รายงานวิจัยฉบับสมบูรณ์

โครงการทบทวนความยั่งยืนทางการเงินของบริษัทที่ได้รับผลกระทบจากน้ำท่วม ปี 2554: กรณีศึกษาของนิคมอุตสาหกรรม 7 แห่งของประเทศไทย

(Financial Stability Review of the Floods Affected Firms: A Case Study of the 7 Industrial Parks in Thailand)

โดย ผู้ช่วยศาสตราจารย์ ดร. คณิตศร เทอดเผ่าพงศ์

2 พฤษภาคม 2561

สัญญาเลขที่ MRG 5980138

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มหาวิทยาลัยรังสิต

สนับสนุนโดยสำนักงานกองทุนสนับสนุนการวิจัย
(ความเห็นในรายงานนี้เป็นของผู้วิจัย
สกว. และ สกอ. ไม่จำเป็นต้องเห็นด้วยเสมอไป)

Abstract

Project Code: MGR 5980138

Project Title: Financial Stability Review of the Floods Affected Firms: A Case Study of the 7 Industrial Parks in Thailand

Investigator: Asst. Prof. Dr. Kanitsorn Terdpaopong
Rangsit University

E-mail Address: kanitsorn@rsu.ac.th

Project Period: 2 Years

เหตุการณ์น้ำท่วมในประเทศไทยในปี พ.ศ. 2554 ได้ทำลายธุรกิจเกือบทุกประเภทที่อยู่ในเขตน้ำท่วม รายงานฉบับนี้เป็นรายงานการสำรวจความความแตกต่างที่น่าจะเป็นอันเกิดขึ้นกับบริษัทอุตสาหกรรมการผลิต ที่มีขนาด มีสัญชาติ และมีลักษณะการถือหุ้น ที่แตกต่างกัน โดยนำข้อมูลที่รวบรวมมาจากบริษัทที่ตั้งอยู่ในนิคมอุตสาหกรรม 7 แห่ง ซึ่งมีจำนวนบริษัท 514 บริษัท โดยเก็บรวบรวมข้อมูลตัวแปร เช่น อัตราผลตอบแทนของสินทรัพย์ และอัตราผลตอบแทนของส่วนของเจ้าของ รวมถึง กำไรขั้นต้น กำไรส่วนเกิน และ กำไรจากการดำเนินงาน จากปี 2554 ถึงปี 2559 ผลการวิจัยพบว่าธุรกิจขนาดเล็กซึ่งได้รับผลกระทบทันทีจากเหตุการณ์น้ำท่วม ภายหลังเหตุการณ์น้ำท่วมบริษัทขนาดเล็กนี้ สามารถบริหารจัดการและกลับมามีสถานะใกล้เคียงกับบริษัทขนาดใหญ่ภายในปี 2558 นอกจากนี้ บริษัทที่ผู้ถือหุ้นคนไทยแม้จะได้รับผลกระทบอย่างรุนแรงในเบื้องต้น แต่สามารถกลับมามีกำไรขั้นต้นสูงกว่าบริษัทที่มีผู้ถือหุ้นจากต่างประเทศ รายงานฉบับนี้ได้ให้ข้อสรุปเกี่ยวกับสาเหตุ และข้อแนะนำเพื่อการนำไปใช้เพื่อลดความเสียหายที่เป็นผลจากภัยพิบัติทางธรรมชาติ

The floods that hit Thailand in 2011 damaged almost every kind of business in the flood zones. This paper examines possible differences in effects among manufacturing companies of different sizes, and different nationalities of ownership. Data was gathered from 514 companies in seven industrial parks with respect to such variables as return on assets and on equity, as well as on gross, operating and net profit margins, for the years 2011 through 2015. The research finds that the small businesses were hurt the most immediately after the floods, but managed financially to rebound to almost the same level as large businesses by 2014. Furthermore, the Thai companies at first suffered, but managed to achieve even greater gross profit margins than foreign companies by 2014. The paper concludes causes and implications, and suggests ways to mitigate damage among those groups of companies that fared worst from the disaster.

Keywords: Floods, manufacturing companies, Thailand, sizes, ownership structures

Executive Summary
Project Title: Financial Stability Review of the Floods Affected Firms: A Case Study of the 7 Industrial Parks in Thailand

The floods that hit Thailand in 2011 damaged every kind of business in the flood zones. This paper examines both financially direct effect and indirect effect by investigating, first of all, the possible differences in effects among manufacturing companies of different sizes, and different nationalities of ownership and financial stability focusing on performance, profitability, and leverage of the insurance companies which were directly effect from the deluge in 2011. For this first objective, we gathered data from 514 companies in seven industrial parks with respect to observe financial variables such as return on assets and on equity, as well as on gross, operating and net profit margins, for the years 2011 through 2015. See more financial information on Appendix 1.

Secondly, this research studied the continuation of the floods affected automotive firms located in Rojana Industrial Park, Ayutthaya, Thailand. We employ the Z"-score of Altman as a tool to predict the potential distress of the firms. The ultimate purpose of this paper is to study of how quickly the firms can financially recover after the historic 2011 floods.

Small businesses were hurt the most immediately after the floods, but managed to rebound to almost the same level as large businesses by 2014. Thai companies at first suffered, but managed to achieve even greater gross profit margins than foreign companies by 2014. The paper discusses causes and implications, and suggests ways to mitigate damage among those groups of companies that fared worst from the disaster. Financial stability of the Thai non-life insurance companies was extremely shaken, especially on the flood year and it took at least one year to fully recover.

As this research project received grants from Thailand Research Fund (TRF), the paper findings are published via an international journal, *Corporate Ownership & Control, Volume 15, Number 3, Pages* 125-137 (Scopus Index) which can be found from the website: http://doi.org/10.22495/cocv15i3art11. Furthermore, the findings also published through two international research conferences, one on proceedings of the Asia-Pacific Management Accounting Association 2017 (13th) Annual Conference. Shanghai, China, November 6-9, 2017 and other on Proceeding of TARC 2017 TRENDS IN ACCOUNTING RESEARCH CONFERENCE hosted by Accounting Department, School of Economics and Business, Kaunas University of Technology, Kaunas, Lithuania, October 4-6, 2017.

1. Introduction and Problem Statements

The 2011 Thailand flood ranks as the country's most damaging flood to date. The cause of the 2011 flooding was by unusually high monsoonal rainfall between May and October 2011, furthermore the anomalous high rainfall from four tropical storm remnants crossed the north of the country. With the combination of these factors, it made the highest annual rainfall in Thailand's 61-year precipitation record, with 7.5 flood magniture[1] (Gale & Saunders, 2013). The floods covered an area of about 97,000 square km of the Thai population and the areas of Thailand' manufacturing industry. Such floods damaged many industries, agriculture and the country's economy. The seven industrial estates, located in central part of Thailand, namely 1) Rojana, 2) Saharattanakhon, 3) Hi-Tech, 4) Bang Pa-In, 5) Factory Land, 6) Navanakorn and 7) Bangkadi, located in the central part of Thailand, were flooded and submerged for over three months. The floods were described as 'historic' as they were the worst floods in Thailand in three decades. The estimated economic losses was USD 7,944 million. The floods interrupted the country's domestic growth (a drop of GDP in the last quarter of 2011, was 3.3 per cent when compared to the same period the year before) especially in the manufacturing sector. The 2011 flood was recorded as the worst flood ever for Thailand's manufacturing sector. The 70 % of the losses from this 2011 floods were largely on industrial, while 15.3 % on affected on agricultures, and 13.7 % on services (transportations, logistics, and service industry) and others (Kasikorn Research Center, 2011).

Thailand Manufacturing Production Index (MPI) during the fourth quarter fell by 21.8% in areas where major producers and complex production networks resided, especially for the automobile, electronics, hard disk drives (HDD) and electrical appliances industries. Facing the shortage in parts, inputs, and raw materials producers failed to accommodate sustained demand both at home and abroad. With this widespread supply constraints led to shortages of downstream products, such as computers, and drove up their prices. Recovery in the electronics sector takes longer than for others, given the high degree of precision and cleanliness required for the installation and restoration processes of machinery and equipment. Most electrical appliances plants suffered indirectly from their flood-hit suppliers. This led to a 43% decline in production from the same period the year before.

[1] Flood magnitude = log (Duration × Severity × Area Affected). 'Severity' depends on the estimated recurrence interval of floods in the region affected and is defined on a scale between 1 and 2.

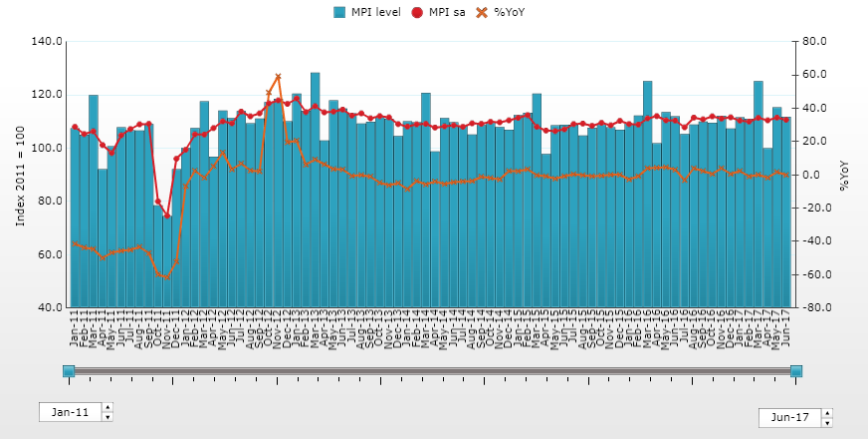


Exhibit 1 Manufacturing Production Index from January 2011 to June 2017
Source: The Office of Industrial Economic presented in Bank of Thailand
: https://www.bot.or.th/English/Statistics/Graph/Pages/Mpi.aspx

In contrast, certain industries, such as food and beverage, rubber and plastic and construction materials (accounting for a total weight of 27.7% MPI), continued to grow, undeterred by flood damage, thanks to plant locations scattered across Thailand. The tourism sector declined during the flooding in central Thailand in the fourth quarter of 2011, but continued to rise later. This is indicated by a decrease in the number of foreign tourists in 2011 (19.1 million) compared with 2010 (19.9 million). The severe floods in central Thailand, including Bangkok, led to foreign inbounds to decline; however, the number of tourists rebounded quickly after the floods, pointing to the resiliency of the tourism sector. This was in line with higher occupancy rates across all regions, particularly for the central and the southern regions, as inbound tourists from China, Russia and India rose markedly given these countries' strong growth.

Not only the domestic economy was ruined by the floods, but Thailand's flood devastation also extended its impact on production worldwide, including Asia, America and South Africa as Thailand is the world's major production base, particularly for HDD and automobiles. Many producers and component suppliers for the HDD and automobile industries were concentrated in Ayutthaya and Pathum Thani, which were in the flood zone. In general, the concentration of plants and suppliers helped facilitate transportation and product development and also allowed a lean management system, whereby firms reduced storage costs for products and raw materials by keeping inventories at minimum levels and producing just enough to meet orders. As the severe floods hit the mentioned areas, however, such a concentration turned into a disadvantage as a large number of assembly plants and suppliers had to suspend production immediately. As a result, non-flooded factories also had to scale down or cease production due to shortages of intermediate inputs.

Thailand has served as a world production base for HDDs, accounted for 41% of global production, surpassing China's share of 25%. About 90% of Thailand's output was exported to China (33%), USA (17%), Hong Kong (13%) and Japan (8%) for the production of downstream products such as computers and storage devices. Four out of five major HDD assembly companies, namely, Western Digital, Seagate, Hitachi Global Storage Technologies (HGST) and Toshiba, are located in the Thai industrial estates. This has made HDD production in Thailand cost- and time-efficient. Three major producers of spindle motors in Thailand (Nidec, Minebea and Alphana Technology)

accounted for 66% of global output. Many multinationals related to HDD industry companies, such as TDK, Hutchinson, NHK Spring and AGC, have their plants located in Ayutthaya and Pathum Thani. Even though they gain the economies of scale, the geographical concentration of these plants made them vulnerable in a crisis. During the historic floods in 2011, HDD assembly plants and component plants were flooded simultaneously. Non-flooded HDD factories in Thailand and abroad also had to suspend production as their inventories of raw materials could sustain production for only 1 to 2 weeks. This caused low production for this period. It can be seen that the severity of natural disasters—floods in this case—has a significant negative effect on the supply chain, either directly or indirectly (Bank of Thailand, 2012). See Exhibit 2 below.

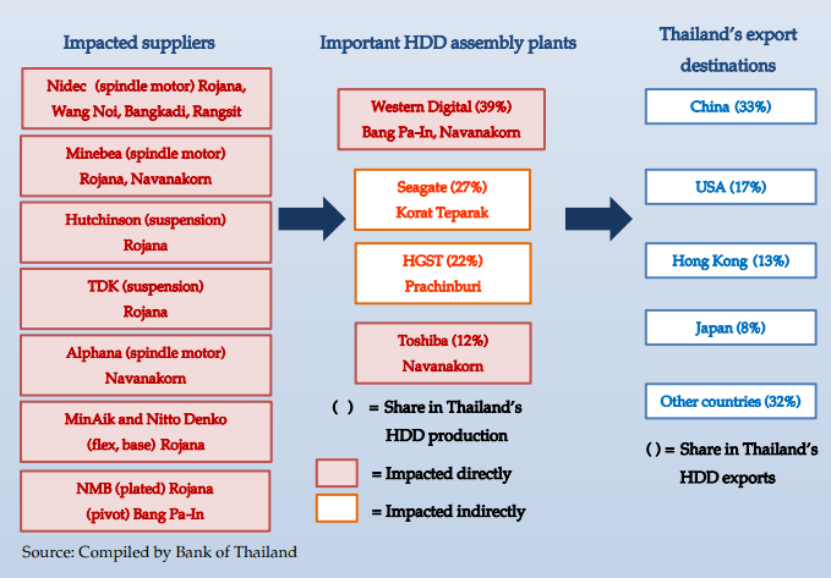


Exhibit 2: Supply-chain Effect of the 2011 Floods
https://www.bot.or.th/English/MonetaryPolicy/EconomicConditions/AnnualReport/AnnualReport/AnnualReport_2011.pdf

The top 5 companies hardest hit by the historic flood according to the Risk Management Monitor by Holbrook, M. (2011) are 1) TOYOTA – output loss of 37,500 vehicles; 2) FORD – lose production of 30,000 vehicles; 3) LENOVO; 4) Canon- lose of sales $660,000; and 5) Sharp. The loss also happened to these companies' supply chain as well, which often-overlooked segment when disaster strikes. As during the flood, the indirectly affected firms that experienced supply constraints had to seek alternative suppliers in Thailand or abroad. After the floods, several companies that experiences serious damages to critical machinery had to import these machines anew, this had caused some delays due to the importing and installation processes involved. Many plants filed for damage assessments from the insurance companies and started to receive the compensation. The manufacturing production improved gradually and, finally, returned to normal in the following year. The MPI of the country started to rise again in this period, especially the automobile sector (Exhibit 3 and 4).

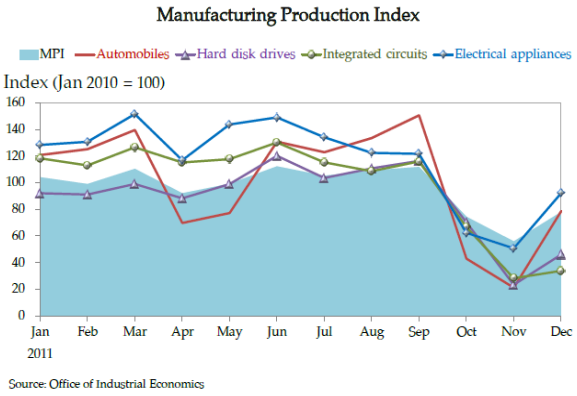


Exhibit 3: Manufacturing Production Index (MPI), 2011

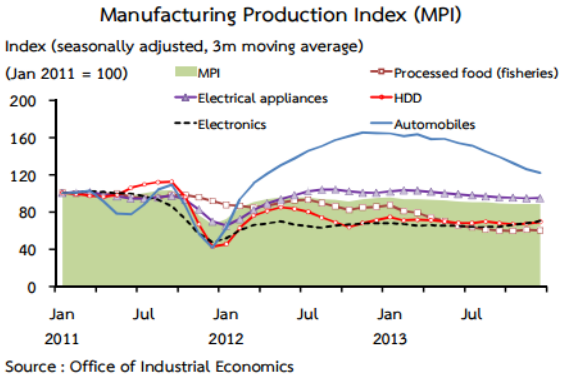


Exhibit 4: Manufacturing Production Index (MPI), 2011 - 2013

Source: https://www.bot.or.th/English/MonetaryPolicy/EconomicConditions/AnnualReport/AnnualReport/AnnualReport_2011.pdf

The impact of the flood also went to other countries nearby in Southeast Asia; the most affected countries based of the 2011 Thailand Floods Event Recap Report by Aon Benfield (2012) were Cambodia, Vietnam, Laos and Myanmar. Total economic losses were estimated at KHR660.0 billion (USD161.0 million) in Cambodia, VND2.9 trillion (USD135.0 million) in Vietnam, LAK1.4 trillion (USD174.0 million) in Laos, and Total economic losses were listed at MMK11.0 million (USD1.7 million) in Myanmar. The total economic loss affected to these four countries were estimated at USD471 million (Aon Benfield, 2012).

Due to such floods in 2011, the Thai government initiated a National Disaster Fund of THB50.0 billion (USD1.6 billion) to support the provision of natural disaster risk coverage to households, small firms and industries. Water management and flood project emerged during such period. The Thai government designed a water management and flood prevention plan worth THB300.0 billion (USD9.7 billion), with an additional THB50.0 billion (USD1.6 billion) on infrastructure and 17 additional river basins. The Royal Irrigation Department (RID) had proposed 8,000 separate projects at a cost of THB1.7 trillion (USD55.0 billion) that would increase Thailand's water storage capacity (Aon Benfield, 2012).

Even though the flood has passed for some years already, the Thai government still gives heed to future natural disasters and tries to find strategies to prevent such causes and mitigate damage from both direct and indirect causes. The insurance industry, which was indirectly affected by the floods, provides a prime example of the latter. The compensation received from the insurance companies assisted the directly impacted companies to be able to recover quickly. After the floods, some companies rebounded better than others. This stimulates our curiosity in terms of (i) the intrinsic effects of the floods on companies as reflected in their financial statements, (ii) what financial measures or indicators to consider, (iii) which financial ratios illustrate the significant impact and (iv) most of all, how well the Thai industrial estates recovered from the historic floods in 2011. These problem statements focus our interest and cause us to seek empirical evidence. Data from both the Bank of Thailand and other representative source documents underpinned our hypotheses that flood-affected firms regained their financial strength after the floods. This paper is taking floods in 2011 as an event to see the financial movement of the companies in industrial estates. This is to see how financial performance has been affected by such disaster, seeing via financial ratios. Findings of this paper are hopefully prompting management, investors, owners and public authorities to well aware of the damages that had happened and potential damages that would have happened in the future if such disaster or similar had returned. It would be a good case for other countries in South East Asia that could have had similar situations in their countries to be well aware of either direct or indirect effects if that disaster could have incurred in their countries.

2. Literature Review

Natural disasters such as floods have caused damages to the areas where floods affected and have relatively indirect affect at national and international level. Several researchers put great attempt to manage disaster like floods, some tried to mitigate the damages, some to measure the damages, and others tried to put strategic plans to prevent/improve the situation by which assurance policies, legal and institutional requirements for flood management, stakeholder involvement, and environmental considerations in flood management are among them. As the aim of this paper is to investigate the financial movements of the flood-affected firms whether they regained financial strength after the floods in 2011, the focus of this paper is then to financially measure the firms that had been affected by floods. The key is to assess whether which financial ratios are best represent the deviation of financial situations after the floods. To measure financial stability or failure, several research started from the Beaver (1966) adopted six ratios as predictors of failure, including current ratio, working capital to total sales, cash flows to total debt, return on assets, and debt asset ratio. Several seminal researchers such as Altman (1968), selected five financial ratios including working capital to total assets, earnings before interest and tax expenses to total assets, total asset turnover, retained earnings to total assets and market value equity/total debt to create a model called Z-score model as a predictive failure model . Ohlson (1980) utilised nine different features; some of which are repeated in Beaver's and Altman's studies. The findings from those researchers are resourceful and referred by many researchers nowadays. Several financial ratios have been introduced into models in order to distinguish the financial distress of companies or to predict financial failure. Many potential ratios are used for such purposes. The study of Ozkan-Gunav and Ozkan (2007) mentioned that financial indicators have been consulted by researchers as a major basis for predicting financial distress and business crises among other common methodologies, including peer group

analysis, comprehensive risk assessment systems and statistical and econometric models. However, using different financial ratios to predict outcomes may cause different prediction results. The studies of Min et al. (2006) and Shin et al. (2005) found that the following financial ratios are commonly used by many researchers: adequacy of long-term capital, current ratio, inventory turnover, earnings per share (EPS) and debt coverage stability, fixed asset turnover, profit growth rate, revenue per share, net profit growth rate before tax and after tax. Some authors, such as Lin et al. (2011), examined the financial data offered by the Taiwan Economic Journal (TEJ), the authoritative financial data bank covering extensive financial data sets of all listed companies traded on the Taiwan Stock Exchange (TWSE) since 1980. They selected all 74 financial ratios, referred to as the 'TEJ feature set,' and combined this set with another 21 financial ratios recommended by their previous research literature, plus some financial ratios that have not been mentioned in prior research, but with great potential to increase the prediction accuracy. Later, only major financial features were selected into their model. They concluded that for predictive financial distress model the financial ratios such as tax rates and continuous four-quarterly EPS are the key elements to increase the accuracy of the predictive model.

In our research, the main objective is to investigate financial movement or changes in flood-affected companies. The paper employs the observation of various financial ratios used by previous researchers. However, to investigate the usage of the financial ratios objectively, the paper also categorises the financial ratios into 4 categories namely liquidity (to measure a company's ability to pay its short-term debts), profitability (to assess a business's ability to generate earnings compared to its expenses and other relevant costs incurred during a specific period of time), proficiency (to measure the ability of a business to use its assets and liabilities to generate sales) and leverage (to measure the ability of the business to meet its long-term debt obligations). The four categories are used throughout the paper in terms of hypotheses setting, results and conclusion. The paper explores most commonly used ratios – 25 ratios all together. Later, key financial ratios are selected and used in this paper analysis. The following is a summary of the 25 most commonly used ratios. See Table 1.

Table 1: Summary of the 25 commonly used ratios from researchers

No.	Variables		Used by
Liquidity Ratios:			
1	CR	Current ratio or Current assets/ current liabilities	Beaver (1966); Ohlson, J. A. (1980); Zmijewski (1984); Osteryoung, J., Constand, R. L.,& Nast, D. (1992); Samad, A., & Hassan, M. K. (1999); Feng, C. M., & Wang, R. T. (2000); Martens et al. (2008); Lin, F., Liang, D., & Chen, E. (2011);Terdpaopong, K., & Mihret, D. G. (2011); Delen, D., Kuzey, C., & Uyar, A. (2013); Terdpaopong, K., & Hovey, M. (2013);Ahmad, R. (2016); Cultrera, L., & Brédart, X. (2016); Demerjian, P. R., & Owens, E. L. (2016); Lakshmi, T. M., Martin, A., & Venkatesan, V. P. (2016); Sharma, M. P. G., & Kaur, M. R. P. (2016); Nadya M.,and Isrochmani M. (2017); Shaonan T., Yan Y. (2017)
2	ART	Accounts receivable turnover ratio or Total revenue/average account receivables	Rai, A., Patnayakuni, R., & Patnayakuni, N. (1997); Lin, F., Liang, D.,& Chen, E. (2011); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Delen, D., Kuzey, C., & Uyar, A. (2013); Wei, Y. S., Samiee, S., & Lee, R. P. (2014)); Aston, J., & Ngwa, L. N. (2016), Cultrera, L., & Brédart, X. (2016); Rao, M. K. (2016); Umer F. (2017) ; Karnawi K., (2017).; Shaonan T., Yan Y. (2017)
3	INV	Inventory turnover ratio or Cost of goods sold/average inventory	Osteryoung, J., Constand, R. L., & Nast, D. (1992); Padachi, K. (2006); Delen, D., Kuzey, C., & Uyar, A. (2013); Wei, Y. S., Samiee, S.,& Lee, R. P. (2014); Sharma, M. P. G., & Kaur, M. R. P. (2016)); Venkatesan, V. P. (2016); Rao, M. K. (2016); Umer F. (2017) ; Karnawi K., (2017).; Shaonan T., Yan Y. (2017)
4	WCA	Working capital/total asset	Beaver (1966); Altman (1968); Ohlson, J. A. (1980); Osteryoung, J., Constand, R. L., & Nast, D. (1992);Lin, F., Liang, D., & Chen, E. (2011);Terdpaopong, K., & Mihret, D. G. (2011); Delen, D., Kuzey, C., & Uyar, A. (2013),Wei, Y. S., Samiee, S., & Lee, R. P. (2014), Almamy, J., Aston, J., & Ngwa, L. N. (2016), Cultrera, L., & Brédart, X. (2016), Lakshmi, T. M., Martin, A., & Venkatesan, V. P. (2016); Sharma, M. P. G., & Kaur, M. R. P. (2016)., ., Shaonan T., Yan Y. (2017)
5	CA	Current asset ratio or Current assets/total assets	Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Terdpaopong, K., & Mihret, D. G. (2011); Lin, F., Liang, D., & Chen, E. (2011); Wei, Y. S., Samiee, S., & Lee, R. P. (2014)., Shaonan T., Yan Y. (2017)
6	QAS	Quick asset/sales	Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Lin, F., Liang, D., & Chen, E. (2011); Wei, Y. S., Samiee, S., & Lee, R. P. (2014) ., Shaonan T., Yan Y. (2017)
7	QAA	Quick asset/total assets	Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Delen, D., Kuzey, C., & Uyar, A. (2013); Wei, Y. S., Samiee, S., & Lee, R. P. (2014); Ahmad, R. (2016); Kiser, E. K., Prager, R. A., & Scott, J. R. (2016); Laitinen, E. K., & Suvas, A. (2016), Shaonan T., Yan Y. (2017)
8	WCS	Working capital/sales	Beaver (1966); Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Ohlson (1980)
9	CLTL	Current liabilities/total liabilities	Feng, C. M., & Wang, R. T. (2000); Joshua A. (2007); Pathak R. (2011); Mian S. N., Haris K. S., & Muhammad M. N. (2012); Salim M., & Yadav R. (2012); Jonchi, S. (2013); Muhammad, M. S., & Ammar Ali Gull. (2013); Nadeem, A.S., & Zongjun,W. (2013); Stewart C. M. (2014); Wei, Y. S., Samiee, S., & Lee, R. P. (2014)
10	CLS	Current liabilities/sales	Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Lin, F., Liang, D., & Chen, E. (2011); Wei, Y. S., Samiee, S., & Lee, R. P. (2014)., Shaonan T., Yan Y. (2017)
11	CFS	Cash flow/sales	Deakin (1972); Kim, M., Kross, W. (2005); Lorek, K.S, Willinger, G.L. (2009); Shaonan T., Yan Y. (2017)
12	CFD	Cash flow/total debt	Beaver (1966); Deakin (1972); Blum (1974); Zmijewski (1984); Martens et al. (2008); Lin, F., Liang, D., & Chen, E. (2011); Delen, D., Kuzey, C., & Uyar, A. (2013); Kiser, E. K., Prager, R.

No.	Variables		Used by
			A., & Scott, J. R. (2016)., Shaonan T., Yan Y. (2017)
13	CFA	Cash flow/total assets	Deakin (1972); Ohlson (1980); Samad, A., & Hassan, M. K. (1999); Lin, F., Liang, D., & Chen, E. (2011); Delen, D., Kuzey, C., & Uyar, A. (2013); Wei, Y. S., Samiee, S., & Lee, R. P. (2014)., Shaonan T., Yan Y. (2017)
Profitability Ratios:			
14	GPM	Gross profit margin ratio or Gross profit/ total revenue	Samad, A., & Hassan, M. K. (1999); Feng, C. M., & Wang, R. T. (2000); Delen, D., Kuzey, C., & Uyar, A. (2013); Monica T. (2014); Ahmad, R. (2016); Kanagaretnam, K., Zhang, G., & Zhang, S. B. (2016); Ali R., Umer F. (2017); Karnawi K., (2017). Rao, M. K. (2016) ., Shaonan T., Yan Y. (2017)
15	OPM	Operating profit margin ratio or Operating profit margin/total revenue	Rai, A., Patnayakuni, R., & Patnayakuni, N. (1997); Feng, C. M., & Wang, R. T. (2000); Monica T. (2014); Delen, D., Kuzey, C., & Uyar, A. (2013); Ahmad, R. (2016); Umer F. (2017); Karnawi K., (2017). Rao, M. K. (2016) ;Shaonan T., Yan Y. (2017)
16	NPM or EAITR	Net profit margin ratio or Earnings after interest and tax expenses/ total revenue	Rai, A., Patnayakuni, R., & Patnayakuni, N. (1997); Samad, A., & Hassan, M. K. (1999); Ohlson, J. A. (1980); Feng, C. M., & Wang, R. T. (2000); Lin, F., Liang, D., & Chen, E. (2011); Kabajeh M., Said M. A., Dahmash F.N., (2012); Delen, D., Kuzey, C., & Uyar, A. (2013) ; Monica T. (2014); Ali R., Umer F. (2017) ; Rao, M. K. (2016); Umer F. (2017); Karnawi K., (2017).; Shaonan T., Yan Y. (2017)
17	ROE	Return on equity ratio or Net income/total equity	Rai, A., Patnayakuni, R., & Patnayakuni, N. (1997); Samad, A., & Hassan, M. K. (1999); Kabajeh M., Said M. A., Dahmash F.N., (2012); Umar M., Tanveer Z., Aslam S., & Muhammad S (2012). Delen, D., Kuzey, C., & Uyar, A. (2013); Velnampy T., (2013); Warusawitharana M., (2013); Irina B., Elvira Z. (2014) Sakina I.C., Agatha R. (2015); Ahmad, R. (2016); Lakshmi, T. M., Martin, A., & Venkatesan, V. P. (2016); Sharma, M. P. G., & Kaur, M. R. P. (2016);, Ali R., Umer F. (2017) ; Karnawi K., (2017).; Shaonan T., Yan Y. (2017)
18	EBITA	Earnings before interest and taxes/total assets	Altman (1968); Lin, F., Liang, D., & Chen, E. (2011);Terdpaopong, K., & Mihret, D. G. (2011);Terdpaopong, K., & Hovey, M. (2013);Wei, Y. S., Samiee, S., & Lee, R. P. (2014); Almamy, J., Aston, J., & Ngwa, L. N. (2016), Shaonan T., Yan Y. (2017)
Efficiency Ratios:			
19	ROA	Return on assets ratio or Net income/total assets	Beaver (1966); Deakin (1972); Ohlson (1980); Zmijewski (1984); Delen, Samad, A., & Hassan, M. K. (1999); Padachi, K. (2006); Terdpaopong, K., & Mihret, D. G. (2011); Kabajeh M., Said M. A., Dahmash F.N., (2012); Delen, D., Kuzey, C., & Uyar, A. (2013); Rai, A., Delen, D., Kuzey, C., & Uyar, A. (2013);Terdpaopong, K., & Hovey, M. (2013); Velnampy T., (2013); Ahmad, R. (2016); Laitinen, E. K., & Suvas, A. (2016); Al-Qaisi, K. (2016); Cultrera, L., & Brédart, X. (2016); Mwizarubi, M., Singh, H., Mnzava, B., & Prusty, S. (2016); Rao, M. K. (2016); Nadya M.,and Isrochmani M. (2017); Shaonan T., Yan Y. (2017)
20	TAT	Total asset turnover ratio or Total revenue /average assets	Altman (1968); Rai, A., Patnayakuni, R., & Patnayakuni, N. (1997); Lin, F., Liang, D.,& Chen, E. (2011);Terdpaopong, K., & Mihret, D. G. (2011);Delen, D., Kuzey, C., & Uyar, A. (2013);Terdpaopong, K., & Hovey, M. (2013);Almamy, J., Aston, J., & Ngwa, L. N. (2016); Lakshmi, T. M., Martin, A., & Venkatesan, V. P. (2016); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Delen, D., Kuzey, C., & Uyar, A. (2013); Rao, M. K. (2016) Venkatesan, V. P. (2016); Almamy, J., Aston, J., & Ngwa, L. N. (2016)., Shaonan T., Yan Y. (2017)
21	REA	Retained earnings/total assets	Altman (1968); Ding et al. (2008); Lin, F., Liang, D., & Chen, E. (2011); Wei, Y. S., Samiee, S., & Lee, R. P. (2014); Almamy, J., Aston, J., & Ngwa, L. N. (2016); Lakshmi, T. M., Martin, A., & Venkatesan, V. P. (2016)., Shaonan T., Yan Y. (2017)

No.	Variables		Used by
22	MVD	Market value equity/total debt	Altman (1968); Martens et al. (2008); Lin, F., Liang, D., & Chen, E. (2011); Almamy, J., Aston, J., & Ngwa, L. N. (2016)
23	INTC	Interest coverage ratio or Operating revenue/interest expense	Feng, C. M., & Wang, R. T. (2000); Wei, Y. S., Samiee, S., & Lee, R. P. (2014); Cultrera, L., & Brédart, X. (2016)
Leverage Ratios:			
24	DE	Debt equity ratio or Total debt/equity	Beaver (1966); Deakin (1972); Samad, A., & Hassan, M. K. (1999); Lin, F., Liang, D., & Chen, E. (2011); Terdpaopong, K., & Mihret, D. G. (2011);Delen, D., Kuzey, C., & Uyar, A. (2013); Terdpaopong, K., & Hovey, M. (2013);Brîndescu-Olariu, D. (2016); Demerjian, P. R., & Owens, E. L. (2016); Sharma, M. P. G., & Kaur, M. R. P. (2016)., Shaonan T., Yan Y. (2017)
25	DA	Debt ratio or Debt to assets ratio	Beaver (1966); Deakin (1972); Ohlson (1980); Samad, A., & Hassan, M. K. (1999); Feng, C. M., & Wang, R. T. (2000); Aivazian V.A., Ge Y., Qiu J.P., (2005); Ahn S., Denis D.J., Denis D.K., (2006); Yuan Y., (2006); Ding et al. (2008); Martens et al. (2008); Faris N. AL. (2012); Terdpaopong, K., & Hovey, M. (2013), Zhuo J., Hailiang Y. G. Yinc (2015); Shaonan T., Yan Y. (2017)

Variable selection method

The 25 ratios are graphed to see the frequent uses of the ratios by many researchers. From our search, the Return on assets (ROA), current ratio (CR), return on equity (ROE), debt asset ratio (DA), and working capital to total asset ratio (WCA) are the top five being used in the research papers. See Exhibit 5.

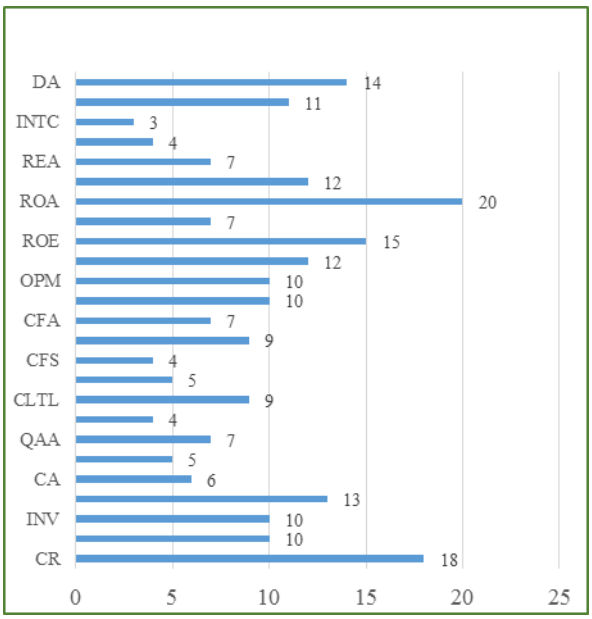


Exhibit 5: Financial ratios commonly used by the researchers

In this study, the samples are those companies located in 7 industrial estates (see appendix 1) by which all of them are non-publicly held companies. The availability of data is an issue. Some information such as cash flow to debt ratio, cash flow to asset

ratio, cash flow to sales and market value equity to total debt ratio many not be available. As most of the companies (99%) located in the industrial estates are privately held companies and, therefore, are only required by the Ministry of Commerce to disclose statements of financial position and income statements to public. Furthermore, some ratios are dropped off the picture due to repetition of similar measurements. After careful consideration, most frequently used 12 ratios which have been used no lesser than 10 papers are selected into our study as follows. See Table 2.

Table 2: Ratios used in the study

No.	Variable	Definitions
Liquidity Ratio:		
1	CR	Current Ratio (Current assets / Current liability)
2	ART	Total revenue / Average account receivables
3	INV	Cost of goods sold / Average inventory
4	WCA	Current assets – Current Liability / Total Assets
Profitability Ratio:		
5	GPM	Gross Profit Margin Ratio (Gross profit margin / Total revenue)
6	OPM	Operating Profit Margin Ratio (Operating profit margin / Total revenue)
7	NPM	Net Profit Margin Ratio (Earnings after interest and tax expenses / Total
8	ROE	Return on Equity Ratio (Earnings after Interest and Taxes / Average equity)
Efficiency Ratio:		
9	ROA	Return on Asset Ratio (Earnings after Interest and Taxes / Average assets)
10	TAT	Total asset turnover (Total revenue / Average assets)
Leverage Ratio or Financial Ratio:		
11	DE	Debt Equity Ratio (Total debt / Total equity)
12	DA	Debt Asset Ratio (Total debt / Total assets)

As our study's objective is to investigate the financial movement of flood-affected firms after the floods, we hypothesise that the liquidity of the flood-affected firms would decline after the flood year. The anticipation of this is that the firms would lack their liquidity desperately due to the increase of the expense unexpectedly. The companies' ability to cover their short term obligation would come short. Thus, the first hypothesis is stated as:

Hypothesis 1 ($H1_1$): The liquidity of the flood-affected companies after the floods (2012–2015) is statistically higher than that of the flood year (2011).

The profitability of the flood-affected companies is expected to decline during the flood year. Due to the fact that the companies had high amount of expenses in the flood year and that situation may carry further to some years after. However, we expect that the profitability will spring up after the flood year, just a matter of how soon. The declined volumes of gross profit margin, operating profit margin, net profit margin are expected to change. Those figures and related ratios are viewed to rise significantly after the flood years. The second hypothesis is then stated as follows.

Hypothesis 2 ($H2_1$): The profitability of the flood-affected companies after the floods (2012–2015) is statistically higher from that of the flood year (2011).

Due to unplanned circumstance as floods in 2011, the companies may not be able to manage their assets and other obligations efficiently. The companies' ability to use their assets and manage their liabilities effectively may of course questionably, however; after the flood year, those companies should be able to manage their assets and liabilities to generate sales better. The third hypothesis is set as follows.

Hypothesis 3 ($H3_1$): The efficiency of the flood-affected companies after the floods (2012–2015) is statistically higher than that of the flood year (2011).

With the changes of the financial situation of those companies, the study aims to investigate how much the capital comes in the form of debt or loans, or to assess the ability of the companies to meet their financial obligations. The leverage ratios indicate the level of debt incurred by businesses and such figures supposed to decline after the flood years. The fourth hypothesis is then set.

Hypothesis 4 ($H4_1$): The leverage of the flood-affected companies after the floods (2012–2015) is statistically lower than that of the flood year (2011).

This paper is proposed four explanations for a flood phenomenon. These four hypotheses are set based on the information that the companies were affected tremendously in the flood year and the situation may carry for sometimes depending on how they can mitigate their situation in the flood year and how quickly these companies can improve themselves after the floods. Furthermore, with the assistance from the government during and after the floods would decline the worst situation to some extent.

3. Research Methodologies and Hypothesis

3.1 Research Method

The financial records of industrial companies from 2011 to 2015 were used. The records were divided into two time periods; the flood year (2011) and post flood years (2012 – 2015). Financial ratios of the samples were analysed to see the changes or movement between those two periods. The financial ratios used in this study are the 12 ratios listed in Table 2. The research employs quantitative analysis with non-parametric *tests* at the 90%, 95% and 99% confidence intervals.

3.2 Population and Sample Selection

The population of this study is the number of companies that were affected by the 2011 floods. The hardest-hit industries, reported by the Department of Industrial Works, were electrical appliances and equipment, medical equipment, automobiles and food and beverage manufacturers by which more than 7,510 industrial and manufacturing plants were damaged by floods in 40 separate provinces.

The samples were purposively selected to this study. They are seven Thai industrial estates located in the central part of Thailand were many plants both domestic and

overseas located; comprising of 651 companies. Those seven industrial estates ranking by size namely 1) Rojana; 2) Navanakorn; 3) Hi-Tech; 4) Bang Pa-in; 5) Factory Land; 6) Saharattananakhon; and 7) Bangkadi Industrial Estates, were hardest hit by the 2011 floods.

Due to some companies' reports were missed to report their financial statements (75 companies), some were out of business or closed down after the floods (43 companies), and other were newly registered businesses after 2011 (19 companies), the samples scaled down to 514 companies (78.96% of the 7 industrial estates). The Rojana Industrial Estate was the largest industrial estate among all with 146 companies (28.40 % of the whole samples) and Navanakorn was the second largest with 135 companies residing in the park (26.27 %), Hi-Tech (74 companies; 14.40%), Bang Pa-in (58 companies; 11.28%), Factory Land (42 companies; 8.17%), Saharattananakhon (33 companies; 6.42%) and Bangkadi (26 companies; 5.06%) (See Exhibit 6).

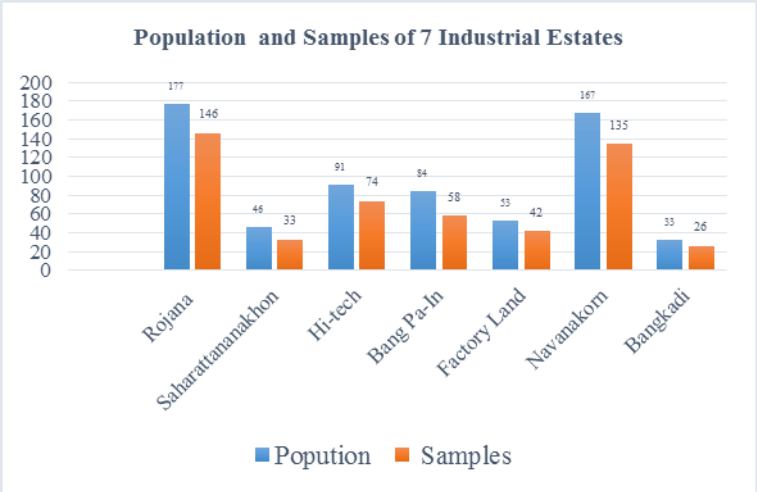


Exhibit 6: Population and samples of the 7 industrial estates

4. Findings and Discussion

Financial records from years 2011 to 2015 are collected into our study. In the flood year (2011), records show that the revenues of those companies in the seven industrial estates was USD 43,536 million, with a high interest and tax expenses making a lowest net profit of USD 1,622 million (3.72% of total revenue) among these five years of the study. The net profit of each industrial park is illustrated in Exhibit 7. The net profits of all industrial estates pictured the changes year by year started from 2011 to 2015 and shown the movements in the same manners.

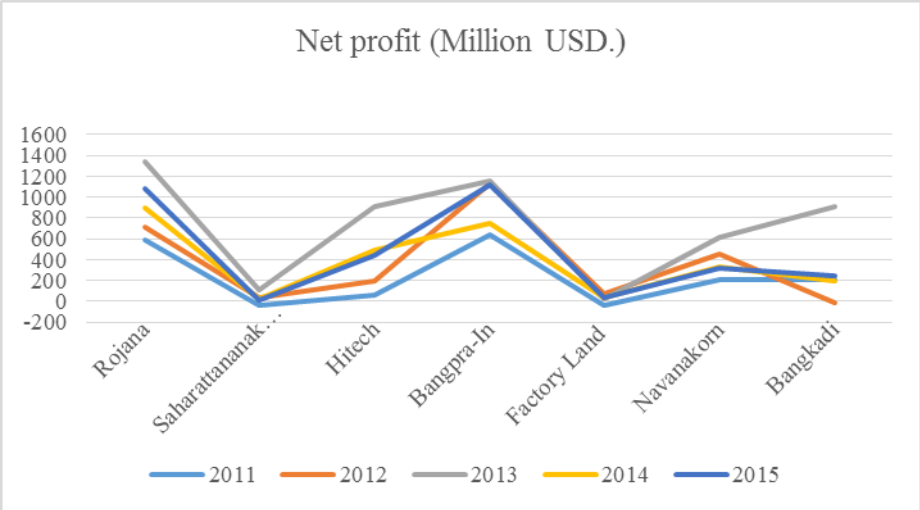


Exhibit 7: Net profit of the 7 companies in the Thai industrial estates

These companies had total assets of USD 26,196 million, which rose dramatically to USD 30,490; 34,825; and 35,899 million in 2012, 2013 and 2014, respectively. Among the 5 years of our data, net profit of the flood year illustrates the lowest amount ever (Tables 3).

Due to the floods, even though the revenue was high (USD 43,536 million) in 2011, the companies experienced high cost of goods sold, and high interest and tax expense; as a result, the net profit illustrates the lowest amount on the record.

Table 3: Financial Data 2011 – 2015

					Unit: Million USD
Year	2011	2012	2013	2014	2015
Total Revenues	43,536	38,148	49,262	46,145	46,600
Cost of Goods Sold	37,307	31,857	40,972	39,287	37,183
Gross Margin	6,229	6,291	8,290	6,858	9,417
Selling and Administrative expense	2,851	2,749	3,231	3,484	2,766
Interest Expense and Tax	1,756	849	-102	557	3,489
Net Profit	**1,622**	**2,693**	**5,161**	**2,817**	**3,162**
Accounts Receivable	5,971	6,866	7,461	7,766	7,962
Inventory	3,547	3,935	4,172	4,524	4,250
Current Assets	15,890	17,057	17,754	18,895	18,402
Noncurrent Assets	10,306	13,433	17,071	17,003	16,538
Current Liabilities	10,974	13,765	13,305	12,163	11,743
Noncurrent Liabilities	1,678	2,156	2,659	2,685	2,574
Owner Equity	13,543	14,569	18,861	21,051	20,623
Total Assets	**26,196**	**30,490**	**34,825**	**35,899**	**34,940**
Exchange Rate THB : 1 USD	*30.4944*	*31.0848*	*30.7319*	*32.4841*	*34.2524*

Exchange Rate: Bank of Thailand

When considered the growth figures, there was negative growth in 2012, which is understandable that they were in a recovery period. Rising growth of revenue is seen in 2013 but declines again in 2014 and 2015. Despite these reduced figures shown in Table

4, the financial records on the post-flood period indicate rising profit compared with the flood year.

These results indicate that the liquidity of the samples is quite large despite the floods in 2011. Current asset is averaged at 60% of total assets, whereas current liability is about 40%, which leaves the companies with more working capital. The financial capital of those companies is composed mainly of current debt (around 40%) and owner equity (around 50–60%) (Table 4). It is understandable that many companies are not large in size and that most of them (99) are non-public. To gain long-term liability may not be easy and accessible for small and medium-sized companies (20% and 25%, respectively) and perhaps most of all, the main shareholders of those companies are Japanese whose has hold 48.2%, Thai 39.3%, and other nationalities 17.9%.

Table 4: Financial Records 2011 – 2015

Unit: %

Year	2011	2012	2013	2014	2015	Growth 2012	Growth 2013	Growth 2014	Growth 2015
Total Revenue	100.	100.	100.	100.	100.	-12.4	29.1	-6.3	1.0
Cost of Goods Sold	85.7	83.5	83.2	85.1	79.8	-14.6	28.6	-4.1	-5.4
Gross Margin	14.3	16.5	16.8	14.9	20.2	1.0	31.8	-17.3	37.3
Selling and Administrative expense	6.5	7.2	6.1	7.6	5.9	-3.6	9.2	16.1	-20.6
Interest Expense and Tax	4.0	2.2	0.3	1.2	7.5	-51.7	-84.9	335.2	526.4
Net Profit	4.3	7.1	10.5	6.1	6.8	66.0	91.6	-45.4	12.2
Accounts Receivable	22.7	22.5	21.4	21.6	22.7	15	8.67	4.09	2.52
Inventory	13.5	12.9	11.9	12.6	12.1	10.92	6.05	8.43	-6.06
Current Assets	60.6	55.9	50.9	52.6	52.6	7.35	4.09	6.43	-2.61
Noncurrent Assets	39.3	44.0	49.0	47.3	47.3	30.34	27.08	-0.4	-2.74
Current Liabilities	41.8	45.1	38.2	33.8	33.6	25.43	-3.34	-8.58	-3.46
Noncurrent Liabilities	6.41	7.07	7.64	7.48	7.37	28.48	23.32	0.95	-4.11
Owner Equity	51.7	47.7	54.1	58.6	59.0	7.57	29.46	11.61	-2.03
Total Assets	100	100	100	100	100	16.39	14.22	3.08	-2.67

The means of our samples with a single value that represents the center of the data are also described. From our study, there were deficit ratios in the flood year (2011). The average return on assets (ROA) of the flood year (2011) was −2.97, the average return on equity (ROE) was −5.90, the operating profit margin ratio (OPM) was −5.88 and the net profit margin ratio (NPM) was −7.47. The records showed that the negative profit incurred in 2011 had risen to positive figures in 2012, 2013, 2014 and 2015.

The financial records of our sample were normally distributed when outliers were dropped out and the standard deviation, as a measure of the dispersion of a set of data from its mean, of the financial ratios used in this study were within acceptable ranges (Table 5).

Table 5: Means and Standard Deviations

No	Ratios	Means					Std. Deviation				
		2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Liquidity Ratio											
1	CR	2.01	1.88	2.00	2.11	2.31	1.72	1.77	1.86	1.81	1.91
2	ART	8.20	7.67	7.17	6.83	6.65	4.10	4.02	3.54	3.20	3.19
3	INV	10.08	8.90	9.01	8.87	8.98	6.48	6.31	5.83	5.42	5.51
4	WAC	-0.07	0.03	0.05	-0.11	0.06	0.99	0.82	0.73	0.96	0.66
Profitability Ratio											
5	GPM	13.43	8.38	11.31	14.14	16.45	12.49	12.07	12.88	13.27	11.44
6	OPM	-4.47	3.41	4.64	2.82	2.91	17.56	17.89	14.86	11.68	10.62
7	NPM	-5.43	3.64	5.29	2.47	2.84	17.28	18.06	14.24	11.56	10.92
8	ROE	-8.47	19.02	14.90	16.79	7.85	40.51	45.02	31.20	32.36	18.98
Efficiency Ratio											
9	ROA	-5.21	6.94	6.49	3.82	3.78	17.87	19.56	14.25	9.57	9.41
10	TAT	1.27	1.21	1.14	1.13	1.15	0.60	0.70	0.59	0.58	0.59
Leverage Ratio											
11	DE	0.76	1.01	1.06	0.86	0.70	2.33	2.51	2.16	1.87	1.88
12	DA	0.55	0.58	0.53	0.50	0.49	0.35	0.35	0.34	0.34	0.35

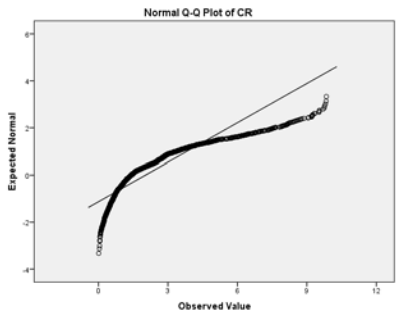
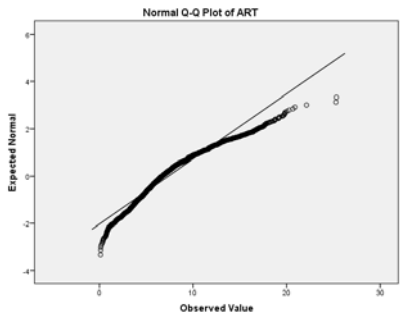
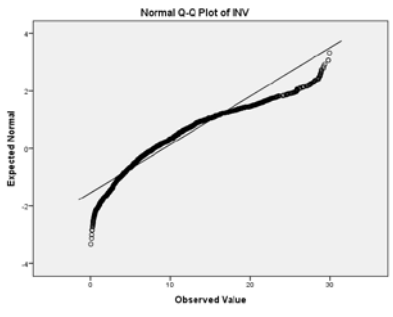
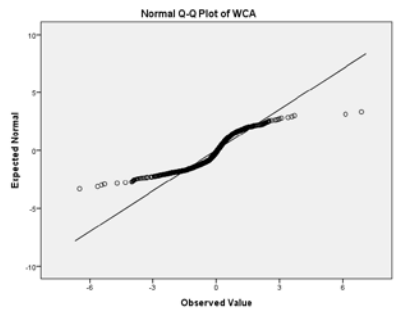
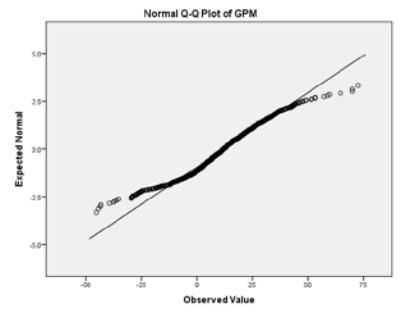
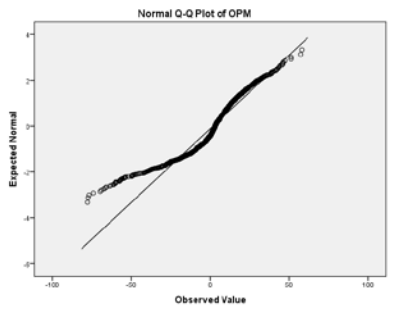
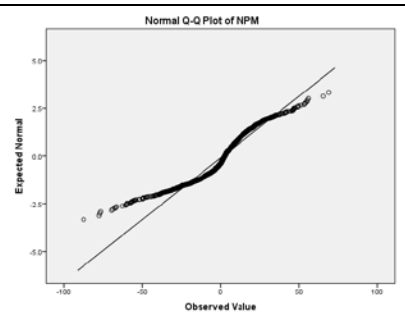
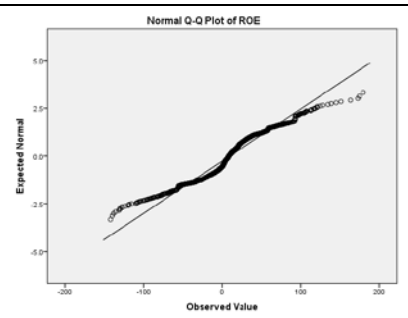
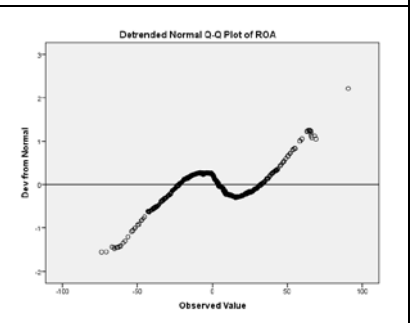
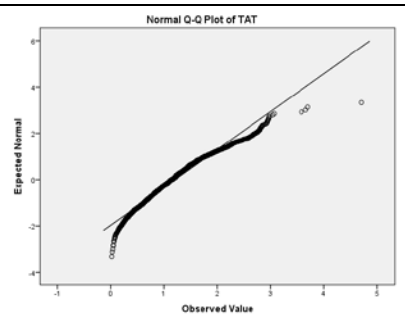
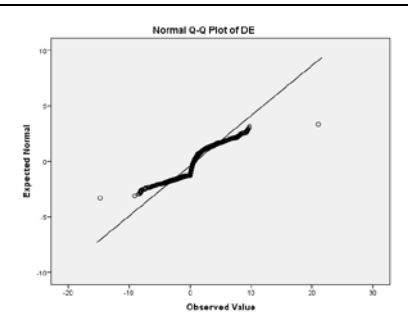
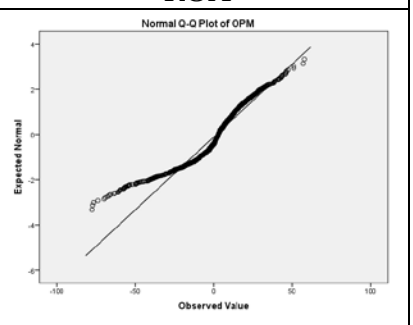
To start analysis the samples of this study, tests for normality was conducted. This was to calculate the probability that the sample was drawn from a normal population. The hypothesis used for this normality testing is

H0: The sample data are not significantly different than a normal population.
Ha: The sample data are significantly different than a normal population.

The null-hypothesis of this test is that the population is normally distributed. Thus, if the p-value is less than the chosen alpha level (in this case 0.05), then the null hypothesis is rejected and there is evidence that the data tested are not from a normally distributed population; in other words, the data are not normal. On the contrary, if the p-value is greater than the chosen alpha level (0.05), then the null hypothesis that the data came from a normally distributed population cannot be rejected. When testing for normality, we are mainly interested in the Normal Q-Q Plots (Exhibit 8) and the tests of and normality (Table 6), to test for the normality of data, respectively.

From the Exhibit 7, to say that these data come from a normal distribution, the circles all must lie quite close to the line; there might be a little random wriggle about the line; this does not disqualify these data from being normal. However, none of the Q-Q plots illustrates the normal distribution as several of them either has low or high outliers for the circles farthest to the left or the right. These circles represent outliers, which deliberately introduced into otherwise normal data. Some of the Q-Q plots illustrate left-skewed data or right skewed data where circles in the Q-Q plot start out on one side of the line, then are almost exclusively on the other side for a long stretch, then move to the other side of the line again. Some also illustrate either narrow hump or wide hump where the pattern is "below the line-above-below-above" indicates that the hump is in fact too wide for normality. The data of this study seems do not come in the flavours of normal.

Exhibit 7: QQ-Plot of 12 Variables

		
CR	ART	INV
		
WAC	GPM	OPM
		
NPM	ROE	ROA
		
TAT	DE	DA

The Table 6 presents the results from two well-known tests of normality, namely the Kolmogorov-Smirnov Test and the Shapiro-Wilk Test. With the large sample size of this study, the Kolmogorov-Smirnov Test is more appropriate for our numerical means of assessing normality, while Shapiro-Wilk Test is for small sample sizes (< 50 samples).

Independent-Samples Kolmogorov-Smirnov Test is used to test the distribution of ratios across categories of Years. Samples of 514 on the flood year and 2,056 on the after flood years, totaled of 2,570 samples, are entered into the analysis. For the Table XX, with the Kolmogorov-Smirnov test where $\alpha = .05$, given that $p = .000$ for all variables – we would conclude that each of the ratio is NOT normally distributed. With the probabilities are less than 0.05 so we reject the null hypotheses (Ho). The nonparametric test is then used to test whether each financial ratio from two different periods is statistically different.

Table 6: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Liquidity Ratio						
CR	.159	2287	.000	.807	2287	.000
ART	.093	2287	.000	.943	2287	.000
INV	.088	2287	.000	.918	2287	.000
WCA	.160	2287	.000	.834	2287	.000
Profitability Ratio						
GPM	.054	2287	.000	.974	2287	.000
OPM	.137	2287	.000	.908	2287	.000
NPM	.136	2287	.000	.905	2287	.000
ROE	.115	2287	.000	.938	2287	.000
Efficiency Ratio						
ROA	.098	2287	.000	.932	2287	.000
TAT	.064	2287	.000	.968	2287	.000
Leverage Ratio						
DE	.245	2287	.000	.823	2287	.000
DA	.067	2287	.000	.936	2287	.000

a. Lilliefors Significance Correction

However, as the sample size increases, normality parameters becomes MORE restrictive and it becomes harder to declare that the data are normally distributed. So for very large data sets, normality testing becomes less important. As the sample size increases, the probabilities decrease. In other words, it gets harder to meet the normality assumption as the sample size increases since even small differences are detected.

The study finds that there are some financial ratios illustrate the statistical differences about the two periods. The significance of which ratios are lower than the probability of 0.05, the null hypotheses are to be rejected. There are eight ratios together namely:

Liquidity ratio:	ART, INV
Profitability ratio:	GPM, OPM, NPM and ROE
Efficiency ratio:	ROA, TAT
Leverage ratio:	None

Table 7: Hypothesis Test Summary

	Null Hypothesis	Sig.	Decision
	Liquidity		
1	$H1_1$: The distribution of CR is no statistical difference across different years	0.961	Retain the null hypothesis.
2	$H2_1$: The distribution of ART is no statistical difference across different years	0.000	Reject the null hypothesis.
3	$H3_1$: The distribution of INV is no statistical difference across different years	0.000	Reject the null hypothesis.
4	$H4_1$: The distribution of WCA is no statistical difference across different years	0.065	Retain the null hypothesis.
	Profitability		
5	$H5_1$: The distribution of GPM is no statistical difference across different years	0.000	Reject the null hypothesis.
6	$H6_1$: The distribution of OPM is no statistical difference across different years	0.000	Reject the null hypothesis.
7	$H7_1$: The distribution of NPM no statistical difference across different years	0.000	Reject the null hypothesis.
8	$H8_1$: H0he distribution of ROE is no statistical difference across different years	0.000	Reject the null hypothesis.
	Efficiency		
9	$H9_1$: The distribution of ROA is no statistical difference across different years	0.000	Reject the null hypothesis.
10	$H10_1$: The distribution of TAT is no statistical difference across different years	0.000	Reject the null hypothesis.
	Leverage		
11	$H11_1$: The distribution of DE is no statistical difference across different years	0.805	Retain the null hypothesis.
12	$H12_1$: The distribution of DA is no statistical difference across different years	0.131	Retain the null hypothesis.
Asymptotic significances are displayed. The significance level is .05.			

Liquidity

The analysis of liquidity generally focuses on the measure in which the companies have the ability to honor their obligations on short term from the current assets and to compare all the potential liquidities associated to the current assets with all the debts due to be paid in less than one year. After the floods, the companies' two ratios - ART and INV showed statistically significant difference from the flood year, while CR and WCA did not show any differences. This is interesting fact to interpret that actually the companies did not suffer much in terms of their liquidity. Of cause they cannot produce or had to delay the production, the effect is then illustrated on the short coming of the inventories and then accounts receivable. The ratios related to those accounts then show the effects from the producing disruption.

Profitability

Every company is most concerned with its profitability. Profitability ratios are used to determine the company's bottom line and returns to its shareholders or investors. The analysis result shows that all profitability ratios – GPM, OPM, NPM and ROE of the companies after the flood year are statistically significant differences from the flood year. It can be interpreted that companies had difficulties controlling their cost of inventory and the manufacturing of the products and subsequently pass on the costs to its customer. Overall operating efficiency, incorporating all of the expenses of ordinary, daily business activity, was down due to the increasing of the production cost and other expenses. The

net profit margin after consideration of all expenses including taxes, interest and depreciation, is also the end result of the high production cost and other expenses. This is the part that illustrates the strong, and negative impact to the companies due to the floods in 2011.

Efficiency

Return on assets and total assets turnover portrait the efficiency with which the company is managing its investment in assets and using them to generate profit. These two ratios – ROA measures the amount of profit earned relative to the firm's level of investment in total assets while TAT measures the revenue earned relative to its' assets. After the floods, the efficiency of those companies were dropped significantly. Revenue earned cannot meet the high expenses during the floods and the asset cannot generate profit sufficiently.

Leverage

Two ratios measuring the companies' leverage are debt to asset (DA) and debt to equity (DE). They measure how much capital comes in the form of debt, or assesses the ability of the companies to meet there financial obligations. Both ratios did not show any statistical differences between the flood year and the after flood years. This is actually according to the liquidity of the companies. Even though they experienced the floods, their liquidity did not have any problems which resulting on no significance on current ratio and working capital ratio. With no strong effect on liquidity, their leverage seems to have no influence from the floods.

5. Conclusion and Suggestions

According to the World Bank, total economic losses from the historic floods in Thailand were estimated to be THB1.4 trillion (USD45.7 billion). In the World Bank report, the private sector was the largest affected estimated of the losses 90% of the total losses, and 6% by the public sector and the other 4% includes combined miscellaneous losses (Aon Benfield, 2012) and the economic losses to neighboring countries in South East Asia was around USD471 million. Total of the losses both in Thailand and neighbouring countries initiated by this historic floods was estimated to USD46.17 billion. Such losses urged us the look deeply to industrial/manufacturing areas where the most losses occurred.

This study uses a non-parametric independent samples analysis to investigate the financial differences of Thai manufacturing companies located in the seven industrial estates. We observed 25 variables that have been used by many researchers as financial ratios for evaluating financial performance. We carefully hand-picked the variables to this study. Due to some unavailable information of the financial data, some ratios had to be omitted from our study. Most commonly used 12 variables were selected for those sample size of 514 companies. The variables were categorised into two periods - flood year (2011) and post-flood years (2012–2015). Those 12 variables were distinguished into 4 different categories to be able to objectively measure the companies' liquidity, profitability, efficiency and leverage.

The study found that eight variables (ART, INV, GPM, OPM, NPM, ROE, ROA, and TAT) out of 12 illustrate statistically significant differences among those two periods. The companies located in the Thai industrial estates, from our finding, did not have the liquidity and leverage problems. Their liquidity which measured from current ratio and working capital to total assets ratio did not illustrate the significant differences on the

flood year and post-flood years. Only the inventories which were ceased production and those companies could not be able to supply their inventories to their regular customers or to fulfil the delivery contract. The ceased production comes from the delivery of the spare parts from their supply chain which most of the supply chains cannot deliver their products or services. With the pause of production, the sales cannot be made which relatively affected to the revenue, and the net profit of the companies. Their profitability and the efficiency of the revenue and net profit dropped accordingly.
The variables that illustrate the significant changes between those two periods are graphed below (See Exhibit 8).

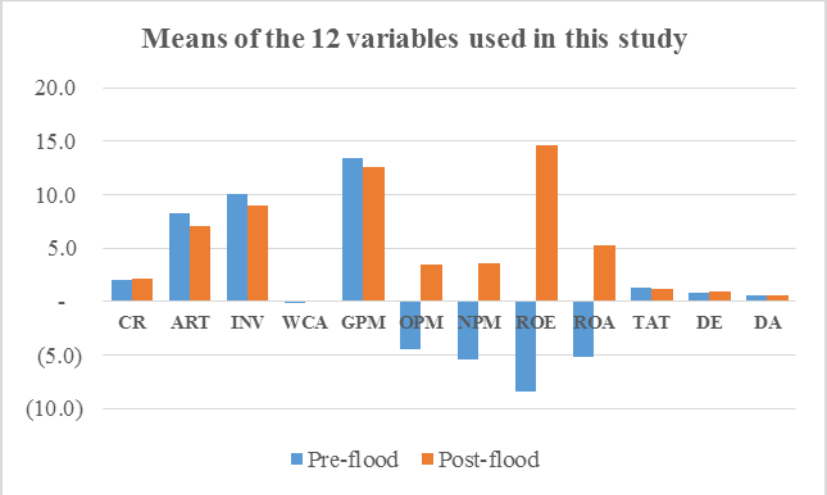


Exhibit 8: Graphs of the significant ratios

From our set hypotheses, we can conclude that the Thai manufacturing companies in those seven industrial estates suffered on their liquidity, but not at a significant level. They did not experience harsh problems on liquidity; their leverage illustrated no significant differences. We partly accept null hypotheses on liquidity where accounts receivable and inventories had statistically significant difference between the pre- and post-flood (accept null hypotheses H1 and H4 but reject null hypotheses H2 and H3) and accept the hypotheses on leverage (hypotheses 11 – 12). The paper can also conclude that these companies have profitability and efficiency problems due to the floods; we then reject null hypotheses of the profitability (hypotheses 5 – 8), and efficiency (null Hypotheses 9 – 10).

This paper still has some limitations which have to be pointed out. We collected financial records mainly from financial statements of the manufacturing companies. We are positive that the sample size is large enough as covers all companies that we could access their financial information. Most companies are non-public, which means they are not required by governmental authority to publicise their financial statements; however, we are able to collect their financial statements to use in this study analysis. We would suggest, however, studying more deeply into the business size, financial structures, and major shareholder nationalities, the contingency plans of companies, their insurance policies and government policies. The future study could line in supports of the government, of the mother companies (if they are subsidiary of a company overseas) during natural disasters as these factors may severely influence companies' strategies to prevent, avoid and mitigate damages and would affect the financial performance of the companies differently. For example, we see from the literature that size does matter (Amit and Villalonga, 2014; Cultrera and Brédart, 2016). Small and medium-sized

companies may have different viewpoints, different strategies and different limitations over business operations including how to deal with floods or other natural disasters. Different financial structures or different types of shareholder nationality structures may also result in different business strategies. Such factors are not included in the future study, which opens the door for future research.

Our paper findings show that these 2011 floods can harm financial strength of the companies, and definitely decline profitability, and efficiency, having a contingency plan for floods or other natural disasters could bring tremendous benefits to the companies. Governments need to provide concrete assistance and active protocol before, during and after disasters and not only financial assistance, but related assistance in order to help businesses dealing with the situation professionally. The likelihood that a Thai flood of the magnitude of 2011 will happen again has been estimated in 10 – 20 years. However, this estimate is perhaps biased low due to the limited 20–30 year extent of the historical data used for model building, nevertheless one may reasonably expect that another Thailand flood as devastating as in 2011 will occur within the next two to three decades unless flood defences and flood management practices are improved (Gale & Saunders, 2013).

Governments then need to lay out risk diversification plans, strategically. Industrial estates may benefit from the economies of scale and economies of agglomeration, where raw materials, components, other service companies and facilities and skilled labour are pooled in the same place to reduce production costs. However, scattered plant location policies that optimise all aspects of the supply chain may also have great benefit in a case of disaster incidents. What is the good approach to balance the policies should be in concern of the governmental authorities.

Our world becomes smaller with no physical borders. The effect of one country goes beyond border to other country. Neighbouring countries in South East Asia where countries are in similar geography, where supply chain at arm's length, may need to give heed and concern approaches they could have dealt with the situation alike. Lessons from Thai historic floods in 2011 and its consequences could be learned and could benefit other countries.

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Appendix 1

1. Rojana

					Unit: 1,000 USD
Year	2011	2012	2013	2014	2015
Total Revenue	17,142,163	12,412,206	21,815,449	20,818,147	20,567,230
Cost of Goods Sold	15,099,297	11,376,927	19,981,451	18,572,654	17,640,217
Gross Margin	2,042,867	1,035,279	1,833,998	2,245,493	2,927,012
Administrative Expense	1,111,863	1,043,197	1,327,688	1,429,720	1,233,355
Total Expense	16,599,372	12,952,755	21,371,123	20,052,287	19,586,676
Net Profit	583,982	740,698	1,371,422	928,921	1,062,004
Accounts Receivable	1,986,466	2,386,475	2,668,315	2,558,445	2,879,337
Inventory	1,205,756	1,613,929	1,699,606	1,882,470	1,733,183
Current Assets	5,696,330	6,019,818	6,578,860	6,435,973	6,874,218
Noncurrent Assets	4,025,739	5,418,037	7,182,334	7,013,851	7,305,872
Current Liabilities	4,382,738	5,227,149	5,774,020	4,947,732	5,045,016
Noncurrent Liabilities	623,192	849,166	1,163,473	917,874	1,028,347
Owner Equity	4,716,138	5,361,539	6,823,702	7,584,218	8,106,728
Total	9,722,068	11,437,854	13,761,194	13,449,824	14,180,091
Exchange Rate	31.7270	30.4944	31.0848	30.7319	32.4841

2. Saharattananakorn

					Unit: 1,000 USD
Year	2011	2012	2013	2014	2015
Total Revenue	782,581	912,084	1,038,018	930,408	680,185
Cost of Goods Sold	651,636	714,789	797,963	793,067	439,018
Gross Margin	130,945	197,295	240,055	137,341	241,168
Administrative Expense	71,903	92,951	94,857	90,808	55,832
Total Expense	954,605	1,014,511	1,084,593	1,111,387	838,476
Net Profit	(38,372)	37,454	109,203	23,284	5,597
Accounts Receivable	58,013	67,442	91,395	85,295	82,325
Inventory	61,483	95,467	93,021	97,921	96,920
Current Assets	319,295	434,780	424,149	401,002	394,447
Noncurrent Assets	260,370	389,723	468,752	485,008	410,251
Current Liabilities	299,500	418,991	355,542	347,297	313,145
Noncurrent Liabilities	27,942	95,394	93,031	98,869	82,925
Owner Equity	252,224	310,118	444,327	439,844	408,627
Total	579,665	824,503	892,900	886,009	804,698
Exchange Rate	31.7270	30.4944	31.0848	30.7319	32.4841

3. Hitech

					Unit: 1,000 USD
Year	2011	2012	2013	2014	2015
Total Revenue	7,470,391	8,594,081	8,990,400	8,934,187	8,417,050
Cost of Goods Sold	6,547,236	7,488,502	7,235,617	7,810,648	7,062,176
Gross Margin	627,583	406,958	716,504	886,476	686,387
Administrative Expense	513,296	502,852	490,305	461,793	344,604
Total Expense	7,740,208	8,786,521	8,329,611	8,743,167	8,255,064
Net Profit	53,701	205,789	929,051	511,087	429,107
Accounts Receivable	1,085,910	1,637,193	1,780,689	1,793,007	1,791,672
Inventory	832,455	842,726	810,114	910,654	843,005
Current Assets	2,692,727	3,154,304	3,323,308	3,357,379	3,362,763
Noncurrent Assets	1,795,238	2,417,476	2,558,262	2,706,552	2,376,115
Current Liabilities	1,920,257	2,765,909	2,383,482	2,385,235	2,117,577
Noncurrent Liabilities	241,771	262,442	235,508	261,713	214,076
Owner Equity	2,325,936	2,543,428	3,262,580	3,416,983	3,407,226
Total	4,487,965	5,571,779	5,881,570	6,063,932	5,738,878
Exchange Rate	31.7270	30.4944	31.0848	30.7319	32.4841

4. Bangpra-In

					Unit: 1,000 USD
Year	2011	2012	2013	2014	2015
Total Revenue	6,989,694	6,957,687	6,767,429	4,918,428	7,532,891
Cost of Goods Sold	6,027,509	5,308,076	5,313,986	3,839,557	4,897,642
Gross Margin	962,185	1,649,611	1,453,443	1,078,872	2,635,249
Administrative Expense	128,599	210,503	210,211	203,695	134,746
Total Expense	6,314,256	5,727,546	5,537,379	4,098,285	5,182,296
Net Profit	639,071	1,178,742	1,174,225	769,721	1,096,069
Accounts Receivable	1,566,491	1,704,774	1,494,999	1,698,384	1,682,560
Inventory	325,330	348,372	448,043	460,372	483,770
Current Assets	3,291,024	3,036,814	3,032,721	3,937,465	3,196,666
Noncurrent Assets	1,232,137	1,831,019	2,027,453	2,166,530	2,197,842
Current Liabilities	1,747,264	1,947,829	1,608,281	1,479,516	1,672,767
Noncurrent Liabilities	343,080	471,895	612,329	686,481	758,323
Owner Equity	2,432,817	2,448,109	2,839,564	3,937,998	2,963,419
Total	4,523,161	4,867,832	5,060,174	6,103,995	5,394,508
Exchange Rate	31.7270	30.4944	31.0848	30.7319	32.4841

5. Factory Land

					Unit: 1,000 USD
Year	2011	2012	2013	2014	2015
Total Revenue	345,544	376,945	362,376	388,902	236,692
Cost of Goods Sold	282,205	376,171	315,211	318,607	64,738
Gross Margin	63,339	774	47,166	70,295	171,954
Administrative Expense	70,110	40,813	41,571	39,797	13,473
Total Expense	388,770	425,295	362,385	359,152	213,092
Net Profit	(40,739)	71,172	26,109	33,919	28,197
Accounts Receivable	50,460	70,871	56,428	69,530	30,131
Inventory	32,803	30,971	27,710	36,582	15,056
Current Assets	178,780	168,413	142,056	175,742	124,313
Noncurrent Assets	118,430	234,596	203,276	192,888	121,101
Current Liabilities	138,198	152,307	121,977	114,366	39,517
Noncurrent Liabilities	22,276	41,811	15,286	12,014	9,595
Owner Equity	136,735	208,892	208,069	242,251	196,303
Total	297,210	403,009	345,332	368,631	245,414
Exchange Rate	31.7270	30.4944	31.0848	30.7319	32.4841

6. Navanakorn

					Unit: 1,000 USD
Year	2011	2012	2013	2014	2015
Total Revenue	7,029,589	7,043,401	6,927,848	7,120,200	6,311,335
Cost of Goods Sold	5,560,495	5,264,086	5,200,993	5,628,124	4,828,035
Gross Margin	1,469,095	1,779,315	1,726,855	1,492,075	1,483,300
Administrative Expense	697,866	737,221	802,765	825,901	735,884
Total Expense	6,681,540	6,509,510	6,180,960	6,669,223	5,921,360
Net Profit	211,893	477,653	625,819	343,065	306,383
Accounts Receivable	816,381	888,493	971,006	1,081,622	1,023,334
Inventory	848,919	864,468	893,509	917,935	853,144
Current Assets	2,652,391	3,435,003	2,776,757	3,094,271	2,897,780
Noncurrent Assets	2,130,849	2,663,793	3,310,194	3,126,116	2,932,409
Current Liabilities	1,657,615	2,616,880	2,167,574	1,978,369	1,700,593
Noncurrent Liabilities	396,607	366,218	458,554	641,749	403,486
Owner Equity	2,729,017	3,115,698	3,460,823	3,600,269	3,726,109
Total	4,783,239	6,098,795	6,086,951	6,220,387	5,830,189
Exchange Rate	31.7270	30.4944	31.0848	30.7319	32.4841

7. Bangkadi

					Unit: 1,000 USD
Year	2011	2012	2013	2014	2015
Total Revenue	3,775,741	1,851,668	3,360,463	3,034,379	2,854,661
Cost of Goods Sold	3,138,416	1,328,181	2,126,694	2,324,641	2,250,947
Gross Margin	637,325	523,486	1,233,768	709,738	603,714
Administrative Expense	257,062	120,998	263,744	432,033	248,265
Total Expense	3,508,256	1,864,442	2,409,265	2,791,108	2,602,187
Net Profit	212,016	(18,608)	924,709	207,333	234,265
Accounts Receivable	407,196	111,018	398,466	479,968	472,669
Inventory	240,591	138,657	200,449	218,235	225,076
Current Assets	1,059,129	807,986	1,476,212	1,493,664	1,552,155
Noncurrent Assets	743,203	478,339	1,320,820	1,312,410	1,194,087
Current Liabilities	828,800	636,019	894,301	910,927	854,182
Noncurrent Liabilities	23,563	69,536	81,262	65,895	77,593
Owner Equity	949,969	580,771	1,821,468	1,829,252	1,814,467
Total	1,802,333	1,286,325	2,797,032	2,806,074	2,746,242
Exchange Rate	31.7270	30.4944	31.0848	30.7319	32.4841

8 Total 7 Industrial Estates

					Unit: 1,000 USD
Year	2011	2012	2013	2014	2015
Total Revenue	43,535,705	38,148,071	49,261,983	46,144,653	46,600,045
Cost of Goods Sold	37,306,793	31,856,733	40,971,914	39,287,299	37,182,773
Gross Margin	5,933,340	5,592,717	7,251,789	6,620,291	8,748,784
Administrative Expense	2,850,699	2,748,535	3,231,141	3,483,746	2,766,159
Total Expense	42,187,006	37,280,580	45,275,316	43,824,610	42,599,153
Net Profit	1,621,552	2,692,901	5,160,537	2,817,330	3,161,622
Accounts Receivable	5,970,918	6,866,266	7,461,297	7,766,252	7,962,028
Inventory	3,547,338	3,934,590	4,172,451	4,524,169	4,250,155
Current Assets	15,889,676	17,057,117	17,754,063	18,895,497	18,402,341
Noncurrent Assets	10,305,966	13,432,982	17,071,091	17,003,355	16,537,678
Current Liabilities	10,974,373	13,765,083	13,305,176	12,163,442	11,742,795
Noncurrent Liabilities	1,678,432	2,156,461	2,659,443	2,684,596	2,574,345
Owner Equity	13,542,837	14,568,555	18,860,534	21,050,815	20,622,879
Total	26,195,642	30,490,099	34,825,154	35,898,853	34,940,019
Exchange Rate	31.7270	30.4944	31.0848	30.7319	32.4841

Output จากโครงการวิจัยที่ได้รับทุนจาก สกว.

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Gagarina Str. 9, 111-113, Sumy 40000, Ukraine
Tel.:+380-542-610360
e-mail: alex_kostyuk@virtusinterpress.org

LETTER OF PAPER ACCEPTANCE

FROM: Alexander Kostyuk, Editor, Corporate Ownership and Control and
Director, Virtus Interpress, Ukraine DATE: March 28, 2018

TO/ATTN: [1]Kanitsorn Terdpaopong

Rangsit University, Pathumthani, 52/347, Muang-Ake Phaholyothin Road,
Lak-Hok, Muang Pathum Thani 12000, Thailand
Email: kanitsorn@rsu.ac.th

[2]Raymond A. Zepp
Dewey International University, Street 207, Krong Battambang, Battambang, Cambodia
Email: zepp@diu.edu.kh

[3]Penprapak Manapreechadeelert
Rajamangala University of Technology Suvarnabhumi, 60 Moo 3 Asian Highway,
Phranakhon Si Ayutthaya 13000, Thailand
Email: penprapak.m@rmutsb.ac.th

I am pleased to inform you that your paper **Corporate Sustainability and Environmental Disasters: A Case of the 2011 Thai Floods** has been blindly, peer reviewed, revised and recommended for acceptance for publishing in Corporate Ownership and Control (COC) ISSN - 1727-9232, volume 15 (2018).

[1] Corresponding author
Assistant Prof. Dr. Kanitsorn Terdpaopong serve ing Program Director at Rangsit University, Thailand. Her research interests are o enterprises; succession plans for small and medium firms; business valuation; and n ctices. With a decade of research experience, she has received grants from public rese Thai Research Fund, The Office of Higher Education Commission and received interna ment of Foreign Affairs and Trade (DFAT), Australia, received an Endeavour executi the Australia Government and a fellowship award from the Ministry of Foreign Affairs of the Republic of China (Taiwan).

[2] Professor Dr. Raymond A. Zepp is a cofounder and current Vice-President of Dewey International University in Cambodia. His specialization is in mathematics and statistics. He has served as Fulbright Professor in the Ivory Coast, as consultant to the World Bank in Cambodia, as UNDP statistician in Mozambique, as ADB consultant in Sri Lanka, and as USAID consultant in Haiti.

[3] Penprapak Manapreechadeelert is an accounting lecturer in Rajamangala University of Technology Suvarnabhumi, Thailand. Her specialization is in financial accounting.

Director of Virtus Interpress,
Editor, Corporate Ownership and Control
Alexander Kostyuk

CORPORATE OWNERSHIP & CONTROL

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CONTENTS

The study explores the determinants of corporate cash holdings in the Chinese context. Owing to the unique economic problems in the developing and emerging economies, the study aims to investigate whether the research findings on developed countries could be generalized globally. Applying fixed-effects estimations on a sample of 115 Chinese firms listed between 2012 and 2016, the authors find that the level of corporate cash holdings has a significantly negative relationship with leverage, bank debt, non-cash liquid assets and managerial ownership. In particular, cash flow volatility, investment opportunity and dividend have a significantly positive relationship with cash holdings levels. These findings are consistent with the majority of the existing studies carried out in the Western context. The authors also find that firm size, cash flow, board independence and ownership concentration have a significant influence on the level of corporate cash holdings.

In the study, the figures and functions of the external statutory auditor and internal statutory auditor are analysed. From the dedicated and practical study of several documents, it is shown that with the progress of time, internal control carried out by the supervisory board is supported by an external control by the auditors or an audit firm. Until the mid-70s, auditing control was voluntary and the companies, without any impositions, believed it preferable to remain anchored to a purely internal control rather than an audit company. The law 136/1975 which made the external accounting control by an auditing company compulsory is under control of the Consob and the Draghi law clearly distinguishes the roles carried out by the auditors and work done by the supervisory board. After alluding to the reform of the commercial law, which took place in 2003, the law 39/2010 is analysed, modified by the recent law 135/2016. Successively, civil, criminal and administrative responsibility of the external and internal statutory auditors are analysed since with the EU Recommendation of 2008 (2008/473/EC) the state members are encouraged to limit the civil responsibility making the auditors no longer unlimitedly and jointly responsible but responsible relatively to the damage caused in the first person.

The paper examines a set of Greek Listed Companies with respect to the interconnections between their Boards of Directors (BoD's). The main objective is to explore if and to what extent these Directors are interlocked, and if this possible interlocking may affect the course of economic or financial decisions through the information content of announced earnings, including implications on the current financial crisis in Greece. For this purpose, the authors use two different modes of research methodology, namely social network analysis and OLS methodology (panel analysis). The results of the study indicate the existence of a highly connected and interdependent network between companies and the people constitute the BoD's. Also, the results show that in their entirety the companies are related and there is a high degree of interaction.

A large body of research deals with voting premium as a proxy of private benefit of control. Almost all of them find positive voting premium, in particular in Italy. Therefore appears interesting to ask what is the current status of private benefits of control in Italy in the last decade (2007-2017). Surprisingly, the authors show three major findings: i) reduction of non-voting share in the Italian scenario; ii) prevalence of negative voting rights premium more than positive ones, thus conflicting with the assumption and the observations by other researchers; iii) limits of the voting premium method. The authors' purpose is that this study, despite its limitations, may encourage further researches focused on the analysis of the improvement and the change in the Italian corporate governance. The article points out that interesting evidence already exists, although still much remains to do in the future.

CORPORATE SUSTAINABILITY AND ENVIRONMENTAL DISASTERS: A CASE OF THE 2011 THAI FLOODS

Kanitsorn Terdpaopong [*], Raymond A. Zepp [**], Penprapak Manapreechadeelert [***]

* *Corresponding author* Rangsit University, Thailand;
Contact details: Rangsit University, Pathumthani, 52/347, Muang-Ake Phaholyothin Road, Lak-Hok, Muang Pathum Thani 12000, Thailand
** Dewey International University, Cambodia
*** Rajamangala University of Technology Suvarnabhumi, Thailand

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Abstract

Manufacturing companies suffered from the floods that happened in 2011 and left many companies in the financial fragile situation. This research examines whether the Thai floods of 2011 had differential effects among variously sized businesses, as well as among Thai, Japanese and other foreign companies. Financial records were gathered from 514 companies out of an initial 651 from seven industrial estates in Thailand affected by the floods. This research collects quantitative data to verify that disasters have differing effects on different types of companies. Comparisons were made among the various types of companies from years 2011 through 2015 on: Return on Assets (ROA), Return on Equity (ROE), Gross Profit Margins (GPM), Operating Profit Margins (OPM), and Net Profit Margins (NPM), using Kruskal-Wallis ANOVA, and Dunn's post-hoc tests. Significant differences were found among the various sizes on companies in most of the five measures in most years, especially 2011-2013. Similar, but smaller differences were found among companies of different nationalities. The study suggests ways in which companies and government agencies may work together to mitigate the effects of future disasters.

Keywords: Corporate Sustainability, Natural Disaster, Floods, Corporate Governance, Government Policy, Sizes, Ownership

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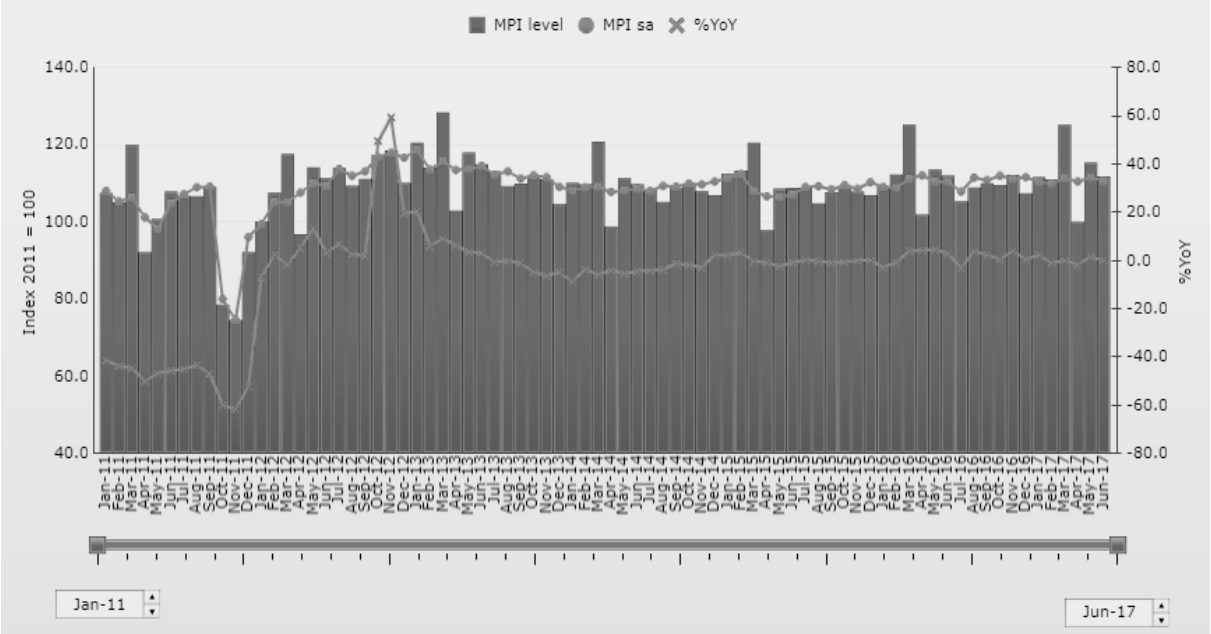
1. INTRODUCTION

The floods of late 2011 hit Thailand with devastating effects. The year 2011 is recorded as the worst year ever for Thailand's manufacturing sector. The historic floods in the fourth quarter hit seven industrial estates, which impacted 17% of total manufacturing production. The Manufacturing Production Index (MPI) during the fourth quarter fell by 21.8% (BOT, 2011) in areas where major producers and complex production networks resided, especially production in the automobile, electronics, hard disk drive, and electrical appliance industries. Due to such historic floods, damage

resulted directly from a halt in production and indirectly through disruptions to supply chains and transportation.

After the floods, manufacturing production improved gradually and finally returned to normal in the following year. The MPI started to rise after the flood (see Figure 1). The MPI in June 2017 illustrates the rise to 111.8, especially in the automobile sector as many plants still need to wait for damage assessments from the insurance companies to be completed. The Office of Industrial Economics has changed the base year and weight from 2000 to 2012. Moreover, serious damage to critical machinery in many industrial estates forced firms to import these machines anew, thus causing further delays due to the importing and installation processes involved. The indirectly affected firms that experienced supply constraints had to seek alternative suppliers in Thailand or abroad.

Figure 1. Manufacturing production index (MPI) from January 2011 to June 2017



Source: The Office of Industrial Economics (https://www.bot.or.th/English/Statistics/Graph/Pages/Mpi.aspx)

In Thailand, there are 53 industrial estates; all of which are registered under the Industrial Estate Authority of Thailand. These industrial estates contain companies of all types: small, medium, and large businesses, as well as Thai-owned, Japanese-owned, and other foreign-owned companies. Overall, Thai-owned companies comprise 36%, Japanese-owned 25%, Singaporean 6%, and American 5% of the total (see Figure 2). Manufacturing factories are the predominant type of business with 22%, while vehicles and logistics make up another 12% (see Figure 3) (Industrial Estate Authority of Thailand, 2017).

Figure 2. Nationality ownerships as of 2016

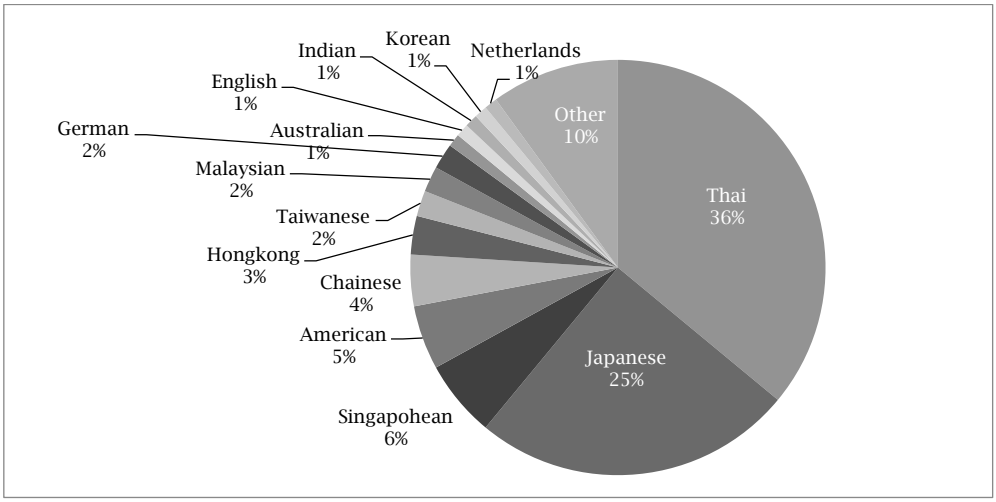
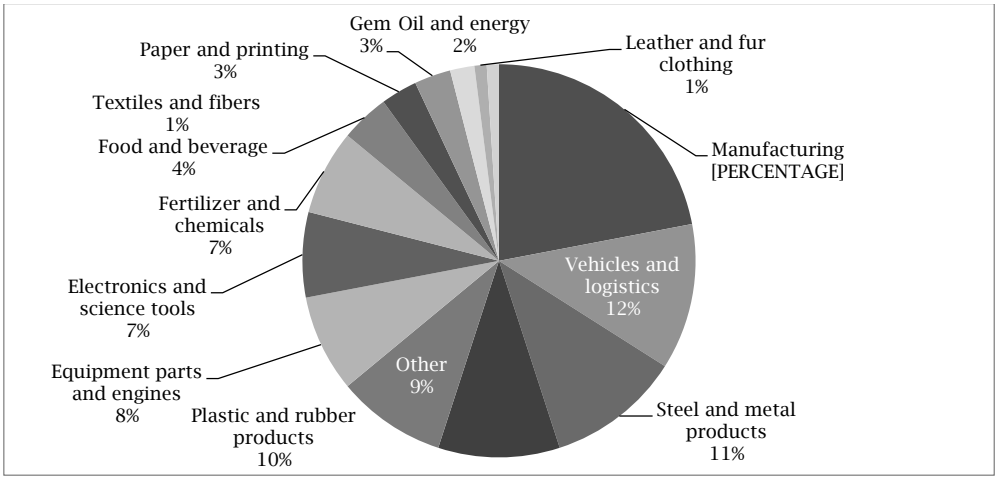


Figure 3. Business sectors as of 2016



The flood in 2011 had caused significant damage to Thai industrial estates. Especially in the central part of the country where several industrial estates located and were major manufacturing hubs of the country and the region. These manufacturing estates are vital sources of employment which directly influenced the robust of the country's economy. Therefore, the Thai government put an effort to assist the industrial estates by subsidizing two-thirds of the total budget for the construction of flood barriers surrounding 6 industrial estates[16] (a total length of 143 kilometres) – i.e. Bangpa-in Industrial Estate, Ban Wa (Hi-Tech) Industrial Estate, Saha Rattana Nakorn Industrial Estate, Bangkadi Industrial Park, Rojana Industrial Zone, and Nava Nakorn Industrial Zone – accounting for approximately 3 billion Baht or USD 92.07 million. This was to prevent the large scale of damage to the industrial estates. The damage still occurred despite the integration of the government and the private company's efforts.

Our research study is based on the understanding that any damages to such manufacturing will inevitably impact the national income. In those industrial estates by which Thai and Japanese are major nations among many other nations affected tremendously by the floods in 2011. Several companies located in those industrial estates went bankrupt after the national disaster (evidence from 43 companies were closed down after 2011), many presented deficit on their operating income and several had to cease their business with little to no cash inflows. It is therefore important to prevent future flood damages and at the same time to restore the confidence of both Thai and foreign investors and employees in industrial estates.

The aim of this study built on the point, and the well awareness of the authors, that at this point there are a few studies researched on the topic of the 2011 floods, for example the study by Singkran (2017) examined the 2011 flood with an emphasis on the Chao Phraya River Basin and analysed the existing plans and measure relevant to the floods risk management; the study by Haraguchi and Lass (2015) investigated investigates the impact of floods on the global economy through supply chains, and proposes measures for the related supply chain risk; the study by Marks and Rebel (2016) investigated on how decentralization reforms and the associated power relations between government agencies at different levels affected disaster risk outcomes in Thailand, in particular, during the 2011 floods in Central Thailand; the study by Ng (2016) deeply explained on the governance approach and its responding to a reactionary flood governance regime in Ayutthaya, Thailand. However, none of them studied on the environmental impact on the individual manufacturing company's performance and none of them studied whether these companies' sustainability is influenced by their sizes or their nationality of ownership. Therefore the goals of this study are to examine corporate sustainability as the consequence of the historic floods through the financial performance of companies in those seven industrial estates with the focus on sizes and ownership.

2. LITERATURE REVIEW

Even though the relevant authorities have expended great efforts to deal with floods, consequences from such natural disasters still left several companies financially distressed. Most of the companies located in the industrial estates suffered financially from the floods directly. With an eye to mitigating future disasters, it is worth studying whether the floods affected the financial status of these different types of companies to different degrees. If differences are found, it is natural to discuss the reasons for the differences, and how best to make the hardest hit companies less vulnerable in the future.

A study by Terdpaopong and Manapreechadeelert (2017) initially employed the observation of various financial ratios – 28 ratios used by previous researchers. In conclusion from previous studies, a small number of financial ratios were selected as the best impacts that influence and represent companies' capability. This study examines five different measures of financial health which highly suggested being significant ratios for business performance: return on assets (ROA), return on equity (ROE), gross profit margins (GPM), operating profit margins (OPM), and net profit margins (NPM). These measures are compared across companies of different sizes and of different ownership/nationalities. If certain types of companies are found to have suffered more than

[16] Industrial Estate Authority of Thailand, Flood Prevention System. Source: http://www.ieat.go.th/en/investment/why-invest-in-industrial-estate/flood-contingency-pla n-for-industrial-estates

others, one must ask what factors caused their poor performance. Once these factors have been identified, it will then be possible to suggest ways for these companies to avoid similar losses in the event of future disasters.

In certain industrial parks, where industries were clustered, hundreds of companies were severely damaged, not only in the immediate physical destruction of assets but also in loss of sales and disruption of supply chains. These industrial parks contained companies of all types: small, medium, and large businesses, as well as Thai-owned, Japanese-owned, and other foreign-owned companies.

Generally speaking, the literature is quite clear about the differential effects of flooding on large versus small businesses: large businesses are usually better prepared than small ones.

Agnello et al. (2013) studied companies in a large industrial park in Italy and found that the proximity of companies within the park area led to the pooling and sharing of information about risk management. However, a similar study by Nordloff et al. (2015) found that such risk management considerations did not always apply to the work environment. Nordloff et al. (2015) concluded that "Company size does not appear to be associated with perceptions of work environment prioritizations".

A study of large businesses in Australia by Ahmad et al. (2014) showed that "the majority of the firms involved in the survey not only extensively implement Environmental Risk Management (ERM) but also extensively embed ERM into their corporate strategic processes. Further, they have also implemented the system for more than five years.

On the other hand, many studies report on the lack of preparedness by small enterprises. Small companies are more disproportionally affected by a crisis than are larger or resource-rich enterprises (Corey & Deitch, 2011). "The impact of a crisis on small companies may be particularly great because of the personal impact on owner-managers and their lack of preparedness and resources making them more vulnerable" (Doern, 2016, p. 276).

The chief cause of this is often an attitudinal one, as summarized by Speiers (2017).

Owner managers feel they have more important matters to address than a "might happen" event at some indeterminate time in the future. Yet the preparation and testing of a plan to manage a crisis is an imperative as small companies tend to be fragile and lack the resilience of their larger counterparts and, as such, mortality rates are high.

Risk management is naturally related to corporate governance, especially in the area of longer-term planning and strategic management. Smaller, owner-managed companies tend to take a short-sighted approach based on day-to-day survival (Clarke & Klettner, 2009). Crossan et al. (2015) emphasise "A lack of governance within small companies that is a contributory factor in business failure…. Many of these failures can be mitigated by the introduction of robust governance structures that would potential[ly] provide better planning and management structures".

These short-term attitudes also affect the recovery of owner-managed businesses after a disaster, according to a UK Government report (2006). "Around half of all companies experiencing a disaster and which have no effective plans for recovery fail within the following 12 months". The report proposes that appropriate elements of corporate governance such as enterprise risk management would mitigate the impact and effects of a crisis.

Indeed, Pedone (1997) states that 90% of companies without a plan for recovery will fail within two years post-crisis. Budge, Irvine, & Smith (2008) view this attitude of small business managers as a "reactionary posture" They attribute these attitudes to a combination of consequences:

- resource scarcity, (Aleksić et al., 2013);
- ineffectual planning (Corey & Deitch, 2011);
- limited business skills (Minichilli & Hansen, 2007);
- flimsy corporate governance (Faghfouri, 2015);
- denial: "Finally, when considering risk and the possibility of a crisis event, it is a posture of denial and 'head in the sand' that prevails" (Spillan, 2001).

Still, these attitudes have serious consequences that can be avoided with better foresight "Yet, when managers take a pro-active approach to crisis management planning, both crisis prevention, and post-crisis survival rates are improved" (Runyan, 2006).

More closely related to the Thai floods of 2011, Do et al. (2016) studied the effects of the same flooding in neighbouring Can Tho, Vietnam. The authors emphasised that the closure of businesses and the resulting supply chain damage was financially even more deleterious that the initial structural damage. "Only 25 percent of small businesses had repaired their establishments by February 2012. A lack of financial resources was an important reason why … small businesses had not yet carried out these repairs".

The second consideration in Vietnam was that government and NGO assistance in the recovery process tended to focus on larger companies, while "low-income households are rather left alone with their adaptation costs" (Garschagen, 2013).

Due to the literature review, the first hypothesis is drawn regarding the size differences between small, medium and large companies that even though all of them were severely affected by the 2011 floods, their financial ratios are to be statistically different.

H_1: During the years 2011-2015, the financial ratios of flood-affected companies are different statistically among the companies of different sizes.

The study also examines whether floods affect local companies any differently from foreign companies, of which Japanese companies are numerous. There is evidence from the literature that local companies in various countries are not well prepared for natural disasters. In Nigeria, for example, Iroegbu (2005) found that Nigerian construction companies "have failed to place more emphasis on risks during the construction project and such risks when not properly managed have added to project failure". In Saudi Arabia, local companies used outmoded or conventional methods of risk management that were not appropriate (Algahtany, 2016).

Adeleke et al. (2017) studied variables that affected risk management in Nigeria. They singled out Organisational External Factors that could negatively impact response to disasters. These include political factors, such as, according to Jabnoun et al. (2005): discriminatory legislation,

covering tax regimes, riots, strikes, civil unrest, wars, terrorism, invasions, and religious turmoil.

Such political factors could have more harmful effects on locally owned companies, especially if they include factors such as mentioned by Israelsson and Hansson (2009):

[A] Political decision also positively influences construction risk management within the organization, by which some companies are politically connected to one another. … Those who are connected to the ruling party tend to receive more capital, support, and huge projects with experts, compared with those who are not.

In Thailand itself, Maier-Knapp (2015) pointed out political factors that could have affected the 2011 flood response. In particular, local government and national government do not always share the same perspectives of a problem, and hence their proposed solutions may differ and even conflict. "The illustration of the flood crisis highlighted the delicate relationship between the central authorities and the authorities on the subnational level".

Flood-related institutions were created to raise the confidence levels of foreign investors to harness various areas of expertise of the many state agencies; their efficacy is ultimately contingent on the cooperative attitudes of the established bureaucracies, which are also increasingly developing along expertise-driven and participatory lines.

The Adeleke study (op. cit.) also identified technological factors that could affect risk management. Multinationals, along with larger companies, might be able to take advantage of economies of scale to purchase technology to prevent or mitigate flood damage, while small or local companies might find the installation of a single piece of equipment too expensive.

In addition to examining external organisational factors, Adeleke also studied the effects of rules and regulations. The study concluded clearly that companies that follow the rules on risk avoidance and mitigation are most likely to escape major damage. An earlier longitudinal study by Aniekwu (1995) "affirmed that organizations that duly follow the prescribed rules and regulations by the government either while procuring materials, drawing plans, or performing other activities involved in construction will record less occurrence of risk in the project".

This statement sounds obvious, but in light of his citation of previous studies showing that in many countries, companies are not following guidelines and prescribed risk management practices, it should be clear that in spite of regulations, companies are still failing to prepare for disasters. More emphasis must be placed on the enforcement of those rules.

One may also surmise that it is the small, local businesses who are failing to follow the rules. Large multinationals are probably more strictly regulated, either by their home country or by local officials. Thus, it may be the small, local companies who suffer most when disaster strikes. Still, the above-cited studies do not offer any direct quantitative comparison between local companies and foreign-owned companies.

Our second hypothesis regarding the companies' nationality shareholders would be that the financial ratios of the flood-affected companies will illustrate some differences among different nationality. In other words, the companies with one nationality would perform differently when compared to companies with another nationality. Thus, the hypothesis is stated as follows.

H_2: During the years 2011-2015, the financial ratios of flood-affected companies are different statistically among the companies of different nationality shareholders.

3. METHODOLOGY

3.1. Indicators

In the present research, the main objective is to investigate financial changes of the flood-affected companies. A preliminary study (Terdpaopong & Manapreechadeelert, 2017) initially employed the observation of various financial ratios – 28 ratios used by previous researchers. For this study selected 5 ratios which might be most affected by the floods – Return on Assets (ROA)[17], Return on Equity (ROE)[18], Gross Profit Margin (GPM)[19], Operating Profit Margin (OPM)[20], and Net Profit Margin (NPM)[21]. The financial records of industrial companies from 2011 to 2015 were used.

3.2. Population and sample selection

This study uses seven Thai industrial estates namely 1) Rojana[22] 2) Navanakorn[23], 3) Hi-Tech[24], 4) Bangpa-in[25], 5) Factory Land[26], 6) Saharattananakhon[27], and 7) Bangkadi[28]. Total of these 7 industrial estates comprises of 651 companies as samples. The sample selected for this study is 514 companies (78.96% of the population), which omits companies that missed reporting their financial statements (75 companies), companies out of business or closed down after the floods (43 companies), and newly registered businesses after 2011 (19 companies). The Rojana Industrial Estate was the largest industrial estate

[17] Return on Assets (ROA) indicator of how profitable a company is relative to its total assets, calculated by taking Net Income / Total Assets.

[18] Return on Equity (ROE) measures a corporation's profitability by revealing how much profit a company generates with the money shareholders have invested, calculated by taking Net Income/Shareholder's Equity.

[19] Gross Profit Margin (GPM) is a company's financial health and business model by revealing the proportion of money left over from revenues after accounting for the cost of goods sold (COGS), calculated by taking Revenue less Cost of Goods Sold and divided by Revenue.

[20] Operating Profit Margin (OPM) is a measurement of what proportion of a company's revenue is left over after paying for variable costs of production such as wages, raw materials, etc., calculated by taking Operating Income divided by Net Sales.

[21] Net Profit Margin (NPM) is the ratio of net profits to revenues for a company or business segment. Typically this ratio will be expressed as a percentage, net profit margins show how much of each dollar collected by a company as revenue translates into profit. The equation to calculate net profit margin is taking Net Profit divided by Revenue.

[22] Rojana Industrial Park Public Co., Ltd. was established in 1988 by a joint venture between Japanese (Nippon Steel & Sumikin Bussan Corporation) and Thai (Vinichbutr's Group) companies for the purpose of development and operation of industrial parks in Ayutthaya province, Rayong province and Prachinburi province. Source: http://www.rojana.com/index.html

[23] Since the establishment in 1971, Nava Nakorn Industrial Zone remains one of the most trusted industrial estate developers in Thailand. Source: https://www.navanakorn.co.th/ewt_news.php?nid=238&filename=indexEN

[24] Hi-Tech Industrial Estate is one of the projects under Thai Industrial Estate Corp., Ltd. The company was established on January 11, 1986 with the main purpose of developing an industrial estate in Ayutthaya catering to high technology but less polluted industries. Source: http://www.industrialpark-th.com/about_us/profile.php

[25] Bangpa-in Industrial Estate establish in 1989, located at Ayutthaya. Source: http://www.bldc.co.th/about_us.php?id=6

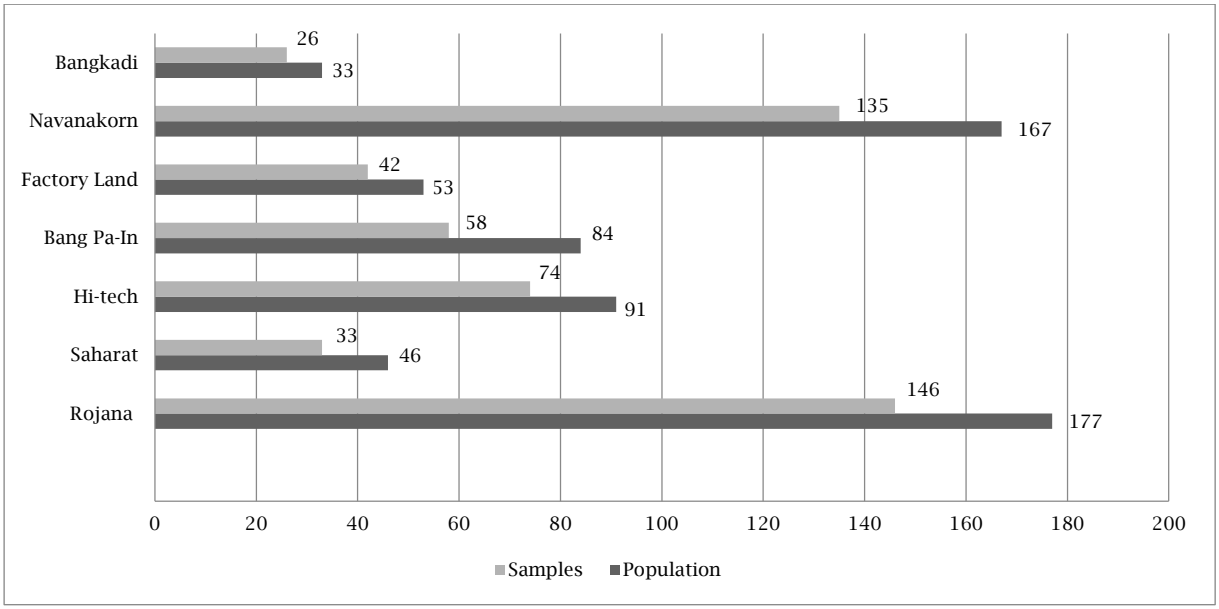
[26] Factory Land – Wangnoi is a small industrial estate consisting of 65 SMEs, located in Ayutthaya. Source: http://www.diw.go.th/liz/fac_list.asp?zone=000014.

[27] Saha Rattana Nakorn Industrial Estate established in 1994 located in Ayutthaya. Source: http://thailandindustry.blogspot.com/2012/09/blog-post_8789.html

[28] In 1987, Bangkadi Industrial Park Co., Ltd. was founded on 483 acres of land on Tivanon Road, Pathumthani province through a joint venture between Thai Toshiba and Mitsui Group with the goal of attracting foreign investment into Thailand with cooperation from Board of Investment of Thailand (BOI). Source: http://www.bangkadi.co.th/philosophy.html

among all with 177 companies and Navanakorn was the second largest with 167 companies residing in the park. The samples selected for this study come from Rojana (28.40%), Navanakorn (26.26%), Hi-Tech (14.40%), Bangpa-in (11.28%), Factory Land (8.17%), Saharattananakhon (6.42%) and Bangkadi (5.06%).

Figure 4. Population and sample size



3.3. Sizes and nationalities

Companies can be classified into different categories according to their sizes; for this purpose different criteria may be used (e.g. number of persons employed, employees, total balance sheet (total assets), total capital investment (total equity), but the one most common in a statistical context is number of persons employed which includes employees but also working proprietors, partners working regularly in the enterprise and unpaid family workers. Small and Medium-sized Enterprises (abbreviated as SMEs) are further subdivided into:

- micro enterprises: fewer than 10 persons employed;
- small enterprises: 10 to 49 persons employed;
- medium-sized enterprises: 50 to 249 persons employed;
- large enterprises: 250 or more persons employed.

The OECD estimates that SMEs account for 90% of firms and employ 63% of the workforce in the world (Munro, 2013). These figures can also be implied for Thai SMEs. In Thailand, SMEs are divided into 3 different sectors - production, service and trading firms. The companies in Thailand are classified either as micro, small, medium or large enterprises based on both the number of employees and the amount of fixed assets, excluding land (Institute for Small and Medium Enterprises Development, 2006). Businesses in the production and service sectors are classified as small enterprises if their assets are not more than THB 50 million and employ no more than fifty people; while medium enterprises are those with assets between THB 50 to 200 million and employ between fifty and two hundred people. On the other hand, businesses in the wholesale trading sector are classified as small enterprises if their assets are less than THB 50 million and employ no more than twenty-five people and as medium enterprises, if their assets are between THB 50 to 100 million and employ between twenty-six and fifty people. When a situation where the number of employees and the value of fixed assets places the firm in both categories, that is either small or medium, the lower of the two determines how the enterprise will be classified.

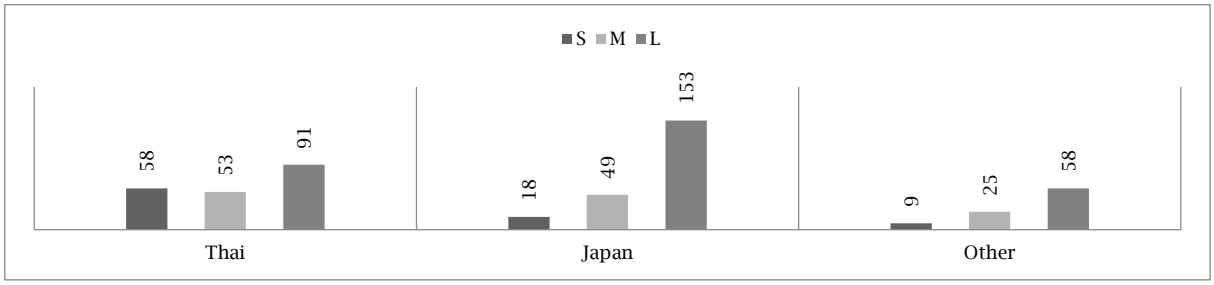
In this study, however, finding such information on the number of employees of the companies in the industrial estates is difficult. The second best the study can find is values of assets. After careful consideration, the value of the company assets (total assets) at the end of the year was used to categorize the companies' sizes. The study divided companies into three different sizes.

- Small (S) - Total assets < THB 50 million (USD[29] 1.60 million)
- Medium (M) - Total assets < THB 200 million (< USD 6.41million)
- Large (L) - Total assets > THB 200 million (> USD 6.41million)

Due to the national majority of the companies in the industrial estates are Japanese, Thai and other. The data taken into accounts for the nationalities are to consider these three main nationalities (see Figure 5).

[29] Exchange rate 1 USD = 31.203 THB. Source: https://www.bloomberg.com/quote/USDTHB:CUR

Figure 5. Firm size by nationality graph



The companies in 7 industrial estates classified by sized and nationalities are presented below in Table 1.

Table 1. Information as of December 2011 (small changes after this are of minor relevance)

Size and nationality			*Industrial Estates*							*Total*
			Rojana	*Saharat*	*Hitech*	*Bang pa-in*	*Factory land*	*Nava nakorn*	*Bang kadi*	
L	Nationality	Thai	25	3	15	10	3	27	8	91
		Japanese	62	10	25	10	4	30	12	153
		Other	17	2	16	7	0	15	1	58
	Total		104	15	56	27	7	72	21	302
M	Nationality	Thai	12	4	4	6	5	20	2	53
		Japanese	15	8	6	6	1	12	1	49
		Other	7	2	4	4	4	4	0	25
	Total		34	14	14	16	10	36	3	127
S	Nationality	Thai	3	2	1	8	18	24	2	58
		Japanese	4	2	3	4	2	3	0	18
		Other	1	0	0	3	5	0	0	9
	Total		8	4	4	15	25	27	2	85
Total	Nationality	Thai	40	9	20	24	26	71	12	202
		Japanese	81	20	34	20	7	45	13	220
		Other	25	4	20	14	9	19	1	92
	Total		146	33	74	58	42	135	26	514

Note: L: Large, M: Medium, S: Small

3.4. Statistical methods

Before the actual analysis, various assumptions of multicollinearity, linearity, and normality were ascertained. The data were analysed for normality using Kolmogorov-Smirnov tests, which show the data were highly non-normal. As the result, the non-parametric Kruskal-Wallis tests were applied to small, medium and large companies, as well as the Thai, Japanese and other major nationality shareholders (Singapore, America, China and etc.).

4. FINDINGS

The floods of October 2011 had serious effects on the financial status of 514 companies in the economic zones studied. The following losses (all in percentages) were recorded for the year 2011, 2012 and the bounce-back 2012-2011.

Table 2. Means of the five variables – entire sample

		2011	*2012*	*Bounce-back 2012-2011*
Return on Assets	(ROA)	-5.21	6.94	12.15
Return on Equity	(ROE)	-8.47	19.02	27.48
Gross Profit Margin	(GPM)	13.43	8.38	-5.41
Operating Profit Margin	(OPM)	-4.47	3.41	7.88
Net Profit Margin	(NPM)	-5.43	3.64	9.06

It should be noted that the gross profit margin, as calculated by subtracting production costs from revenues, was positive for the year 2011 since the cost of repairs and replacements from the flood were not counted in the GPM. Rather, those disaster costs were taken into account in calculating the OPM and the NPM, which were indeed negative for the year.

The only measure to drop was GPM, which fell 5.41% from 13.48% to 8.38%. This drop could be due to several possible factors, either from loss of revenue or from increased costs. It is probably that supply chains were disrupted so that products could not reach sales outlets, and therefore sales fell. It is also possible that customers who could not be serviced during the flood turned to other businesses outside the flood zones and possibly remained with those new outlets.

The effects reported above were not uniform among businesses. It was the purpose of this study to examine the differential effects of the flooding on

large, medium, and small businesses, as well as on Thai, Japanese, and other foreign companies.

4.1. Return on assets and equity (ROA and ROE)

The following table shows the mean percentage ROA and ROE for small, medium, and large companies in years 2011 through 2015.

Table 3. Means of ROA and ROE by size

	2011	*2012*	*2013*	*2014*	*2015*	*Bounce 2011-2012*
ROA:						
Small	-7.82	3.21	2.21	2.94	2.92	11.03
Medium	-8.7	5.69	4.17	3.14	2.7	14.39
Large	-3.01	8.51	8.66	4.36	4.47	11.52
ROE:						
Small	-10.44	13.63	7.78	28.16	8.44	24.06
Medium	-16.08	21.63	15.73	21.12	5.97	37.71
Large	-4.72	19.43	16.56	11.77	8.47	24.15

Table 4. Means of ROA and ROE nationalities

	2011	*2012*	*2013*	*2014*	*2015*	*Bounce 2011-2012*
ROA:						
Thai	-5.8	5.72	5.17	3.9	4.37	11.51
Japanese	-5.1	7.69	6.97	2.96	3.34	12.79
Other	-4.19	7.83	8.21	5.73	3.56	12.02
ROE:						
Thai	-8.97	15.37	11.12	19.42	7.72	24.34
Japanese	-7.38	19.15	16.36	11.72	7.79	26.53
Other	-9.97	26.69	19.7	23.13	9.15	36.66

In order to compare the data among sizes and among nationalities, it was necessary to avoid parametric statistical methods. Kolmogorov-Smirnov tests revealed highly non-normal distributions in all cases. As a result, the non-parametric Kruskal-Wallis ANOVA test statistic was used. The following significances were recorded.

Table 5. Kruskal-Wallis test

Significance levels for Kruskal-Wallis tests for sizes and nationalities		
	Between S, M and L	
	ROA	*ROE*
2011	0.001**	0.034*
2012	0.004**	0.186
2013	0.005**	0.276
2014	0.735	0.007
2015	0.171	0.6
2012-2011	0.239	0.312
	Between Nationalities	
	ROA	*ROE*
2011	0.259	0.765
2012	0.462	0.106
2013	0.54	0.092
2014	0.044*	0.001**
2015	0.477	0.923
2012-2011	0.604	0.984

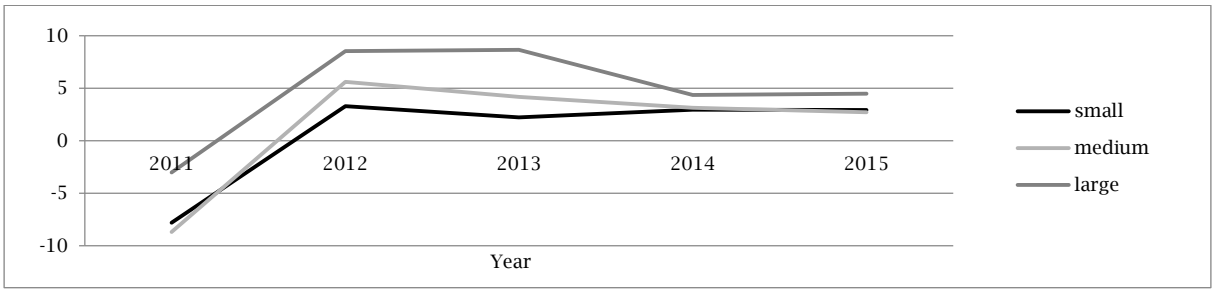
*Note: **p < .01*
**p < .05*

Thus, highly significant differences were found, especially among the various sizes of companies. In the cases where significances were found, post-hoc comparisons were made using the Dunn's test for non-parametric statistics. In the tests for company size, all significant differences yielded post-hoc significance involving the large companies, in most cases large versus small. There were no significant differences between small and medium companies, suggesting that small and medium companies can be grouped together as one statistical entity.

In the two cases of significant differences among nationalities, the Dunn's test showed a paired significance between Japanese and other companies of .042 for ROA in 2014, while the ROE in 2014 found a Japan-Thai difference (p<.010) as well as a Japan-Other difference (p<.002).

In order to visualize the nature of these significances, one can turn to a graphic representation, for example, that of the ROA means over the course of the period 2011-2015:

Figure 6. ROA graph by size



One observes that large companies' ROAs were hurt less than small and medium companies in 2011 and that this advantage to large companies continued through 2013. No significant differences were observed for 2014 and 2015 when the ROAs of the three sizes became roughly equal. Note also that the bounce-back from 2011 to 2012 was roughly the same for all sizes, as evidenced by the similar positive slopes of all three parallel graphs between 2011 and 2012.

4.2. Gross profit margins (GPM), operating profit margin (OPM), and net profit margin (NPM)

4.2.1. Gross profit margins (GPM)

Overall means for the gross profit margins (GPM) of all 514 companies in 5 different years were as follows:

Table 6. GPM 2011-2015

	2011	*2012*	*2013*	*2014*	*2015*	*Bounce 2011-2012*
GPM all 514 companies (%)	13.43	8.38	11.31	14.14	16.5	-5.05

Thus, profit margins fell in 2012 but recovered by 2013 and continued to rise thereafter. The following table shows the mean percentage GPM for small, medium, and large companies in years 2011 through 2015.

Table 7. GPM classified by sizes 2011-2015

	2011	*2012*	*2013*	*2014*	*2015*	*Bounce 2011-2012*
Small GPM	13.89	11.5	15.29	16.42	18.03	2.42
Medium GPM	12.87	9.2	12.25	15.73	17.54	3.17
Large GPM	13.75	7.16	9.79	12.82	15.54	-6.59

Table 8. GPM classified by nationalities 2011-2015

	2011	*2012*	*2013*	*2014*	*2015*	*Bounce 2011-2012*
Thai GPM	14.5	12.2	14.99	16.88	18.45	-2.3
Japanese GPM	13.08	5.59	8.84	12.56	15.11	-7.48
Other GPM	11.94	6.64	9.13	11.88	15.25	-5.3

Table 9. GPM significance levels for Kruskal-Wallis tests by sizes and nationalities

Between S, M and L	
	GPM
2011	0.568
2012	0**
2013	0**
2014	0.012*
2015	0.028*
2012-2011	0.003**
Between Nationalities	
	GPM
2011	0.297
2012	0**
2013	0**
2014	0**
2015	0.006**

*Note: **p < .01*
**p < .05*

As in the case of S-M-L comparisons, Dunn's tests revealed that all significant paired differences involved large companies, while there were no significant paired differences between medium and small companies.

Significant paired differences among nationalities, according to the Dunn's post-hoc test, were a mixed bag, with Japan figuring in results of all four significant years. The results were

- 2012: Japanese-Thai (p<.001) and Japan-Other (p<.003);
- 2013: Japanese-Thai (p<.001) and Other-Thai (p<.001);
- 2014: Japanese-Thai (p<.001) and Other-Thai (p<.005);
- 2015: Japanese-Thai (p<.009).

Note that all sizes and nationalities had approximately equal GPMs in 2011, but those figures diverged in 2012. Small companies had consistently higher GPMs than medium and large companies, and Thai companies had consistently higher GPMs than foreign companies. This can perhaps be explained by the differing effects of supply chain disruptions: small companies were disrupted less than larger companies, and Thai companies were disrupted less than foreign companies. It is likely that larger, foreign companies had more overseas export supply chains, and so they suffered more than did smaller Thai companies. These data are illustrated in the two graphs shown below.

Figure 7. GPM graph by size

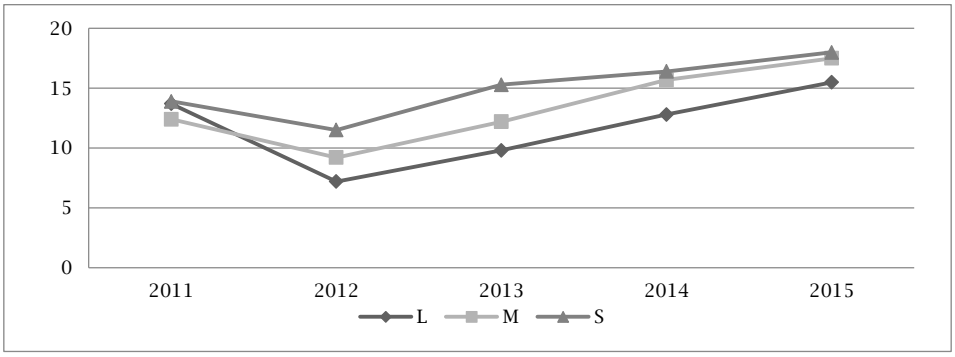
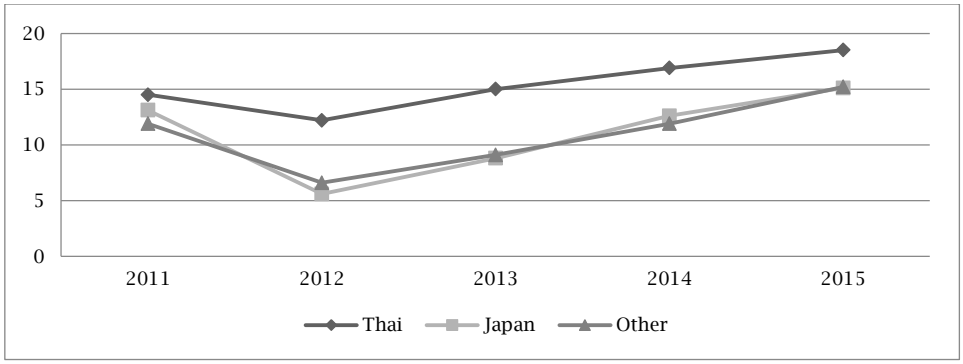


Figure 8. GPM graph by nationalities



It is interesting that by 2014, the smaller companies had lost their GPM advantage so that there were no significant differences in 2014 and 2015. On the other hand, Thai companies retained their advantage over foreign companies throughout the period 2012-2015.

4.2.2. Operating profit margin (OPM)

The following table explains the operating profit margin of the companies in the industrial estates classified by their sized and their nationalities. Data was illustrated in 2 different periods; on the flood year and after the flood years. The comparisons between the 2 different periods were presented as a bounce back in each category.

Table 10. OPM classified by sizes and nationalities

	2011	*2012-2015*	*Bounce*
Size:			
Small	-7.6960	0.3686	8.0650
Medium	-8.5334	1.6034	10.1370
Large	-1.8533	5.0856	6.9390
Nationalities:			
Thai	-4.4793	3.8087	8.288
Japanese	-4.9146	2.8612	7.776
Others	-3.3867	4.0399	7.427

The study found that the medium-sized companies are the one with the highest bounce back; 10.1371, while small companies possessed the bounce back of 8.0650 (second highest) and large companies 6.9390 (the least bounce bank). When considering the nationalities, the bounce back records are quite similar, Thai nationality is the highest bounce back of 8.288 (see Table 10).

The p-value from the Kruskal-Wallis Tests from the year 2011 to 2015 are statistically different among 3 different sizes of the manufacturing companies. In some years such as 2014, p-value equals 0.054, 2015 p-value 0.003 which present lower than .05, while in 2011 p-value 0.001, 2.12 and 2.13 p-value 0.00 which present lower than .01, can be interpreted that those are statistically different at significant levels .01 and .05. While there is no statistical difference on nationalities, the p-value is greater than .05. These can be interpreted that companies of different sizes illustrate statistically significant operating incomes (see Table 11).

Table 11. OPM significance levels for Kruskal-Wallis tests by sizes and nationalities

Between S, M and L	
	OPM
2011	0.001**
2012	0**
2013	0**
2014	0.054*
2015	0.003**
2012-2011	0.188
Between Nationalities	
	OPM
2011	0.322
2012	0.723
2013	0.655
2014	0.067
2015	0.323

*Note: **p < .01*
**p < .05*

4.2.3. Net profit margin (NPM)

Gross profit takes into account only production costs, not administrative costs, repairs, renovations, taxes, etc. When these costs are subtracted off to obtain Net Profit Margins (NPM), a different picture emerges. Thus, these additional costs dragged a GPM of 13.43 in 2011 down to an NPM of -5.43 and sprung back to positive figures in 2012 and after 2012 onwards (see Table 12).

Table 12. NPM 2011-2015

	2011	*2012*	*2013*	*2014*	*2015*	*Bounce 2011-2012*
NPM all 514 companies (%)	-5.43	3.64	5.29	2.47	2.84	9.07

When the sizes and nationalities are considered, the study found that medium companies are the highest bounce back from 2011 with the bounce back of 11.211 which mean the medium-sized companies enable to recover the most among other sizes, and followed by small companies and large companies, while companies with different nationalities have a similar bounce back (see Table 13 below).

Table 13. NPM classified by sizes and nationalities

	2011	*2012-2015*	*Bounce*
Size:			
Small	-9.3286	0.1086	9.437
Medium	-9.3180	1.8933	11.211
Large	-2.6911	5.2328	7.924
Nationalities:			
Thai	-5.8177	3.8055	9.623
Japanese	-5.6315	2.9837	8.615
Others	-4.0753	4.3859	8.434

When considering the p-value from the Kruskal-Wallis Tests from the year 2011 to 2015 (Table 14), the study found that there are statistically different among 3 different sizes of the manufacturing companies. This picture is the same direction with the Kruskal-Wallis Test of OPM. Thus, the interpretation is that companies of different sizes illustrate statistically significant net operating incomes, while nationalities illustrate no significant difference.

Table 14. NPM significance levels for Kruskal-Wallis tests by sizes and nationalities

Between S, M and L	
	NPM
2011	0**
2012	0.001**
2013	0**
2014	0.003**
2015	0.005**
2012-2011	0.304
Between Nationalities	
	NPM
2011	0.144
2012	0.752
2013	0.626
2014	0.07
2015	0.492

*Note: **p < .01*
**p < .05*

For companies of different sizes, the significant differences in GPM carried over into differences in operating profit margins (OPM) and in net profit margins (NPM) as well.

On the other hand, no significant differences in OPM or NPM were observed between companies of different nationalities, despite differences having been found between GPMs. Net profit margins were negative in 2011 where NPM ratio was -5.43 in 2011 but rose in 2012 to 3.64 (see Tables 2 and 12). The advantage to Thai companies in GPM was erased when costs were subtracted to calculate OPM and NPM. This probably means that Thai companies had relatively high repair and renovation costs compared with foreign companies.

One other possible explanation for the rise in non-production costs is that insurance premiums might have increased for local Thai companies more than for foreign companies. This is because foreign-owned companies may have foreign or international insurance policies, which might not have raised premiums for a single event in Thailand, while Thai insurance companies might have raised rates significantly. This possibility would help to explain the fact that the significance levels recorded for GPM were erased not only for the following year, 2012, but for subsequent years as well, since Thai insurance premiums would have remained high and dragged down the profit margins of Thai-owned companies.

Finally, it must be stated that foreign-owned companies are highly diverse. Some may have foreign management while others have Thai management; some may import parts and raw materials from abroad, while others use local parts and materials. These differences may contribute to differences in flood-related profit margins among the many types of foreign-owned companies.

Although small companies were initially hit the hardest by the floods, they were able to recover just as well as the larger companies. This result suggests that the smaller companies were ill-prepared in the area of risk management, especially in risks to assets. The rebound suggests that longer-term effects such as sustained loss of business to competitors or supply chain disruption were not that serious.

While significant differences in ROA and other variables were observed between large and small companies, many of those differences vanished when comparing Thai-owned with foreign companies. In fact, the gross profit margins of Thai companies were consistently higher than those of foreign companies. Thus, it appears that it was the smaller companies, rather than just the Thai-owned companies, who were least prepared to deal with the floods.

What were the causes of this lack of preparedness? This is an area for further research, possibly through in-depth interviews with those companies who lost the most. We can guess from reading the extensive literature on risk management by small countries around the world, that the problem is an attitudinal one (Speiers, 2017). Owner-managers tend to think in the short term and do not have a strategic plan for avoiding and coping with disaster.

It might also be useful to contact representatives of those 43 companies that actually closed because of the floods. Information on those companies is largely unavailable at present; it is difficult to know whether they were mostly large or small, local or foreign-owned. But it is precisely those failed companies who suffered most from the floods, and they could provide insights into just where they went wrong.

The literature suggests several ways of improving the situation, especially through various ways of improving corporate governance and strategic management. The situation of the industrial parks in Thailand suggests that the type of solution advocated by Agnello (2015), in the area of factory safety may be fruitful if applied in those parks. This is because the proximity of dozens if not hundreds of companies of all sizes and ownership within a single area could make it easier for risk management information and strategies to be shared or 'pooled' among the companies. Agnello goes on to state the positive results of such a pooling process among companies in a large industrial park in Italy:

Pieces of knowledge previously fragmented among plant operators and contractors, have to be pooled…. The selection is also a good chance to break the contractors' isolation and involve them in safety objectives. Thus by pooling experience and practical knowledge, the common understanding of safety issues has been strengthened.

More importantly, if many companies interacted in the area of risk management, owner-managers might come to have a more proactive, far-sighted, and strategic attitude. Perhaps risk management committees could be established among the companies within the park, on which managers from all sorts of companies would be represented.

The second area for improvement appears to be better coordination between local and national governments. The Maier-Knapp study (2015) reported above showed that local government and national government do not always share the same perspectives. These differences may lead to confusion and even conflict. Various levels of Government in Thailand, as well as in other countries, need to develop clear and consistent risk management strategies which determine precisely which agencies are to deal with which problems.

5. CONCLUSIONS AND SUGGESTIONS

Thailand's 2011 flood crisis caused significant damage to industrial estates, industrial parks, and industrial zones, especially those in 7 industrial estates. Being major manufacturing hubs and key sources of employment in Thailand, these industrial estates are important to the country's economy. Therefore, any damage to them impacts national income significantly and inevitably. The Thai floods of 2011 had differential effects on companies of different sizes, with smaller but measurable differences among Thai, Japanese, and other foreign companies.

From our study, the businesses of medium-sized suffered the most financially, followed by

small and large-sized, especially in their return on assets (ROA) and return on equity (ROE), and their gross profit margins (GPM) in 2011 and 2012. However, all types of companies recovered by approximately the same margins by 2013. For operating profit margin (OPM) and net profit margin (OPM), the medium-sized companies again suffered from the historic floods and followed by small and large companies respectively. Even though medium-sized companies suffered the most, they were also the group that can recover quickly and illustrated the high bounce back when compared to small and large companies. This finding is interesting to the point that one would have expected large companies had recovered quickly and strongly. However, this is not the case for the Thai manufacturing in those seven industrial estates. Due to the floods that equally happened to all companies in these areas, we found that the medium-sized companies presented the recovery highest among other. The explanation for this could be that for small companies to recover, they highly require new investment, and a decision to make recovery or to regain the situation may not be professional like medium-sized or large-sized company. The literature suggests that small owner-managed businesses often do not take a long-term, strategic view, and simply hope for the best. They are therefore inadequately prepared for natural disasters like floods. While the large-sized companies to reconcile the situation may require longer process and may need executive management to make a big move to resolve the problem. These could prolong the recovery stage of the large companies. The setbacks for those small and large-sized companies, however, may not be a big issue for medium-sized companies. Our study rejects the null hypothesis 1 and accepts the alternative hypothesis stated that the financial ratios of flood-affected companies are different statistically among the companies of different sizes.

Interestingly, the result from this study also finds that ownership or nationalities did not influence in the companies' performance. The Kruskal-Wallis Tests did not pick up the significance from different nationalities. The explanation for this non-significance on nationalities could come from the fact that those companies were located in the same areas and were hit by floods at a similar level, and then the effect could occur similarly. We accept the second null hypothesis stated that the financial ratios of flood-affected companies are statistically similar among the companies of different nationality shareholders.

When many companies of all sorts are located in a single industrial park, as is the case with companies in this study, it makes sense for the companies to work together on their risk management strategies. In this way, the strategic attitudes of the larger companies may rub off on the smaller ones.

A government may play a role in the preparation of risk management strategies, especially flood prevention system. From the historic floods in 2011, the Industrial Estate Authority of Thailand had made quick-install flood barriers – a preparation in accordance with I-EA-T's Flood Contingency Plan among other strategic prevention plans[30]. This is to prevent future flood damage and to restore the confidence of Thai investors and foreign and other stakeholders. This is especially true if local and national government agencies can agree on a strategy and coordinate their efforts. The literature has shown that rules and regulations are important factors in risk avoidance and mitigation, but only if these regulations are actually followed. A government must enforce regulations so that all companies strictly adhere to policies.

6. LIMITATION AND FUTURE RESEARCH

Although this research was carefully prepared, there are still limitations and shortcomings. First of all, the research was conducted based on the data available of 514 companies in those 7 industrial parks where the entire population for these 7 industrial estates was 651 companies. The study omitted 75 companies, of which 43 of them were closed down after the floods and 19 are newly registered after the floods, while 13 of them were considered as outliers with extreme financial ratios and were dropped from the study. There could be a nonresponse bias in our study, since the 43 of them that went out of business after the floods were actually the most flood-affected. Had their information been included, the results could have been different, in fact, more extremely negative. However, obtaining their information after they closed down is difficult and takes great effort.

Secondly, this study, the paper takes 5 financial ratios into account. This is under cautious consideration that these 5 ratios are the most significant among many found in the literature, and illustrate statistical differences. For future research, one may look wider to cover more financial ratios, plus including interviews with the business owners of the flood-affected companies of different sizes and nationality. This approach would acquire more qualitative information, such as insights as to why some companies suffered more than others. A further recommendation is that for future research, one might look at the ways to reduce and mitigate risks from natural disasters. This is not just to find ways to prevent such natural disasters, but also to reduce the potential damage that could result from the natural disasters, how to use community networks to benefit each other, to diversify risks that could occur. Further, a business continuity plan should be in place – one that is reviewed regularly to maintain the relevance and workability. Businesses should develop foresight based on what should have been done if something had happened, in order to prepare for strategic planning. Such pro-active planning will sustain the survival of the businesses and the economy as a whole; whether or not the businesses will be unavoidably hit by natural disasters, the sustainability of the business should occupy the top priority in strategic planning.

[30] I-EA-T's Flood Contingency Plan where I-EA-T stands for Industrial Estate Authority of Thailand. Source: http://ieat.go.th/en/investment/why-invest-in-industrial-es tate/flood-contingency-plan-for-industrial-estates

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Acceptance letter

Paper: Financial Stability of the Thai Industrial Estates: Post Historic 2011 Floods

Dear Kanitsorn Terdpaopong,

We are pleased to inform you that your paper has been accepted for presentation at the 2017 Trends in Accounting Research Conference. This year the conference theme, which is to be held in Kaunas (Lithuania), 4-6 October 2016, will be on ***Contemporary issues of information technology in accounting.***

Please inform your co-authors about the acceptance of your paper.

One of the conditions in issuing this acceptance of your paper is your ***availability*** for the entire scholarly programme. The detailed schedule of paper sessions is still being finalised and will be available in due course, while a preliminary outline programme of the conference is already posted on the website of the TARC 2017.

The presenting author(s) must be registered to attend the conference by ***15 August 2017 (to benefit from the early bird rate).***

You may update the title and the abstract of your paper online yourself, as well as a full paper by no later than ***15 August 2017*** via e-mail tarc@ktu.lt

Again, congratulations on having your paper selected for the TARC 2017 Conference!

We look forward to an enjoyable and stimulating meeting in Kaunas!

Sincerely yours,

Professor Lina Dagilienė, TARC 2017 Conference Chair

Financial Stability of the Thai Industrial Estates: Post Historic 2011 Floods

Kanitsorn Terdpaopong [a*], Penprapak Manapreechadeelert[b]

[a]*Faculty of Accountancy, Rangsit University, Thailand*
[b]*Faculty of Business Administration and Information Technology, Thailand*
E-mails: [a]kanitsorn@rsu.ac.th; [b]penprapak.m@rmutsb.ac.th*

ABSTRACT

Research background The effect of the floods in central part of Thailand in 2011 left the severely negative impact to the companies located in the industrial estates. The supply-chain of goods produced from the industrial estates had ceased and caused a halt on other related businesses.

Purpose of the article The paper aims to investigate the financial stability of the companies located in seven (7) industrial estates after the flood year in 2011.

Methodology/methods We categorize data into two periods, on the flood year (2011) and post-flood (2012 – 2015). We use several financial ratios to statistically measure the financial changes to those companies post-flood years (2012 – 2015). Our samples of 514 manufacturing companies are handpicked from the population of 651 companies (80 percent of the population). We employ parametric dependent and independent samples *t*-test at 90, 95 and 99 % confidence interval. Observing twenty eight (28) financial ratios that have been used by many researchers, omitted the unavailable obtaining data, we later select thirteen (13) ratios into our study.

Findings We find that the profits of those 514 companies located in the industrial estates illustrate the low profits in 2011 and actually lowest among the five years of our data collection. Some financial ratios illustrate negative effects stronger than others. Nine (9) ratios out of the thirteen (13) are indicated in our conclusion of the paper that convince to be most statistically different when compared between the two periods.

Conclusions From our finding, the companies, fortunately, recovered from the flood damages right one year after the incidence. Key nine (9) financial ratios are found to illustrate significant differences of the post-flood years. It may prove quality of financial stability of the flood-affected companies, but it may come with the expense of the companies and the monetary regimes of the government. Grouping manufacturing companies to locate in the same area may be convenient in terms of logistics, cost-efficient, and management, however, mitigating risks such as natural disasters like floods is also more important. Every company should have a proper plan for such event. Advantages of being in the same location may need to weigh up against the risk involved. Investors, public policy makers, business owners may require ultimate understanding and legitimate alternatives to prevent such effect if such case would reoccur in the future.

Keywords: floods, industrial estates, manufacturing sector, financial stability, Thailand

JEL Classification: G01, M11, M21, M41

Introduction and Problem Statements

During October 2011, Thailand had experienced huge floods that damaged many industrial industries, agricultures, and economies of the country. The seven industrial estates that were flooded and submerged for over three months namely Rojana, Saharattanakhon, Hi-Tech, Bang Pa-In, Factory Land, Navanakorn, and Bangkadi, located in the central part of Thailand. This could be said that it was the historic floods in Thailand for the last three decades. The flood interrupted domestic growth of the country, especially the manufacturing sector that suffered severely from both natural disasters in Japan (March 2011) and domestic floods. This year has been marked as a worst year ever for the manufacturing sector in Thailand. The disaster in Japan weighed down the automobile industry heavily in the second quarter of 2011, but the industry rebounded quickly to normal in the third quarter. Subsequently, the historic floods in the fourth quarter hit seven industrial estates which was 17 percent of total manufacturing production, Manufacturing Production Index (MPI) in quarter fell by 21.8 percent (See Appendix 1), where major producers and complex production networks resided, especially for the automobile, electronics, hard disk drives, and electrical appliances industries. Due to such historic flood, it caused damage directly through production halt and indirectly through disruptions in supply chains and transportation. The report summarized by the Bank of Thailand reported that despite the damages on the manufacturing sector, luckily the agricultural sector remained resilient, and increased with expanded farming areas, while agricultural prices also edged higher. As a result, farm income continued to grow from the year before. Interestingly, the Bank of Thailand reported that during the floods which most factories ceased their operation, most business retained their employees to ensure a prompt post-flood operation. Minority of employees were laid off, but they should easily be reemployed as soon as businesses start to recover given tight labor market conditions.

During the flood period, even though there was supportive farm and non-farm income which in turn improved domestic consumer and business confidence, however; over three months of operation halt had caused a severe shortage of goods, which interrupted consumption and investment momentum. Major industries severely hit by the floods are automobiles, hard dis drives (HDD), electronics, electrical appliances, textiles and garments, and petroleum. Facing the shortage in parts and inputs, producers failed to accommodate sustained demand both at home and abroad. Given Thailand's role as a major supplier of automotive parts, the domestic floods' impact also caused car assembly plants in other countries to scale down or even halt production temporarily.

The widespread supply constraints also led to shortages of downstream products such as computers and drove up their prices. Recovery in Electronics sector will take longer than others, given high precision and cleanliness required for the installation and restoration processes of machinery and equipment. Most electrical appliances plants suffered indirectly from flood-hit suppliers. This led to a 43 percent drop in production from the same period last year.

In contrast, certain industries such as food and beverage, rubber and plastic, and construction materials (accounting for a total weight of 27.7 percent in the MPI) continued to grow undeterred by flood damage thanks to scattered plant locations across Thailand. Tourism sector had dropped

during the flooding in central Thailand in the fourth quarter 2011but continued to rise later. It is seen via the number of foreign tourists totaled 19.1 million persons in 2011, growing by 19.9 percent from the previous year. The severe floods in central Thailand including Bangkok led foreign inbounds to decline but the number of tourists rebounded quickly after the floods, pointing to the resiliency of the tourism sector. This was in line with higher occupancy rates across all regions, particularly for the central and the southern regions, as inbound tourists from China, Russia, and India rose markedly given these countries' strong growth.

After the floods, manufacturing production improved gradually and finally return normal in following year, the MPI started to rise after such period especially automobiles section (see Exhibit 2), as many plants still need to wait for insurance companies' damage assessment to be completed. Moreover, serious damage to main machines in many industrial estates forces firms to import these machines anew, thus causing further delay due to the importing and installation processes. The indirectly affected firms experienced supply constraints had to seek for alternative suppliers in Thailand or abroad.

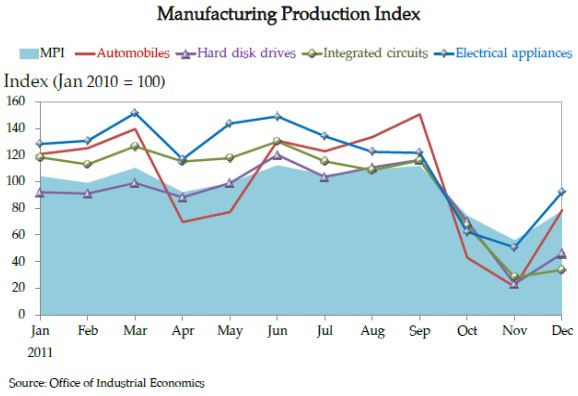

Exhibit 1: Manufacturing Production Index (MPI), 2011

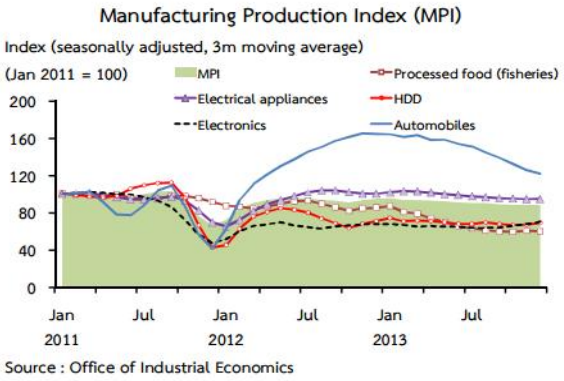

Exhibit 2: Manufacturing Production Index (MPI), 2011 - 2013

https://www.bot.or.th/English/MonetaryPolicy/EconomicConditions/AnnualReport/AnnualReport/AnnualReport_2011.pdf

Not only domestic economy was ruined, the Thailand's flood devastation extended its impact to production worldwide including Asia, America, and South Africa. As Thailand is the world's major production base, particularly for hard disk drives (HDD) and automobiles. Many producers and component suppliers for the HDD and automobile industries were concentrated in Ayutthaya and Pathum Thani which was the flood area. In general, concentration of plants and suppliers helped facilitate transportation and product development, and also allowed the use of "lean management system"– in which firms reduced storage costs for products and raw materials by keeping inventories at minimum levels and producing just enough to meet orders. As the severe floods hit the mentioned areas, however, such concentration turned into a disadvantage as a large number of assembly plants and suppliers had to suspend production immediately. As a

result, non-flooded factories also had to scale down or cease production due to shortages of intermediate inputs.

Thailand has served as a world production base for Hard Disk Drive (HDD). Four out of five major HDD assembly companies – namely, Western Digital, Seagate, Hitachi Global Storage Technologies (HGST), and Toshiba are located in Thai industrial estate. Thailand's HDD production accounted for 41 percent of global production, surpassing China's share of 25 percent. About 90 percent of Thailand's output was exported to China (33 percent), U.S. (17 percent), Hong Kong (13 percent), and Japan (8 percent) for production of downstream products such as computers and storage devices. Thailand also served as a production base for major component makers. This has made HDD production in Thailand cost- and time-efficient. Three (3) major producers of spindle motors - Nidec, Minebea, and Alphana Technology, had their production in Thailand alone accounting for 66 percent of global output. Many multinational related to HDD industry companies such as TDK, Hutchinson, NHK Spring, and AGC have their plants located in Ayutthaya and Pathum Thani. Even though they gain the economies of scale, these plants' concentration made them vulnerable in crisis times. During the historic floods in 2011 when HDD assembly plants and component plants were flooded simultaneously. Non-flooded HDD factories in Thailand and abroad also had to suspend production, as their inventories of raw materials could sustain production for only one to two weeks. It caused the low production in such period. It can be seen that the severity of natural disaster, like flooding in this case, has a great negative effect to the supply-chain, either directly or indirectly (Bank of Thailand, 2012). See Exhibit 3 below.

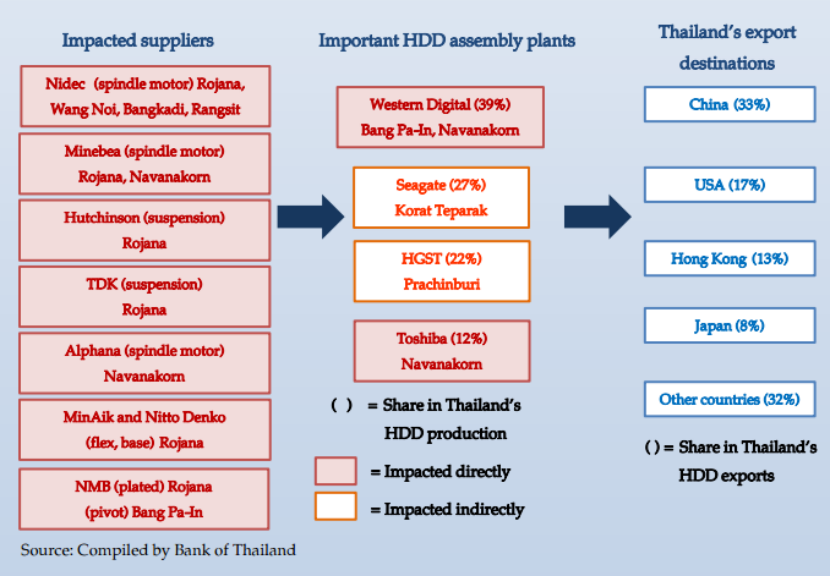

Exhibit 3: Supply-chain Effect of the 2011 Floods

https://www.bot.or.th/English/MonetaryPolicy/EconomicConditions/AnnualReport/AnnualReport/AnnualReport_2011.pdf

Even though the flooding has passed for some years already, Thai government still gives heed for natural disasters that may come and tries to put strategies to prevent such causes and mitigate the damages both direct and indirect effects. Insurance industries, as one of the indirect industry from the floods, has come into the pictures since such disaster incidence. The compensation received from the insurance companies assisted the direct impacted companies to be able to recover quickly. After the floods, some companies regained better than others. Within seven industrial estates, some parks regained better than others. These caused our curiosity in terms of how intrinsically effect from the floods to those companies, can those effect be seen from their financial statements, and to which figures should we consider, which financial ratios illustrate the significant impact, and most of all, how well our Thai industrial estates recover from the holistic floods in 2011. Those problem statements brought into our interest and to find empirical evidence we conducted this research with the objective mainly to investigate the financial changes of the Thai industrial estates after the historic 2011 floods. From revealed data both from the Bank of Thailand and from other respective documents take us to hypothesize our research that the floods affected firms would have gained their financial strength after the floods and such that their financial ratios as being the outcomes of the companies' financial position and performance would be statistical difference from the floods year. We are looking at financial ratios that would best fit to illustrate the business performance and financial position. Several financial ratios have been used in our research.

Literature review

Recent research has used financial ratios to establish the diagnosis models for business crises. Several financial ratios were introduced into models in order to distinguish the financial distress of the companies or to predict the financial failure. Many potential ratios were used for such purposes. The study of Ozkan-Gunav and Ozkan (2007) mentioned that financial indicators have been consulted by researchers as a major basis for predicting financial distress and business crises among other common methodologies include peer group analysis, comprehensive risk assessment systems, and statistical and econometric models. However, using different financial ratios to prediction may cause different prediction results. The studies of Min, Lee and Han (2006), and Shin, Lee, & Kim (2005) found that following financial ratios were mostly used by many researchers, such as adequacy of long term capital, current ratio, inventory turnover, EPS and debt coverage stability, fixed asset turnover, profit growth rate, revenue per share, net profit growth rate before tax and after tax, etc. Several legend researchers such as Altman (1968) selected5 financial ratios such as Sales to total assets; Beaver (1966) adopted 6 ratios including debt ratio, Ohlson (1980) utilized nine different features which are resourceful and referred by many researchers nowadays. Some authors such as Fengyi Lin, Deron Liang, and Enchia Chen (2011) examined the financial data offered by Taiwan Economic Journal (TEJ), the authoritative financial data bank covering extensive financial data sets of all listed companies traded in Taiwan Stock Exchange (TWSE) since 1980.They selected all 74 financial ratios, referred as the TEJ feature set, and combine this set with another 21 financial ratios recommended by their

previous research literature, plus some financial ratios that have not been mentioned in prior research but with great potential to increase the prediction accuracy. Later, only major financial features were selected into their model, they concluded tax rates, and continuous 4 quarterly EPS (earnings per share) are also key element to increase the predictive model accuracy.

In our research as the main objective is to investigate the financial changes of the flood affected companies, we employ the observation of various financial ratios that had been used by previous researchers. Following is the summary of twenty eight (28) ratios mostly used.

Table 1: Ratios used by previous researchers

No.	Definitions	Used by
1	Current ratio (CR)	Beaver (1966); Ohlson, J. A. (1980); Zmijewski (1984); Osteryoung, J., Constand, R. L.,& Nast, D. (1992); Samad, A., & Hassan, M. K. (1999); Feng, C. M., & Wang, R. T. (2000); Martens et al. (2008); Lin, F., Liang, D., & Chen, E. (2011);Terdpaopong, K., & Mihret, D. G. (2011); Delen, D., Kuzey, C., & Uyar, A. (2013);Terdpaopong, K., & Hovey, M. (2013);Ahmad, R. (2016); Cultrera, L., & Brédart, X. (2016); Demerjian, P. R., & Owens, E. L. (2016); Lakshmi, T. M., Martin, A., & Venkatesan, V. P. (2016; Sharma, M. P. G., & Kaur, M. R. P. (2016)
2	Cash flow/total debt	Beaver (1966); Deakin (1972); Blum (1974); Zmijewski (1984); Martens et al. (2008); Lin, F., Liang, D., & Chen, E. (2011); Delen, D., Kuzey, C., & Uyar, A. (2013); Kiser, E. K., Prager, R. A., & Scott, J. R. (2016)
3	Cash flow/total asset	Deakin (1972); Ohlson (1980); Samad, A., & Hassan, M. K. (1999); Lin, F., Liang, D., & Chen, E. (2011); Delen, D., Kuzey, C., & Uyar, A. (2013); Wei, Y. S., Samiee, S., & Lee, R. P. (2014)
4	Cash flow/sales	Deakin (1972); Li and Sun (2009); Lin, F., Liang, D., & Chen, E. (2011)
5	Debt ratio (Debt to Assets ratio: DA)	Beaver (1966); Deakin (1972); Ohlson (1980); Samad, A., & Hassan, M. K. (1999); Feng, C. M., & Wang, R. T. (2000); Ding et al. (2008); Martens et al. (2008); Terdpaopong, K., & Hovey, M. (2013)
6	Working capital/total asset	Beaver (1966); Altman (1968); Ohlson, J. A. (1980); Osteryoung, J., Constand, R. L., & Nast, D. (1992);Lin, F., Liang, D., & Chen, E. (2011);Terdpaopong, K., & Mihret, D. G. (2011); Delen, D., Kuzey, C., & Uyar, A. (2013),Wei, Y. S., Samiee, S., & Lee, R. P. (2014), Almamy, J., Aston, J., & Ngwa, L. N. (2016), Cultrera, L., & Brédart, X. (2016), Lakshmi, T. M., Martin, A., & Venkatesan, V. P. (2016); Sharma, M. P. G., & Kaur, M. R. P. (2016)
7	Market value equity/total debt	Altman (1968); Martens et al. (2008); Li and Sun (2009); Lin, F., Liang, D., & Chen, E. (2011); Almamy, J., Aston, J., & Ngwa, L. N. (2016)
8	Current assets/total asset	Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Terdpaopong, K., & Mihret, D. G. (2011); Lin, F., Liang, D., & Chen, E. (2011); Wei, Y. S., Samiee, S., & Lee, R. P. (2014).
9	Quick asset/total asset	Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Delen, D., Kuzey, C., & Uyar, A. (2013); Wei, Y. S., Samiee, S., & Lee, R. P. (2014); Ahmad, R. (2016); Kiser, E. K., Prager, R. A., & Scott, J. R. (2016); Laitinen, E. K., & Suvas, A. (2016)
10	Sales/total asset	Altman (1968); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Li and Sun (2009); Delen, D., Kuzey, C., & Uyar, A. (2013); Almamy, J., Aston, J., & Ngwa, L. N. (2016)
11	Current debt/sales	Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Lin, F., Liang, D., & Chen, E. (2011); Wei, Y. S., Samiee, S., & Lee, R. P. (2014)

No.	Definitions	Used by
12	Quick asset/sales	Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Lin, F., Liang, D., & Chen, E. (2011); Wei, Y. S., Samiee, S., & Lee, R. P. (2014)
13	Working capital/sales	Beaver (1966); Deakin (1972); Osteryoung, J., Constand, R. L., & Nast, D. (1992); Ohlson (1980); Martens et al. (2008)
14	Net income/total asset (or ROA)	Beaver (1966); Deakin (1972); Ohlson (1980); Zmijewski (1984); Patnayakuni, R., & Patnayakuni, N. (1997); Delen, Samad, A., & Hassan, M. K. (1999); Padachi, K. (2006);Terdpaopong, K., & Mihret, D. G. (2011);Delen, D., Kuzey, C., & Uyar, A. (2013); Rai, A., Delen, D., Kuzey, C., & Uyar, A. (2013);Terdpaopong, K., & Hovey, M. (2013);Ahmad, R. (2016); Laitinen, E. K., & Suvas, A. (2016); Al-Qaisi, K. (2016); Cultrera, L., & Brédart, X. (2016); Mwizarubi, M., Singh, H., Mnzava, B., & Prusty, S. (2016); Rao, M. K. (2016)
15	Retained earnings/total asset	Altman (1968); Ding et al. (2008); Lin, F., Liang, D., & Chen, E. (2011); Wei, Y. S., Samiee, S., & Lee, R. P. (2014); Almamy, J., Aston, J., & Ngwa, L. N. (2016); Lakshmi, T. M., Martin, A., & Venkatesan, V. P. (2016)
16	Earnings before interest and taxes/total asset	Altman (1968); Li and Sun (2009); Lin, F., Liang, D., & Chen, E. (2011);Terdpaopong, K., & Mihret, D. G. (2011);Terdpaopong, K., & Hovey, M. (2013);Wei, Y. S., Samiee, S., & Lee, R. P. (2014); Almamy, J., Aston, J., & Ngwa, L. N. (2016)
17	Net income/total equity(or ROE)	Rai, A., Patnayakuni, R., & Patnayakuni, N. (1997); Samad, A., & Hassan, M. K. (1999); Delen, D., Kuzey, C., & Uyar, A. (2013); Ahmad, R. (2016)
18	Gross profit margin as a percentage of total revenue	Feng, C. M., & Wang, R. T. (2000); Delen, D., Kuzey, C., & Uyar, A. (2013); Ahmad, R. (2016); Kanagaretnam, K., Zhang, G., & Zhang, S. B. (2016); Rao, M. K. (2016)
19	Operating profit margin as a percentage of total revenue	Rai, A., Patnayakuni, R., & Patnayakuni, N. (1997); Feng, C. M., & Wang, R. T. (2000); Delen, D., Kuzey, C., & Uyar, A. (2013); Ahmad, R. (2016); Venkatesan, V. P. (2016)
20	Earnings after interest and tax expenses (EAIT) as a percentage of total revenue	Rai, A., Patnayakuni, R., & Patnayakuni, N. (1997); Ohlson, J. A. (1980); Feng, C. M., & Wang, R. T. (2000); Lin, F., Liang, D., & Chen, E. (2011); Delen, D., Kuzey, C., & Uyar, A. (2013)
21	Total revenue divided by average assets	Lin, F., Liang, D.,& Chen, E. (2011);Terdpaopong, K., & Mihret, D. G. (2011);Delen, D., Kuzey, C., & Uyar, A. (2013);Terdpaopong, K., & Hovey, M. (2013);Almamy, J., Aston, J., & Ngwa, L. N. (2016); Lakshmi, T. M., Martin, A., & Venkatesan, V. P. (2016);Rao, M. K. (2016)
22	Total revenue divided by average account receivables	Osteryoung, J., Constand, R. L., & Nast, D. (1992); Delen, D., Kuzey, C., & Uyar, A. (2013); Wei, Y. S., Samiee, S., & Lee, R. P. (2014)
23	Cost of goods sold divided by average inventory	Padachi, K. (2006); Delen, D., Kuzey, C., & Uyar, A. (2013); Wei, Y. S., Samiee, S.,& Lee, R. P. (2014); Sharma, M. P. G., & Kaur, M. R. P. (2016)
24	Operating expenses as a percentage of total revenue	Delen, D., Kuzey, C., & Uyar, A. (2013)
25	Total assets divided by total equity	Rai, A., Patnayakuni, R., & Patnayakuni, N. (1997); Padachi, K. (2006).,Delen, D., Kuzey, C., & Uyar, A. (2013)
26	Total debt divided by total equity (DE ratio)	Samad, A., & Hassan, M. K. (1999); Padachi, K. (2006); Lin, F., Liang, D., & Chen, E. (2011);Terdpaopong, K., & Mihret, D. G. (2011);Delen, D., Kuzey, C., & Uyar, A. (2013);Terdpaopong, K., & Hovey, M. (2013);Brîndescu-Olariu, D. (2016); Demerjian, P. R., & Owens, E. L. (2016); Sharma, M. P. G., & Kaur, M. R. P. (2016)
27	Operation revenue/interest expense	Feng, C. M., & Wang, R. T. (2000); Wei, Y. S., Samiee, S., & Lee, R. P. (2014); Cultrera, L., & Brédart, X. (2016)
28	Short Term Debt-to-Total Debt	Feng, C. M., & Wang, R. T. (2000); Wei, Y. S., Samiee, S., & Lee, R. P. (2014); Kanagaretnam, K., Zhang, G., & Zhang, S. B. (2016)

After the collections of ratios used by many researchers, we hand-picked some financial ratios into our research. Due to limitation of data collection, some ratios require unavailable data and cannot be collected such as cash flow to debt ratio, cash flow to asset ratio, cash flow to sales, and market value equity to total debt ratio. Most of the companies (99 percent) located in the industrial estates are private-held companies whereby only required by the Ministry of Commerce to disclose statement of financial position and income statement to public. After careful consideration, thirteen (13) ratios were selected into our study. See below table 2.

Table 2: Financial ratios used in this study

No.	Variables	Ratios	Definitions
1	ROA	Return on Assets Ratio (%)	Earnings after Interest and Taxes (EAIT) as a percentage of average assets
2	ROE	Return on Equity Ratio (%)	Earnings after Interest and Taxes (EAIT) as a percentage of average equity
3	GPM	Gross Profit Margin Ratio (%)	Gross profit margin as a percentage of total revenue
4	OPM	Operating Profit Margin Ratio (%)	Operating profit margin as a percentage of total revenue
5	NPM	Net Profit Margin Ratio (%)	Earnings after interest and tax expenses (EAIT) as a percentage of total revenue
6	TAT	Total Assets Turnover (Times)	Total revenue divided by average assets
7	ART	Account Receivable Turnover Ratio (Times)	Total revenue divided by average account receivables
8	INV	Inventory Turnover Ratio (Times)	Cost of goods sold divided by average inventory
9	OET	Operating Expense Turnover Ratio (%)	Operating expenses as a percentage of total revenue
10	CR	Current Ratio (Times)	Current assets divided by current liability
11	DA	Total Debt to Total Assets Ratio (Debt ratio) (Times)	Total debt divided by total assets
12	AE	Assets to Equity Ratio (Times)	Total assets divided by total equity
13	DE	Total Debt to Equity Ratio (Times)	Total debt divided by total equity

Research Methodologies and Hypothesis

Research Method

Financial records of industrial companies were taken from 2011 to 2015. The records were divided to two categories. The first category was the flood year which was 2011, while the second category included the financial records of the industrial companies post-flood from 2012-2015 (four years after the floods). Financial analysis of the industrial companies carried out to measure the effect of the flood effects on these companies. Financial ratios used in this study are thirteen ratios as illustrated on Table 2. The research employs quantitative analysis where

parametric *t*-test both dependent and independent, at the 90, 95, 99 percent confident interval, were employed in making comparison of the financial impacts between the financial ratios on the flood year (2011) and after the flood years (2012, 2013, 2014, 2015).

Population and Samples

Number of population of the Thai industrial estates is 651 companies. The samples selected into this study is 514 companies (78.96 % of the population), omitted the companies that missed report their financial statements (75 companies), out of business or closed down their businesses after the floods (43 companies) and newly registered businesses after 2011 (19 companies). Rojana Industrial Estate was the largest industrial estate among all – 177 companies, where Navanakorn was the second largest with the 167 companies residence in the park. The samples selected into the study come from Rojana (28.40%), Navanakorn (26.26%), Hi-tech (14.40 %), Bang Pa-in (11.28 %), Factory Land (8.17 %), Saharattananakhon (6.42 %), and Bangkadi (5.06). See Exhibit 4 below.

Exhibit 4: Population and Sample Size

Hypothesis

As our study's objective is to investigate the financial movement of the floods affected firms after the floods, we hypothesize our research that the financial strength of the floods affected firms will be different from the flood years. The Hypothesis is written below.

Hypothesis 1: Financial ratios of the flood affected companies after the floods (2012 – 2015) are statistically different from that of the flood year (2011).

Findings and Discussion

Financial records from years 2011 to 2015 are collected into our study. On the flood year (2011), the records show the revenue of those companies in 7 industrial estates of USD 43,536 million with net profit of USD 1,622 million(3.72 % of total revenue), and total assets of USD 26,196 million. The total assets rise dramatically to USD 30,490, 34,825 and 35,899 million in 2012, 2013 and 2014 respectively. Among the five years of our data, net profit of the flood year illustrates the lowest amount ever. See Tables 3 and 4.

Table 3: Financial Data 2011 – 2015

Unit: Million USD

Year	2011	2012	2013	2014	2015
Total Revenue	43,536	38,148	49,262	46,145	46,600
Cost of Goods Sold	37,307	31,857	40,972	39,287	37,183
Gross Margin	5,933	5,593	7,252	6,620	8,749
Administrative expense	2,851	2,749	3,231	3,484	2,766
Total Expenses	42,187	37,281	45,275	43,825	42,599
Net Profit	1,622	2,693	5,161	2,817	3,162
Accounts Receivable	5,971	6,866	7,461	7,766	7,962
Inventory	3,547	3,935	4,172	4,524	4,250
Current Assets	15,890	17,057	17,754	18,895	18,402
Noncurrent Assets	10,306	13,433	17,071	17,003	16,538
Current Liabilities	10,974	13,765	13,305	12,163	11,743
Noncurrent Liabilities	1,678	2,156	2,659	2,685	2,574
Owner Equity	13,543	14,569	18,861	21,051	20,623
Total Assets	26,196	30,490	34,825	35,899	34,940
Exchange Rate	*30.4944*	*31.0848*	*30.7319*	*32.4841*	*34.2524*

Exchange Rate: Bank of Thailand, website: http://www2.bot.or.th/statistics/ReportPage.aspx?reportID=123&language=th

Due to the floods, the companies located in the seven industrial estates illustrate the high amount and proportion of cost of goods sold, and low amount and proportion of gross margin. As a result, the net profit shows the lowest amount in the record. Post-flood in 2012 when compared to the records on 2011 found that there are negative growth in 2012 which understandably they were in the recovery period. After post-flood in 2012, the growth is seen in 2013 before drop again in 2014 and 2015. Despite the drops on those figures shown in Table 4, the financial records on post-flood period still gain the rising momentum of the profit compared to the flood year in 2011. See Tables 3 and 4.

Table 4: Financial Records 2011 – 2015

									Unit: %
Year	2011	2012	2013	2014	2015	Growth 2012	Growth 2013	Growth 2014	Growth 2015
Total Revenue	100.00	100.00	100.00	100.00	100.00	-12.38	29.13	-6.33	0.99
Cost of Goods Sold	85.69	83.51	83.17	85.14	79.79	-14.61	28.61	-4.11	-5.36
Gross Margin	13.63	14.66	14.72	14.35	18.77	-5.74	29.66	-8.71	32.15
Administrative expense	6.55	7.2	6.56	7.55	5.94	-3.58	17.56	7.82	-20.6
Total Expenses	96.9	97.73	91.91	94.97	91.41	-11.63	21.44	-3.2	-2.8
Net Profit	3.72	7.06	10.48	6.11	6.78	66.07	91.63	-45.41	12.22
Accounts Receivable	22.79	22.52	21.43	21.63	22.79	15.00	8.67	4.09	2.52
Inventory	13.54	12.9	11.98	12.6	12.16	10.92	6.05	8.43	-6.06
Current Assets	60.66	55.94	50.98	52.64	52.67	7.35	4.09	6.43	-2.61
Noncurrent Assets	39.34	44.06	49.02	47.36	47.33	30.34	27.08	-0.4	-2.74
Current Liabilities	41.89	45.15	38.21	33.88	33.61	25.43	-3.34	-8.58	-3.46
Noncurrent Liabilities	6.41	7.07	7.64	7.48	7.37	28.48	23.32	0.95	-4.11
Owner Equity	51.7	47.78	54.16	58.64	59.02	7.57	29.46	11.61	-2.03
Total Assets	100.00	100.00	100.00	100.00	100.00	16.39	14.22	3.08	-2.67

Financial structure of those companies in seven industrial estates is illustrated in Table 4. Liquidity of the samples is quite large despite the floods in 2011. Current asset is averaged of 60 percent of total assets while current liability is about 40 percent, which leave the companies more room for their working capital. Financial capital of those companies is majority from current debt (around 40 percent) and owner equity (around 50 – 60 percent). See Table 4. It is understandable that many companies are not large in size, and most of them (99) are non-public. To gain long-term liability may not be easy and accessible for small and medium-sized companies (20 and 25 percent respectively) and perhaps most of all, the main shareholders of those companies are foreign where by Japanese has hold 48.2 percent, Thai 39.3 percent and other nationalities 17.9 percent.

Table 5: Means and Standard Deviations

No	Ratios	Means					Std. Deviation				
		2011	**2012**	**2013**	**2014**	**2015**	**2011**	**2012**	**2013**	**2014**	**2015**
1	ROA	-2.97	5.97	6.46	3.70	3.72	15.69	15.33	14.60	10.91	10.07
2	ROE	-5.90	15.22	14.15	8.74	8.24	37.18	45.65	36.90	40.83	31.00
3	GPM	13.94	8.71	11.45	13.96	15.90	16.94	17.57	15.80	18.52	18.02
4	OPM	-5.88	3.83	3.91	2.48	2.68	24.93	24.14	24.27	14.48	13.79
5	NPM	-7.47	4.23	3.54	1.53	2.18	24.73	22.90	23.88	17.68	15.98
6	TAT	1.45	1.28	1.23	1.22	1.22	1.04	0.88	0.77	0.76	0.75
7	ART	9.80	8.85	7.90	7.01	6.92	10.53	6.91	5.57	3.89	4.28
8	INV	12.11	10.27	10.96	10.75	10.90	12.49	9.76	11.17	10.98	9.75
9	OET	15.64	15.59	14.72	14.94	14.09	13.85	12.87	12.45	13.59	11.99
10	CR	2.09	2.02	2.19	2.23	2.41	2.12	2.23	2.48	2.24	2.38
11	DA	0.65	0.63	0.57	0.54	0.53	0.66	0.54	0.49	0.48	0.49
12	AE	2.15	2.02	2.17	1.82	1.84	3.54	3.85	3.09	2.96	3.23
13	DE	0.85	1.12	1.15	0.84	0.77	2.58	3.34	2.91	2.71	2.37

There are deficit ratios on the flood year (2011). The average return on assets (ROA) of the flood year (2011) illustrated the negative figure of -2.97 and the average return on equity (ROE) was -5.90 and operating profit margin ratio (OPM) -5.88 and net profit margin ratio (NPM) -7.47, respectively. The records show that negative profit incurred in 2011 and was risen to positive figures in 2012, 2013, 2014 and 2015. Financial records of our sample are normal distribution where outliers were dropped out and the standard deviation, as a measure of the dispersion of a set of data from its mean, of the financial ratios used in this study are in the acceptable ranges. See Table 5.

As the study employed the dependent sample *t*-test, at 90, 95 and 99 percent confidence interval, the data on the flood year (2011) is compared to each post-flood year (2012, 2013, 2014, and 2015). The results show that ten (10) ratios out of thirteen (13) ratios illustrate the statistical difference in 2012, and 2013 and nine (9) ratios in 2014 and twelve (12) ratios in 2015. Most of the ratios used in this study show the significant difference mostly at 99 percent confidence interval. See Table 6 and Appendices 1 – 4.

Table 6: Summary of Yearly Statistical Significant Ratios (Flood year to Each Post-flood year)

Paired Samples Test		Sig. (2-tailed)				Reject H_0			
		2011 2012	2011 2013	2011 2014	2011 2015	2011 2012	2011 2013	2011 2014	2011 2015
Pair 1	ROA	0.00	0.00	0.00	0.00	***	***	***	***
Pair 2	ROE	0.00	0.00	0.00	0.00	***	***	***	***
Pair 3	GPM	0.00	0.00	0.82	0.00	***	***	-	***
Pair 4	OPM	0.00	0.00	0.00	0.00	***	***	***	***
Pair 5	NPM	0.00	0.00	0.00	0.00	***	***	***	***
Pair 6	TAT	0.00	0.00	0.00	0.00	***	***	***	***
Pair 7	ART	0.03	0.00	0.00	0.00	**	***	***	***
Pair 8	INV	0.00	0.01	0.00	0.02	***	***	***	**
Pair 9	OET	0.50	0.03	0.15	0.03	-	**	-	**
Pair 10	CR	0.09	0.56	0.13	0.00	*	-	-	***
Pair 11	DA	0.82	0.00	0.00	0.00	-	***	***	***
Pair 12	AE	0.87	0.56	0.03	0.08	-	-	**	*
Pair 13	DE	0.03	0.14	0.53	0.62	**	-	-	-

*** 99 percent confidence interval
** 95 percent confidence interval
*90 percent confidence interval

The study also use the independent samples *t*-test to compares the means of two independent groups (in this case one group is the flood-year ratios and another is post-flood ratios) in order to determine whether there is statistical evidence that the associated population means are significantly different. It finds that most ratios, except for OET, CR, AE and DE, show statistical different. See Table 7.

Table 7: Summary of the Statistical Significant Ratios (Pre-flood to Post-flood)

	Ratios	Mean Difference	Std. Error Difference	95% Confidence Interval of the		t	Sig. (2-tailed)	Reject H_0
				Lower	Upper			
Pair 1	ROA	-7.91	0.78	-9.44	-6.38	-10.17	0.00	***
Pair 2	ROE	-17.42	1.99	-21.33	-13.51	-8.73	0.00	***
Pair 3	GPM	1.52	0.89	-0.23	3.27	1.70	0.09	*
Pair 4	OPM	-9.03	1.21	-11.41	-6.65	-7.46	0.00	***
Pair 5	NPM	-10.33	1.20	-12.70	-7.97	-8.58	0.00	***
Pair 6	TAT	0.21	0.05	0.11	0.31	4.23	0.00	***
Pair 7	ART	2.13	0.49	1.17	3.09	4.35	0.00	***
Pair 8	INV	1.39	0.62	0.17	2.61	2.24	0.03	**
Pair 9	OET	0.79	0.66	-0.50	2.08	1.20	0.23	-
Pair 10	CR	-0.12	0.12	-0.35	0.11	-1.04	0.30	-
Pair 11	DA	0.09	0.03	0.02	0.15	2.71	0.01	***
Pair 12	AE	0.18	0.17	-0.15	0.52	1.09	0.28	-
Pair 13	DE	-0.12	0.14	-0.41	0.16	-0.85	0.39	-

Conclusion and suggestions

In this study we used dependent and independent samples t-test analysis to investigate the financial differences of Thai manufacturing companies located in the seven industrial estates where all of them had direct experience of the historic floods in 2011. We observed twenty eight variables that have been used by many researchers in terms of employing financial rations to evaluate financial performance and to develop predictive financial distress models. We carefully handpicked the variables to use in our study by choosing variables that are mostly used. Further, we select the variables based upon the availability of the financial records as some information are not available to us. Such unavailable information, of course, has to be omitted from our study. Thirteen variables are selected and used to investigate the financial differences of the companies after the 2011 floods. 514 companies from seven (7) industrial estates were used as samples of our study.

The variables are categorized into two sessions, one on flood year (2011) and other post-flood (2012 – 2015). We found that nine (9) variables (ROA, ROE, GPM, OPM, NPM, TAT, ART, INV, DA) out of thirteen (13) illustrate the statistically significant difference. The financial records show the deficit ratios on the flood year and that makes the significant differences when compared to post-years, especially on 2012 and 2013. The *t*-value of the post-flood years illustrates negative which means the *t*-value of the post-flood year higher than the flood year. See Exhibit 5.

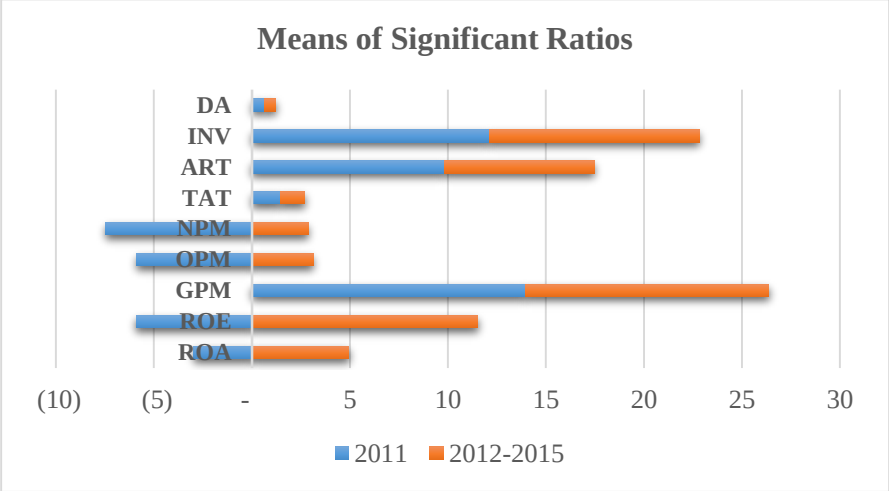

Exhibit 5: Significant Ratios in Comparison of Pre and Post-flood

The financial ratios that illustrate the higher variance between the flood year and post-flood year are i) return on assets (ROA) with *t*-value -10.17, ii)return on equity (ROE) with *t*-value -8.73,

iii) net profit margin (NPM) with *t*-value -8.58, and iv) operating profit margin (OPM) with *t*-value -7.46, all significant at 99 percent confidence interval. These nine variables are considered to be the most important ratios to see the variances between the flood year and post-flood year information. From such finding, we reject the null hypothesis and accept the alternative hypothesis that stated 'financial ratios of the flood affected companies after the floods (2012 – 2015) are statistically different from that of the flood year (2011)'.

Overall, these results may have important implications for companies. In this analysis, we investigate the financial changes of the direct-impacted companies from the historic floods in 2011. We also attempt to determine which financial ratios impact company performance the most. According to our findings, nine variables are significance and four (4) variables impact company performance the most. These ratios are also the measurements of profitability, relative to the companies' earnings. These ratios indicate the potential ability of a company to control their costs and expenses. The higher these ratios, the more successfully the firm can control its costs and expenses, and by doing so improve its performance. The debt to assets ratio (DA) is found to impact company leverage as well. Due to debt is a source of financing, other than equity, if a firm has higher debt, especially current or short-term debt, it may affect the company liquidity at the end. The company that obtained debt appropriately in profitable operations, will in all likelihood have a higher performance. In this study, the financial structure of the samples relies more on short-term debt, relative cost that come with such short-term debt should be in management concern. The results draw us to the ultimate conclusion that after the historic floods in 2011, even though the manufacturing companies were flooded over three months, caused to cease their production and halt all supply-chain businesses both domestic and overseas, their financial stability has regained post-flood and has illustrated the good performance.

This paper still has some limitations. We collect financial records mainly from financial statements of the manufacturing companies. We are positive that the number of samples is large enough as it covers all companies that we could be access the financial information. Most of the companies are non-public which mean they have not been required to publicize their financial statements. But still, we are able to collect all of their financial statements to use in our study. However, we would suggest to study more deeply to the business size, financial structures, major-nationality shareholders, contingency plan of the companies, an insurance policy of the companies and the government supporting policies in terms of natural disasters, as these factors may severely affect the strategies to prevent, avoid, and mitigate the damage of natural disasters. For example, we see from the literature that size matters (Amit and Villalonga (2014); Cultrera and Brédart (2016)). Small and medium-sized companies may have different view point, different strategy and different limitation over business operations including how to deal with floods or other natural disasters. Different financial structures, or different types of major-nationality shareholders may also differ the business strategies. Such factors are not included in this study and that open more rooms for future research. We also want to provide some thoughts on having contingency plan if the floods would reoccur or other natural disasters. Government need to provide concrete assistance after the disasters, not only financial assistance but related assistance in order to help the businesses during the recovery stage. Government needs to lay out

risk diversification plans. Industrial estates may benefit the economies of scale and economies of agglomeration where raw material, component, other service companies and facilities, and skilled labor are pool together in the same place to reduce production costs, but scattered plant location policies, obtaining the optimal location concerning every aspect all together, may have great benefit as well.

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Appendices

Appendix 1: Paired Samples Test between 2011 and 2012

		Paired Differences					t	df	Sig. (2-tailed)	Reject H_0
		Mean	Std. Deviation	Std. Error Mean	95% Confidence					
					Lower	Upper				
Pair 1	ROA	-7.99	21.86	1.06	-10.08	-5.90	-7.51	421	0.00	***
Pair 2	ROE	-20.54	67.02	3.19	-26.82	-14.27	-6.43	439	0.00	***
Pair 3	GPM	5.21	16.00	0.73	3.77	6.66	7.10	473	0.00	***
Pair 4	OPM	-8.68	33.14	1.53	-11.70	-5.67	-5.66	466	0.00	***
Pair 5	NPM	-10.16	31.69	1.46	-13.04	-7.28	-6.93	467	0.00	***
Pair 6	TAT	0.18	0.79	0.04	0.11	0.25	5.08	498	0.00	***
Pair 7	ART	0.75	7.77	0.35	0.05	1.44	2.12	486	0.03	**
Pair 8	INV	1.79	7.90	0.36	1.08	2.51	4.93	471	0.00	***
Pair 9	OET	-0.33	10.74	0.49	-1.30	0.64	-0.68	473	0.50	-
Pair 10	CR	0.14	1.88	0.09	-0.02	0.31	1.69	483	0.09	*
Pair 11	DA	0.00	0.41	0.02	-0.03	0.04	0.22	496	0.82	-
Pair 12	AE	-0.03	3.68	0.17	-0.36	0.31	-0.16	472	0.87	-
Pair 13	DE	-0.26	2.59	0.12	-0.50	-0.02	-2.15	452	0.03	**

Appendix 2: Paired Samples Test between 2011 and 2013

		Paired Differences					t	df	Sig. (2-tailed)	Reject H_0
		Mean	Std. Deviation	Std. Error Mean	95% Confidence					
					Lower	Upper				
Pair 1	ROA	-9.47	19.58	0.92	-11.27	-7.66	-10.31	454	0.00	***
Pair 2	ROE	-18.62	49.08	2.34	-23.22	-14.01	-7.95	438	0.00	***
Pair 3	GPM	2.51	16.39	0.76	1.03	4.00	3.32	469	0.00	***
Pair 4	OPM	-10.46	31.30	1.42	-13.26	-7.67	-7.35	483	0.00	***
Pair 5	NPM	-11.27	31.36	1.42	-14.06	-8.48	-7.94	487	0.00	***
Pair 6	TAT	0.22	0.75	0.03	0.16	0.29	6.63	497	0.00	***
Pair 7	ART	1.63	8.05	0.37	0.91	2.36	4.45	480	0.00	***
Pair 8	INV	1.37	10.55	0.49	0.41	2.33	2.80	464	0.01	***
Pair 9	OET	1.11	11.39	0.52	0.08	2.13	2.13	479	0.03	**
Pair 10	CR	-0.06	2.11	0.10	-0.24	0.13	-0.59	484	0.56	-
Pair 11	DA	0.06	0.37	0.02	0.03	0.09	3.61	495	0.00	***
Pair 12	AE	0.11	3.93	0.18	-0.25	0.46	0.59	467	0.56	-
Pair 13	DE	-0.19	2.69	0.13	-0.44	0.06	-1.49	448	0.14	-

Appendix 3: Paired Samples Test between 2011 and 2014

		Paired Differences					t	df	Sig. (2-tailed)	Reject H_0
		Mean	Std. Deviation	Std. Error Mean	95% Confidence					
					Lower	Upper				
Pair 1	ROA	-6.61	16.63	0.78	-8.14	-5.09	-8.53	459	0.00	***
Pair 2	ROE	-14.16	49.83	2.34	-18.76	-9.56	-6.05	452	0.00	***
Pair 3	GPM	-0.21	19.23	0.88	-1.94	1.53	-0.23	472	0.82	-
Pair 4	OPM	-8.75	25.39	1.17	-11.05	-6.45	-7.47	469	0.00	***
Pair 5	NPM	-9.07	26.59	1.21	-11.45	-6.68	-7.46	478	0.00	***
Pair 6	TAT	0.24	0.80	0.04	0.17	0.31	6.62	495	0.00	***
Pair 7	ART	2.40	7.75	0.35	1.71	3.10	6.80	479	0.00	***
Pair 8	INV	1.35	10.15	0.47	0.42	2.28	2.85	460	0.00	***
Pair 9	OET	0.94	14.13	0.65	-0.34	2.21	1.45	476	0.15	-
Pair 10	CR	-0.13	1.88	0.09	-0.30	0.04	-1.53	477	0.13	-
Pair 11	DA	0.09	0.44	0.02	0.06	0.13	4.78	494	0.00	***
Pair 12	AE	0.42	4.16	0.19	0.05	0.80	2.21	466	0.03	**
Pair 13	DE	0.08	2.82	0.13	-0.18	0.35	0.63	445	0.53	-

Appendix 4: Paired Samples Test between 2011 and 2015

		Paired Differences					t	df	Sig. (2-tailed)	Reject H_0
		Mean	Std. Deviation	Std. Error Mean	95% Confidence					
					Lower	Upper				
Pair 1	ROA	-6.73	17.09	0.80	-8.31	-5.15	-8.36	450	0.00	***
Pair 2	ROE	-13.18	47.41	2.24	-17.58	-8.78	-5.88	447	0.00	***
Pair 3	GPM	-2.58	18.66	0.90	-4.35	-0.81	-2.87	430	0.00	***
Pair 4	OPM	-8.65	25.52	1.17	-10.96	-6.35	-7.37	471	0.00	***
Pair 5	NPM	-9.23	26.13	1.20	-11.58	-6.88	-7.72	477	0.00	***
Pair 6	TAT	0.25	0.86	0.04	0.17	0.32	6.35	491	0.00	***
Pair 7	ART	2.70	7.72	0.35	2.01	3.39	7.64	476	0.00	***
Pair 8	INV	1.25	10.51	0.51	0.24	2.26	2.44	417	0.02	**
Pair 9	OET	1.39	13.46	0.65	0.11	2.66	2.14	431	0.03	**
Pair 10	CR	-0.33	2.04	0.09	-0.51	-0.14	-3.45	470	0.00	***
Pair 11	DA	0.11	0.49	0.02	0.06	0.15	4.74	489	0.00	***
Pair 12	AE	0.34	4.17	0.19	-0.04	0.72	1.76	465	0.08	*
Pair 13	DE	0.07	2.88	0.14	-0.20	0.34	0.50	438	0.62	-

Acceptance letter

Paper: Financial Distress Prediction – Automotive Manufacturing Companies in Thailand

Dear Kanitsorn Terdpaopong,

We are pleased to inform you that your paper has been accepted for presentation at the 2017 Trends in Accounting Research Conference. This year the conference theme, which is to be held in Kaunas (Lithuania), 4-6 October 2017, will be on ***Contemporary issues of information technology in accounting.***

Please inform your co-authors about the acceptance of your paper.

One of the conditions in issuing this acceptance of your paper is your ***availability*** for the entire scholarly programme. The detailed schedule of paper sessions is still being finalised and will be available in due course, while a preliminary outline programme of the conference is already posted on the website of the TARC 2017.

The presenting author(s) must be registered to attend the conference by ***15 August 2017 (to benefit from the early bird rate).***

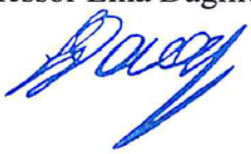
You may update the title and the abstract of your paper online yourself, as well as a full paper by no later than ***15 August 2017*** via e-mail tarc@ktu.lt

Again, congratulations on having your paper selected for the TARC 2017 Conference!

We look forward to an enjoyable and stimulating meeting in Kaunas!

Sincerely yours,

Professor Lina Dagilienė, TARC 2017 Conference Chair



TARC 2017 TRENDS IN ACCOUNTING RESEARCH CONFERENCE hosted by Accounting Department, School of Economics and Business, Kaunas University of Technology, October 4-6, 2017 Kaunas, Lithuania

Financial Distress Prediction – Automotive Manufacturing Companies in Thailand

Kanitsorn Terdpaopong [a*] Penprapak Manapreechadeelert [b],
[a*] *Faculty of Accountancy, Rangsit University, Thailand*
[b] *Faculty of Business Administration and Information Technology, Rajamangala University of Technology Suvarnabhumi, Thailand*

*E-mails: [a]*kanitsorn@rsu.ac.th*
[b]penprapak.m@rmutsb.ac.th;

ABSTRACT

Research background The 2011 floods - worst deluge ever in the Thai history - happened in Thailand from October – December 2011. Hundreds of manufacturing firms especially the firms located in industrial parks, central part of Thailand, had been affected severely. However, the continuation of the firms after the floods is a mystery whether they have recovered, or failed to continue as there has been no disclosure so far.

Purpose of the article We aim to study the continuation of the floods affected automotive firms located in Rojana Industrial Park, Ayutthaya, Thailand. We employ the Z"-score of Altman as a tool to predict the potential distress of the firms. The ultimate purpose of this paper is to study of how quickly the firms can financially recover after the historic 2011 floods.

Methodology/methods This study uses the automotive firms located in the Rojana Industrial Park, Thailand as a sample set to investigate their financial performance, the tendency of their distresses after the floods using the discriminant power of the Z"-score of Altman. The study observes financial ratios of 35 sample firms that are in automotive sector over a period of five years from 2010 (one year prior to the flood), 2011 (the year that the floods incurred, and 2012 – 2014 (the years after the floods).

Findings Of course, the floods caused financial damage to those companies and left them to present negative profits on their income statements. The firms' earnings per share ratio is found to be the most powerful one that clearly illustrates such changes. Applying the Z"-score, the result shows that the model can help us to predict financial distresses that occur in such companies.

Conclusions Even though the losses from floods were large and affected the firms tremendously in the flood year, where the number of fail firms is double from 2010 to 2011(10 companies in 2010 to 20 companies in 2011). After the floods in 2012 onwards the financial status of the floods affected firms were improved. The finding from this study will raise the awareness of the business managers, investors, governments and other related parties to be concerned about the methods to prevent that may cause such natural disaster. To mitigate flood hazards and regulate development in flood-prone areas should be everyone concern as it proves that damages did occur to businesses sustainability and this inevitably woven the strong economy of the country. Furthermore, to help researchers and policy makers assess national progress in reducing vulnerability to flood hazard, reasonably accurate assessment of flood damage are needed.

Keywords: financial distress, floods, manufacturing firms, automotive, Rojana Industrial Park

JEL Classification: C53, G01, G33, M21, M41

* Corresponding author. Tel.: +66-81-809-5085

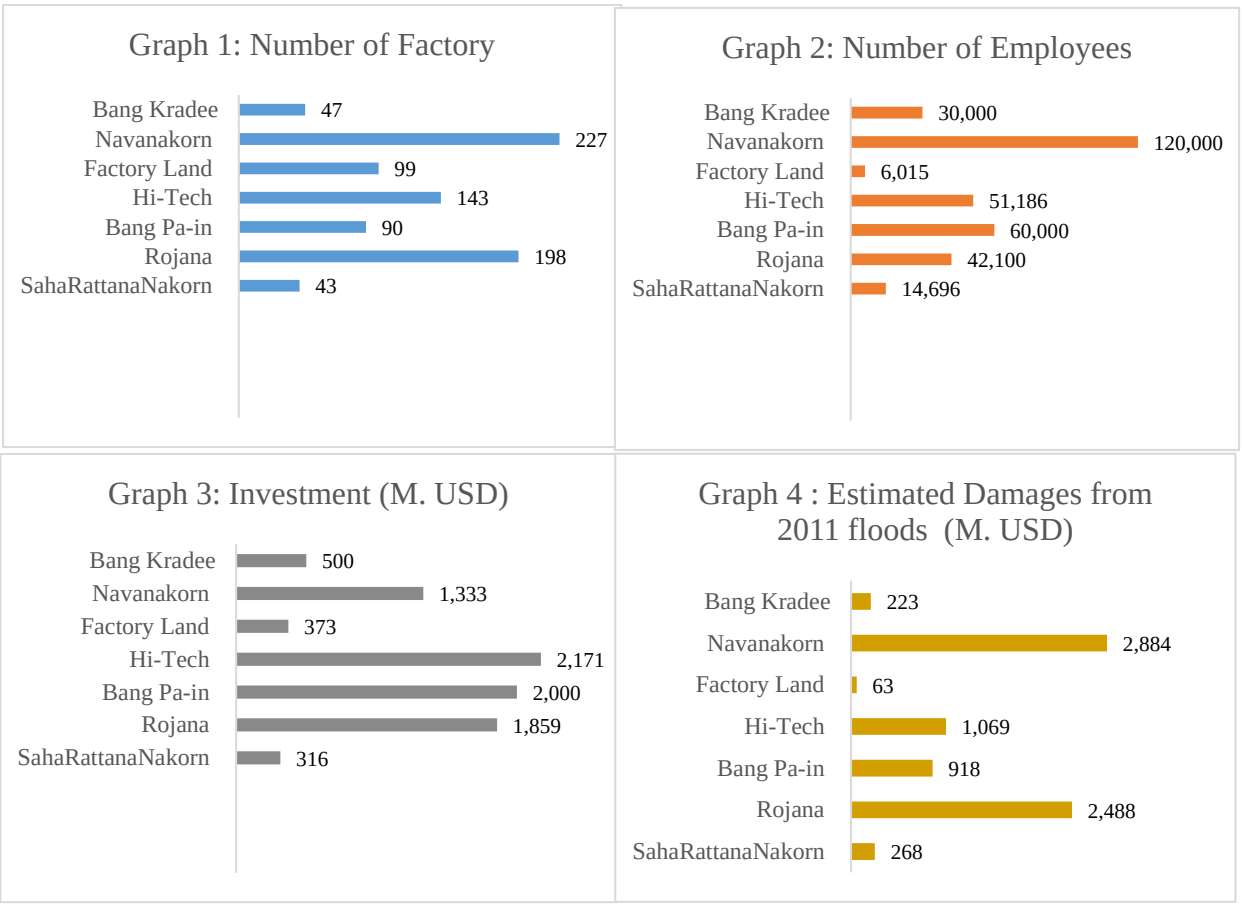
1. Introduction

Thailand has experienced the worst deluge in over seven decades in Thailand in 2011. The massive floods were brought by the influence of five monsoon seasons producing widely scattered rains throughout the rainy season and accumulating into massive amounts of water. Many provinces of Thailand were hit severely due to the collapse of the water drainage management system causing considerable loss of money to both private and public sectors. The manufacturing production index (MPI) in October 2011 fell from 38.9% in September 2011 to 35.8% in October 2010, particularly revolving around the production of hard disk drives (HDDs), motor vehicles, electronic components, wearing apparel, and petroleum products (Office of Industrial Economics, 2011).

The flood – reported by the Thai Meteorological Department on 2 November 2011- began on 25th July 2011and soon spread through the provinces in the Northern, Northeastern, and Central Thailand to a total of 64 provinces. The Bank of Thailand (2012) reported that the flood situation became worse and reached its greatest effect in October. Seven industrial parks where many industrial factories following the government decentralization policy were located were submerged in the floods for many months. As such, the companies located in the industrial parks could not operate their businesses and caused a delay of products delivery. The companies failed to operate their business as usual and led to unemployment and the economic decline of the country. The seven industrial parks namely Bang Kradee, Navanakorn, Factory Land, Hi-tech, Bang Pa-in, Rojana and Saha Rattana Nakorn were tremendously damaged. The estimated loss caused by floods was about USD 7,913 million. The most affected manufacturing industries were electrical equipment and automotive manufacturing, which comprised 27 percent of the overall industrial sectors of Thailand. The products affected included hard disk drives, integrated circuits and electrical equipment such as printers and digital cameras. The flood crisis had far greater impact on the electronic sector, perceived as half of the country's overall manufacturing output, comprised of the electronic household appliance sector, while the impact on automobile manufacturing was estimated at 10%. The affected products include automobiles and the spare parts.

The 2011 floods damaged businesses in Thailand tremendously both directly and indirectly, especially the areas of the industrial parks where many factories were located as mentioned earlier. Some companies moved their factory locations to a new place where they could escape such natural disaster to reoccur in other years to come. Several companies still stick to their same location and try to survive after the loss. The questions for us to ponder is how long these companies will take to fully recover and come back to a profitable stage again. Several companies have become bankrupt in that year or after. From the literature, many research have predicted the financial failures of companies that were associated with some events such as the economic crisis 1997, the financial crisis of 2007–08 (also known as the Global Financial Crisis and 2008 financial crisis) using financial tools to aid them in discriminating failure or non-failure firms. Several financial institutions use financial models to predict or to spot the financial failure of their customers, many of such select an event such as economic crisis in 2004 and then predict the distress of the sample firms after such event. However, this study seems to be the first study that takes the 2011 floods as an important event and tries to see the effect placed on private companies after the floods by employing the Altman Z"-score model.

Illustration 1 below shows the information on the seven industrial estates and estimated damages from the 2011 floods on Graph 4.



http://www.ieat.go.th/main/default/ShowMenuDetail/id/83

Illustration 1: Seven Industrial Characteristics and Estimated Damages from 2011 Floods

We study the floods which affected the automotive firms located in Rojana Industrial Park, Ayutthaya province, Thailand with the ultimate purpose to see how well the firms can recover after the 2011 floods. We adopt the Z"-Score model as a means to investigate the financial changes of our sampling companies - the flood affected firms in Rojana Industrial Park, Thailand. The selected sector of our sampling companies is the automotive sector due to the fact that this sector is the largest sector that was greatly affected by the 2011 floods.

Our paper divided into 5 sessions; session one is the introduction of our paper, two is on the literature review, three on research methods and sessions four and five are our results and conclusion as well as suggestions respectively.

2. Literature Review

The literature of the prediction models goes back to the study of Beaver (1966) by which univariate was used to predict business distress. Altman (1968) extended Beaver's approach and used multiple discriminant analysis in developing a model that combined five financial ratios to derive a "Z-score" to predict the financial failures of companies. Altman (1968) calculated the Z-score for distinguishing groups of bankrupt and non-bankrupt firms. He found that his model provides about 95% accuracy in predicting the bankrupt firms and the non-bankrupt firms. The original Z-score model received criticism by Gharghori et al. (2006) and Hillegeist et al. (2004) for using historical data, and statistics over the years and the model were derived from small firm samples and old data. Despite such concerns, the original Z-score model still maintain popularity and most widely used for financial distress prediction. The model in its original version is: $Z = 1.2X1 + 1.4X2 + 3.3X3 + 0.6X4 + 1.0X5$, where X1 = Working Capital/Total Assets, X2 = Retained Earnings/Total Assets, X3 = Earnings before Interest and Taxes/Total Assets, X4= Market Value Equity/Total Liabilities, X5= Sales/Total Assets. Altman's original Z-score predicts that the firms with Z-score above 2.99 are less likely to file for bankruptcy, while firms with Z-score between 1.81–2.99 are considered gray area and with Z-score below 1.81 are more likely to fail.

After his original model, Altman (2002) revised his model to fit the emerging market and more appropriate for manufacturing firms. The model in its emerging market context drops X5 and use book value of equity to replace the market value in X4. The revised Z-score becomes $Z'' = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4$.

Even though there are many models initiated to predict financial distress of companies, Z-score seems to gain favorable than others. Another model that is likely to gain popularity is Springate Z-score by Springate (1978). He suggested a Z-score model that discriminates the failed firms from safe firms, $Z = 1.03X1 + 3.07X3 + 0.4X5 + 0.66X6$; where X6 is Earnings before tax/Current liabilities.

Numerous studies have used the Altman's Z-score and evidence of the effectiveness of such model in predicting corporate financial distress (e.g. Begley et. al (1966) and Grice and Ingram (2001) find that the Z-score performs better with manufacturing companies than with companies in other industries, Samarakoon and Hasan (2003) found that the Z-score model has a remarkable degree of accuracy in predicting distress using financial ratio on Sri Lanka firms, Balasundaram (2009) applies Altman Z-score in predicting distressed in manufacturing firms listed in Colombo Stock Exchange in Sri Lanka and more recently, during the last decade many researchers such as Kwak et al. (2005), Merkevicius et al. (2006), Sun (2007), Agarwal and Taffler (2008), X und Zhang (2009), Li and Miu (2010), Terdpaopong and Mihret (2011), Chen et al. (2012), Singhal and Zhu (2013), Terdpaopong and Hovey (2013), Acosta-González and Fernández-Rodríguez (2014) employ Z-score models in their studies.

In spite of such preferences, the model was criticized by many researchers. Gharghori et al. (2006) and Hillegeist et al. (2004) argued that the Altman's model used different accounting variables that were derived from financial statements which are backward looking and may not provide predictive power for the financial sustainability of a company's future. Furthermore, financial statements are prepared on a going concern assumption that may not be the case for a

company in a real condition. Further model development in the literature is the combination of a market-based model, and an accounting-based model (e.g. Altman's) provides better bankruptcy prediction than a single type of variable. A market-based model is found to be significant in predicting company distresses. Li and Miu (2010) emphasise on the market-based model and reduce the focus on the accounting-based model. The result is consistent with the finding of Das (2009) that a developed model incorporates both accounting, and market-based variables outperformthe aforementioned models. Such hybrid model appears from the result of Xu and Zhang (2009) are also useful in predicting the bankruptcy of Japanese listed companies. Some studies use a large number of financial ratios to maintain the accuracy of the model such as Lam (2004) used 16 financial ratios to predict bankruptcy. Regarding many considerations on the predictive model, Altman Z-score model seems to be most preferable among others. According to Begley et al. (1966), Grice and Robert (2001), Samarakoon and Hasan (2003), Balasundaram (2009) and many others, overall accuracy of Altman Z-score is significantly higher in the case of manufacturing firms.

As Z-score model seems to be the best-known and most widely used for forecasting the financial failure of companies, our research will then employ the Z-score model into our study. Due to our focus on automotive sector which are manufacturing firms, we will employ the revised Z-score. Our research is built around the point that how flood affected firms can examine their financial sustainability using revised Z-score. We do not re-estimate Z"-score model but use the original Z"-score coefficients as our focus not on re-estimation the model for our data. The result of Altman, Iwanicz-Drozdowska, Laitinen and Suvas' (2014) study on the testing of Z-Score and Z"-Score models and their prediction accuracy reveal that the re-estimation of the coefficients used in the Z"-score model only marginally improved classification performance. The sets of additional variables such as age, industry and country give weak supports to the improvement of classification. Yet, the original Z"-score model performs well even in an international context and robust across countries and overtime.

This paper therefore, examines the 2011 floods affected firms to see the movement of their financial situation, it is to answer our question that how stable they become after the floods. Furthermore, apart from analyzing such firms from the year they were flooded, we also examine how the Z"-score model predicts such firm individually after the floods. The results may give directions to the application of Z"-score models in decision making to the management of the firms, to financial institutions, to relevant stakeholders – creditors, employees, authorities.

3. Research Methodologies and Hypothesis

3.1 Population and Samples

The samples of this study are 35 companies in the automotive sector located in Rojana Industrial Park, Thailand. The samples are purposively selected for the study, as these companies were in the sector that were severely flood-affected. The names of the samples are removed to maintain their confidentiality. Considering the flood happened in October 2011, the closest financial report date which is December 2011 is chosen to be the year that the study focuses as a year when the floods incurred. Financial statements of the sampling companies were collected. However, there are some companies that their financial statement date is not 31 December,

because some companies close their financial statement on 31 March. Thus, the financial statements of the year after the 2011 flood period is 2012 then chosen to be the year that the floods occurred. We have eight companies that have accounting period which end on March 31, three companies on September 30, and 24 companies on December 31. Each year of our study, we collected financial data from their annual reports except 2010 we collected only 34 companies due to the fact that there was one company established in 2011, does not exist in 2010). From these 5-year observations, there are 174 firm-year observations together in our study.

	N-1	N	N+1	N+2	N+3
Year	2010	2011	2012	2013	2014
Number of firms-data observation	34	35	35	35	35

3.2 Research Method and Hypotheses setting

The study employs a quantitative method in analyzing data. As our objective is to investigate the financial stability of the sampling firms during the floods period, we use the revised Z"-score model in predicting the likelihood of financial failure of the flood affected firms. This research applies the model of Altman Z"-score of an emerging market score (EMS) (Altman, 1968; Altman & Hotchkiss, 2005; Altman & Narayanan, 1997) to measure the stage of the firms' financial stability whether, by using the model, the firms will more likely be distressed, or non-distressed or perhaps fall into the gray area where the firms may be either distressed or non-distressed. The model is as follows.

$$Z'' = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4$$

Where, X_1 = Working capital/total assets
X_2 = Retained earnings/total assets
X_3 = EBIT/total assets
X_4 = Book value of equity/book value of total liabilities

The score as the results from the Z" model will be classified into three categories whether the score falls on fail zone where the Z"-score is less than 1.1, gray zone where Z'-score between 1.1–2.6 and on safe zone where Z"-score more than 2.6.

Z"-score	Identified zones
>2.6	Safe Zone
1.1 – 2.6	Gray Zone
<1.1	Fail Zone

The firms that fall onto the gray and fail areas demonstrate uncertainty about their financial distress. Due to the massive floods in 2011 that damaged many businesses in the affected areas, we are convinced that the model will be more likely to categorize the firms in 2011 as failed firms more than other years. We then set our hypothesis as follows.

H_1: The number of floods affected firms on the floods year (2011), using Z"-score model, will fall in the gray and failed zones higher than that of on the year before (2010) and after (2012, 2013, 2014).

The paper examined the Z"-score model whether the model classifies the firms individually onto their possible positions on safe, gray or fail zone.

4. Results and discussion

The samples of 35 flooded firms in Rojana Industrial Park were investigated. The effect on these firms was severe. The annual reports of these firms illustrated the damages caused by floods of about USD 226.68 million. As as result of the floods, the firms illustrated the deficit in their financial statements - negative USD 3.19 million of earnings before interest and taxes expenses (see Table 1) and negative USD 108.67 million (see Appendix 2) were then presented as a big picture of these losses. We investigated deeply on their shareholding proportion. We found that majority of these companies' shareholders were Japanese nationality (75.19 percent), while Thai was 9.85 percent and other nationalities from Germany, Singapore, China, America, Hong Kong, Malaysia and Indonesia – 14.96 percent. Interestingly, we found that out of 35 companies of our samples, 17 of them (48.57 per cent) were hold purely by Japanese Shareholders. And yet, Japanese shareholders are the main shareholders among other nationalities in these samples. The following table illustrates the means figures used in our hypothesis.

Table 1: Means of significant figures

	2010	2011	2012	2013	2014
Unit: USD					
Working capital (WC)	13,756,771.36	3,399,398.32	11,340,104.08	10,473,010.91	12,222,003.62
Total assets (TA)	72,833,507.18	63,356,903.54	104,585,506.66	98,548,465.41	86,401,099.93
Retained earnings (RE)	26,091,256.11	16,127,058.28	34,506,023.42	34,284,231.18	38,318,548.73
Earnings before interest and taxes expenses (EBIT)	8,056,998.23	- 3,193,680.40	34,506,023.42	17,944,067.80	12,508,375.33
Book Value of Equity (BE)	10,259,653.79	9,565,942.78	9,922,656.07	10,031,679.35	9,951,528.29
Book Value of Liability (BVL)	35,512,869.90	36,596,437.74	58,538,354.47	54,901,422.70	37,534,992.92
Unit: Time					
X1: WC/TA	0.11	- 0.01	0.01	- 0.04	0.04
X2: RE/TA	0.22	0.04	0.25	0.42	0.18
X3: EBIT/TA	0.07	- 0.13	0.19	0.08	0.04
X4: BVE/BVL	0.64	1.56	0.20	-1.10	1.14
N: Unit: Companies	34	35	35	35	35
Exchange rate: Baht to 1 USD	30.04 THB	31.51 THB	30.55 THB	32.47 THB	32.95 THB

The paper explores means of significant figures that are used in the hypothesis. Working capital (WC) of the sampling companies in 2011, were 3,399 million USD, lower than other years from our observation. This low figure pattern is also shown on total assets (TA), retained earnings (RE), earnings before interest and taxes expenses (EBIT), equity (BE) and liability (BVL). We found that the EBIT illustrated negative figure in 2011 (-3,194 million USD) and it is only one year that they had a negative figure while other years were positive. This can be interpreted that in 2011 these companies were affected badly by floods towards the end of the year. The floods led these companies into deficit on profitability and affected other relevant ratios such as WC/TA (X1), and EBIT/TA (X3) of the companies in 2011. See Table 2.

We adopted Z"-score; 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4, where X1 = Working capital/total assets, X2 = Retained earnings/total assets, X3 = EBIT/total assets, X4 = Book value of equity/book value of total liabilities to examine the financial sustainability of the firms. The Z"-score of the firms were computed and classified into three categories – A: the safe firm where Z"-score is more than 2.6, B: gray firm Z"-score between 1.1 – 2.6 and chance of being failed or not is no clarity, and C: potentially failed firm where Z"-score is less than 1.1. We analyze individually our firm samples. Each year, the firm was labeled either A, B or C.

We investigated the changes of the firms' status by comparing the companies in the flood year (2011) with the year before (2010) and the years after (2012 – 2014). We found that the firms that were labeled fails (or labeled C in the illustrations below), 10 of them maintained the same status once they were hit by the floods in 2011, while the firms once labeled B (7 companies) maintained their status with only 3 companies but some showed a better status and other failed into C rank. The firms with labeled A in 2010 became C and B and only about half could maintain their own good status. Towards the end of 2011 with the floods affection, 20 companies were labeled C, 6 labeled B and 9 labeled A. It can be summarized that the effect from the 2011 floods made many companies fall into a financially difficult situation. See Illustration 2.

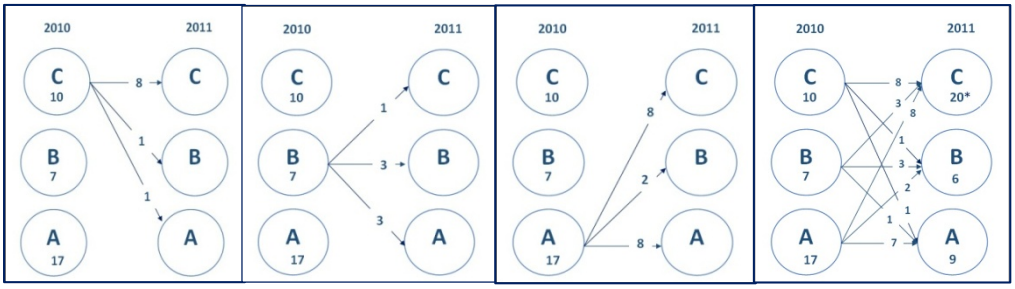


Illustration 2: Financial distress changes from 2010 to 2011

The financial status of the sampling companies in 2011 when compared to 2012 has changed into a better direction. The status of the companies with labeled C improved their level to either B or A while some remained the same. The pattern is similar to the firms with label B. Even though the labeled A firms may not all be able to maintain their own status, at the end of the year the firms labeled A has increased from 9 companies to 15, labeled B – 20 companies – is

very much the same and labeled C has improve by which the number has gone down to be in labeled C only 13 companies. See Illustration 3.

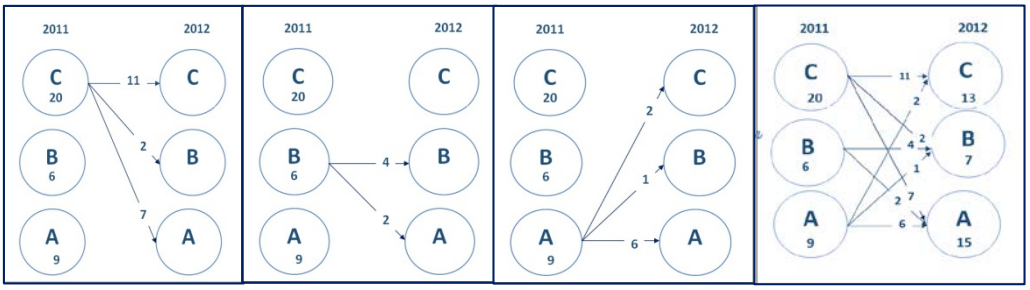


Illustration 3: Financial distress changes from 2011 to 2012

The financial status of the sampling companies is even more improved in 2013, bear in mind that these is two years after the floods where most of the firms could maintain their financial status similar to the previous year. At the end of the year, the companies had their status with labeled C – 14 companies, B – 3 companies and A – 18 companies. Comparing to previous years, the year 2013 was the best financial year after the floods. See Illustration 4. The financial status has dropped down to a small degree in 2014 where the number of the companies labeled A have dropped from 14 to 13, B from 3 has increased to 7 and C from 18 has dropped a little bit to 15. See Illustration 5.

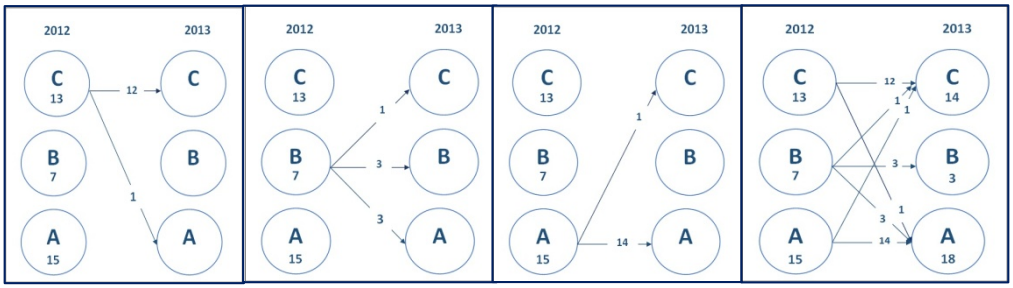


Illustration 4: Financial distress changes from 2012 to 2013

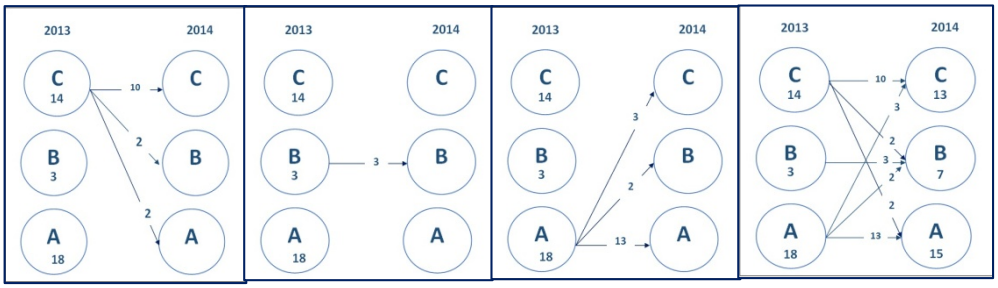


Illustration 5: Financial distress changes from 2013 to 2014

To sum up, we adopted the Z"-score model to investigate the changes of the sampling companies that were affected by floods in 2011, we found that in 2010 which is the first year of our observation data, the number of firms that were labeled B and C are 7 and 10 companies; total of 17 companies out of 34 or 50 % of our samples. In 2011; the flood year, the number of potentially failed firms – 6 companies- and gray firms- 20 companies- are ranked the highest (74 % of our samples). In 2012, 2013 and 2014, the number of gray and fail firms decline to 57%, 49% and 57% respectively. Z"-score model helps us to understand how the financial stability of those firms especially on years following the floods. Most of the firms; 74 %, fall into potentially failed firms in 2011 but regain their businesses later after the floods year.

Table 2: Z"-scores summary results

No	Z"-score									
	N-1 (2010)		N (2011)		N+1 (2012)		N+2 (2013)		N+3 (2014)	
	No.	%	No.	%	No.	%	No	%	No.	%
Total A (Safe)	17	50%	9	26%	15	43%	18	51%	15	43%
Total B (Gray)	7	21%	6	17%	7	20%	3	9%	7	20%
Total C (Fail)	10	29%	20	57%	13	37%	14	40%	13	37%
Total B + C	17	50%	26	74%	20	57%	17	49%	20	57%
Total A + B + C	34	100	35	100%	35	100%	35	100%	35	100%

Drawing such results from Illustrations 1 – 4 and Table 3, our hypothesis as set that the number of floods affected firms in the flood year (2011) will fall in the gray and failed zones higher than that of the year before (2010) and after (2012, 2013, 2014) is supported.

5. Conclusions and suggestions

Floods that happened in 2011 severely damaged thousands of businesses in the flood areas. Most firms in those industrial parks which were submerged in the floods for more than five months caused them unable to run their businesses as usual and still bear the cost of recovery and rehabilitation after the floods. Such natural disaster caused many companies to have negative profit in that year.

Altman Z"-score model is used to investigate the financial status of the sampling firms. The model is statistically powerful and classifies the firms into three different categories – A; safe firm, B; gray firm, and C; failed firm. The illustration 5 below helps us to see that 2011 was the year that those firms become the most unprofitable.

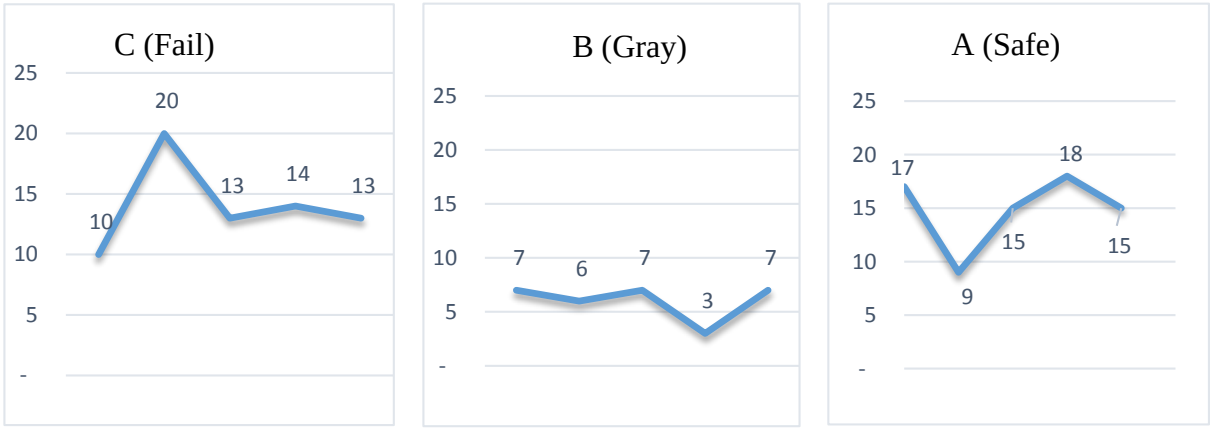


Illustration 6: Classifications of C, B and A

The illustration 6 on C graph shows that in 2011 the number of fail firms is doubled from 2010 to 2011(10 companies in 2010 to 20 companies in 2011). This trend differ for the companies that are categorized as safe firms. The number of safe firms from 17 companies in 2010 falls down to only 9 companies in 2011. For the companies that were classified as gray shows a small change. The financial status using the Z"-score model illustrates a recovery of these firms after 2011. As the statistical results show a large number of firms that fall onto gray and failed zones, 6 and 20 companies respectively (26 companies in total) in 2011 which is higher than either prior (17 companies in total) or after the floods years (20 companies in 2012, 17 companies in 2013 and 20 companies in 2014), our hypothesis is then supported.

The samples we used in this study are the companies that were once located in Rojana Industrial Park that were flooded in 2011. At this current stage, many firms relocated their businesses to new industrial park areas in Saraburi, Nakornrachasrima, Prachinburi provinces; some remain in the same location. Some firms have merged with other firms mainly due to financial reasons. However, these companies have been hold mainly by Japanese shareholders, financial strategies were then adopted or in line with their mother companies in overseas. Gathering information on their annual reports, we found that the damages from floods – reported USD 226.68 million – were mostly covered by insurance policies in the following year. Most companies reported their losses from floods (except 4 companies did not report the damages) and such losses were then covered by the insurance policies. After the floods, four companies has increased their capital. The size of assets of the sampling companies increased from USD 2,217 million in 2011 to USD 3,660 in 2012, or increased 65 percent from 2011(see Appendix 1). Even though the losses from floods were large and affected them tremendously during the flood year, after the floods in 2012 onwards the financial status of the floods affected firms were improved.

Interpretation of our result has to be done with care, due to the fact that our study uses the Altman Z"-score model to predict the potentially financial failure of those 35 firms. Even though this model is well known and most accepted from the literature, considering using another model with different variables and plus the non-financial variables may be useful. Using Z"-score model allows us to see that the 2011 floods damaged businesses at large. Fortunately, many of those floods affected firms were able to regain their financial strength soon enough in 2012, 2013 and 2014. However, the damage that incurred for these companies

is just one small samples of the damage the happened to the Thai economy. The direct effect from floods incurred by other businesses in the floods year is little mentioned, let alone the indirect effect on the country's economy at large. The private sectors should implement some risk management plan to prevent, to avoid and to mitigate potential risk that might happen in the future. The investment in such plan needs to be the concern of the management. The government should then be more concerned on the public policy that needs to be implemented in the country to manage such risk either risk on the direct and indirect effect from the natural disasters.

This study is expected to be useful to investors, as well as firms' managements, and relevant entities such as creditors, financial institutions, regulators. The study provides the signals of financial distress as the floods affected firms received in the floods year. The investor, creditors, will have information to analyze whether their investment is worth its value or the firms shows some signs of bankruptcy. The firms' management can pay more attention to managing, monitoring and assessing their firms' financial stability. They can also see from our results that such firms are falling into the safe, gray, or failed zone. Moreover, the regulators and related authorities can investigate those firms in concern and provide appropriate assistance in due course.

However as our samples are limited, further study may consider enlarging number of samples to cover other sectors and cover wider or even other industrial parks that were also affected by floods or enlarge the samples to cover other natural disaster events. The severity of different natural disaster or event such as economic crisis may affect business entities differently both scales of severity and influences. Researchers may consider exploring both direct effects (as in the case of this study) and indirect effects that may occur to both business and public sectors. The insurance plans or policies to diversify such disasters loss is worth thinking of.

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APPENDIX 1: TOTAL ASSETS OF THE ROJANA INDUSTRIAL PARK ON THE YEARS BEFORE AND AFTER THE FLOODS

Unit: USD

Firm /year observation	2010	2011	2012	2013	2014
1	818,611	880,556	813,081	765,002	769,285
2	40,340,241	45,244,486	49,156,600	46,249,896	44,886,951
3	9,780,897	5,743,828	12,492,818	11,754,098	12,274,420
4	4,653,677	4,640,840	5,966,114	5,505,746	5,082,853
5	13,674,589	6,147,047	14,968,891	13,224,620	12,641,551
6	5,442,218	3,921,792	8,279,358	6,538,831	7,568,151
7	10,805,923	9,809,915	12,390,605	10,963,554	10,909,690
8	44,296,906	41,443,931	53,654,407	55,761,299	55,458,407
9	6,680,224	5,172,125	7,062,945	6,613,140	6,189,638
10	1,672,852,527	1,374,836,281	2,586,247,648	2,433,318,929	2,004,911,417
11	54,220,802	143,299,168	105,343,036	99,113,943	137,281,234
12	80,791,117	67,499,714	141,006,011	128,211,721	129,605,619
13	7,757,384	10,293,198	7,196,862	6,782,388	5,523,884
14	21,447,397	20,386,816	27,358,941	25,741,165	23,500,897
15	11,805,649	17,564,057	17,705,677	16,658,714	16,086,674
16	127,021,019	94,944,130	147,814,286	143,315,963	106,656,111
17	22,307,131	17,405,206	17,131,876	19,406,541	18,648,142
18	40,258,554	47,793,100	56,140,893	52,821,197	45,262,652
19	19,343,712	16,256,733	25,950,769	25,616,582	26,250,593
20	14,091,670	14,423,312	19,813,083	15,037,524	14,863,569
21	7,763,954	9,375,027	11,149,813	10,490,508	12,484,014
22	31,634,262	49,589,840	45,715,466	43,012,242	44,382,806
23	6,124,009	3,750,841	3,868,707	8,477,582	8,614,363
24	743,101	1,013,820	2,148,015	2,790,101	2,836,507
25	2,689,015	2,883,837	2,893,067	2,532,722	2,214,618
26	0	1,488,396	2,948,749	3,166,588	3,276,876
27	5,787,072	9,976,183	13,357,104	12,510,201	12,467,903
28	2,332,236	3,140,765	3,968,906	3,332,031	3,120,081
29	22,401,117	18,445,097	25,598,068	24,075,546	25,476,526
30	2,557,440	1,971,137	4,403,469	3,809,804	3,595,938
31	50,334,954	44,237,883	68,008,296	55,507,320	58,208,324
32	63,950,598	63,589,627	73,819,892	68,732,086	69,857,926
33	22,424,068	19,524,765	24,703,563	25,904,808	27,903,546
34	1,900,137	3,004,888	5,670,869	5,776,946	2,959,441
35	47,307,033	37,793,285	55,744,851	55,676,950	62,267,891
Total	2,476,339,244	2,217,491,624	3,660,492,733	3,449,196,289	3,024,038,497
Exchange Rate 1 USD: Thai Baht	*30.04 THB*	*31.51 THB*	*30.55 THB*	*32.47 THB*	*32.95 THB*

Source: http://www.exchange-rates.org/HistoricalRates

APPENDIX 2: NET PROFIT OF THE ROJANA INDUSTRIAL PARK ON THE YEARS BEFORE AND AFTER THE FLOODS

Unit: USD

Firm /year observation	2010	2011	2012	2013	2014
1	182,530	57,072	-27,213	-24,979	23,773
2	3,289,784	-3,844,781	312,096	293,641	370,361
3	526,392	-5,898,746	12,334,924	11,605,541	66,606
4	643,833	629,634	700,882	342,685	125,421
5	2,512	-8,376,191	7,004,155	1,391,625	370,361
6	629,322	-1,504,469	3,993,154	1,406,646	1,048,244
7	-127,626	147,254	-117,587	1,636,301	372,161
8	1,718,022	-4,727,307	5,361,013	4,580,439	-2,317,793
9	1,446,600	-1,011,826	-487,626	-36,052	477,620
10	201,095,576	-26,904,913	488,030,001	533,262,214	299,869,113
11	3,080,765	-5,025,331	12,125,647	14,609,088	24,669,631
12	7,598,112	-22,513,385	18,188,647	363,543	-1,161,400
13	-141,485	-1,628,141	-1,128,010	-1,051,180	-161,125
14	1,140,268	-1,580,587	5,768,562	5,427,459	3,448,039
15	1,369,093	-723,980	3,522,998	3,314,678	212,381
16	24,372,712	-8,944,932	25,699,768	8,920,978	13,980,501
17	642,515	-1,182,529	-94,025	3,334,675	-337,999
18	3,126,224	1,809,153	13,620,105	12,814,727	2,777,966
19	2,047,669	-4,572,749	14,221,168	601,926	1,166,351
20	10,045	-2,361,633	4,295,475	-6,694,195	-1,275,554
21	-594,231	-1,239,055	-480,950	-452,511	-795,042
22	23,260	-8,137,942	2,158,253	2,030,632	1,262,606
23	519,662	916,698	945,505	-481,722	-159,252
24	48,312	83,320	188,917	-136,392	22,734
25	-391,340	-430,593	126,622	44,900	-51,907
26	0	-327,092	-104,123	-39,123	-153,471
27	510,946	508,222	5,554,846	-43,484	129,322
28	279,405	42,099	93,831	44,041	207,591
29	5,706,068	2,545,176	9,697,678	1,573,465	1,833,937
30	187,002	-79,288	136,897	155,229	82,761
31	3,361,039	1,231,649	16,505,733	2,016,889	5,739,413
32	9,164,040	4,309,191	5,323,096	3,798,108	3,098,705
33	871,678	-4,377,457	4,883,364	2,240,761	2,379,931
34	-257,859	-280,130	672,933	-271,681	-53,720
35	1,857,096	-5,278,659	15,189,913	4,923,438	7,034,248
Total	273,937,940	-108,672,247	674,216,648	611,502,312	364,302,515
Exchange Rate 1 USD: Thai Baht	*30.04 THB*	*31.51 THB*	*30.55 THB*	*32.47 THB*	*32.95 THB*