Preventive Sectors and Risk Finance

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Abstract: Risk finance embeds a variety of approaches, most of which applied to specific financial problems. The purpose of this project paper is to apply a preventive approach to two economic sectors in Thailand; Health Care and the Food Market. In addition, we refer to a number of preventive strategies. In addition, we introduce specific applications to outline the approaches commonly used in Preventive and Risk Finance.

1. Introduction

Thailand is a country with a stock market as well as cyclical movements of its economic activities. These affect corporate and other firms traded on Thai stock market, as well as an important Touristic season with travelers coming and activating the Thai economy. The following provide an evolution of markets pertaining to the Food economic section, the Health Care Sector and in particular the Covid-virus 19. The intent of this paper is to attend to these sectors and assess the possibilities to prevent their risk and economic consequences. Prevention is in our context far more general than risk management. While risk management is meant to provide a set of tools to mitigate future losses or risk consequences. Preventions in addition provide strategic approaches to mitigate consequences of a broad set of factors. For example, while risk management is mostly based on the future known states of risk probabilities while preventive finance is far more concerned with the uncertainties of future activities. Further while risk provides essentially and ex-ante approach, preventive finance is both an ex-ante management approach betting and guessing future outcomes to mitigate their consequences, they also design and invest in ex-post approaches, emphasizing the importance of future actions and their stored investments, to be expanded ex-post when future events of consequence arise and preventive actions can mitigate their consequences. Preventive approaches are common, appearing in many names such as : Inventory Management to meet future needs; Investing

in Defensive Stocks such as portfolio targeted to mitigate stock losses by introducing options to mitigate these losses; The design of Hospitals to account for potential excess demands and incomplete supplies; Weather conditions such as Hurricanes or Draught, or other events reducing the Agricultural capital of Thailand; etc. Some events in Thailand such as the stock market is cyclical and require therefore preventive activities to stabilize the market.

Typically, Investors pursue the Chicago Volatility market trends as a mean to profit the volatility expansion phase and buying stocks or set up savings to prevent future recessions and their losses. Preventive investments and strategies are then broadly applied in dynamic, unstable and cyclical economic and financial environments. Financial products such as yields bonds generate low and stable returns although in competition with dynamic financial markets, theoretically (and in some cases) outperform Bond yields. A preventive finance, is then an approach combining principles of risk management and a strategic approach to integrate economic, political, competitive and gamed, financial prediction and statistics into Preventive investments and policies. This paper, based on such Preventive approaches, will comprise the following sectors: Healthcare, food & beverage, as well given the current covid-12 virus a covariation with the consequences of the corona virus will be considered as well.

2. Prevention and Finance motivation.

Prevention is a financial function defined by factors that contribute to cyclical and dynamic economic environment. Technically, prevention is planned and applied to mitigate consequences. These factors may include specific market and environmental features as well as stock prices and their specific features. The intent of this project is to investigates the relevant factors providing valuable information to invest and prevent losses. Further, Thailand is selected as a topic to research due to its active touristic market accounting for 21.60% of total GDP during 2019. After the Covid 19 strikes, stock market has drop from 1,800 index to 916 indices (approximately half of the value gone). We consider three Baskets, pertaining to Health, Food and the Covid 12 virus.

Thailand as result, felled to an economic recession and a crisis period for several sectors comparing their performance to that of the National market index (SET).

3. Data and preliminary analysis

The project 1st Explored the "Defensive sector" which are Healthcare and Food sector, how these indexes were defined as defensive? What are the measurements of defensiveness?
The Exploration analysis will separate into 2 analyses.

3.1 Crisis period data exploration

The crisis period data exploration will be explored different sectors comparing their performance to the market index (SET) during the crisis period. The sector indexes are the following:

1. SET : market index (benchmark)
2. Food : Food & Beverage sector
3. Health : Healthcare sector
4. Bank : Banking sector
5. Prop : Property development sector
6. ICT : Information Communication Technology sector
7. Energ : Energy Sector
8. Trans : Transportation Sector

These sectors are analyzed across 3 different period of crisis. 1997 Tom yum kung crisis: evaluated from Jan 1996 – August 1998; The 2008 Global Financial crisis: evaluated from July 2017 – Feb 2019 2019; and the Covid-19 Crisis: evaluated from Feb 2018 – Oct 2020.

3.2 Sector operation performance investigation

The further enhance of the analysis is to demonstrate that healthcare and food sectors are "defensive sectors" among other Thailand stock sectors. To do so, we compare the financial ratios of Corporate firms in the food and healthcare sectors. Based on data, we observe, their fluctuations between food and healthcare sectors during each of the crisis period vs their non-crisis period.

3.1 Crisis period data exploration

Figure 3.1 Comparing 8 different sectors during the Tom yum kung crisis (East Asian crisis 1997)

The East Asian crisis is the most devastating that happen to Thailand. The figure 3.1 show the comparison if one investor invest 100$ in any of the sector at the beginning. How would they end up at the end of the crisis period? If he was investing in SET index (National Market index) From 100$ they would end up approximately 20$ or in another word -80% decreased in value. When comparing SET index to 7 other major indexes: **Food, Energy and Transportation** are outperforming the market index (SET). The **Health Care sector** are the approximately the same return as SET index. While Property**, ICT and Energy** were outperformed by the market index (SET).

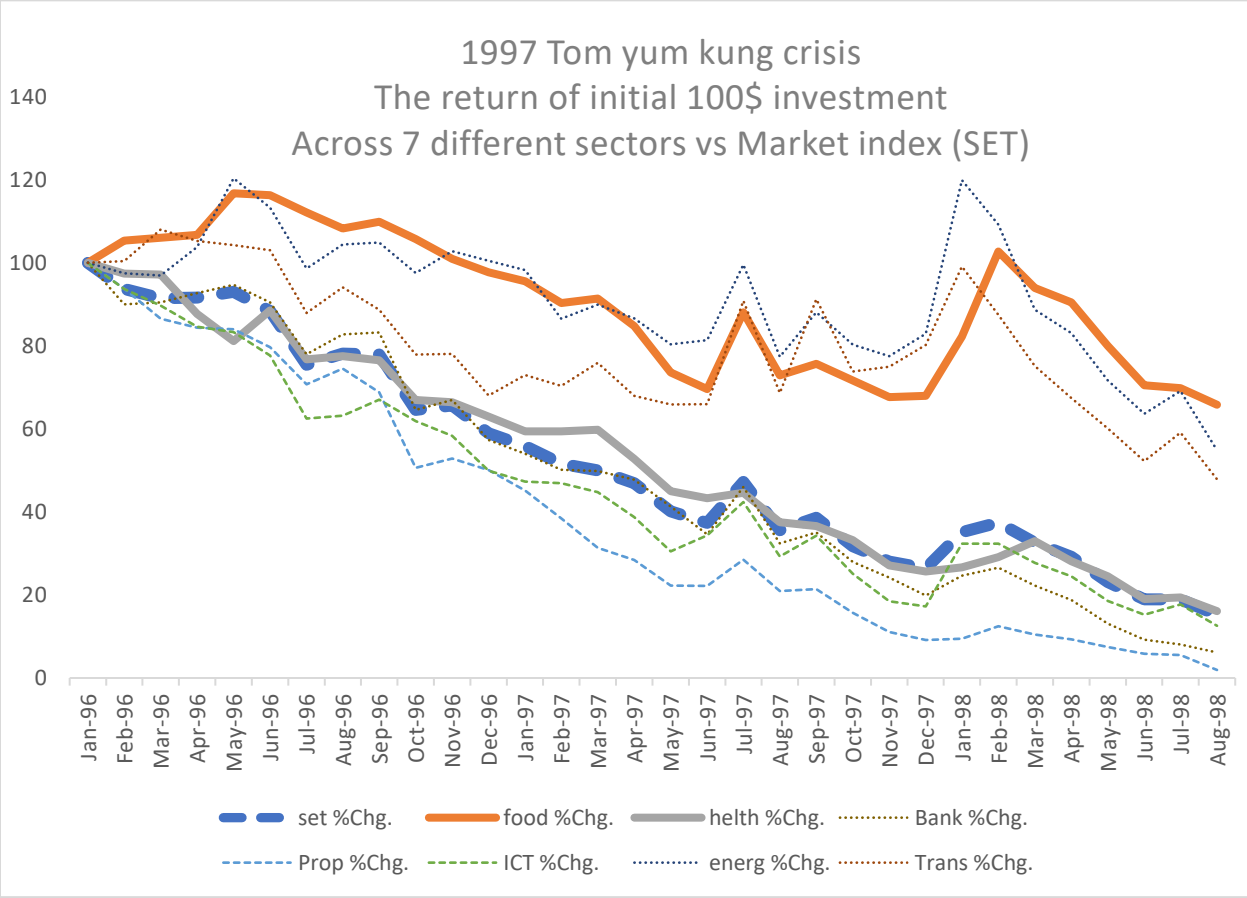


Figure 3.1 Comparing 8 different sectors during the Tom yum kung crisis for initial investment of 100$

Figure 3.2 Comparing 8 different sectors during the Global Financial Crisis 2008

The global financial crisis was the most dangerous crisis that happened to the world. While this crisis has much less effect to Thailand comparing to Tom yum kung crisis, the stock market in Thailand has plummeted and it is important to manage the risk that one investor has faced. The figure 3.2 show the comparison if one investor invest 100$ in any of the sector at the beginning. How would they end up at the end of the crisis period? If he was investing in SET index (National Market index) From 100$ they would end up approximately 45$ or in another word -65% decreased in value. When comparing SET index to 7 other major indexes: **Food, ICT** sectors are outperforming the market index (SET). The **Health Care, Energy, Banking** sectors are performed about the same as SET index. While **Property, Transportation and Banking** sectors were outperformed by the market index (SET).

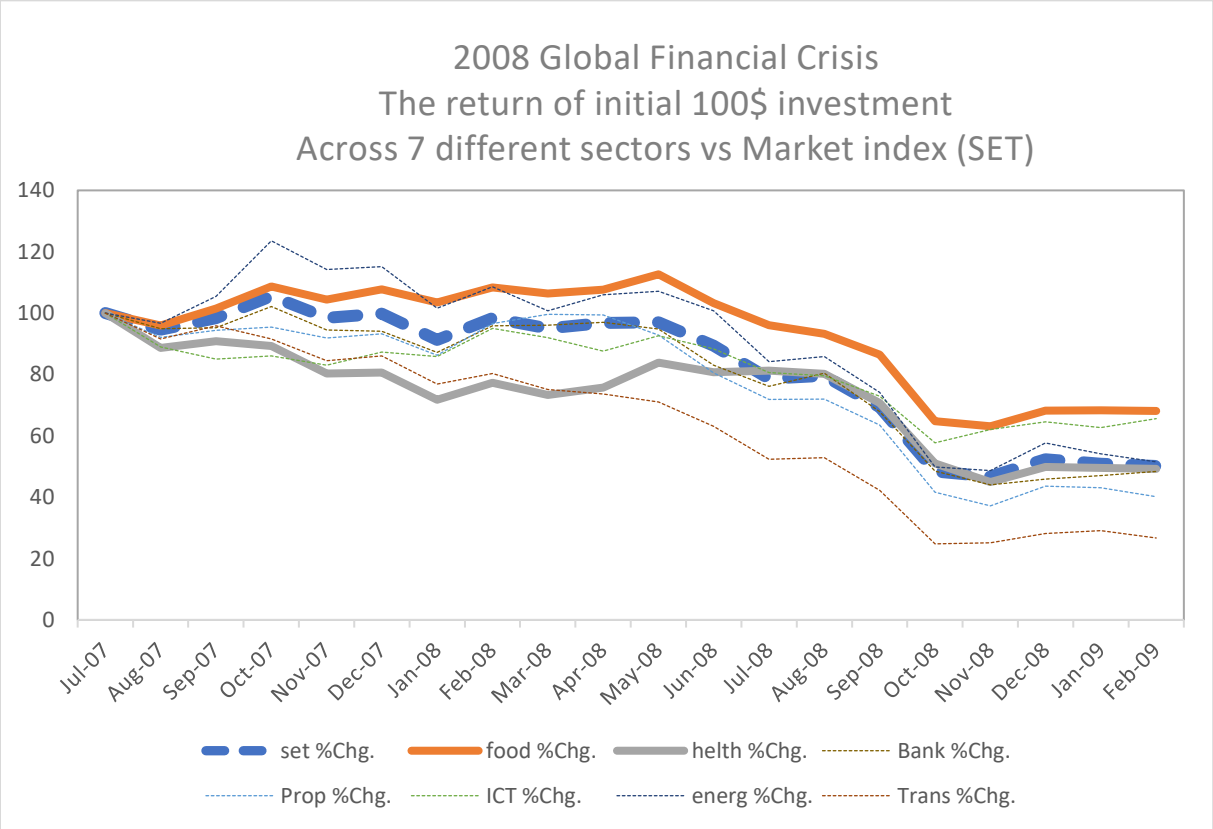


Figure 3.2 Comparing 8 different sectors during the Global Financial Crisis 2008 for initial investment of 100$

Figure 3.3 Comparing 8 different sectors during the Covid-19 crisis.

The covid-19 virus alone can cause the economy to stagnant. Thailand heavily relied on the foreign traveler to fund the economic. This process was halt which result in hugged declined in stock market. While The drop might not be strong as 2 previous crises, we are not sure yet whenever the Covid-19 situation are going to stop soon, and investor should be prepared and managed there risk accordingly. If he were investing in SET index (National Market index) From 100$ they would end up approximately 70$ or in another word -30% decreased in value. When comparing SET index to 7 other major indexes**: Food, Health, Transportation, ICT** sectors are outperforming the market index (SET). The **Energy** sectors are performed about the same as SET index. While **Property, Banking** sectors were outperformed by the market index (SET).

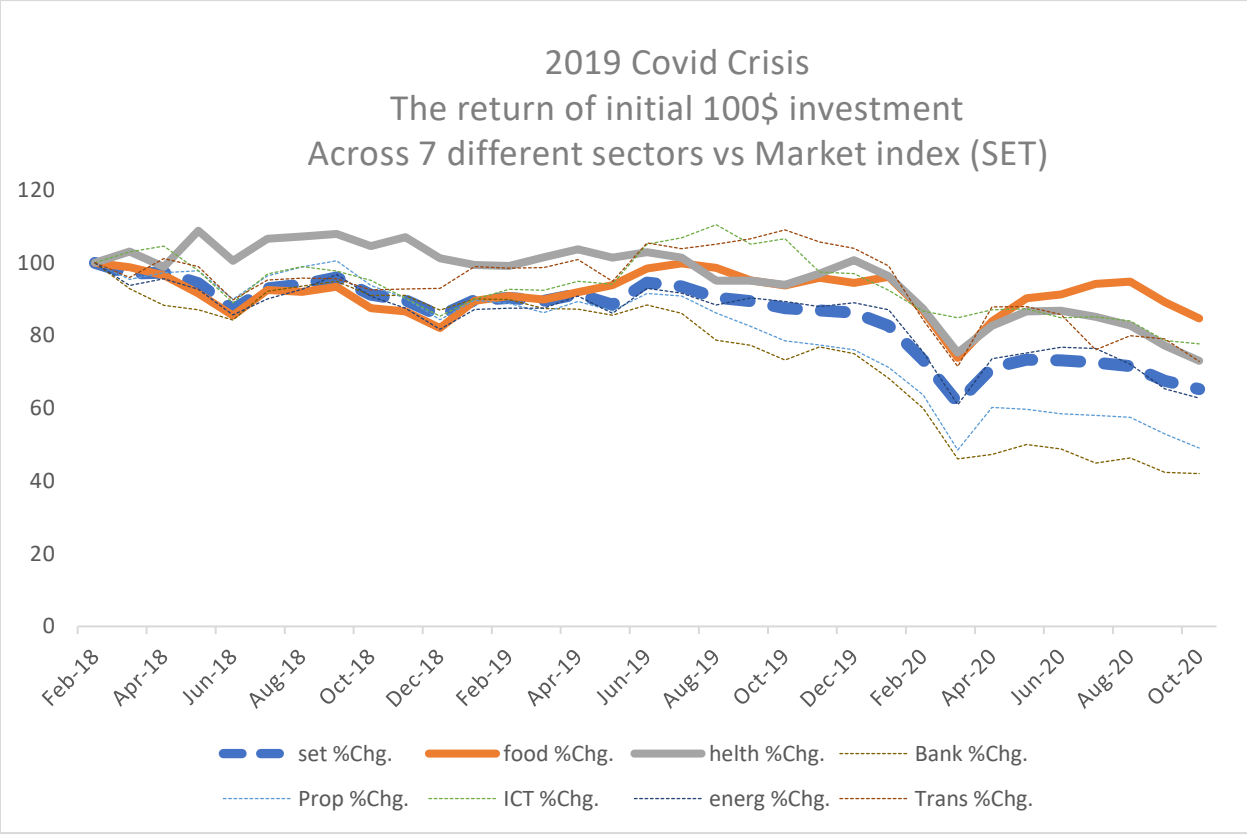


Figure 3.3 Comparing 8 different sectors during the Covid-19 crisis for initial 100$ investment.

From comparison of 3 crisis, the Food sector are clearly the winner during the crisis period, while the banking and property sectors are obvious loser here. For the first glance, Investor should stay away from these 2 sectors during the crisis period to prevent the huge loss.

Aside from 3 figure above, the exploration will take place further in the correlation analysis and performance measurement table.

Figure 3.4 The correlation metric of all period 1990 January – 2020 November.

The correlation investigates the linear relationship between the returns of different sectors. The sectors that has lower correlation to the SET index (market index) indicated the lower risk for portfolio diversification. The below figure shows the correlation table value ranging from -1 to 1 if the value closed to 1 indicated high correlation and thus higher risk that are non-diversifiable. From the figure 3.4: The lowest correlation metric are **food and the healthcare** sector with the value of 65% and 52% respectively. We can use this information to infer that Food and Healthcare sector are one of the most defensive sectors comparing to the Thailand market index (SET).

	set %Chg.	*food %Chg.*	*helth %Chg.*	*Bank %Chg.*	*Prop %Chg.*	*ICT %Chg.*	*energ %Chg.*	*Trans %Chg.*
set %Chg.	1.00							
food %Chg.	0.65	1.00						
helth %Chg.	0.52	0.46	1.00					
Bank %Chg.	0.88	0.52	0.38	1.00				
Prop %Chg.	0.83	0.58	0.52	0.76	1.00			
ICT %Chg.	0.79	0.40	0.35	0.63	0.55	1.00		
energ %Chg.	0.76	0.52	0.33	0.58	0.51	0.56	1.00	
Trans %Chg.	0.76	0.52	0.41	0.64	0.63	0.55	0.56	1

Figure 3.4 The correlation metric of all period 1990 January – 2020 November.

Figure 3.5 Crisis Investment return across different major sectors.

After the graphical representation, the information is concluded in the figure 3.5 to see which sectors are consistent outperformer during the crisis period. From the Figure 3.5, the only sector that consistently beat the market return (SET) during 3 different crisis period were **Food** sectors.

While the **Healthcare, ICT, Energy, Transportation** were able to beat the market 2 out of 3 times. The project will also measure toward these sectors as "Somewhat defensive"

The **Banking and Property** were not able not beat the market at every period. Then they can be considered as the "Non defensive sectors"

	TR 1997	TR 2008	TR 2019	Outperform vs Mkt During 1997	Outperform vs Mkt During 2008	Outperform vs Mkt During 2019
SET (Market Index)	-0.85	-0.50	-0.35	0	0	0
Food	-0.34	-0.32	-0.15	1	1	1
Health	-0.84	-0.51	-0.27	1	0	1
Bank	-0.94	-0.52	-0.58	0	0	0
Property	-0.98	-0.60	-0.51	0	0	0
ICT	-0.87	-0.34	-0.22	0	1	1
Energy	-0.45	-0.48	-0.37	1	1	0
Transportation	-0.52	-0.73	-0.27	1	0	1

Figure 3.5 Crisis Investment return across different major sectors.

Data Exploration on crisis return conclusion

After the initial exploration, the project decided to investigate on the Food and Healthcare sectors.

Food sector are prevalent enough of the data exploration that they were able to beat the market index (SET) at any crisis period by large amount.

Healthcare sector: Even though they are “Somewhat defensive”, from the theoretical standpoint the healthcare sector will be one of the most defensive sectors of all other sectors. The people could not afford to be ill make the healthcare sector appearing even in the period of crisis.

In addition, these 2 sectors had the lowest correlation to the market index (SET)

3.2 Sector operation performance investigation

After the project has choose the food and healthcare as defensive sectors for further investigation, additional analysis must be explored. The returns of the sector alone cannot be the only dimension for investor to make the decision. The company performance during the crisis must also be evaluated. The following figure will contain the information regarding the financial ratios. The evaluation will be for different 4 period. Tomyumkung crisis 1997, Global financial crisis 2008 , Covid-19 crisis 2020, and the non-crisis period. The major evaluation will measured the volatility of the ratios across 4 period. The financial ratios metric that the project will considered are the following:

1. **P/E ratios: Price/ Earning:** The consistent price / earning indicated lower volatility measured from individual company price to their representative earning.
2. **EPS ratios: Earning Per Shares:** Major represent earning of each company, less fluctuated earning indicated more attractive for risk adverse investor.
3. **ROA : Return of Asset :** The return of asset indicate how much profit can each asset generate.
4. **ROE: Return of equity :** The return of equity indicate how much profit will be divided for each equity holder.
5. **Gross Profit Margin :** Almost the same measurement as profit however, the gross profit are measured that company can survived or not, if gross profit margin is negative which mean they cannot generate revenue to covered their cost of good sold.
6. **D/E: Debt to Equity** : This ratios measure the debt of the company, the bankruptcy company tend to have more debt.
7. **Current Ratios :** This ratios measure the liquidity asset that company has in order to pay the short term debt. This measure the liquidity operation of the company.
8. **Fixed Asset turnover :** Food and healthcare sector usually generate revenue by relying on fixed asset (Hospital , Factory) the fixed asset turnover is the appropriate measure for company that has rely on fixed asset to generate revenue.

1. P/E

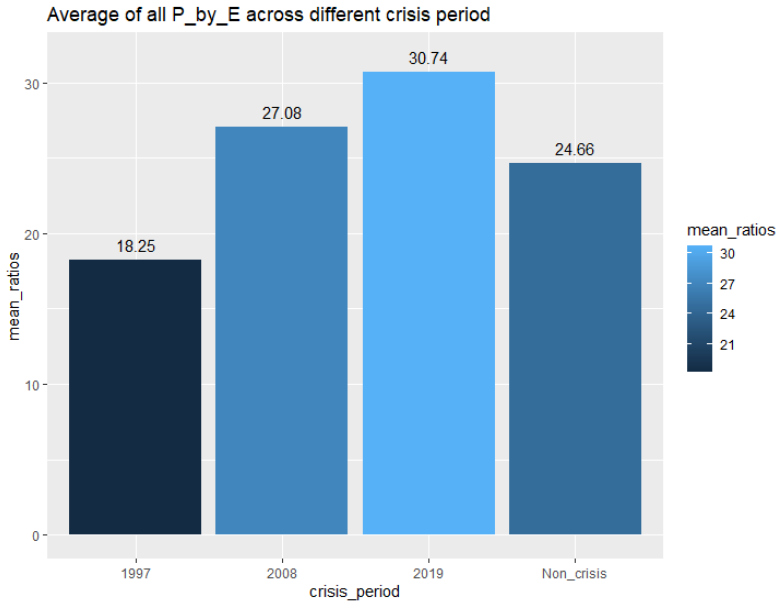


Figure 3.7 Health Care Sector P/E

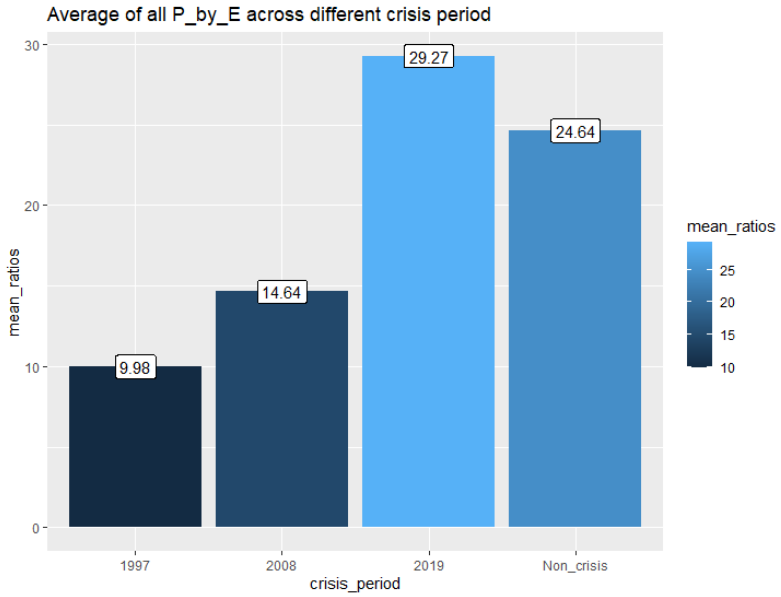


Figure 3.8 Food Sector P/E

For P/E: Price / Earnings Ratios. The healthcare sector has quite stable P/E across different period. While the Food sector P/E were entirely different across 4 period of measurement. The 1997 crisis lead the price of the equity to be low while they were being high price traded during COVID-19 crisis compared to their earning. The diagram has shown that even though the food sector might overperform vs the market in every crisis period. The healthcare sector is much more stable in P/E.

2. EPS

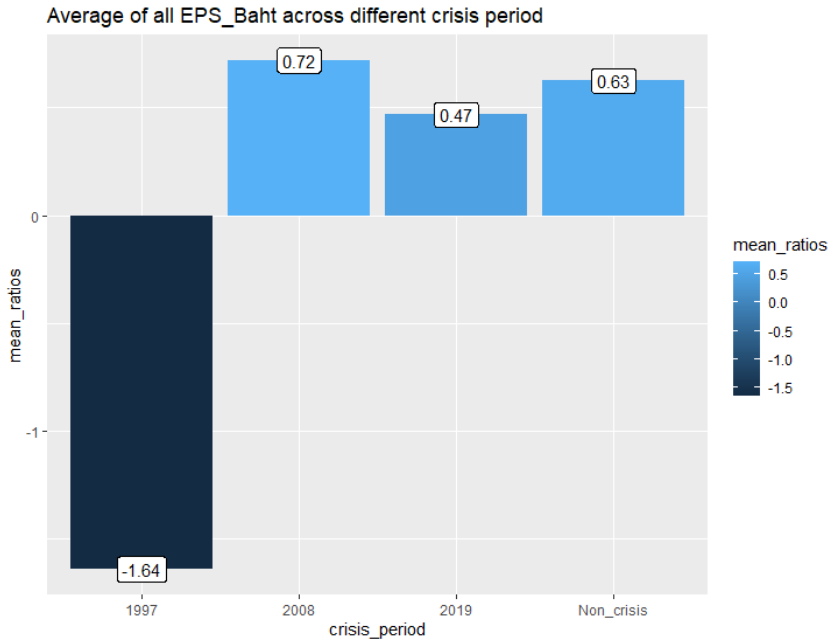


Figure 3.9 Health Care Sector EPS

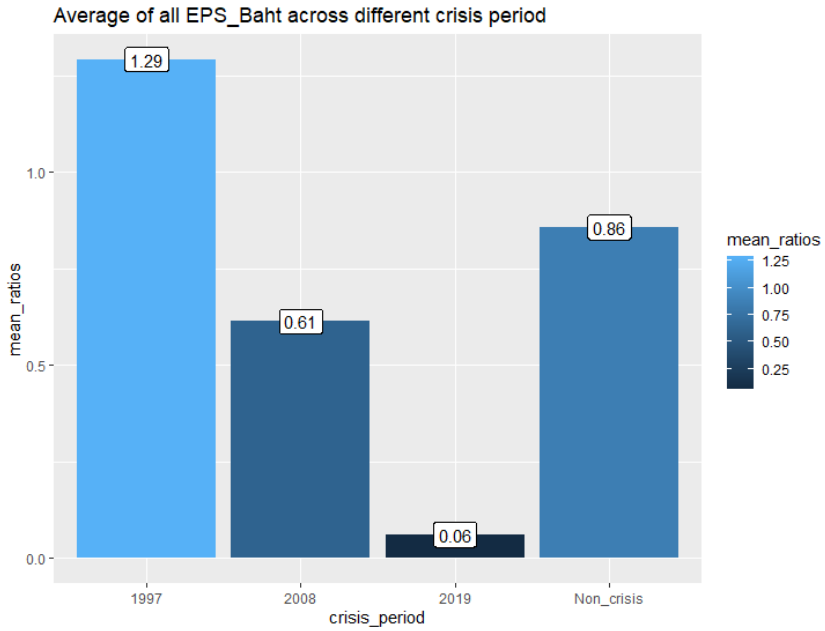


Figure 3.10 Food Sector EPS

For EPS: Earnings per share Ratios. The healthcare sector has quite stable EPS except during the 1997 crisis the earning were negative for most hospital. While the Food sector EPS were entirely different across 4 period of measurement. The healthcare sector is much more stable in P/E. The negative earnings of 1997 caused from foreign debt that increased in value. However, the healthcare sector nowadays were owned mostly by the doctor which they were risk adverse in general, further evident of risk aversion will be in the D/E ratios analysis.

3. ROA

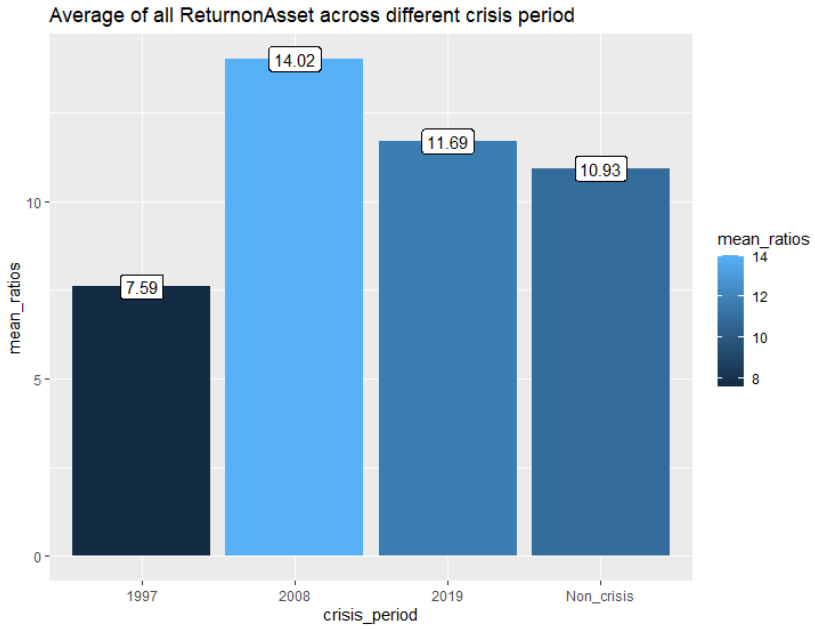


Figure 3.11 Health Care Sector ROA

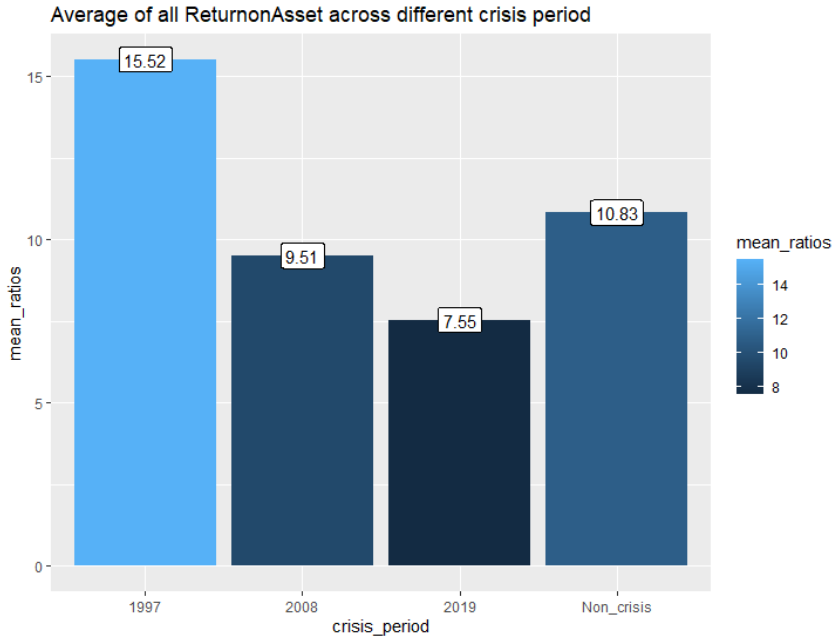


Figure 3.12 Food Sector ROA

For ROA: Return on Asset Ratios. Both sector has nonstable ROA. During the non crisis period both of the sectors has approximately the same ROA 10.83 and 10.93 however, the other crisis were entirely different.

In 1997 Food >> Health

In 2008 Health >> Food

In 2019 Food > Health

The good things for this non stable ROA is these sector are unstable in different direction and thus both sector can be put into the basket for better diversification.

4. ROE

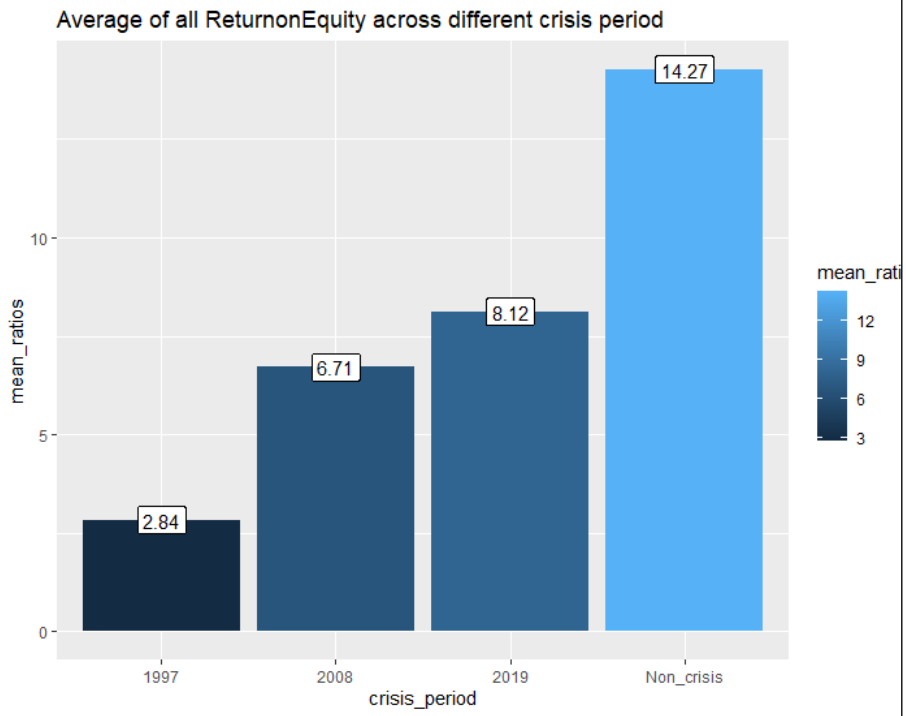


Figure 3.13 Health Care Sector ROE

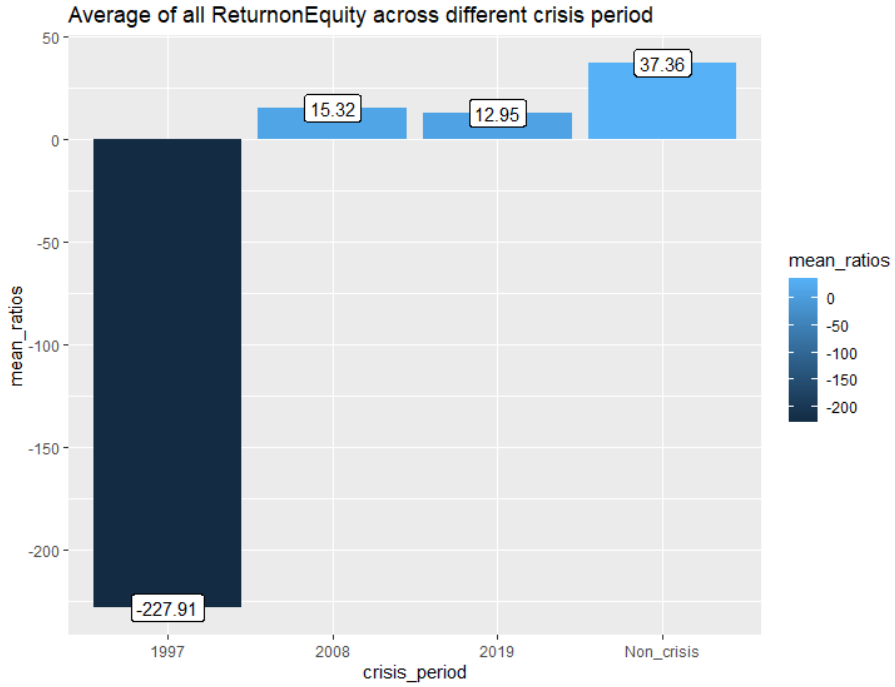


Figure 3.14 Food Sector ROE

For ROE: Return on Equity Ratios, which indicated how much the equity holder will get from the profit that company has generated.

Both sectors have quite volatile ROE across different crisis period. The healthcare one has negative ROE due to negative equity.

However, during the other period ROE were quite high for the healthcare sector 15.32, 12.95 and 37.36 are big return to equity holder. However, these ROE ratios are consider the worst metric for risk adverse investor due to how non stable they were.

5. Gross Profit Margin

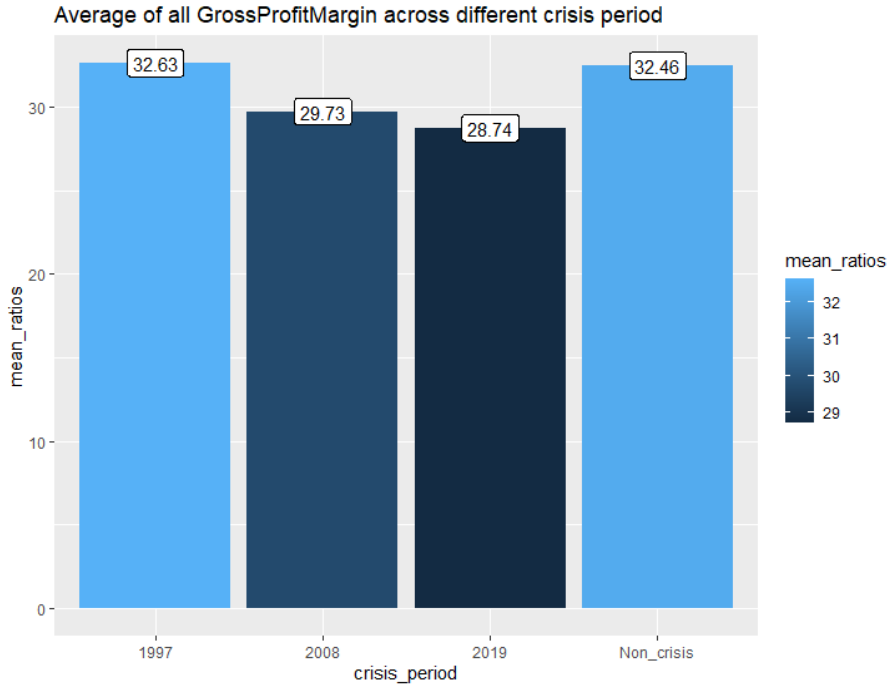


Figure 3.15 Health Care Sector Gross Profit Margin

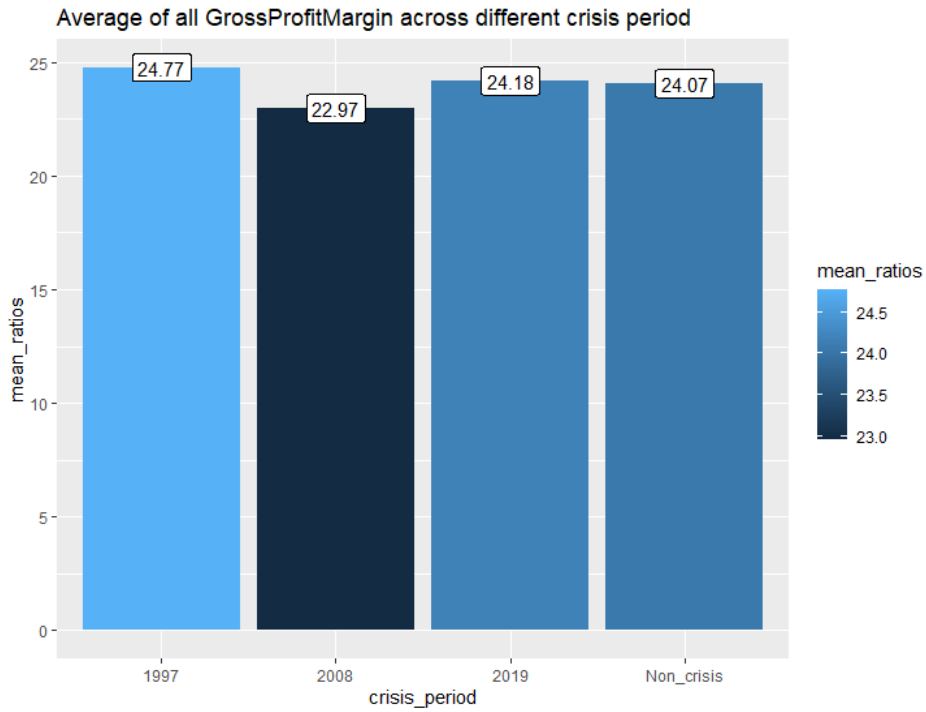


Figure 3.16 Food Sector Gross Profit Margin

For Gross profit Margin: The first 4 metric were based entirely on the profit part. However, the real measurement of company survivability is whether the company can cover their variable cost or not.

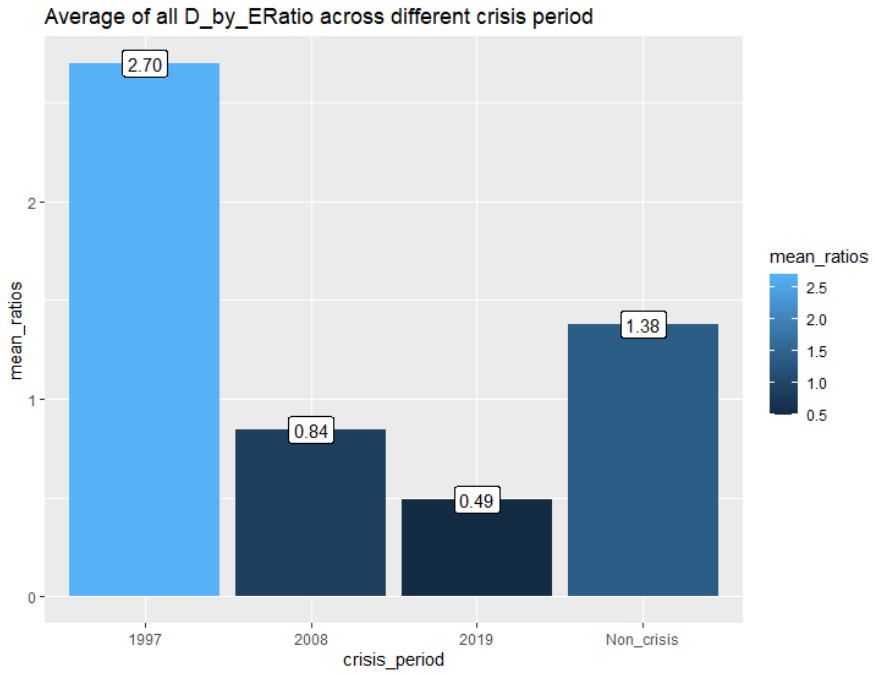
Both of Gross profit and healthcare sector have quite high gross profit margin and are very stable.

Healthcare: approximately 30%

Food: approximately 24%

The gross margin looks stable across different crisis period.

6. D/E



For Debt to Equity ratios: These 2 sectors have incredibly low debt to equity ratios. While low D/E ratios can indicate lower growth of the company, it is the best measure for defensive stock. In addition, the owner of hospital usually be the doctor who has more risk adverse than other people. The highest of each sector were happened in 1997, where every company in Thailand has doubled their foreign debt amount. Therefore, it is understandable for this period to have higher D/E ratios. Some of the company may have the negative equity during the 1997 period.

Figure 3.17 Health Care Sector D/E

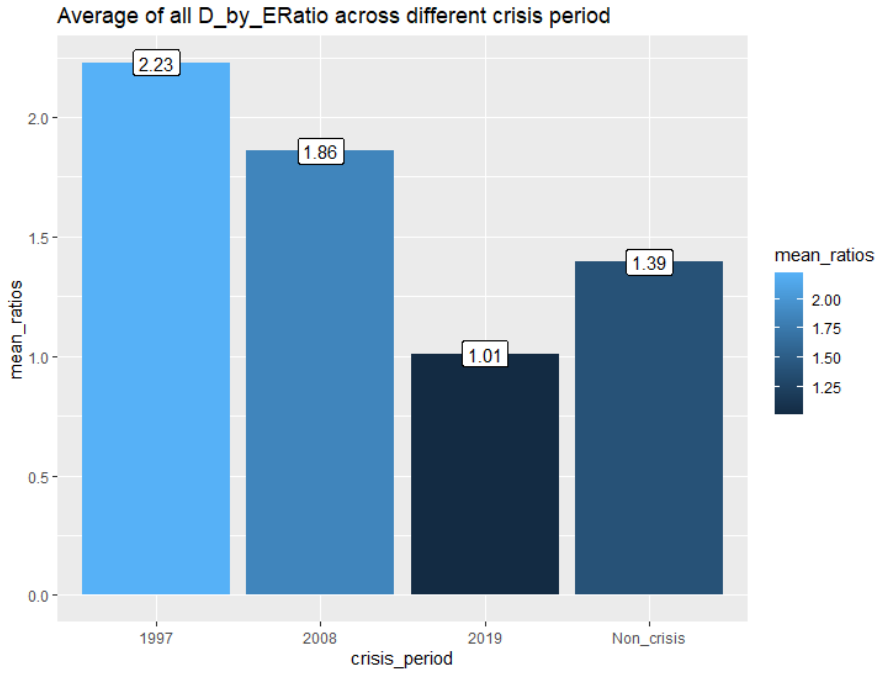


Figure 3.18 Food Sector D/E

7. Current Ratio

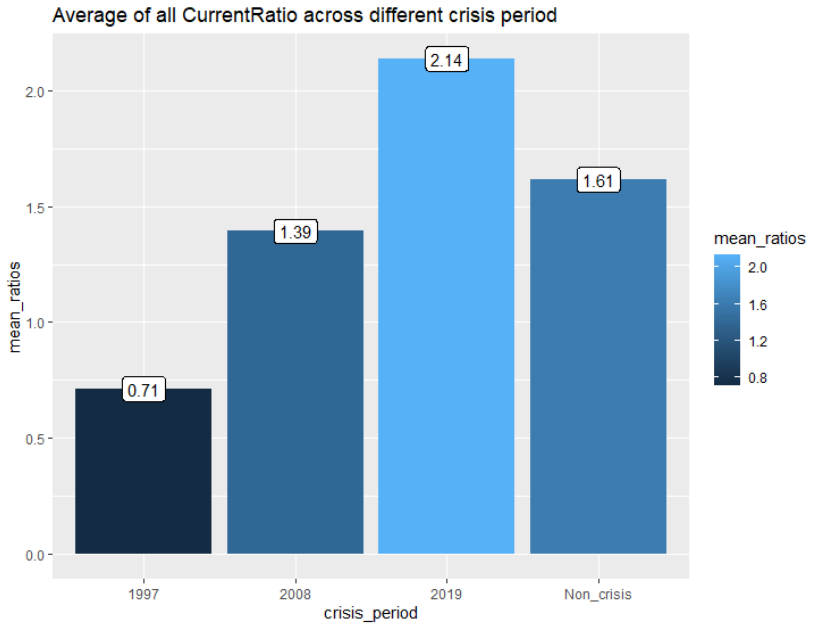


Figure 3.19 Health Care Sector Current Ratio

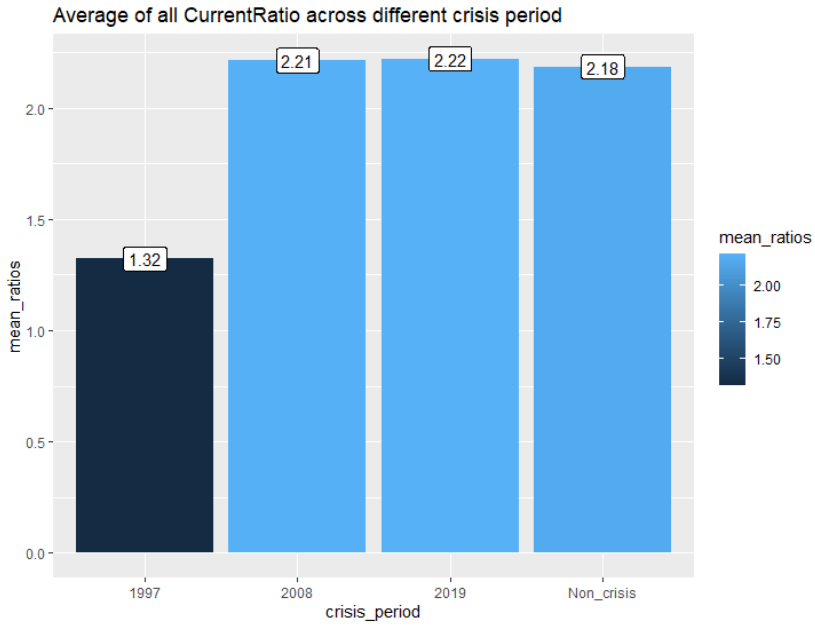


Figure 3.20 Food Sector Current Ratio

For Current ratios: the food sector has quite stable and high current ratios. (Around 2.2 except the 1997 period) the company has easily ability to repay their short-term debt and thus lower liquidity risk. The healthcare sector are more fluctuated however , they usually required less amount of cash to pay to supplier which mainly the pharmacy supplier.

8. Fixed assets turn over

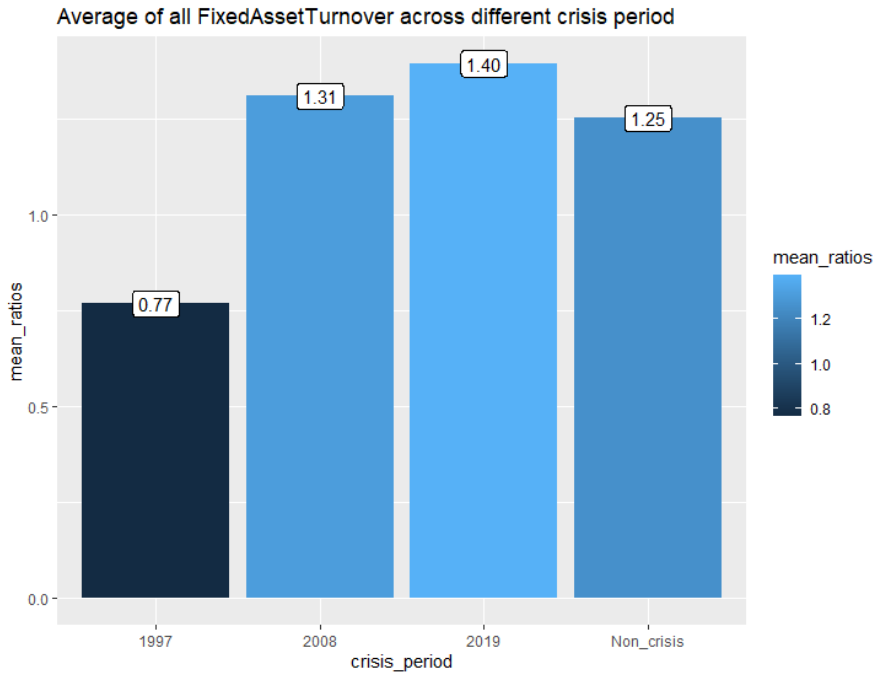


Figure 3.21 Health Sector Fixed assets turn over

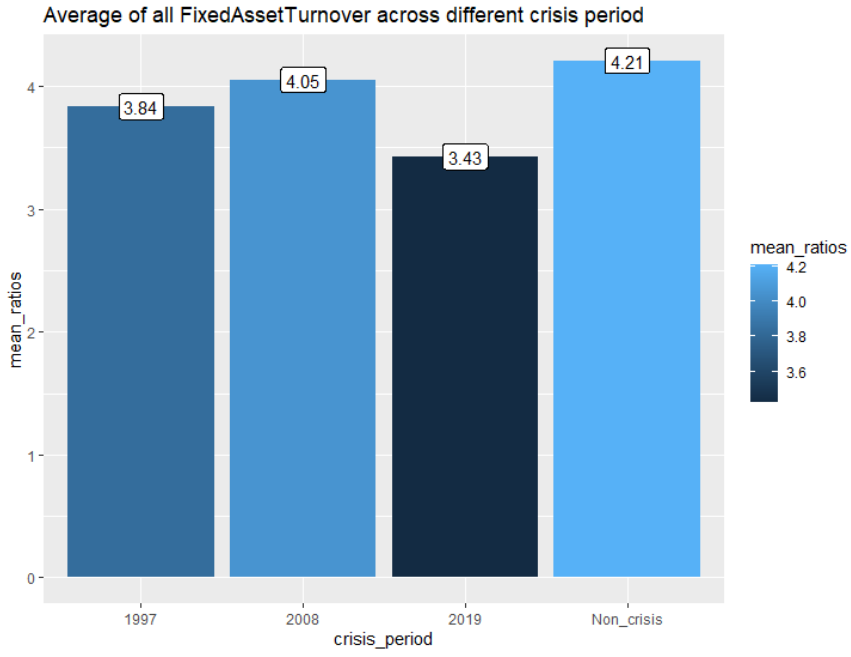


Figure 3.22 Food Sector Fixed assets turn over

For Fixed asset turnover: this most important ratios for high fixed asset company like healthcare (hospital) and food (factory).

The fixed asset turnover for both sector where quite high and extremely stable comparing to other metric.

Healthcare has around 1.3 times except the 1997 period.

Food has around 4 times

The higher ratios of fixed asset turnover of food comparing to healthcare to due they are not solely relied on the fixed asset to generate their income.

While the healthcare relied heavy on the hospital asset to generate the income, which indicated less fixed asset turnover.

However, the fixed asset turnover of healthcare sector still high and very stable which is appropriate for high fixed asset defensive sectors.

Sector operation performance investigation Conclusion

Both sectors have quite stable metric and high number of ratios required to generate consistent income during the crisis. There are some ratios that present some underperforming during the 1997 crisis which quite understandable from how devastating the 1997 crisis effect on Thailand economy.

4. Methodology

After we explored the definition of preventive sector and how they behave during the crisis period vs non-crisis period by investigating at both their cumulative return and their financial ratios, the next question is “How can we invest these sectors during the crisis period?”. The investment decision usually based on financial performance. However, during the crisis this interaction between the financial performance and the actual return might be different from what noncrisis period is. Therefore, this research main objective is to find the way how to invest these sectors during the crisis period. The methodology that the project will used will be indicated as followed:

4.1 Crisis period vs Non crisis period identification

4.2 The return objective

4.3 The Financial ratios identification

4.4 Dimension reduction on company performance

4.5 Panel regression for causation

The analysis will be done across 2 sector food and healthcare sector in Thailand so that the final metric for determine the investment factor going to be as followed.

Sector/Period	Crisis period	Non-Crisis period
Healthcare	Healthcare + Crisis period	Healthcare + Non-Crisis period
Food	Food + Crisis period	Food + Non-Crisis period

The focus of our analysis is the metric Healthcare **+ Crisis period** & **Food + Crisis period**

4.1 Crisis period vs Non crisis period identification

From the data exploration the project has divided the data into 4 segments (Q indicated quarter)

1. **East Asian Crisis (Tom yum kung crisis):** The crisis ranging from 1996 Q3 – 1998 Q3, Thailand has more than 100% currency depreciation, which lead to double amount in foreign debt repayment. This caused many companies in Thailand when bankrupt.

2. **Global Financial crisis (2008 Crisis):** The crisis ranging from 2007 Q2 – 2009 Q1, even though, Thailand has little investment in CDO CDS from foreign country, the stock market still experiences more than 60% drop in value.

3. **COVID-19 Crisis (Current Crisis):** The crisis ranging from 2019 Q1– 2020 Q3 (Currently the project formulated 2020 Q3), Due to the bubble in stock market from long period of low interest rate, one triggered event could cause the bubble to burst. That event is COVID-19 virus which also directly affect Thailand travel sector.

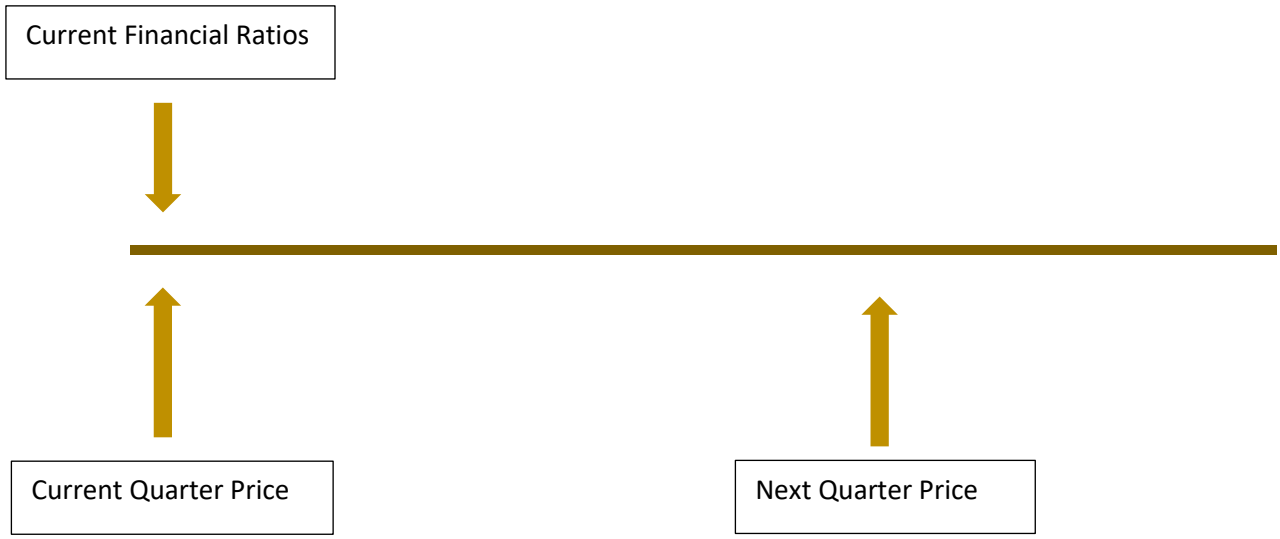
4. **Non-Crisis** All of the quarter ranging from 1992 Q1 – 2020 Q4 excluding 3 crisis period indicated above.

It is important to use the quarterly data since the company financial report came out once per quarter. Therefore, the main obstacle is that each period during the crisis will consisted of very few rows of observations. For instance, the 1997 crisis period only has 9 timeseries period, Covid 2019 crisis only has 8 timeseries period. Therefore, if the regression analysis conduct on these periods separately, the beta parameter cannot be efficient to indicate the causation (More explanation on 4.5 Panel regression for causation). Therefore, the main analysis will be conduct on 2 separate crises. THE CRISIS PERIOD and THE NON-CRISIS PERIOD. In which the crisis period will include all quarter of the 3 crises together which can significantly increase the number of timeseries observation.

4.2 The return objective

The investment decision will be based on future return that one can achieve. The project will therefore have the targeting label as the future return. Because the return column is stationary which is the opposite of the non-stationary behavior of the target price. The Non-stationary variable will cause the regression model to be spurious, therefore the stationary behavior of return variable is necessary.

The next question is “How can we identify the future return?” The return must be after the company financial information reported. And the timeline of each report has to be the same interval for the consistency of measurement. Therefore, the project identify the return as **Next quarter return compared to the current quarter** , in this way the investor can be able to leverage the return information and make their decision clearly after the financial ratios has been reported.



Future Return = (Next Quarter Price – Current Quarter Price) / Current Quarter Price

4.3 Financial Ratios identification.

One of the most important information for investor is the company financial information. This indicates the company health and potential growth. That information has reduced into the form of financial ratios. These financial ratios will be divided into 5 categories:

First, the Profitability ratios: These ratios indicated the profitability of the company. The company that has higher profit usually be more attractive to the investor which in turn can caused the price and future return to increase. These ratios consisted of

1. ReturnonEquity
2. ReturnonAsset
3. NetProfitMargin
4. EBITMargin
5. GrossProfitMargin

Second, the Debt ratios (Solvency Ratios): these ratios indicated the leverage position of the company, higher debt can indicate in both directions, higher growth, and higher company bankruptcy risk. These ratios consisted of

1. Debt to Equity
2. Interest Coverage

Third the Activity ratios: these ratios determine the efficiency for the company operating assets. Showing that different asset can generate the sales or cash. These ratios consisted of

1. FixedAssetTurnover
2. TotalAssetTurnover
3. InventoryTurnover
4. AverageSalePeriod_Days
5. AccountReceivableTurnover
6. AverageCollectionPeriod_Days

Forth the liquidity ratios: these ratios measure the liquidity assets of the company. Usually having the higher liquidity asset eliminate the liquidity risk however the high amount of the liquidity slows down the company growth. (Due to tradeoff between cash and investment) These ratios consisted of

1. CurrentRatio
2. QuickRatio
3. AccountPayableTurnover
4. AveragePaymentPeriod_Days",
5. CashCycle_Days

Price ratios: these ratios indicate the price of the financial asset of the company. These indicated how much the company worth given their performance. The Dividend payout also put here due to the price delusion when the dividend payment happened. These ratios consisted of

1. P/E Ratios
2. P/BV Ratios
3. EV/EBITDA Ratios
4. Dividend Payout Ratios

The project main objective is to identify among these factors which are the best for investment during the crisis period. How these ratios behave between crisis period and non-crisis period. However, the problem arises when dealing with these stacked financial ratios. These ratios came up from the same financial ratios number and thus yield the high multi collinearity. The problem will be further discussing in *section 4.4dimension reduction*. Knowing these information help investors to mitigate their incoming risk and diversify their investment accordingly.

4.4Dimension reduction for the financial ratio identification

These financial ratios may derive from the same information such as return on asset and return on equity:

ROA = net profit/total asset

ROE = net profit/total equity

These 2 ratios use the same net profit, which is the same information derived from the same balance sheet therefore these 2 ratios will surely have high correlation. Most of the financial ratios the project presented here derived from the same financial information. If these features are put together into the regression model, the multicollinearity problem will be caused most of the beta coefficient to be overly insignificant. Therefore, the method of dimension reduction will be applied here. The project will use the PCA: principal component analysis of the feature for dimension reduction technique. The dimension reduction will apply to 5 different group of the ratios separately. (Profitability ratios, Debt ratios, activity ratios, liquidity ratios and price ratios) The final result will be the PCA factor from each financial ratio group in which each financial ratio group may has more than approximately 75% captured in variance. The PCA will be constructed separately for food and healthcare sectors.

The following methodology will separate out the sectors and ratios category

Sectors: Healthcare, Food

Ratios: Profitability, Debt, Activity, Liquidity, Price

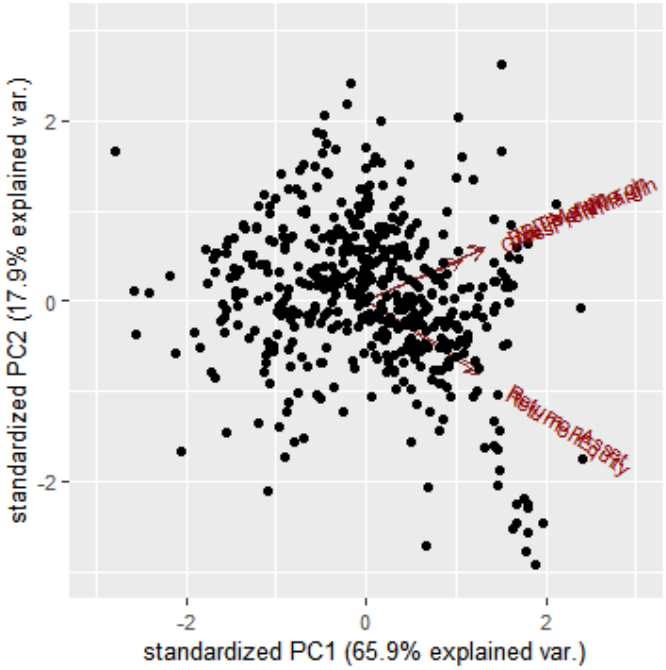
Each of them will also provide 2 figures, 1st being the cumulative variance that each principal component has kept for each ratio's category, 2nd being the direction of original variable to indicate the best variable that has almost the same direction as the Principal component direction. (More explanation will be in the analysis below)

1. Healthcare sectors

1.1 Profitability ratios

```
Importance of components:
                          PC1    PC2    PC3     PC4     PC5
Standard deviation     1.8146 0.9452 0.7614 0.36352 0.31930
Proportion of Variance 0.6585 0.1787 0.1160 0.02643 0.02039
Cumulative Proportion  0.6585 0.8372 0.9532 0.97961 1.00000
```

The Principal Component cumulative proportion of variance of healthcare| Profit ratios



The variance graph for each principal component healthcare PC1 vs PC2 | Profit ratios

From the figure **The Principal Component cumulative proportion of variance of healthcare| Profit ratios,** the project has concluded that the number of Principal components to choose for this category are PC1 and PC2 due to these 2 Principal component capture variations of original data more than 83% (the cut off is 75%) and the variable that followed each principal direction the most is

PC1 : Gross Margin , Return on Asset

PC2 : Return on Equity , Ebit Margin

1.2 Debt ratios

```
Importance of components:
                          PC1    PC2
Standard deviation     1.0482 0.9493
Proportion of Variance 0.5494 0.4506
Cumulative Proportion  0.5494 1.0000
```

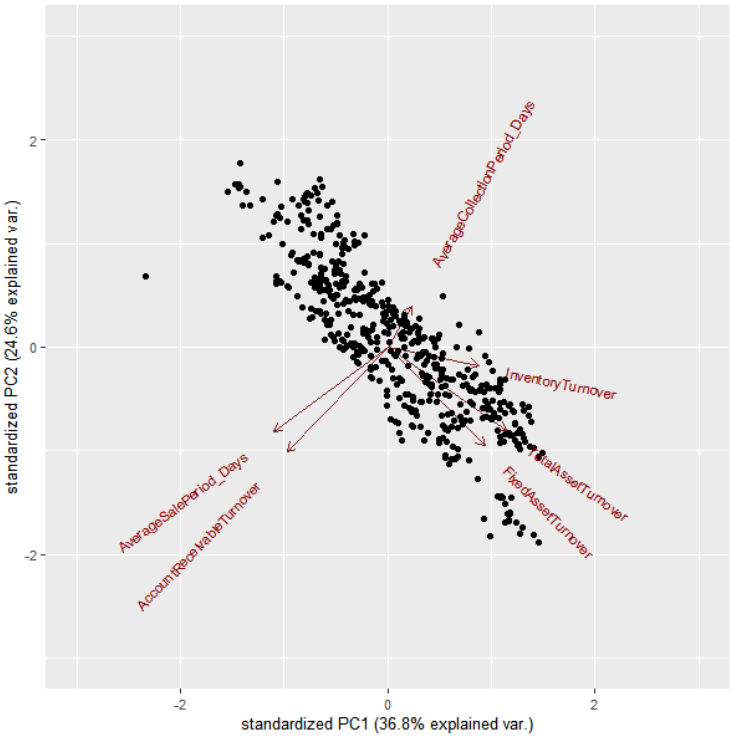
The Principal Component cumulative proportion of variance of healthcare| Debt ratios

From the figure **The Principal Component cumulative proportion of variance of healthcare| Debt ratios,** the project has concluded that this debt ratios will not be using principal component for dimension reduction since the number of components that has captured variance more than 75% is 2 which is equal to the number of variables before conducting the dimension reduction. Therefore, the project will include the original variable D/E ratios and Interest rate coverage as the original variable in to the regression analysis.

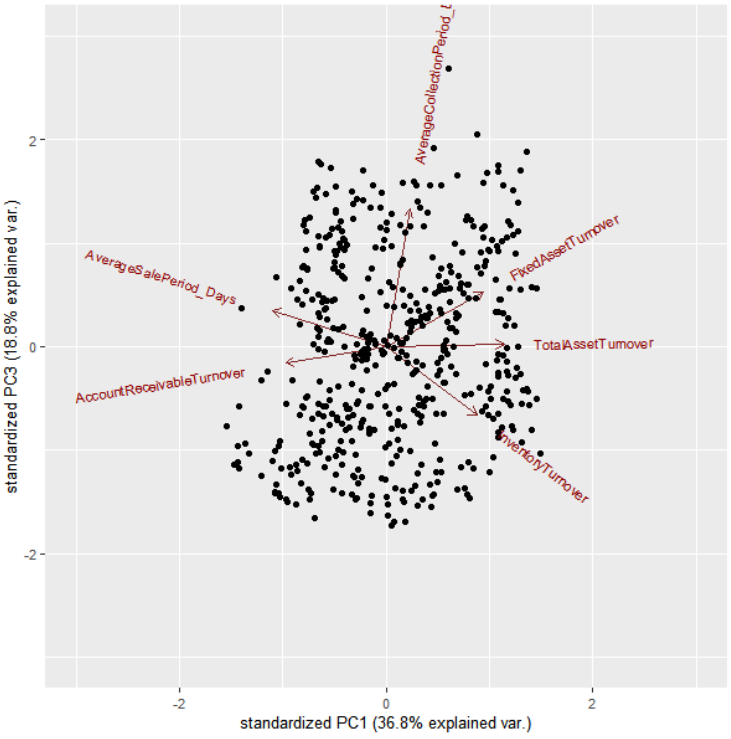
1.3 Activity ratios

```
Importance of components:
                          PC1    PC2    PC3    PC4     PC5     PC6
Standard deviation     1.4855 1.2148 1.0607 0.8378 0.51566 0.47383
Proportion of Variance 0.3678 0.2460 0.1875 0.1170 0.04432 0.03742
Cumulative Proportion  0.3678 0.6137 0.8013 0.9183 0.96258 1.00000
```

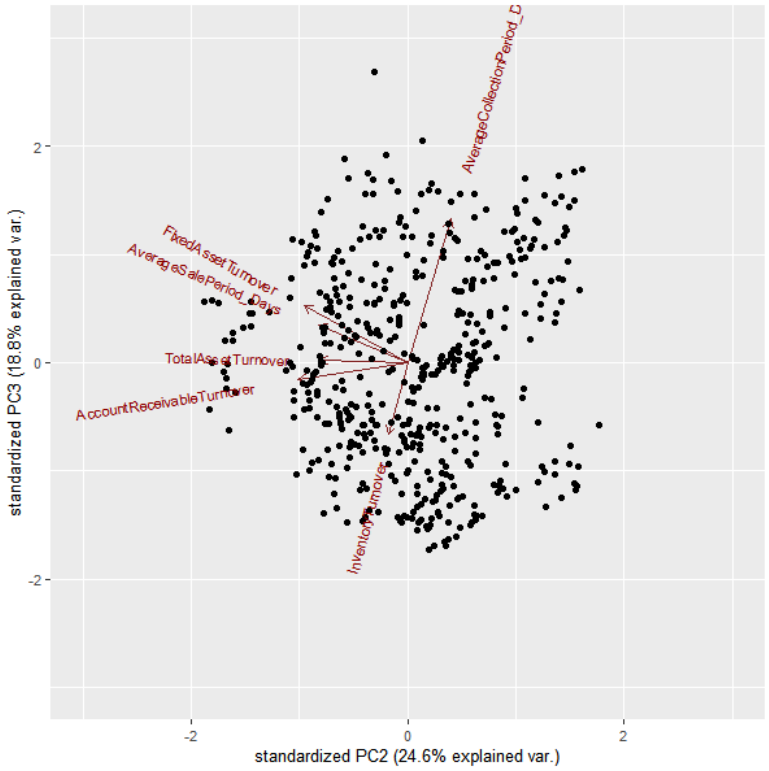
The Principal Component cumulative proportion of variance of healthcare| Activity ratios



The variance graph for each principal component healthcare PC1 vs PC 2 | Activity ratios



The variance graph for each principal component healthcare PC1 vs PC 3 | Activity ratios



The variance graph for each principal component healthcare PC2 vs PC 3 | Activity ratios

From the figure **The Principal Component cumulative proportion of variance of healthcare| Activity ratios,** the project has concluded that the number of Principal components to choose for this category are PC1, PC2, PC3 due to these 3 Principal component can capture variation of original data more than 80% (the cut off is 75%) and the variable that followed each principal direction the most is

PC1 : Inventory turnover, Total asset turn over

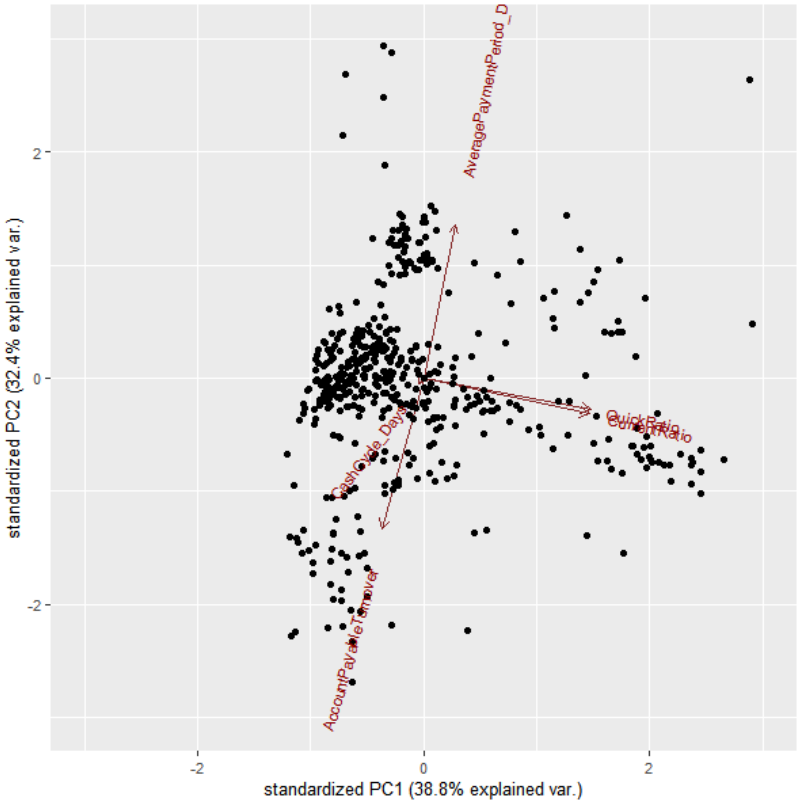
PC2 : Total asset turn over , Account receivable turnover

PC3 : Average Collection Period Day , Inventory turnover

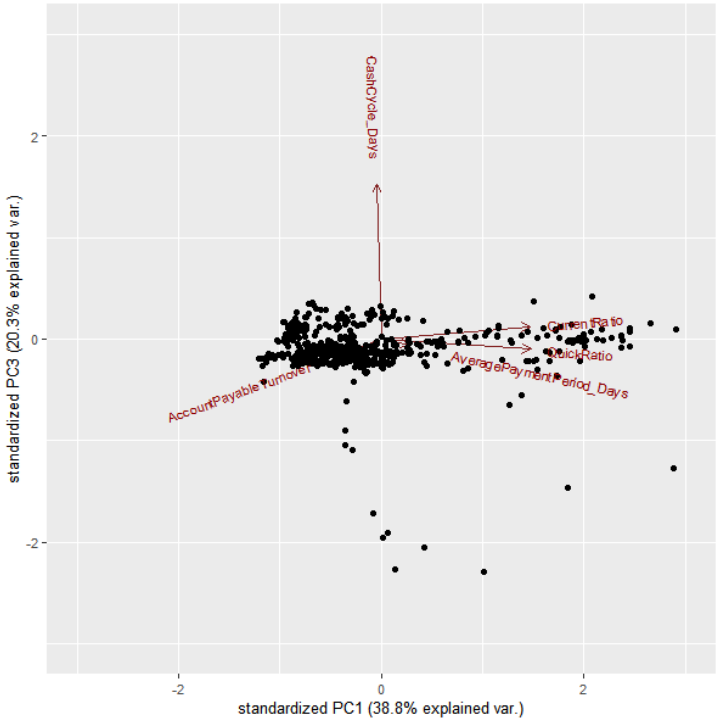
1.4 Liquidity ratios

```
Importance of components:
                          PC1    PC2    PC3     PC4     PC5
Standard deviation     1.3937 1.2730 1.0073 0.59927 0.25115
Proportion of Variance 0.3885 0.3241 0.2029 0.07182 0.01262
Cumulative Proportion  0.3885 0.7126 0.9156 0.98738 1.00000
```

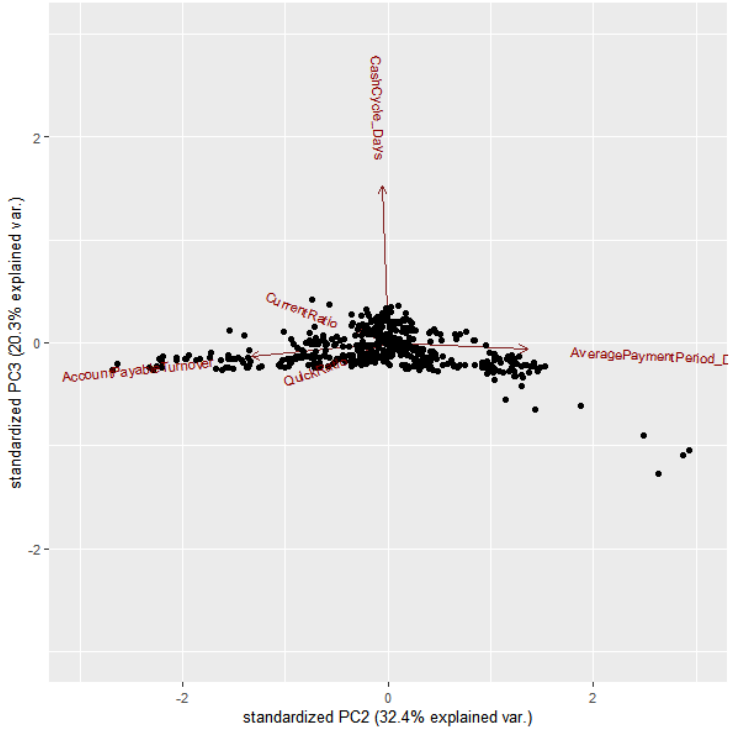
The Principal Component cumulative proportion of variance of healthcare| Liquidity ratios



The variance graph for each principal component healthcare PC1 vs PC 2 | Liquidity ratios



The variance graph for each principal component healthcare PC3 vs PC 2 | Liquidity ratios



The variance graph for each principal component healthcare PC1 vs PC 3 | Liquidity ratios

From the figure **The Principal Component cumulative proportion of variance of healthcare| Liquidity ratios,** the project has concluded that the number of Principal components to choose for this category are PC1, PC2, PC3 due to these 3 Principal components can capture variation of original data more than 91% (the cut off is 75%) and the variable that followed each principal direction the most is

PC1 : Current ratios , Quick ratios

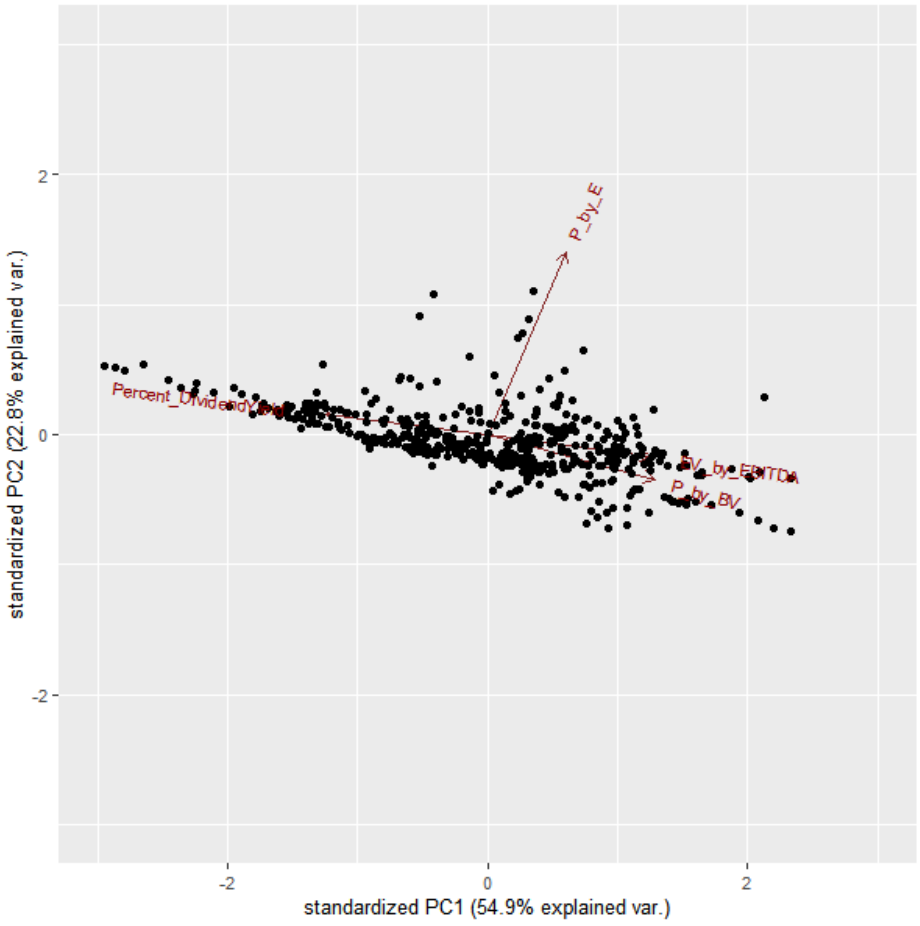
PC2 : Account Payable turnover , Average payment period day

PC3 : Cash cycle day

1.5 Price ratios

```
Importance of components:
                          PC1    PC2    PC3     PC4
Standard deviation     1.4821 0.9551 0.7083 0.62420
Proportion of Variance 0.5491 0.2280 0.1254 0.09741
Cumulative Proportion  0.5491 0.7772 0.9026 1.00000
```

The Principal Component cumulative proportion of variance of healthcare| Price ratios



The variance graph for each principal component healthcare| Price ratios

From the figure **The Principal Component cumulative proportion of variance of healthcare| Price ratios,** the project has concluded that the number of Principal components to choose for this category are PC1, PC2 due to these 2 Principal components can capture variation of original data more than 77% (the cut off is 75%) and the variable that followed each principal direction the most is

PC1 : EV/EBITDA , Percent Dividend Yield

PC2 : P/E

Conclusion of the healthcare sector principal component selection

The overall principal component selection

Healthcare	Number of Principal components selected	% Variance captured by original data
Profitability ratios	2	84%
Debt ratios	Use original variable	100%
Activity ratios	3	80%
Liquidity ratios	3	92%
Price ratios	2	78%

The variable that contributed to each principal component the most

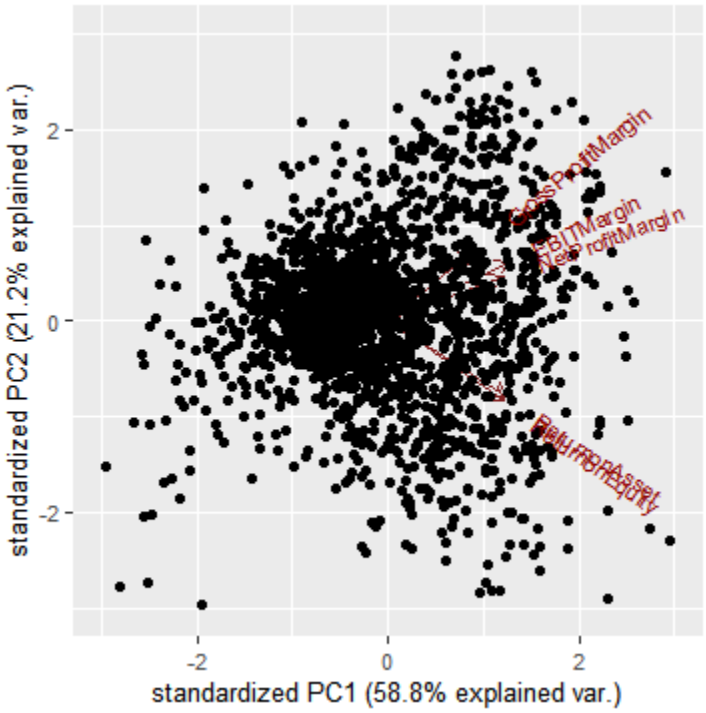
Healthcare	Principal component1	Principal component2	Principal component3
Profitability ratios	Gross Margin, Return on Asset	Return on Equity, Ebit Margin	-
Debt ratios	-	-	-
Activity ratios	Inventory turnover, Total asset turn over	Total assets turn over, Account receivable turnover	Average Collection Period Day, Inventory turnover
Liquidity ratios	Current ratios, Quick ratios	Account Payable turnover, Average payment period day	Cash cycle day
Price ratios	EV/EBITDA, Percent Dividend Yield	P/E	-

2. Food sectors

2.1 Profitability ratios

```
Importance of components:
                          PC1    PC2    PC3     PC4     PC5
Standard deviation     1.7143 1.0295 0.8240 0.47456 0.31163
Proportion of Variance 0.5878 0.2120 0.1358 0.04504 0.01942
Cumulative Proportion  0.5878 0.7997 0.9355 0.98058 1.00000
```

The Principal Component cumulative proportion of variance of Food| Profitability ratios



The variance graph for each principal component Food PC1 vs PC 2| Profitability ratios

From the figure **The Principal Component cumulative proportion of variance of Food | Price ratios,** the project has concluded that the number of Principal components to choose for this category are PC1, PC2 due to these 2 Principal components can capture variation of original data approximately80% (the cut off is 75%) and the variable that followed each principal direction the most are

PC1 : Net Profit Margin , Return on Asset

PC2 : Gross Profit Margin

2.2 Debt ratios

```
Importance of components:
                          PC1    PC2
Standard deviation     1.0493 0.9482
Proportion of Variance 0.5505 0.4495
Cumulative Proportion  0.5505 1.0000
```

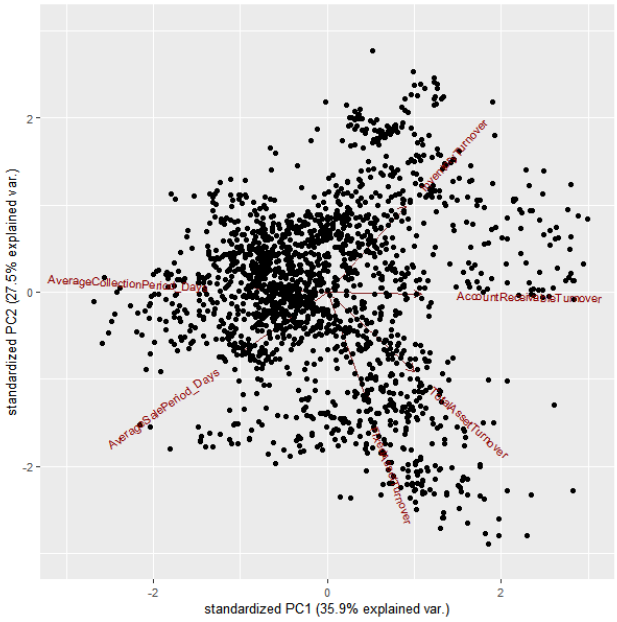
The Principal Component cumulative proportion of variance of Food| Debt ratios

From the figure **The Principal Component cumulative proportion of variance of Food| Debt ratios,** the project has concluded that this debt ratios will not be using principal component for dimension reduction since the number of components that has captured variance more than 75% is 2 which is equal to the number of variables before conducting the dimension reduction. Therefore, the project will include the original variable D/E ratios and Interest rate coverage as the original variable into the regression analysis.

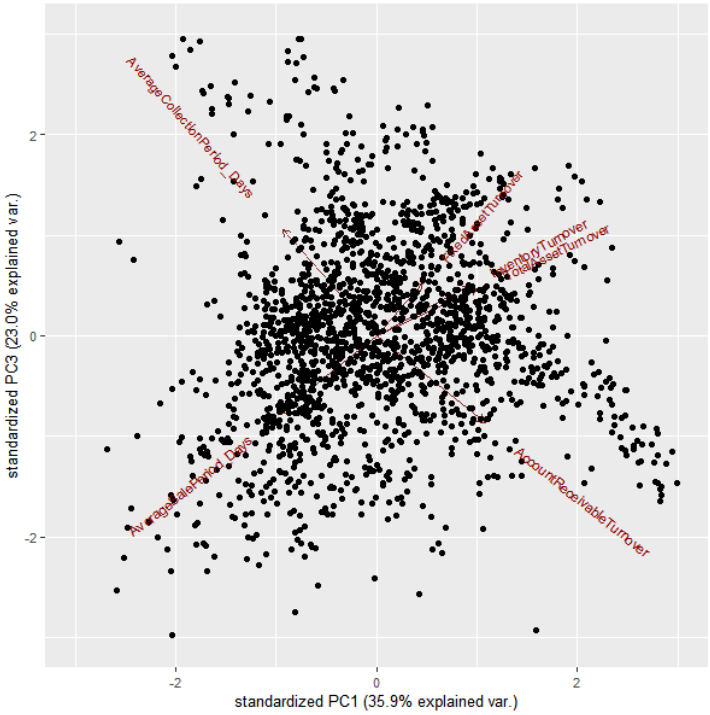
2.3 Activity ratios

```
Importance of components:
                          PC1    PC2    PC3     PC4    PC5     PC6
Standard deviation     1.4668 1.2855 1.1741 0.58849 0.5097 0.45987
Proportion of Variance 0.3586 0.2754 0.2297 0.05772 0.0433 0.03525
Cumulative Proportion  0.3586 0.6340 0.8637 0.92146 0.9647 1.00000
```

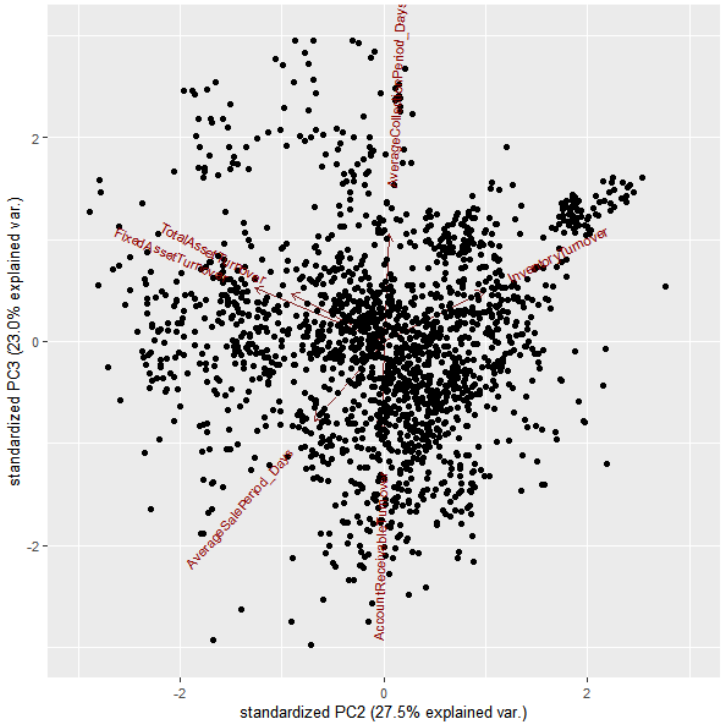
The Principal Component cumulative proportion of variance of Food| Activity ratios



The variance graph for each principal component Food PC1 vs PC 2| Activity ratios



The variance graph for each principal component Food PC1 vs PC 3| Activity ratios



The variance graph for each principal component Food PC2 vs PC 3| Activity ratios

From the figure **The Principal Component cumulative proportion of variance of Food | Activity ratios,** the project has concluded that the number of Principal components to choose for this category are PC1, PC2, PC3 due to these 3 Principal components can capture variation of original data approximately86% (the cut off is 75%) and the variable that followed each principal direction the most are

PC1 : Account receivable turnover , Average collection period day , Total Asset Turnover

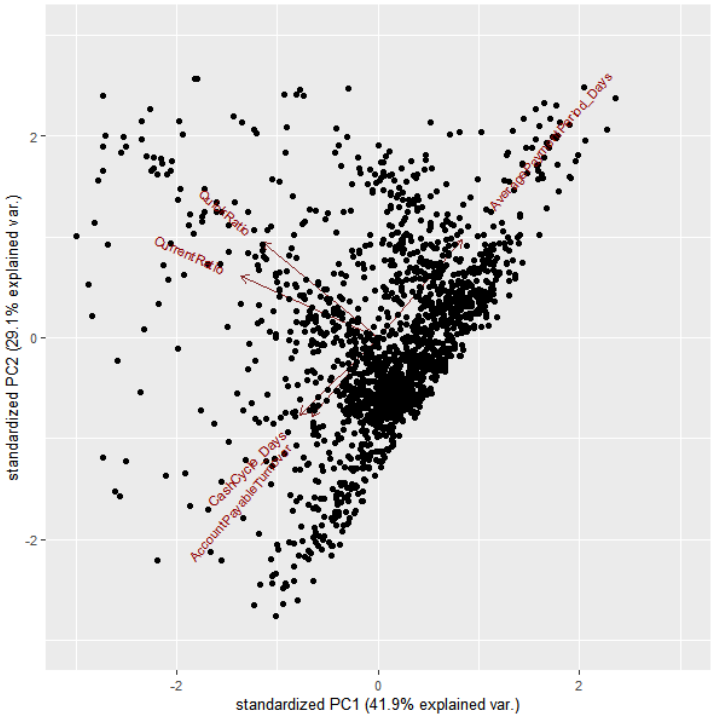
PC2 : Fixed Asset Turnover , inventory Turnover

PC3 : Average Sales Period, Account receivable turnover , Average collection period day

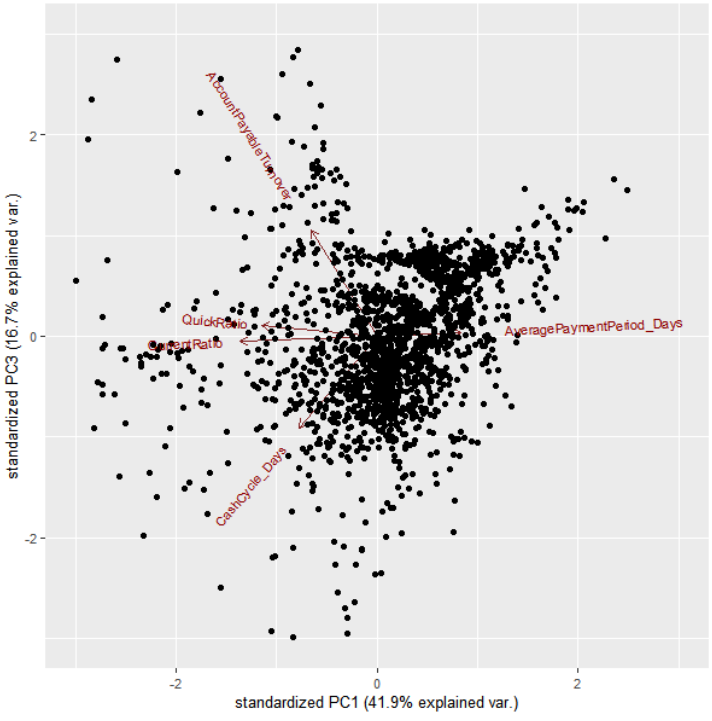
2.4 Liquidity ratios

```
Importance of components:
                          PC1    PC2    PC3    PC4     PC5
Standard deviation     1.4470 1.2052 0.9134 0.7206 0.31636
Proportion of Variance 0.4188 0.2905 0.1668 0.1039 0.02002
Cumulative Proportion  0.4188 0.7093 0.8761 0.9800 1.00000
```

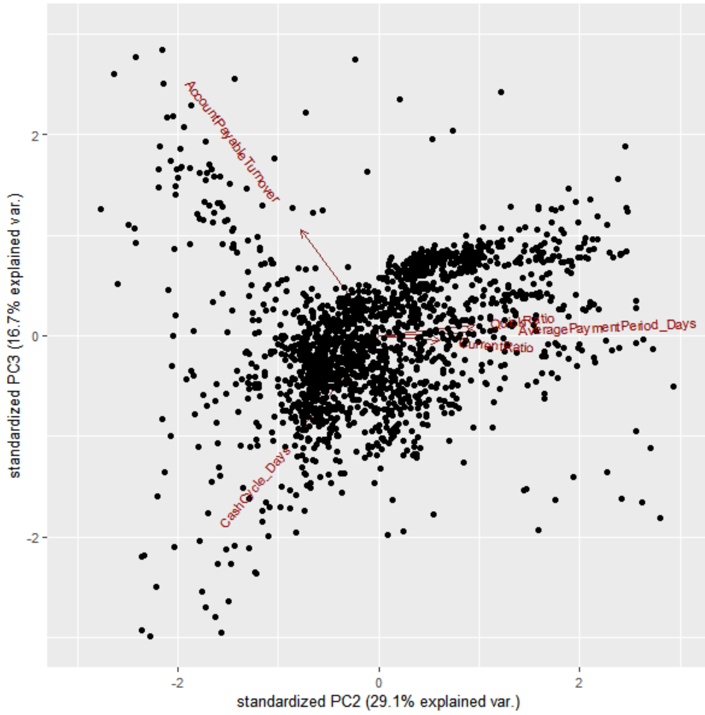
The Principal Component cumulative proportion of variance of Food| Liquidity ratios



The variance graph for each principal component Food PC1 vs PC 2| Liquidity ratios



The variance graph for each principal component Food PC1 vs PC 3| Liquidity ratios



The variance graph for each principal component Food PC3 vs PC 2| Liquidity ratios

From the figure **The Principal Component cumulative proportion of variance of Food | Liquidity ratios,** the project has concluded that the number of Principal components to choose for this category are PC1, PC2, PC3 due to these 3 Principal components can capture variation of original data approximately87% (the cut off is 75%) and the variable that followed each principal direction the most are

PC1: Current Ratios, Quick Ratios, Average Payment Period Day

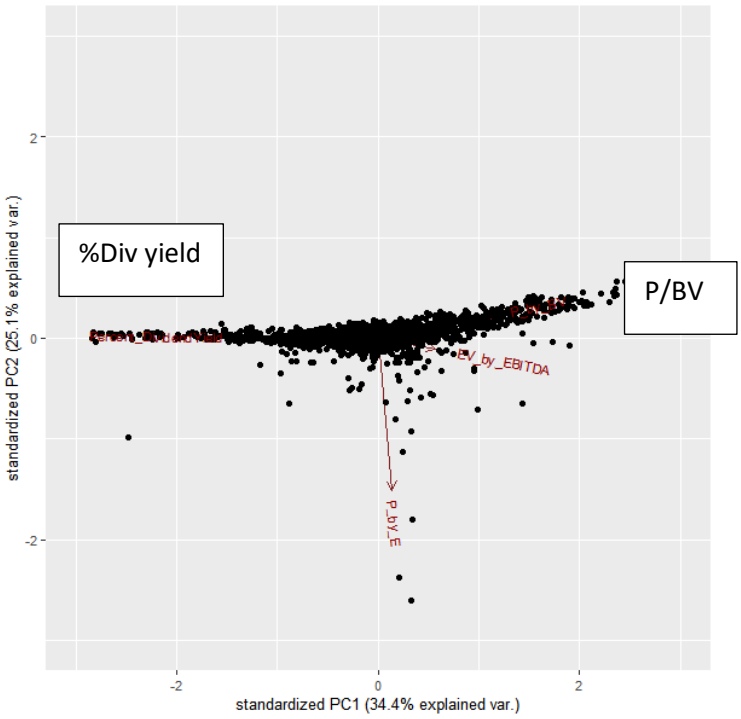
PC2: Cash Cycle day, Average Payment Period Day

PC3: Account Payable Turnover, Cash Cycle day,

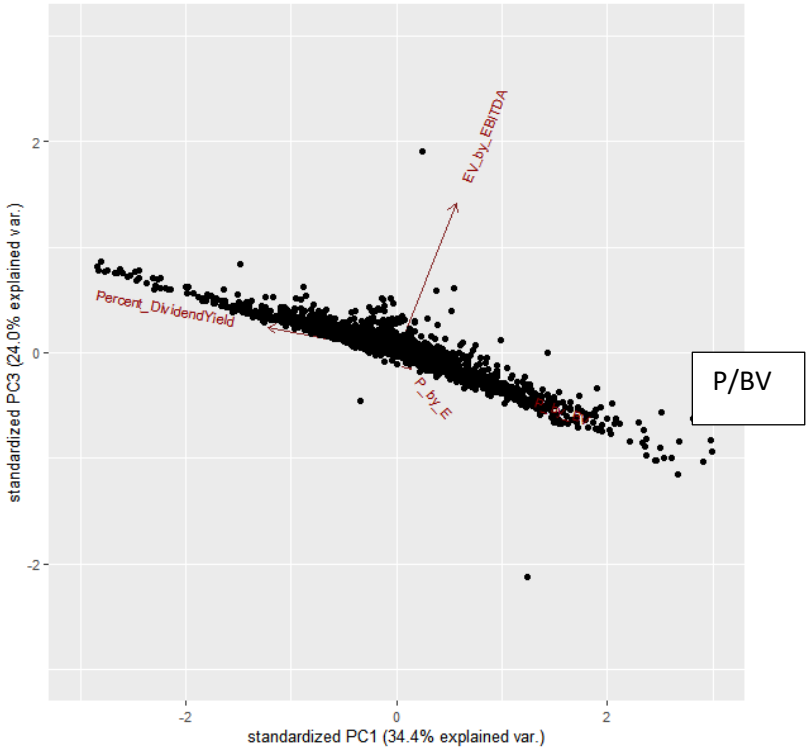
2.5 Price ratios

```
Importance of components:
                          PC1    PC2    PC3    PC4
Standard deviation     1.1727 1.0012 0.9805 0.8131
Proportion of Variance 0.3438 0.2506 0.2403 0.1653
Cumulative Proportion  0.3438 0.5944 0.8347 1.0000
```

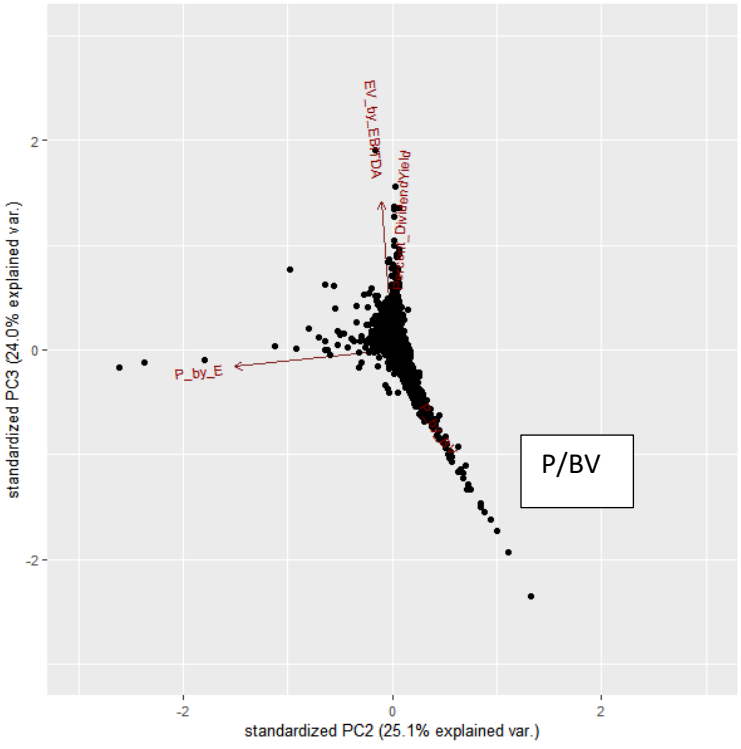
The Principal Component cumulative proportion of variance of Food| Price ratios



The variance graph for each principal component Food PC1 vs PC 2 | Price ratios



The variance graph for each principal component Food PC1 vs PC 3| Price ratios



The variance graph for each principal component Food PC2 vs PC 3| Price ratios

From the figure **The Principal Component cumulative proportion of variance of Food | Price ratios,** the project has concluded that the number of Principal components to choose for this category are PC1, PC2, PC3 due to these 3 Principal components can capture variation of original data approximately 83% (the cut off is 75%) and the variable that followed each principal direction the most are

PC1: P/BV, %Dividend Payout Yield

PC2: P/E

PC3: EV/EBITDA, %Dividend Payout Yield

Conclusion of the Food sector principal component selection

The overall principal component selection

Food	**Number of Principal components selected**	**% Variance captured by original data**
Profitability ratios	2	80%
Debt ratios	Use original variable	100%
Activity ratios	3	86%
Liquidity ratios	3	87%
Price ratios	3	84%

The variable that contributed to each principal component the most

Food	**Principal component1**	**Principal component2**	**Principal component3**
Profitability ratios	Net Profit Margin , Return on Asset	Gross Profit Margin	-
Debt ratios	-	-	-
Activity ratios	Account receivable turnover , Average collection period day , Total Asset Turnover	Fixed Asset Turnover , inventory Turnover	Average Sales Period, Account receivable turnover , Average collection period day
Liquidity ratios	Current Ratios, Quick Ratios, Average Payment Period Day	Cash Cycle day, Average Payment Period Day	Account Payable Turnover, Cash Cycle day,
Price ratios	P/BV, %Dividend Payout Yield	P/E	EV/EBITDA, %Dividend Payout Yield

These principal components will be put into the panel regression model for both sectors to prevent multicollinearity. The most important variable will be used for final interpretation.

4.5 Panel regression for causation

Finally, the project uses the regression analysis to identify the factors that can be used for investment of defensive sector during the crisis period. The panel regression we will be performed due to small number of quarterly timeseries data. More observation will present more efficient of beta coefficient estimated. The timeseries axis will comprise of quarterly timeseries data and the cross-sectional axis will comprise of each stocks information corresponding to each sector. The Healthcare sector have 15 individual stocks and Food sector have 39 individual stocks in Thailand stock market. These cross-sectional data and timeseries data will combined to create more observation for panel regression analysis which will yield more efficient result of beta coefficient.

The panel regression analysis will be done in 4 separate regression according to the diagram below:

Sector/Period	Crisis period (3 Crisis Combined)	Non-Crisis period
Healthcare	*Healthcare + Crisis period*	*Healthcare + Non-Crisis period*
Food	*Food + Crisis period*	*Food + Non-Crisis period*

Modeling structure:

$$y_{it} = X_{it}\beta + \alpha_i + u_{it} \text{ for } t = 1, \ldots, T \text{ and } i = 1, \ldots, N$$

Where

- yit is the quarterly return of next quarter. (So that the investor can identify which feature to look for and hold for the next quarter)
- Xit is the individual factors from each company at each time, mostly the principal component that project has derived for each ratio's category

The panel regression will be performed with the fixed effect modeling to eliminate the fixed effect variable.

5. Panel regression analysis

Sector/Period	Crisis period (3 Crisis Combined)	Non-Crisis period
Healthcare	*Healthcare + Crisis period*	*Healthcare + Non-Crisis period*
Food	*Food + Crisis period*	*Food + Non-Crisis period*

From the diagram, the project will start by analyzing the healthcare sector 1st (crisis vs non crisis) then the food sector 2nd (crisis vs non crisis). For each sector, the analysis of the panel regression model will be discussed and compared for the period of crisis vs non crisis. So that the investor can make the investment decision and mitigate their risk according to the final analysis information.

5.1 Healthcare + Crisis period

The Panel regression analysis diagram will provide the beta coefficient estimate (**Estimate**) of each individual investment factors. The significant value of each estimate provided by (**Pr(>|t|)**) if there are the notation [for instance. or **] indicated that factor is significant and contributed to the future return of their stocks. The significant level (from high to low) is indicated by [0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘’ 1]

Coefficients:					
	Estimate	Std.	Error	t-value	Pr(>|t|)
D_by_ERatio	-1.39E-01	8.30E-02	-1.6684	0.09834	.
InterestCoverage	-1.27E-07	7.37E-07	-0.1725	0.86337	
cash_pc1	-5.38E-02	2.66E-02	-2.02	0.04603	*
cash_pc2	-1.40E-02	6.07E-02	-0.2313	0.81757	
cash_pc3	-2.68E-01	2.25E-01	-1.1952	0.23482	
activity_pc1	1.57E-01	8.76E-02	1.7897	0.07649	.
activity_pc2	1.47E-01	8.38E-02	1.7497	0.08321	.
activity_pc3	4.30E-02	5.14E-02	0.8366	0.40482	
price_pc1	-5.75E-02	2.47E-02	-2.3265	0.02199	*
price_pc2	-2.48E-01	1.25E-01	-1.9761	0.05087	.
profit_pc1	-2.45E-02	2.20E-02	-1.1148	0.26756	
profit_pc2	3.87E-02	3.07E-02	1.2608	0.21029	

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘’ 1

Total Sum of Squares: 3.6887
Residual Sum of Squares: 3.1502

```
R-Squared:      0.146
Adj. R-Squared: -0.073841
F-statistic: 1.43892 on 12 and 101 DF, p-value: 0.16082
```

The above diagram shows the factor contribution to the future return of the healthcare stocks during the crisis period. The analysis focus on the feature that has the significant contribution to the future return of healthcare stock price which comprise of

1. **D/E ratios** (90% Confident Significant)
1. **Cash_pc1** (95% Confident Significant)
2. **Activity_pc1** (90% Confident Significant)
3. **Activity_pc2** (90% Confident Significant)
4. **Price_pc1** (95% Confident Significant)
5. **Price_pc2** (90% Confident Significant)

For the investment of the healthcare sector on the crisis period, the factors that have high contribution to the future return are Debt to Equity ratios, Cash ratios (Liquidity ratios), Activity ratios, Price ratios. These principal component factors have the corresponding most contribution variable as followed:

1. **D/E ratios [**D/E]
2. **Cash_pc1 (liquidity pc1)** [Current ratios, Quick ratios]
3. **Activity_pc1 [**Inventory turnover, Total asset turn over**]**
4. **Activity_pc2** [Total assets turn over, Account receivable turnover]
5. **Price_pc1** [EV/EBITDA, Percent Dividend Yield]
6. **Price_pc2** [P/E]

During the crisis period, the main theme of investment of healthcare sector should be considering the financial ratios of [D/E] [Current ratios, Quick ratios] **[**Inventory turnover, Total asset turn over**]** [Total assets turn over, Account receivable turnover] [EV/EBITDA, Percent Dividend Yield] [P/E]. This information can be used for the risk-return optimization. Next the project compared the healthcare crisis period behavior to the non-crisis period.

5.2 Healthcare + NonCrisis period

The below diagram is the panel regression coefficient of each invest principal component factors during the non-crisis period. The main thing the research interest is the Pr(>|t|) which indicated which principal component factors are the significant contributor to the future return of healthcare stock.

Coefficients:					
	Estimate	Std.	Error	t-value	Pr(>|t|)
D_by_ERatio	6.85E-02	4.36E-02	1.5708	0.11711	
InterestCoverage	-3.47E-07	6.25E-07	-0.5556	0.57886	
cash_pc1	1.75E-02	1.08E-02	1.6167	0.106832	
cash_pc2	3.99E-02	1.79E-02	2.2372	0.025886	*
cash_pc3	6.64E-02	1.06E-01	0.6238	0.533127	
activity_pc1	2.07E-02	2.66E-02	0.7778	0.437203	
activity_pc2	1.48E-03	2.72E-02	0.0544	0.956666	
activity_pc3	-1.09E-02	2.31E-02	-0.472	0.637229	
price_pc1	-6.66E-02	1.12E-02	-5.9393	6.78E-09	***
price_pc2	2.08E-02	9.04E-03	2.3048	0.021747	*
profit_pc1	2.97E-02	1.07E-02	2.783	0.005672	**
profit_pc2	1.55E-02	1.60E-02	0.969	0.333222	

```
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    11.087
Residual Sum of Squares: 9.476
R-Squared:      0.14528
Adj. R-Squared: 0.085597
F-statistic: 5.07104 on 12 and 358 DF, p-value: 7.9931e-08
```

From the diagram above the significant factors that contributed to the future return are

1. **Cash_pc2 (Liquidity ratios)** (95% Confident Significant)
2. **Price_pc1** (Perfectly Significant) [same as crisis period]
3. **Price_pc2** (95% Confident Significant) [same as crisis period]
4. **Profit_pc1** (99% Confident Significant)

There are 2 principal component factors that are consider the same as crisis period which are the **Price_pc1** [EV/EBITDA, Percent Dividend Yield] and **Price_pc2** [P/E]. These factors are the main factors for investment in this sector across all period. Even though **Price_pc1** has same negative contribution as the crisis periods, the **Price_pc2** behave differently, this is the unique characteristic of price behavior which differ from period to period. There are the features that present the significant contribution to future return during the crisis only. Which are **D/E ratios [**D/E], Cash**_pc1 (liquidity pc1)** [Current ratios, Quick ratios], **Activity_pc1 [**Inventory turnover, Total asset turn over**] , Activity_pc2** [Total assets turn over, Account receivable turnover]. The risk manager should pay attention to these sectors due to how they uniquely behave during the crisis period.

5.3 Food + Crisis period

The Panel regression analysis diagram will provide the beta coefficient estimate (**Estimate**) of each individual investment factors. The significant value of each estimate provided by (**Pr(>|t|)**) if there are the notation [for instance. or **] indicated that factor is significant and contributed to the future return of their stocks. The significant level (from high to low) is indicated by [0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘’ 1]

Coefficients:					
	Estimate	**Std.**	**Error**	**t-value**	**Pr(>|t|)**
D_by_ERatio	**-3.44E-02**	**3.54E-02**	**-0.9702**	**0.332683**	
InterestCoverage	**-2.82E-06**	**1.69E-05**	**-0.1672**	**0.86729**	
cash_pc1	**2.53E-04**	**2.17E-02**	**0.0117**	**0.990686**	
cash_pc2	**-3.88E-02**	**2.65E-02**	**-1.4651**	**0.14387**	
cash_pc3	**2.76E-02**	**2.26E-02**	**1.2181**	**0.22409**	
activity_pc1	**5.34E-02**	**2.87E-02**	**1.8599**	**0.063814**	**.**
activity_pc2	**3.43E-02**	**4.10E-02**	**0.8355**	**0.404076**	
activity_pc3	**6.60E-02**	**3.15E-02**	**2.0916**	**0.037269**	*****
price_pc1	**-9.17E-02**	**1.87E-02**	**-4.8943**	**1.57E-06**	*****
price_pc2	**-6.71E-04**	**1.49E-02**	**-0.0452**	**0.963982**	
price_pc3	**4.48E-02**	**1.06E-02**	**4.2494**	**2.82E-05**	*****
profit_pc1	**2.43E-03**	**1.29E-02**	**0.1887**	**0.850465**	
profit_pc2	**8.22E-02**	**2.44E-02**	**3.3738**	**0.000833**	*****
profit_pc3	**1.19E-03**	**2.77E-02**	**0.0429**	**0.965826**	

```
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘’ 1

Total Sum of Squares:    32.068
Residual Sum of Squares: 27.026
R-Squared:      0.15724
Adj. R-Squared: 0.019863
F-statistic: 4.25131 on 14 and 319 DF, p-value: 6.8811e-07
```

The above diagram shows the factor contribution to the future return of the healthcare stocks during the crisis period. The analysis focus on the feature that has the significant contribution which comprise of:

2. **activity_pc1** (90% Confident Significant)
3. **activity_pc3** (95% Confident Significant)
4. **price_pc1** (Perfectly Significant)
5. **price_pc3** (Perfectly Significant)

6. **profit_pc2** (Perfectly Significant)

The investment theme of the Food sector during the crisis period should be based on the activity ratios, price ratios and a little bit of profit ratios. The important factors that mostly contribution to these principal components is

1. **activity_pc1 [**Account receivable turnover, Average collection period day , Total Asset Turnover]
2. **activity_pc3 [**Average Sales Period, Account receivable turnover, Average collection period day]
3. **price_pc1 [**P/BV, %Dividend Payout Yield]
4. **price_pc3 [**EV/EBITDA, %Dividend Payout Yield]
5. **profit_pc2 [**Gross Profit Margin]

The main factors of investment in Food sector during the crisis should be looking at the ratios of **[**Account receivable turnover, Average collection period day, Total Asset Turnover] [Average Sales Period, Account receivable turnover, Average collection period day] **[**P/BV, %Dividend Payout Yield] [EV/EBITDA, %Dividend Payout Yield] [Gross Profit Margin] to identify the investment decision and portfolio optimization of the investor.

5.4 Food + Noncrisis period

Next the project will compare the analysis between crisis period and non-crisis period to show that these behaviors might different across the period of investment. The panel regression of food stock during the non-crisis periods shown below: (The significant value of each estimate provided by (**Pr(>|t|)**) if there are the notation [for instance. or **] indicated that factor is significant and contributed to the future return of their stocks. The significant level is indicated by [0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘’ 1])

Coefficients:					
	Estimate	**Std.**	**Error**	**t-value**	**Pr(>|t|)**
D_by_ERatio	**1.77E-02**	**1.52E-02**	**1.163**	**0.245042**	
InterestCoverage	**-4.39E-07**	**1.15E-06**	**-0.3801**	**0.703962**	
cash_pc1	**-8.51E-03**	**7.08E-03**	**-1.201**	**0.229956**	
cash_pc2	**-1.25E-03**	**8.67E-03**	**-0.1441**	**0.88547**	
cash_pc3	**-1.55E-02**	**1.47E-02**	**-1.0531**	**0.292479**	
activity_pc1	**1.39E-02**	**9.68E-03**	**1.4357**	**0.15132**	
activity_pc2	**3.11E-03**	**1.17E-02**	**0.2658**	**0.790461**	
activity_pc3	**2.02E-02**	**1.02E-02**	**1.9764**	**0.048306**	*****
price_pc1	**1.21E-02**	**2.01E-02**	**0.6009**	**0.548031**	
price_pc2	**-1.59E-02**	**8.42E-03**	**-1.8945**	**0.058359**	**.**
price_pc3	**1.99E-01**	**7.32E-02**	**2.7157**	**0.006693**	******
profit_pc1	**2.74E-02**	**5.64E-03**	**4.8565**	**1.33E-06**	*******
profit_pc2	**1.19E-03**	**9.95E-03**	**0.1197**	**0.904777**	
profit_pc3	**-3.79E-02**	**1.52E-02**	**-2.4971**	**0.012633**	*****

```
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘’ 1

Total Sum of Squares:    63.085
Residual Sum of Squares: 58.52
R-Squared:      0.072362
Adj. R-Squared: 0.039279
F-statistic: 7.96784 on 14 and 1430 DF, p-value: < 2.22e-16
```

The above diagram shows the factor contribution to the future return of the Food stocks during the non-crisis period. The analysis focus on the feature that has the significant contribution which comprise of:

1. **activity_pc3** (95% Confident Significant) [same as crisis]
2. **price_pc2** (95% Confident Significant)
3. **price_pc3** (99% Confident Significant) [same as crisis]

4. **profit_pc1** (Perfectly Significant)
5. **profit_pc3** (Perfectly Significant)

From the panel regression analysis, the project gets the investment factors that has the same for both crisis and non-crisis period which are the **activity_pc3 and price_pc3** not only significant but also get the same sign of coefficient across 2 panel regression. This indicate that these 2 sets of factors are used commonly by the investor **[**Account receivable turnover, Average collection period day, Total Asset Turnover] [EV/EBITDA, %Dividend Payout Yield] for the investment decision. However, there are the factors that uniquely present during the crisis period. Which is **activity_pc1 [**Account receivable turnover, Average collection period day, Total Asset Turnover], **price_pc1 [**P/BV, %Dividend Payout Yield]**, profit_pc2 [**Gross Profit Margin] therefore the project conclude that the investment style of crown investor differed from the crisis period to non-crisis period and as a risk manager, they must consider these financial ratios and need to change their investment behavior for food stocks as the crisis came in.

Panel Regression Summary

The table below present the factors that behave the same and differently during both period for each sector.

<u>Healthcare sector</u>

Factors	Behavior	High Contributor Variable
D/E Ratios	Crisis Only	**[**D/E]
Cash_pc1 (liquidity pc1)	Crisis Only	[Current ratios, Quick ratios]
Activity_pc1	Crisis Only	**[**Inventory turnover, Total asset turn over**]**
Activity_pc2	Crisis Only	[Total assets turn over, Account receivable turnover]
Price_pc1	Both Period But different sign	**[**EV/EBITDA, %Dividend Payout Yield]
Price_pc2	Both Period	[P/E]

Food sector

Factors	Behavior	High Contributor Variable
activity_pc1	Crisis Only	**[**Account receivable turnover, Average collection period day, Total Asset Turnover]
price_pc1	Crisis Only	**[**P/BV, %Dividend Payout Yield]
profit_pc2	Crisis Only	**[**Gross Profit Margin]
activity_pc3	Both Period	**[**Average Sales Period, Account receivable turnover, Average collection period day]
price_pc3	Both Period	**[**EV/EBITDA, %Dividend Payout Yield]

6. Policy implication

The research objective is to find the investment factors for defensive stocks (food and healthcare) during the crisis. The investment factors for **healthcare** are the following

During the crisis

1. **D/E ratios:** investor care the insolvent of the company, during the crisis more debt means higher probability of default
2. **[Inventory turnover, Total asset turn over]:** the company that has the better utilizing their asset will be more attractive to investor
3. **[Total assets turn over, Account receivable]:** the company that has better used of their hospital and can gather the short-term cash faster usually be more attractive for any period.
4. **[EV/EBITDA, %Dividend Payout Yield], [P/E]**: the price and company value are the main driver of the future return.

The investment factors for **Food** are the following

During the crisis

1. **[Account receivable turnover, Average collection period day, Total Asset Turnover]:** how fast the company can collect the cash from the account receivable and how well the company can utilize their asset is the main driver of future return.
2. **[P/BV, %Dividend Payout Yield]**: the price on book value and company value are the main driver of the future return.
3. **[Gross Profit Margin]:** the gross profit margin calculates before the interest payment, therefore this ratios measure at 1st glance the survivability of the company before paying interest.
4. **[Average Sales Period, Account receivable turnover, Average collection period day]:** how fast the company can collect the cash from the account receivable.
5. **[EV/EBITDA, %Dividend Payout Yield]:** the price and company value are the main driver of the future return.

After the investor narrowing these ratios, there can be more precise for crisis investment. These factors are, however, not the guarantee ways to make profit by looking at these factors. The back testing is required before reaching that conclusion. However, it is important as a risk manger and the portfolio manager to manage their risk according to these narrow ratios' information since More information usually leads to ambiguous decision. They now know what to look for.

7. Conclusion

So far this project primary objective is to find the way to invest in stocks during the crisis in Thailand stock market. Among various sectors, the Food Beverage and Healthcare are the most defensive. These sectors presented with less fluctuated financial ratios during the period of crisis. To invest in these sector stocks, the basket of financial ratios was formulated. These ratios are the main information for making the investment, however these ratios came out of the same information in which the dimension reduction need to be perform before putting into analysis. Form the panel regression analysis, the healthcare and the food sector panel regression came up with various significant financial factors. These factors might behave differently between crisis period and non-crisis period. Therefore, the investor cannot just make the same investment theme between the crisis period and non-crisis period.