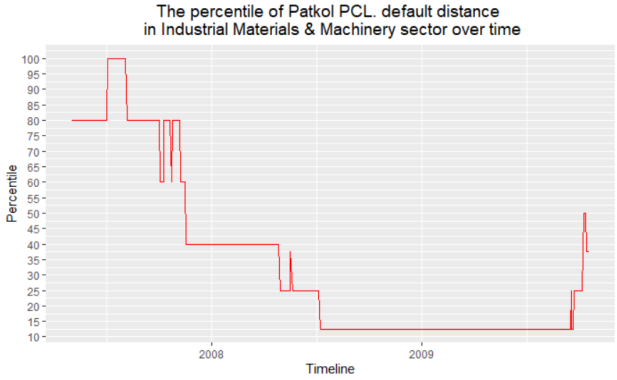


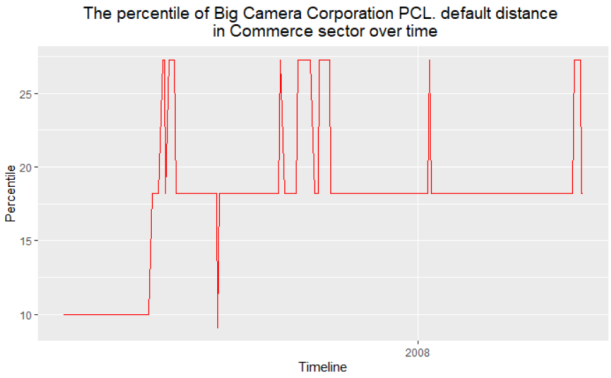

The percentile of Pace Development Corporation PCL. default distance
in Property Development sector over time
Percentile
Timeline


The percentile of PP Prime PCL. default distance
in Agribusiness sector over time
Percentile
Timeline


The percentile of Mida Assets PCL. default distance
in Commerce sector over time
Percentile
Timeline


The percentile of Chai Watana Tannery Group PCL. default distance
in Automotive sector over time
Percentile
Timeline


The percentile of Patkol PCL. default distance
in Industrial Materials & Machinery sector over time
Percentile
Timeline


The percentile of Big Camera Corporation PCL. default distance
in Commerce sector over time
Percentile
Timeline