

# **Impact of Labor and Capital Investment on Investor Idiosyncratic Risk**

**Shen-Ho Chang<sup>1</sup> and Fu-Cheng Chang<sup>2</sup>**

## **Abstract**

Fixed Assets and Human Resources are two factors of production that affects idiosyncratic risk of investors in a business. This research uses the proxy variables of the residual standard deviation. This research is based on the years 2007 to 2017. The companies at the over-the-counter market in Taiwan and Black, Jensen & Scholes proposed One Factor Model in 1972. Fama & French proposed a Three-Factor-Model and Five-Factor-Model in 1993 and 2005. These models tested whether the company's investment in fixed assets and human resources will have effects on the idiosyncratic risk of investors' investment. The result of the study found two consequences as follows:

1. The company's investment in fixed assets significantly correlated to investor idiosyncratic risk.
2. The company's investment in human resources significantly correlated to investor idiosyncratic risk.

**JEL classification numbers:** M40, M41

**Keywords:** Idiosyncratic Risk, Human Resources, Fixed Assets

---

<sup>1</sup> Professor, Department of Accounting, Feng Chia University, Taiwan.

<sup>2</sup> Ph.D. Program of Business, Feng Chia University.

## **1. Introduction**

### **1.1 Motivation and Background**

The decision making of management could lead a company to failure or success. Management assesses the resources that are currently owned by the company, and determine the problems that the company is currently experiencing for decision making. Management must consider a variety of factors when making decisions, such as internal strengths and weaknesses, threats from competitors, bargaining power with suppliers, local culture and legal environment. Secondly, after considering the various factors mentioned above, the management team will plan and formulate various plans, and then will select the best solutions. After the implementation of the best solutions, conduct performance evaluations will be conducted to follow up and correct the direction of decision-making.

However, the decision making plan is often accompanied by risk, and its risk vary from program to program. Therefore, when management selects a plan, it will bring a certain degree of risk to the company. The risks can be divided into overall risks and firm-specific risk. The overall factor risks are the risks brought by the changes in the overall market. For instance, changes in the global economic system will affect the changes of the company's business decision-making.

Therefore, when management chooses a decision-making plan, in addition to considering the benefits and assessing the risks brought by the solution, the operation of the company characteristics will affect the decision making. This type of risk is formed by the characteristics of the company, called "firm-specific risk". For example, if the management is risk avoider, it is possible to choose the program that is less beneficial to the company (Meindl, Ehrlich & Dukerich, 1985; Kerr & Kren, 1992), or to select various plans to avoid the risks, instead of choosing the more profitable program (Beatty & Zajac, 1994; Gray & Gannella, 1997).

However, in addition to looking at the company's financial performance over the years, when investors decide whether to invest funds in the company, they refer to the company's overall business direction, assess whether the company is growing stable and their future business policies. Investors invest in companies for the sole purpose of making a profit, but the benefits they are likely to receive are accompanied by possible risks due to the up and down with industry. Which is the company engaged, or the investment company's business policy for increasing or reducing the risks. Therefore, investors most likely choose portfolio investment to diversify the risk.

Therefore, from the perspective of capital asset pricing, investors' risk can be divided into systematic risks and non-systematic risks. Tong, Xin(2010) distinguishes systemic risks from non-systemic risks with the subprime mortgage storms that occurred in 2007. When the subprime mortgage storm occurred, the subprime loan itself was a non-systematic risk, and the risk was eliminated through package securitization. After the subprime mortgage storm due to the global monetary system that was based on the US, it caused financial crisis and debt crisis in many countries. This kind of risk that affects the entire country and can not be

eliminated by any means is called systemic risk. Systemic risk is also called “market risk”. The risk is caused by the market itself, such as the market cycle or natural disasters, wars and other factors. The risk can not be reduced by diversified investment, so it is also called “Non-diversifiable risk”. And yet, non-systemic risks is usually caused by the company’s industry characteristics, the company’s business management or other unique events such as company litigation or labor disputes, and its risks can be completely eliminated by the portfolio. Also known as diversifiable risk or idiosyncratic risk.

When a company determines a major decision-making behavior, it must face risks. Once the failure decision was made, it may cause a financial crisis of the company, and even expose the company to the risk of bankruptcy. In other words, when the investors decide to invest in the company, they will avoid taking all of the funds to invest in one company due to the risk of the company’s decision-making behavior. Instead, to invest in a company with relatively stable growth to eliminate the possible risk.

Yet, the inherent risks in the company could be turned into idiosyncratic risk of investors. Therefore, due to the investment company conditions, investors must take the inherent risk of the company.

The Theory of the Firm in the Economy indicates production decision-making using investment of labor and fixed assets to conduct production process. The weight of these two factor based investing share different rates depending on the type of industry. In the labor intensity industry, the investment will be more concentrated on human resources, such as, textile industry, clothing industry, etc. On the contrary, the capital intensity industry will invest more on the facilities. Therefore, the decision of a company on factor-based investing will be affected by current operating condition.

However, both human resources and fixed asset investment has a certain degree of risk due to the amount of resources invested. In terms of fixed asset, basis of past documents indicate that the fixed asset directly related to the assessment of capacity utilization and capital expenditure. Normally, production related industry’s first priority is investing in the fixed assets and then engage to the production activity(Zhang Hanjie, 2001). However, once too many fixed assets are invested, it could result in insufficient liquidity of the company’s funds and exceed the company’s capacity. To make excess capacity on every unit of equipment, none of them is able to achieve the maximum utility, and sell fixed assets to reduce the pressure of internal capital shortage in order to improve the company’s internal liquidity(Chen and Guo, 2005). However, if excessive resources are reduced in investing fixed assets can be faced with excessive idle funds, or insufficient capacity, that make the company unable to create additional profits.

In terms of human resources, when hiring more employees the expenditure of the salary will increase. And also the company has to face the staggered quality of employees that cause the productivity to fail to meet the goal. In order to reach the standard goal, hiring qualified labors or giving the employees training could cause extra expenditure. On the other hand, reduce the investment of human resources

could cause lack of labor, then the capacity of the company could be reduced. As Liang, Ting pointed out the problem of improper human resource management and unfulfilled employee skills, the employee turnover rate will increase the cost of human resources(2005). The cause of this problem is due to the uncertainty of labor and then it makes human resources more difficult to manage. If the reward system, employee training and other management measures can be implemented the uncertainty of employees will decrease. Buchanan pointed out improving employee welfare can effectively reduces turnover rates other than just motivate employees to increase productivity(1974).

When managers make company decisions, they must refer to the company's operating environment. Gau, Yong Quan and other scholars conduct research on the market competitive behavior in Taiwan(1990). The study discovered that the company has high capital demand, large market share, large market size and companies with high market power will tend to reduce competition, or engage in non-price competition. As Lin, Hui Ling explains in the research, the market expected profit barriers to entry and market demand could cause more companies of the labor intensity industry to withdraw from market than non-labor intensity companies, and cause more non-capital intensity companies than capital intensity companies to join the market(2002). From above, the operating conditions of a company can influence the management's factor-based decision making, and then the overall direction of operating.

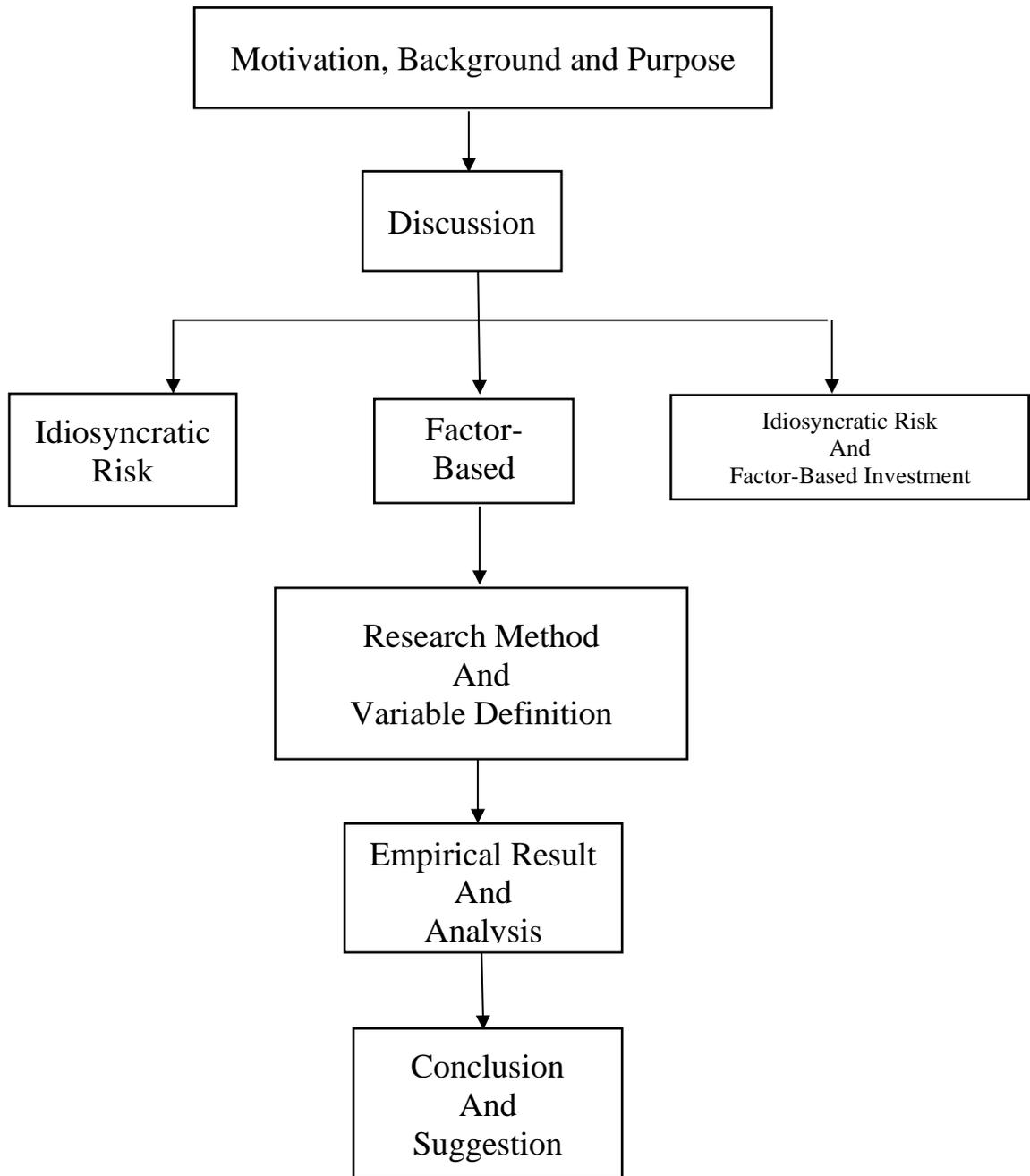
The risks of factor-based investment are different, depending on the operating conditions. However, the above-mentioned risks are specific risks arising from the situation of individual companies. Because investors invest in companies and turn into investors' idiosyncratic risks. This research discusses how the company's production factor based decision making affect investors' idiosyncratic risk.

## **1.2 Purpose**

The purpose of the research is to discuss how the company's production factor based decision making affect investors' idiosyncratic risk. The research includes three conditions as follows:

1. The effects of the company's fixed asset investment decision-making on investor's idiosyncratic risk.
2. The effects of the company's human resources investment decision-making on investor's idiosyncratic risk.
3. The effects of the company's fixed asset and human resource investment decision-making on investor's idiosyncratic risk.

### 1.3 Research Framework



**Figure 1: Research Flowchart**

## **2. Discussion and Development of Theory**

### **2.1 Idiosyncratic Risk and Factor-Based Investment**

#### **2.1.1 Idiosyncratic Risk**

The firm-specific risk refers to the risks of the company caused by the managers' assessment for the company's current operating environment. Instead of the effect of the overall risk that is caused by global market turmoil, the risk characteristic is specifically existed in the company. Venture Capitalist can invest portfolio or eliminate the risk. Hence, it is called idiosyncratic risk.

The idiosyncratic risk of Investment could be affected the firm-specific risk when the investors invest in a company. The risk is caused by the characteristics of the company, so the investors will consider the risk of the firm characteristics to avoid failure on recovery of funds.

In the past, many scholars have discussed many issues about the idiosyncratic risk. As Ashbaugh et al.(2004) and Cheng et al.(2006) discussed about the correlation between idiosyncratic risk and corporate governance. It proves the corporate governance and the cost of funds has a negative correlation. In other words, the company has better governments, the cost of funds is lower, and the investors have lower idiosyncratic risk.

Jin & Myers(2006) use information transparency to verify the idiosyncratic risk of the company. Their empirical results of the research shows the negative correlation between idiosyncratic risk and information transparency. In other words, better information transparency can reduce the degree of information symmetry. The needs of cost of capital is lower, and it means lower idiosyncratic risk.

Huang, I-Hsuan(2011) pointed out that investors use financial statements as a reference when making decisions of investments. Thus, the company's manager will manipulate the earning on financial statements by increasing the earning, in order to show the bright side of the operating performance. When investors make decisions to invest in the company with the financial statement, it is very likely to transfer the risk of the company to them self, and turned into their idiosyncratic risk. The earnings information published in the financial statements is a measure of the investor's assessment of performance. Due to managers attempts to disguise the performance, it makes them manipulate earnings to reach the intended goal. In order to whitewash the speculative investing behavior of exaggerated financial statement, the speculative earnings management could cause investors to face more risks of investment.

Gaspar & Massa(2006) have proved that it depends on the degree of competition in the market, the product in the higher competition market and the higher idiosyncratic risk to the investors.

Moreover, the research of the effects of company management and shareholders' goals consistency on idiosyncratic risk also has been discussed by many scholars. For instance, from the rewards aspect, when a company's equity is more dispersive and the company's shareholders can't effectively supervise the management (Elston & Goldber, 2003), it can make the management and shareholders' interests closer

to each other if the company formulate the rewards mechanism to the management (Bai et al., 2004). Hence, the management will make a strategic decision to maximize shareholders' benefits. Jensen & Meckling(1976) have researched the correlation between management's equity ratio and operating effectiveness. It proves that there is negative correction between management equity ratio and operating effectiveness, which means the management with higher equity ratios tend to make the decision that is more beneficial to shareholders. Himmelberg et al. (1999) conceptually stated that if the manager's shareholding ratio is higher, the manager's interest will be consistent with the shareholders and the management will implement various ways to reduce the idiosyncratic risk.

According to previous research, improving information disclosure and the quality of financial statement can reduce the information asymmetry and stock price volatility (Diamond & Verrecchia, 1991; Healy et al., 1999; Rajgopal & Venkatachalam, 2011). Based on Kothari's research in 2000, the company's idiosyncratic risk can be measured by the volatility of stock price. The results of the study show that high quality financial information can alleviate the information asymmetry between the company's management and the external investors, and reducing information asymmetry allows external investors to understand capital costs and stock price volatility. Barth et al(2013) studied whether the company's revenue is open and transparent, and the relevance of the company's cost of capital. The research shows that companies with open and transparent revenue have reduced the degree of information asymmetry between companies and investors. It makes investors more willing to invest in funds. Therefore, the companies can enjoy lower cost of capital, comparison to the companies with less revenue transparency. In 2006, Jin & Myers conducted country-level research. It proved the company with less transparency also means higher risk to investors, and the higher information transparency means lower risk to investors.

From the above, the company's financial information is a considerable indicator for investors to decide whether to invest in the company. If the company intentionally conceals unfavorable information, the investors could make wrong investment decision due to the information asymmetry. The company's risk will be passed on to the investors and turned into investors' idiosyncratic risk and cause larger volatility of the stock price.

In 2007, Ferreira & Laux researched the effect of the company's idiosyncratic risk in control market. The research found that if the company with more anti-merger terms and company's governance mechanism is better. The company itself has lower idiosyncratic risk.

As mentioned above, information asymmetry tends to cause the investors to have less understanding of the company. Therefore, when investing in the company, investors are more likely to make less favorable investments with less information due to the company's uncertainty. When some negative news of the company was released, the stock will be sold immediately, which causes a great fluctuation to the company's stock prices and leads to an increase of investors' idiosyncratic risk.

### **2.1.2 Factor-Based Investing**

In the past years, many researches discussed about how external factors influenced management. For example, many scholars studied the competition in the product market to make the management of the company slack less, and then not to waste company resources and agency costs (Leibenstein, 1966, Machlup, 1967, Hart, 1983). Jagannathan & Srinivasan (2000) also confirmed that product market competition can indeed make the company's management slack less. Above it explains the competition in the market will make the management of the company more cautious about investment decision-making, so that the company's resources will not be wasted.

Since the production factor based investment decision is a considerable business decision of the company, investors will also consider it when deciding whether to invest in the company. According to the company's specific characteristics, the decision-making of factor based investment will lead the company to a huge consumption of company's funds. Therefore, the investment decision of these two production factors will cause the company to have firm-specific risk, and it will be transferred to investors and turned into idiosyncratic risk. Hence, investors should cautiously assess the "fixed assets" and "human resources" as production factors, to avoid idiosyncratic risk.

Delery & Doty (1996) and Christoffersen, Datta, & Malhotra (2002) shows the main factor of a company's decision making is the production factor. Hansen & Mowen (2000) research indicates that, in order to compete in the market and confront the problem, the company will correct the internal production factors.

A company that invests in the improvement of production factors will also improve the overall financial structure of the company, and make financial soundness out of the company. With proper investment in production factor the company productivity can reach the best condition, and reduce the cost of production to enhance competition in the market (Howell & Souch, 1987; Hendricks, 1988; Bessant & Buckingham, 1989; Polakoff, 1990).

Nickell (1996) conducted research based on the data of a British company. It proves positive correlation on the effect of production factors on the competition in the market. Which means if the company is in a more competitive market and the company is more cautious with the investment of production factor, then the efficiency of using resources is higher.

Good production factors based investment can not only drive the growth of the company, but can also keep the stock price stable and reduce the operating risk. However, if the proportion of production factor based investment is improperly configured, it is very likely to cause the company a financial strait and waste resources. It will turn invested resources into sunk cost and increase the risk.

Chauvin & Hirschey (1993) discover the production factors are positively correlated with the value of the company in the research. Similarly, Blose & Shien (1997) points out that the rise of stock prices happen when a company announces new production factors based investment. Therefore the production factor based

investment decision has more significant influence on the future of a company. Once management makes mistakes on investing decisions, the company could face an operational crisis.

Therefore, for investors, the investment of two production factors, “Fixed Asset” and “Human Resources”, will highly affect the company’s operation. It accompanied by the firm-specific risk, and passed on to investors as idiosyncratic risk. Hence, this research discusses how investors’ idiosyncratic risk is affected when they invest in two production factors based investment, the fixed assets and the labor.

## **2.2 Investment on Fixed Assets and Idiosyncratic Risk**

According to research by Datta et al.,(2005), companies that invest more funds on production equipment tend to cause investment rigidity due to the excessively invest on fixed assets. Yet, in order to reduce rigidity, the company could reduce the cost of transaction by slowing down the investment in production equipment. Therefore, the fixed asset investment of a company is accompanied by operational risks.

Furthermore, if the company plans to improve the overall operational performance, the primary goal is to make investment in production equipment to achieve the desired goals(Richard & Johnson, 2001; Mithas & Whitaker, 2007; Mainga, Hirschsohn,& shkantu, 2009). However, due to the high cost of production equipment, the overinvestments that happens in a company can be turned into extreme high sunk cost. On the other hand, it could also create good performance in the future(Richard & Johnson 2001; Danese & Vinelli 2009; Qu et al. 2011).

Huang, Tai-Feng(2012) points out that the funds needed for the company to invest in fixed assets are mainly borrowing and financing. The company with high proportion of fixed assets mostly get a loan from a bank for investing in fixed assets. Therefore, the key of growth to a company is efficiently using the funding. It can be seen that a company with a high proportion of fixed assets has a higher amount of liabilities than other companies. Therefore the company’s operating risk is higher than other companies. If the funds invested by the company cannot be recovered, it may cause the turnover of funds not to work, which will increase the risk of the company’s debts and endanger the survival of the company.

As Chin, Pao-Kun(2010) points out, fixed assets usually take a large proportion of a company’s total assets. If the company’s fixed assets management is faulty, such as, idle assets, unclear account, non-complying regulation of calculation on depreciation, etc, it is very likely to cause a serious loss. Chen, Hsiao-Ning(2010) also explained the necessity of formulating the system of fixed assets management, the process of building fixed assets budgets, plans, purchasing and scrapping are able to increase the use value of fixed assets when distinct accountability and responsibility is implemented in division of labor and responsibility attribution.

Chu, Ching-Chiang(2009) mentioned the situations that happen on fixed assets management, such as, classification error, unmet requirements of cost calculation,

and unmet requirements of depreciation calculation for manipulating income. As a result the information distortion of the financial report can increase the risk of the company. If the investors invest in the company, the risk will be passed on to investors as idiosyncratic risk.

Kuo, Tung-Mei(2010) explained that the fixed assets investment has a long recovery cycle. It has to go through a certain time of production and sale to gradually receive the recovery of invested funds. If the company is not operating properly during the recovery period, or employees inappropriately operate the equipment to cause the cost increment of maintenance on fixed assets, it is highly possible to increase the business risk and cause extreme loss to the company.

Tsui, Yu-Chien(2009) pointed out the unsynchronization of information between departments can cause the waste of resources, due to duplicate purchase and use of the fixed assets. Also, if the fixed assets evaluation standard of depreciation is not standardized after purchase, it will cause the difficulty of the fixed assets management subsequently. Therefore, the circulation of information between departments must be well developed and a consistent management approach to avoid waste of the company's resources and increase management costs.

In 2012, Lin, Shu-Hui explained that the company's management will manage earnings by selling fixed assets to avoid letting investors think that the company revenue is declining. Bartov(1993) has research that indicates management will select certain timing point to offer fixed assets for sale to make a profit or loss, in order to make the earnings of companies show a stable status. Herrmann et al.(2003) shows the relevance between sales of fixed assets and earning management in Japanese business. The research discovered that the business in Japan offers fixed assets for sale to meet the expected revenue of the year. This shows that, when the revenue of the year doesn't meet the expectation, or the surplus volatility tends to be higher, the company will offer fixed assets for sale to keep the revenue.

Therefore, the investment on production equipment has certain level of risk. Truly, investing more on production equipment can increase the production of the product, and be able to generate more profits in the future, then the overall business will grow. However, when the company faces insufficient liquidity of funds, or failure of meeting the demand of the market, which cause the drop of revenue, the company will sell currently invested production equipment to maintain the liquidity of the funds.

If companies overly invest, it could turn the funds into sunk cost and it can not be recovered. If the business is in a competitive market, the product could fail to meet the demand of the market when the market has changed. Additionally, if the funds of previous investments of production equipment has been turned into sunk cost, it will cause the insufficient liquidity of funds and raise the firm-specific risk when the funds are not recoverable. Therefore, more fixed asset investments cause higher firm-specific risk. When the investor invests in the company, they could face the risk of unrecovered investments. Hence, our research proposes the hypothesis as follows:

**H1:** The Investment in fixed assets of the company is significantly related to the idiosyncratic risk of investors.

### **2.3 Human Resources and Idiosyncratic Risk**

Due to the uncertainty of human resources, researchers have always paid close attention to the topic of human resources. In order to reduce the uncertainty of human resources in business, formulating reward contracts for employee trainings to control human resources will improve the performance and stability.

Ou, Chin-Shih(2004) has researched the industry of electronic and information technology in Taiwan. The research covers intellectual capital creation activity and corporate performance from 1995 to 2008, and the conclusion indicates a positive correlation. Therefore, when a company invests more on human resources and raises employee's pay, it can improve the quality and productivity of employees, and brings in profits and growth. In 2006, Li, Guei-Fu and his team did a study about the correlation between employee training, capital intensive and corporate performance, from 1995 to 2008. They choose productivity and ability of earning profit as proxy variables to represent corporate performance. The result of the research proves the positive correlation between capital intensive and employee's profitability, besides the training and productivity.

Chen, Sung-Shan takes listed companies at over-the-counter markets in Taiwan, as an example. The research shows the relevance between human resources and economic value added in the industry of electronic and information technology from 1999 to 2009. The results prove that as a capital intensive and knowledge-based industry, human research, economic value added, and corporate value has a positive correlation. This shows that the capital intensive industry values the cultivation of human resources, and sees the benefit of cultivating human resources.

Wang, Teng-Sen's research(2004) indicates that economists consider the capitals have to different types. One is physical capital, and the other is human resources. The human resources investment includes employee education and training. As Barro & Lee(1993) have discovered in the research, human resources and real GDP(Gross Domestic Product) present positive correlation. It means, as long as the company invest on human resources, the employees' productivity will increase and lead the business to grow.

However, investing in human resources doesn't mean zero risk, due to the difference of core value and education level. It causes employees' to be staggered based on ability and quality. The reason this issues happen is because companies only consider the information that is provided by candidates during the recruiting process to decide if they are capable for the position. If the candidates hold their disability information back, it will cause the manager to hire the wrong people and enlarge the risk of human resource management in the future.

Chen, Chun-Hua(2005) points out that the depreciation of human resources effect happens when companies face dynamic demand of the market, newly released policies of the government and training for implementing new techniques. For

employee management, the differences of core values, moral principle or interruption of human resources investment will cause difficulties with management. Wen, Hsiao-Chang(2006) points out the complexity of human resources and the information asymmetry between interviewers and candidates during the recruiting process causes incompetent employees, or leads companies to ban hollowed out, confidential information leak, etc., then cause the business to go bankrupt.

Wong, Li-Chun(2008) explained about hiring. Due to information asymmetric, companies could hire incompetent candidates and then miss out on a more qualified candidate. Thus, it wastes resources and the company must spend additional resources.

In 2010, Chang, Hsiu-Lan proposed that the risk of enterprise human resources can be divided into different types, such as, recruitment risk, pay at risk, performance risk, labor risk, training risk and resignation risk. Due to human complexity, information asymmetries and employee turnover, a business have to pay additional cost to control those uncertain factors, and it will make the employee management more difficult.

Lu, Ching-Ching(2007) points out that human resources investments are long term investment and it has to pay a high price. Therefore, when a business invests in human resources, the recovery takes years. However, human resources investments have uncertainty, once the demand of the market has changed, or innovation of technology, and government policies can cause the waste of human resources costs that are already invested.

Li, Qin(2005) believes that human resources has a relatively high uncertainty, and usually tend to hide their disadvantages for misleading and deceiving. Therefore, the information asymmetric can give the receiver incorrect information. Thus the conflict of interest will happen and cause dispute.

Zheng, Yie(2005) points out that even using contracts to control human resource uncertainty will still be relatively impossible. If the investment of human resources can not bring in the expected profits or value, the company will not only face unrecovered investment, but also the reduction of value. And if the company's benefits do not meet the employees preferences, the employees could engage in illegal work or violate the ethics and moral standards.

From the description above, investing in human resources can not only increase productivity, but also bring benefits to customers. It makes customers satisfied with the products and services, enhance customer returning rate, bring the growth to the business and elevate overall business performance. Thus, employee training can not only let employees increase unit productivity, but also increases every employee's profibilities to increase the profit and liquidity of funds.

However, due to human complexities, uncertainties and candidates' hidden information during job interviews can cause incompetent employees, additional human resources need to be applied for employee personal benefit to hollow out the company or cause confidential information leaks. Therefore, we propose the hypothesis statement as follows:

**H2:** The investment in human resources of the company is significantly related to the idiosyncratic risk of investors.

#### **2.4 The Interaction Effect of Factor-Based Investment**

Edvinsson & Malone(1997) mentioned about consist factors of intellectual capital. The different factors will affect each other, and creates the values to the business. Jeltje van der Meer-Kooistra & Zijlstra(2001) explains the points of human resources is about the employees' knowledge and experience, and it is the backbone of other factors. Thus the employees' skills can affect other factors and indirectly affects the values of the company.

Koch & McGrath(1996) suggested that the company's investment decisions on production equipment will indirectly affect the company's investment decisions in human resources. Therefore, the investment of human resources will increase, while the company is investing in production equipment, and indirectly improve skill level of employees to cope with the current production techniques of the company. Hence, in order to make production equipment and human resources the best match, many companies will also consider the investment of human resources while considering whether to invest in production equipment.

As mentioned previously, when the company invests in a large amount of production equipment for product, the employees are not very familiar with the production process of the equipment that has merely been put into production. If professional training is not provided to employees, the productivity will not reach the ideal state due to the unfamiliarity of the entire production process while producing the products. Which can result in an unmet goal of product quality the company has set, which increases the company's operating risk.

Therefore, when the investment of production equipment and providing employee training simultaneously to allow employees to become familiar with the equipment, they are able to achieve the desired performance in producing products. Reducing the production time of every unit of products and keeping the product quality the company will reach the production goals. Thus the company's operating risks will reduce.

Ou, Chin-Shih(2004) has researched manufacturing from 1995 to 2000. He found that when the company's investment in production equipment increased, the company would also increase investment in human resources. The reason is that whenever the company invests more in production equipment, the difficulty of the company to change the target market in the future will increase. Therefore, the company will increase the total efficiency of the production equipment by investing in human resources at the same time to increase the profitability of the company.

Therefore, when the company is investing in production equipment, if the company does not keep up with the investment of human resources, it will make employee production techniques and productivity fail to keep up with the new production techniques that are required for the new production equipment. This could cause the waste of resources. Therefore, if the company invests in both human resources and

production equipment, its productivity can achieve the company's expectations and reduce operational risks.

If the amount of production equipment invested in by the company is too large, the funds invested previously by the company will likely become sunk costs when the demands in the market are changed. Then the previously invested funds in human resources must be re-invested in response to market changes that require new production technique. It increases the company's operational risk, and the risks mentioned above will be transferred to the investor's idiosyncratic risk. Therefore, this research proposes the following hypothesis:

**H3:** The investment interaction in the company's human resources and fixed assets is significantly related to the idiosyncratic risk.

### 3. Research Methods

This chapter includes three sections. Section one explains the research period and sampling. Section two is empirical model, and the section there is the definition of variables.

#### 3.1 Sampling

This Study is based on the research of listed companies, excluding the financial industry, securities industry and the insurance industry. The research period is from 2005 to 2017. The data are taken from the economic news in Taiwan, and 20,009 samples were excluded from the financial and insurance industry. In order to calculate the change rate of fixed assets and in sales revenue. The data of the year 2005 was deleted and the miss-pairing information was deleted, as well. The final sampling data were 14,626. The selection process are in Table 1, shown as follows:

**Table 1: Sampling Process**

Original Sample Amount	20,009
Deleted Missing Values	(1,856)
Deleted Miss-Pairing Value	(2,399)
Exclude data in 2005 (Calculation of Change Rate)	(1,128)
Sample Amount	14,626

Sources: Organized by Author

**Table 2: Annual Sample Distribution**

<b>Year</b>	<b>Samples</b>
2006	1,174
2007	1,219
2008	1,276
2009	1,329
2010	1,359
2011	1,406
2012	1,447
2013	1,530
2014	1,550
2015	1,570
2016	1,576
2017	1,589
Subtotal	17,025
Substraction : Missing Data	2,399
Total	14,626

Source: Organized by Author

**Table 3: Industry Analysis**

Industry Type	Sampling Size	Percentage	Accumulate Percentage
Cement Industry	107	0.01	0.01
Food Industry	266	0.02	0.03
Plastic Industry	358	0.02	0.05
Textile Industry	653	0.04	0.10
Motor Machinery	993	0.07	0.17
Electrical Cable	86	0.01	0.17
Chemical Industry	373	0.03	0.20
Biomedical Industry	836	0.06	0.25
Glass and Ceramic Industry	65	0.00	0.26
Paper industry	82	0.01	0.26
Steel Industry	570	0.04	0.30
Rubber Industry	134	0.01	0.31
Automotive Industry	105	0.01	0.32
Semiconductor Industry	1,210	0.08	0.40
Computer Industry(PC, Motherboard)	1,183	0.08	0.48
Photoelectric/IO Industry	1,274	0.09	0.57
Other Electrics Industry	95	0.01	0.58
Consumer Electronics Industry	242	0.02	0.59
Software Service	450	0.03	0.62
Communication Equipment	356	0.02	0.65
Information Distribution	529	0.04	0.68
Electronic Equipment	454	0.03	0.72
Electronic Parts	1,848	0.13	0.84
Network Equipment	313	0.02	0.86
Construction Materials	887	0.06	0.92
Shipping Industry	128	0.01	0.93
Tourism Industry	194	0.01	0.95
Trading	214	0.01	0.96
Others	621	0.04	1.00
Total	14,626	1.00	

Source: Organized by Author

### 3.2 Empirical Model

#### 3.2.1 The Effects of Fixed Assets on the Idiosyncratic Risk

Hypothesis 1 is to discuss the effect of fixed assets on idiosyncratic risk. First, the variables of idiosyncratic risk are measured by the residuals from three models above, and the standard deviation is calculated separately. While the independent variable part is the investment of fixed assets, the control variable is added to the return on assets (Lin, PingZhen, Chen Jiaying, 2006), the debt ratio (Su Yan, Wang

YaoZhong, 2005) and the size of the company(Chen,Song-Shan, Liu, Zhen-Jia, Wang Ming-Chang Huang De-Jun 2011). Amount them, the fixed assets invested are measured by the fixed assets ratio and the change rate of fixed assets. The formula of the research is as follows:

$$HR_{i,t}=\alpha_i+\beta_1FixedAssets_{i,t}+\beta_2ROA_{i,t}+\beta_3LEV_{i,t}+\beta_4SIZE_{i,t}+\varepsilon_{it} \quad (1)$$

**HR<sub>i,t</sub>**: The idiosyncratic risk of the company in the t-year.

**Fixed Assets<sub>i,t</sub>**: It is company's t-year investment on fixed assets, including fixed assets ratio and rate of change in fixed assets.

**ROA<sub>i,t</sub>**: Return on assets of the company in the t-year

**LEV<sub>i,t</sub>**: The debt ratio of the company in the t-year

**SIZE<sub>i,t</sub>**: The scale/size of the company in the t-year

### 3.2.2 The Effect of Human Resources on Idiosyncratic Risk.

Hypothesis 2 is to discuss the effect of human resources investment on idiosyncratic risk. The control variable is the same as hypothesis 1. The differences in the formula is the replacement of the independent variable with the variable of human resources investment. The formula is as follows:

$$HR_{i,t}=\alpha_i+\beta_1Employee_{i,t}+\beta_2ROA_{i,t}+\beta_3LEV_{i,t}+\beta_4SIZE_{i,t}+\varepsilon_{it} \quad (2)$$

**HR<sub>i,t</sub>**: The t-year idiosyncratic risk of the company.

**Employee<sub>i,t</sub>**: The t-year human resources investment of the company. It includes number of employees and the business benefits per employee.

**ROA<sub>i,t</sub>**: The return on assets of the company in the t-year.

**LEV<sub>i,t</sub>**: The debt rate of the company in the t-year.

**SIZE<sub>i,t</sub>**: The scale/size of the company on the t-year

Among them, the company's investment in human resources is measured by the number of employees and the business benefits of each employee. It discussed whether the company's investment in human resources is significantly related to idiosyncratic risk.

### 3.2.3 The effect of fixed assets and human resources on idiosyncratic risk

Hypothesis 3 is to discuss the effect on idiosyncratic risk when the company invest in fixed asset and human resources both at the same time. It takes two variables and multiplied by each other. To test whether the effect of investing these two factors simultaneously to idiosyncratic risk is significant. The control variable is the same as the hypothesis 1, the formula of the research is as follows:

$$HR_{i,t}=\alpha_i+\beta_1Fixed\ Assets_{i,t}+\beta_2Fixed\ Assets_{i,t}*Employee_{i,t}+\beta_3ROA_{i,t}+\beta_4LEV_{i,t}+\beta_5SIZE_{i,t}+\varepsilon_{it} \quad (3)$$

**HR<sub>i,t</sub>**: Idiosyncratic risk of the company on the t-year.

**Fixed Assets<sub>i,t</sub>**: The company's investment of fixed assets on the t-year. It includes fixed assets ratio and fixed assets change rate.

**Employee<sub>i,t</sub>**: The company's investment of human resources. it includes number of employees and net operating profit per employee.

**Fixed Assets<sub>i,t</sub>\*Employee<sub>i,t</sub>**: The company's multiplication on the investment of fixed assets and human resources in the t-year.

**ROA<sub>i,t</sub>**: The return on asset of the company in the t-year

**LEV<sub>i,t</sub>**: The debt ratio of the company in the t-year.

**SIZE<sub>i,t</sub>**: The scale of the company in t-year.

### 3.3 The Definition of Variables

#### 3.3.1 Dependent Variables

Due to the difficulty for measuring the idiosyncratic risk, this research refers to the one-factor model that is proposed by Black, Jensen & Scholes in 1972 and the three-factor model and five-factor model that are proposed by Fama & French in 1993 and 2015. The formula is as follows:

#### One-Factor Model

$$R_{it}-R_{ft}=\alpha_i+\beta_i(R_{mt}-R_{ft})+\varepsilon_{it} \quad (4)$$

**R<sub>it</sub>**: Return on Securities or Portfolio in the t-year.

**R<sub>ft</sub>**: Risk-Free Interest Rate in the t-year.

**R<sub>it</sub>-R<sub>ft</sub>**: Excess Return on Portfolio in the t-year.

**R<sub>mt</sub>**: Return on Value-Weighted Market Portfolio in the t-year.

**R<sub>mt</sub>-R<sub>ft</sub>**: It is premium of market risk in the t-year. It happens to investors who take the risk on their investment when the investors ask for additional rate of return. It is a market factor, also known as "Risk Premium".

**β<sub>i</sub>**: Systematic Risk Coefficient

#### Three-Factor Model

$$R_{it}-R_{ft}=\alpha_i+\beta_i(R_{mt}-R_{ft})+s_iSMB_t+h_iHML_t+\varepsilon_{it} \quad (5)$$

**SMB<sub>t</sub>**: It represents the scale factor. It is the differences between large and small companies. The calculation is as follows:

1. Excluding the financial industry, samples of all companies are ranked by market value from small to large. The top 30% are large scale companies, 40% in the middle are medium scale companies, and the remaining 30% are small scale companies.
2. Calculate the average rate of return based on the scale of companies. Then deducted the small scale company's average rate of return by the

large scale company's average rate of return. Finally, the return to scale will come out as a result.

**HML<sub>t</sub>:** It is the book-to-market ratio factor. It is the return on Equity differences between high and low book-to-market companies. It is calculated as follows:

1. Excluding the financial industry, samples of all companies are ranked by net worth market ratio from high to low. The top 30% are book-to-market ratio companies, the middle 40% are medium book-to-market ratio ratio companies, the remaining 30% are low book-to-market ratio companies.
2. Calculate the average rate of return based on the scale of companies. Then take the high book-to-market ratio and subtracted by low book-to-market ratio. The premium of book-to-market ratio will come out as a result.

**B<sub>i</sub>, s<sub>i</sub>, h<sub>i</sub>:** regression coefficient of market factor, scale factor and book-to-market ratio factor.

**Five-Factor Model**

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + \varepsilon_{it} \quad (6)$$

**RMW<sub>t</sub>:** It is profit factor. It represents high profitability companies. The risk is also higher compared with other companies. The way to calculate it is as follows:

1. Excluding the financial industry, samples of all companies are ranked by profit from high to low. the top 30% are high profitability companies, the middle 40% are the companies with medium profitability, the rest 30% are low profitability company.
2. Calculate the rate of return based on the scale of companies. Then take the high profit rate of return and subtracted by low profit rate of return.

**CMA<sub>it</sub>:** Investment factor, it is measured by the reinvest rate. Normally, the reinvestment rate is inversely proportional to the risk of the company. The calculation is as follows:

1. Excluding financial industry, samples of all companies are ranked by investing rate from high to low. The top 30% are high investing ratio companies, the middle 40% are the companies with medium investing ratio, the rest 30% are low investing ratio company. The higher ratio means the company is more actively engaged to invest, and the lower ratio means the company is more conservatively engaged to invest.
2. Calculate the rate of return based on the company's investment ratio. Then the result is the difference of subtracting the high profit rate of

return by low profit rate of return.

After the term of residual is calculated, take the terms of residual of one-factor, three-factor and five-factor, and calculate the standard deviation separately for the proxy variables to measure the idiosyncratic risk.

### 3.3.2 Research Variables

#### Fixed Assets

This research based on fixed assets Ratio and rate of change in fixed assets as a proxy variable of company's fixed assets investment.(Zuang, Yi-Chi, Lee, Jun-Yan, 2003)

#### Fixed Assets Ratio (FR<sub>i,t</sub>)

Refers to the ratio of fixed assets accumulated by the company's total assets every year. The formula is as follows:

$$\text{FR}_{i,t} = \text{Fixed Assets} / \text{Total Assets}$$

This ratio represents the inventory variable of the company's investment in fixed assets.

#### Rate of Change in Fixed Assets, CFR<sub>i,t</sub>

This rate refers to the amount of new investment fixed assets this year compared with last year (Jia-Wei Chen, Kai-Li Wang, An-Qi Wu, Zhen-Yu Wu, 2015).

$$\text{CFR}_{i,t} = (\text{Current Period Fixed Assets} - \text{Former Period Fixed Asset}) / \text{Former Period Fixed Assets}$$

This ratio represents the variable of the fixed assets variation. It is also the adjustment of the company's investment in fixed assets.

#### Human Resources

##### Employee

This research is measured by the number of employees, to test whether the company's labor input will affect the company's specific risk, and increase idiosyncratic risk. However, the number of employees does not involve the quality of labor, so quality is measured by the contribution of each employee.

#### Operating Income Per Employee (OIPE<sub>i,t</sub>)

In this part of research, the operating income per employee can be regarded as a proxy variable of the company's human resources (Jia-Wei Chen, Kai-Li Wang, ). It tests whether the profit that each employee brings to the company can affect the idiosyncratic risk. The formula ia as follows:

$$\text{OIPE}_{i,t} = \text{Operating profit} / \text{number of employees}$$

### 3.3.3 Control Variables

#### Debt Ratio(LEV<sub>i,t</sub>)

Agarwal & Knoeber(1996) points out that if the company properly uses long term debt, it could more effectively reduce the cost of capital that is invested in fixed assets and human resources. However, if the company has a relatively high ratio of long-term liabilities, it could enlarge the operational risk. Therefore, this research use debt ratio as the control variable. The formula is as follows:

$LEV_{i,t} = \text{long-term liabilities} / \text{total assets}$

#### Company Scale/Size (SIZE<sub>i,t</sub>)

McConel & Servares, (1990) explains that the scale of the company will affect the company's value in the market, which affects the company's investment and financing. Therefore, this research uses the scale of the company as the research control variable. The formula is as follows:

$SIZ_{i,t} = \text{Total assets take natural logarithm}$

#### Return on Assets (ROA<sub>i,t</sub>)

As previous studies have pointed out that the rate of return on assets can let the statement reader to understand the overall use of company funds, and understand how much profit is brought to , and the company's overall value by the company. Therefore, this research use return on assets as a control variable to test whether the idiosyncratic risk is affected, after the company invests in two factors, fixed assets and human resources. The formula is as follows:

$ROA_{i,t} = ( \text{Pure Profit of Continue Operating Department} + \text{Interest Expense} \times ( 1 - \text{Tax Rate} ) ) / \text{Average Total Assets} \times 100\%$

## 4. Empirical Results and Analysis

This Chapter is divided into four subsections. The first section is the regression analysis of the Idiosyncratic Risk of fixed assets. The second section is the regression analysis of human resources on idiosyncratic risk, and the third section is the regression analysis of the idiosyncratic risk of the two factors investments.

### 4.1 Fixed Assets Empirical Results

Table 4 is the empirical results of hypothesis 1. As a result, the fixed assets ratio is negatively correlated with the idiosyncratic risk, which means the company's investment in fixed assets can reduce the risk, and then reduce the idiosyncratic risk on investor's investment. In other words, the rate of change in fixed assets is negatively correlated with idiosyncratic. It indicates that the company is engaged in the purchase, disposal of sale and other factors affecting the fixed assets will be adjusted depends on the company's operating condition every year, and the fixed assets take a rather large portion of the total assets of the company. Therefore, the various investments on fixed assets or disposal wild increase the company's risk, and then increase the idiosyncratic risk to investors, which is consistent with the

hypothesis 1 of the research.

**Table 4: Regression Results of Fixed Assets on Idiosyncratic Risk from Every Factor's Model**

	Fixed_Ratio	Size	ROA	LEV
<b>Fixed Assets Ratio as the Independent Variable</b>				
<b>Panel A One-Factor Model</b>				
T-Value	-1.65	-36.94	-3.39	17.9
P-Value	0.0993*	<.0001***	0.0007***	<.0001***
Adj R <sup>2</sup>	10.12%			
<b>Panel B Three-Factor Model</b>				
T-Value	-2.24	-35.71	-1.51	18.17
P-Value	0.025**	<.0001***	0.1322	<.0001***
Adj R <sup>2</sup>	9.33%			
<b>Panel C Five-Factor Model</b>				
T-Value	-1.92	-35.87	-1.09	18.13
P-Value	0.0543*	<.0001***	0.2764	<.0001***
Adj R <sup>2</sup>	9.31%			
<b>Rate of Change in Fixed Assets as Independent Variable</b>				
	Change_Fixed_Ratio	Size	ROA	LEV
<b>Panel D One-Factor Model</b>				
T-Value	5.42	-37.03	-3.98	17.78
P-Value	<.0001***	<.0001***	<.0001***	<.0001***
Adj R <sup>2</sup>	10.28%			
<b>Panel E Three-Factor Model</b>				
T-Value	4.95	-35.86	-2.08	18.03
P-Value	<.0001***	<.0001***	0.0376**	<.0001***
Adj R <sup>2</sup>	9.45%			
<b>Panel F Five-Factor Model</b>				
T-Value	4.11	-36	-1.57	18.01
P-Value	<.0001***	<.0001***	0.1169	<.0001***
Adj R <sup>2</sup>	9.39%			
* 10% Significant ** 5% Significant *** 1% Significant		<b>Fixed_Ratio:</b> Fixed Assets Ratio <b>Change_Fixed_Ratio:</b> Rate of Change in Fixed Assets <b>Size:</b> The Scale/Size of the Company <b>ROA:</b> Return on Asset <b>LEV:</b> Debt Ratio		

Source: Organized by Author

## **4.2 Empirical Results of Human Resources**

Table 5 is the empirical result of the hypothesis 2. As a result, the number of employees is positively correlated with idiosyncratic risk. It means the more employees the company has, the harder for the company to manage human resources. Therefore, the company has to expend more cost for managing it. It is not only increases the risk of the company, but also the risk will be transferred into investor's idiosyncratic risk on the investment, and make the investor's investment in the company even more with higher risk. In other words, every employee's operating net profit is negatively related with idiosyncratic risk, but it only showed higher correlation with the five-factor model. It means the more net profit is earned by each employee, the higher human resources of the company is, and the company's operational risk lower. It also means lower risk for the investors who invest in the company. It consistent with the hypothesis 2 in this research.

**Table 5: Regression Results of Human Resources on Idiosyncratic Risk from Every Factor's Model**

	Employee	Size	ROA	LEV
<b>Employees as Independent Variable</b>				
<b>Panel A One-Factor Model</b>				
T-Value	5.31	-34.97	-3.56	17.82
P-Value	<.0001***	<.0001***	0.0004***	<.0001***
Adj R <sup>2</sup>	10.27%			
<b>Panel B Three-Factor Model</b>				
T-Value	5.62	-34.1	-1.7	18.07
P-Value	<.0001***	<.0001***	0.0895*	<.0001***
Adj R <sup>2</sup>	9.50%			
<b>Panel C Five-Factor Model</b>				
T-Value	5.7	-34.26	-1.27	18.04
P-Value	<.0001***	<.0001***	0.2044	<.0001***
Adj R <sup>2</sup>	9.49%			
<b>Operational Profit Per Employee as Independent Variable</b>				
	OP_Per_Employee	Size	ROA	LEV
<b>Panel D One-Factor Model</b>				
T-Value	-1.2	-36.62	-2.84	17.89
P-Value	0.2311	<.0001***	0.0045***	<.0001***
Adj R <sup>2</sup>	10.11%			
<b>Panel E Three-Factor Model</b>				
T-Value	-0.92	-35.49	-1.19	18.12
P-Value	0.359	<.0001***	0.2343	<.0001***
Adj R <sup>2</sup>	9.31%			
<b>Panel F Five-Factor Model</b>				
T-Value	-1.93	-35.48	-0.44	18.13
P-Value	0.0539*	<.0001***	0.6597	<.0001***
Adj R <sup>2</sup>	9.31%			
* 10% Significant, ** 5% Significant *** 1% Significant		<b>Employee:</b> Number of Employees <b>OP_Per_Employee:</b> Operational Profit Per Employee <b>Size:</b> The Scale/Size of the Company <b>ROA:</b> Return on Assets <b>LEV:</b> Debt Ratio		

Source: Organized by Author

### **4.3 Empirical Results of Interactive Effect on Factor-Based Investment**

Table 6 and 7 is the result of hypothesis 3. Among them, table 6 is the result of the multiplication of the fixed assets ratio and human resource variables. As result shown, it is negatively correlated with fixed assets, and positively correlated with the number of employees. The reason for that is the company's fixed assets investment can reduce the idiosyncratic risk. However as the number of employees increase, and regardless of quality and technique, it will more likely to cause the idle assets and then make the company's idiosyncratic to increase. In other words, the multiplication of the fixed assets ratio and operational net profit is positively correlated to each other. It shows the company can earn more net profit when the fixed assets are operated by high quality employees. It makes the company's return of the fixed assets and human resources, and then reduce the operating risk of the company and investor's idiosyncratic risk.

**Table 6: Regression Results of Interaction between Fixed Asset Ratio and Human Resource Variables from each Factor Model.**

	Fixed_Ratio	Fixed_Ratio *Employee	Size	ROA	LEV
<b>Interaction Between Fixed Asset Ratio and Number of Employees</b>					
<b>Panel A One-Factor Model</b>					
T-Value	-2.93	6.55	-36.09	-3.6	18.14
P-Value	0.0034***	<.0001***	<.0001***	0.0003***	<.0001***
Adj R <sup>2</sup>	10.37%				
<b>Panel B Three-Factor Model</b>					
T-Value	-3.54	6.69	-35.06	-1.72	18.41
P-Value	0.0004***	<.0001***	0.0862*	<.0001***	<.0001***
Adj R <sup>2</sup>	9.60%				
<b>Panel C Five-Factor Model</b>					
T-Value	-3.2	6.52	-35.12	-1.29	18.36
P-Value	0.0014***	<.0001***	<.0001***	0.1959	<.0001***
Adj R <sup>2</sup>	9.57%				
<b>The Ratio of Fixed Assets and the Interaction of Profit Per Employee</b>					
	Fixed_Ratio	Fixed_Ratio *OP_Per_ Employee	Size	ROA	LEV
<b>Panel D One-Factor Model</b>					
T-Value	-1.74	-3.95	-36.03	-1.68	17.65
P-Value	0.0812*	<.0001***	<.0001***	0.0932*	<.0001***
Adj R <sup>2</sup>	10.21%				
<b>Panel E Three-Factor Model</b>					
T-Value	-2.32	-3.31	-34.9	-0.17	17.96
P-Value	0.0203**	0.0009***	<.0001***	0.865	<.0001***
Adj R <sup>2</sup>	9.39%				
<b>Panel F Five-Factor Model</b>					
T-Value	-2	-3.29	-35.06	0.21	17.91
P-Value	0.0451**	<.0001***	<.0001***	0.8337	<.0001***
Adj R <sup>2</sup>	9.37%				
* 10% Significant ** 5% Significant *** 1% Significant		<b>Fixed_Ratio:</b> Fixed Asset Ratio <b>Size:</b> Scale/Size of the Company <b>Employee:</b> Number of Employees <b>ROA:</b> Return on Assets <b>OP_Per_Employee:</b> Operating Profit Per Employee <b>LEV:</b> Debt Ratio			

Source: Organized by Author

Table 7 shows the result of the company's rate of change in fixed assets and the number of employees has no significant correlation. The reason for that is possibly caused by too many uncertainties of the company's annual adjustment of fixed assets and investment in human resources, so the result of the interaction is not significant. In other words, the multiplication of the rate of change in fixed assets and operational net profit per employees is also not significant. Although the net profit per employee can reduce the company's risks which is caused by annual adjustment of fixed assets, it could not possibly reduce the caused.

**Table 7: Regression Results of Interaction between the Rate of Change in Fixed Assets and Human Resources Variables from each Factor**

	Change_Fixed_Ratio	Change_Fixed_Ratio* Employee	Size	ROA	LEV
<b>The Interaction between the Rate of Change in Fixed Assets and the Number of Employees</b>					
<b>Panel A One-Factor Model</b>					
T-Value	5.12	0.83	-36.97	-3.99	17.77
P-Value	<.0001***	0.407	<.0001***	<.0001***	<.0001***
Adj R <sup>2</sup>	10.28%				
<b>Panel B Three-Factor Model</b>					
T-Value	4.61	1.08	-35.82	-2.1	18.02
P-Value	<.0001***	0.2802	<.0001***	0.0358**	<.0001***
Adj R <sup>2</sup>	9.45%				
<b>Panel C Five-Factor Model</b>					
T-Value	3.75	1.27	-35.98	-1.59	17.99
P-Value	0.0002***	0.2036	<.0001***	0.1115	<.0001***
Adj R <sup>2</sup>	9.40%				
<b>The Rate of Change in Fixed Assets and the Interaction of Profit Per Employee</b>					
	Change_Fixed_Ratio	Change_Fixed_Ratio* OP_Per_Employee	Size	ROA	LEV
<b>Panel D One-Factor Model</b>					
T-Value	5.25	-0.25	-37.03	-3.97	17.78
P-Value	<.0001***	0.8016	<.0001***	<.0001***	<.0001***
Adj R <sup>2</sup>	10.27%				
<b>Panel E Three-Factor Model</b>					
T-Value	4.84	-0.38	-35.85	-2.07	18.03
P-Value	<.0001***	0.7044	<.0001***	0.0385**	<.0001***
Adj R <sup>2</sup>	9.45%				
<b>Panel F Five-Factor Model</b>					
T-Value	3.87	0.18	-36	-1.57	17.99
P-Value	0.0001***	0.8592	<.0001***	0.116	<.0001***
Adj R <sup>2</sup>	9.39%				
*10% Significant ** 5% Significant *** 1% Significant		<b>Change_Fixed_Ratio:</b> Rate of Change in Fixed Assets <b>Employee:</b> Number of Employees <b>OP_Per_Employee:</b> Operational Profit Per Employee <b>Size:</b> Scale/ Size of the Company <b>ROA:</b> Return on Assets <b>LEV:</b> Debt Ratio			

Source: Organized by Author

#### 4.4 Additional Test

##### 4.4.1 Sensitivity Analysis

The company's fixed assets and human resources are important production factors of the company, and the amount of investment in both production factors will affect the company's risk. If the company cannot master the two production factors, when the investor invests in the company, its risks will be passed on to investors, and will turn into idiosyncratic risks of the company. Among the two factors of production, the factor of human resources is more difficult to grasp. This study uses two variables, the number of employees and the business benefit per employee to measure human resources, but it is still difficult to find the impact of the company's human resources on idiosyncratic risks, and It is also difficult to find out the relationship between the interaction between human resources and fixed assets and the idiosyncratic risk of investors. Therefore, this study adds the two human resource variables of sales per employee and gross profit per employee, and then tests the interaction results of fixed assets and human resources. Its variables are explained as follows:

1. The business benefit that each employee can earn for the company is used as a proxy for human resources. The formula is as follows:

**$SPE_{i,t} = \text{business benefit} / \text{number of employees}$**

2. Measured by the gross profit that each employee can make for the company, the formula is as follows:

**$GPPE_{i,t} = \text{gross profit} / \text{number of employees}$**

Table 8 shows the empirical results of each employee's operating income and each employee's operating gross profit under each factor model. The research results show that if the operating income per employee is a human resource variable, it will show negative significant relationship with the idiosyncratic risk; if the operating gross profit per employee is tested, it will show a positive significant relationship with the idiosyncratic risk. In other words, the higher the operating profit brought by each employee to the company, the higher the idiosyncratic risk, indicating that the company needs to consider the quality of each employee and appropriately adjust the cost of investing in human resources to make sure the risk can be reduced.

**Table 8: Regression results of additional tests of human resources on idiosyncratic risk from each factor model**

	Sales_Per_Employee	Size	ROA	LEV	Year
<b>Independent variable is operating income per employee</b>					
<b>Panel A One-Factor Model</b>					
T-value	0.58	-36.33	-5.82	16.9	Included
P-value	0.5608	<.0001***	<.0001***	<.0001***	Included
Adj R <sup>2</sup>	17.54%				
<b>Panel B Three-Factor Model</b>					
T-value	0.35	-35.16	-3.25	17.45	Included
P-value	0.7248	<.0001***	0.0011***	<.0001***	Included
Adj R <sup>2</sup>	15.71%				
<b>Panel C Five-Factor Model</b>					
T-value	0.03	-34.9	-3.02	17.13	Included
P-value	0.975	<.0001***	0.0025***	<.0001***	Included
Adj R <sup>2</sup>	13.77%				
<b>Independent variable is gross profit per employee</b>					
	GP_Per_Employee	Size	ROA	LEV	Year
<b>Panel D One-Factor Model</b>					
T-value	3.66	-36.92	-6.26	16.99	Included
P-value	0.0002***	<.0001***	<.0001***	<.0001***	Included
Adj R <sup>2</sup>	17.61%				
<b>Panel E Three-Factor Model</b>					
T-value	3.69	-35.78	-3.7	17.52	Included
P-value	0.0002***	<.0001***	0.0002***	<.0001***	Included
Adj R <sup>2</sup>	15.79%				
<b>Panel F Five-Factor Model</b>					
T-value	2.84	-35.46	-3.36	17.18	Included
P-value	0.0045***	<.0001***	0.0008***	<.0001***	Included
Adj R <sup>2</sup>	13.81%				
*10% significant **5% significant ***1% significant		GP_Per_Employee: Gross profit per employee <b>LEV:</b> debt ratio <b>ROA :</b> Return On Asset <b>Size:</b> the scale/size of the company <b>Year:</b> Sum of i company research period			

Source: Organized by Author

Table 9 is the result of the interaction between fixed assets and the operating income per employee and the operating gross profit per employee. The results show that if the operating income per employee interacts with fixed assets ratio, it will change from a negative significant correlation to a positive correlation, but it is not significant; if it interacts with the operating gross profit per employee, it will be a positive correlation. It means that the company will invest in education and training resources in order to allow employees to operate the equipment. The higher the gross profit earned by each employee for the company, the higher the cost of employee training and education per unit, thus increasing the idiosyncratic risk. Therefore, when investing in human resources, the company needs to evaluate the quality of each employee and adjust the cost of human resources appropriately so that each employee can earn the company's maximum profit for the unit.

**Table 9: Additional test results of interaction between fixed asset ratio and human resources from each factor model**

	Fixed_Ratio	Fixed_Ratio* Sales_Per_Employee	Size	ROA	LEV	Year
<b>Interaction between fixed asset ratio and operating income per employee</b>						
<b>Panel A One-Factor Model</b>						
T-value	-4.3	1.5	-36.04	-5.56	17.15	Included
P-value	<.0001***	0.1342	<.0001***	<.0001***	<.0001***	Included
Adj R <sup>2</sup>	17.63%					
<b>Panel B Three-factor Model</b>						
T-value	-4.6	1.09	-34.81	-3.01	17.7	Included
P-value	<.0001***	0.2777	<.0001***	0.0026***	<.0001***	Included
Adj R <sup>2</sup>	15.83%					
<b>Panel C Five-Factor Model</b>						
T-value	-4.02	1.15	-34.66	-2.78	17.32	Included
P-value	<.0001***	0.2483	<.0001***	0.0054***	<.0001***	Included
Adj R <sup>2</sup>	13.86%					
<b>Interaction between fixed asset ratio and net profit per employee</b>						
	Fixed_Ratio	Fixed_Ratio* GP_Per_Employee	Size	ROA	LEV	Year
<b>Panel D One-Factor Model</b>						
T-value	-4.33	1.97	-36.29	-5.88	17.27	Included
P-value	<.0001***	0.0489**	<.0001***	<.0001***	<.0001***	Included
Adj R <sup>2</sup>	17.64%					
<b>Panel E Three-Factor Model</b>						
T-value	-4.74	2.1	-35.15	-3.33	17.82	Included
P-value	<.0001***	0.0361**	<.0001***	0.0009***	<.0001***	Included
Adj R <sup>2</sup>	15.85%					
<b>Panel F Five-Factor Model</b>						
T-value	-4.15	2.14	-34.98	-3.11	17.44	Included
P-value	<.0001***	0.0324**	<.0001***	0.0019***	<.0001***	Included
Adj R <sup>2</sup>	13.88%					
*10% significant **5% significant ***1% significant			<b>Fixed Ratio:</b> Fixed Asset Ratio <b>ROA:</b> Return On Asset <b>GP_Per_Employee:</b> Gross Profit per Employee <b>LEV:</b> Debt Ratio <b>Size:</b> the scale/size of company <b>Year:</b> Sum of i company research period			

Source: Organized by Author

Table 10 is the result of the interaction between the company's fixed asset change rate and the operating income per employee and the operating gross profit per employee. Empirical evidence shows that the original fixed asset change rate was negatively significantly related to idiosyncratic risks, but after interacting with the company's operating income showing a negative significant correlation. It means that the company's annual adjustment of the amount of fixed assets will bring risks to the company, and then turn into idiosyncratic risks. However, the more operating income the company earns each year, the more it can reduce the company's risk. Therefore, when the company is engaged in the decision to adjust fixed assets, it needs to consider the company's operating income in the previous year and make appropriate adjustments so that the company's fixed assets can bring business benefits to the company; the interaction between fixed assets change rate and the operating gross profit of each employee is negative, but not significant, which shows that the operating gross profit of each employee can reduce the company's risk of adjusting fixed assets every year in accordance with company policies.

**Table 10: Additional test results of interaction of fixed assets change rate and human resources from each factor model**

	Change_Fixed_Ratio	Change_Fixed_Ratio* Sales_Per_Employee	Size	ROA	LEV	Year
<b>Interaction between fixed assets change rate and operating income per employee</b>						
<b>Panel A One-Factor Model</b>						
T-value	7.12	-3.5	-36.55	-6.43	17.08	Included
P-value	<.0001***	0.0005***	<.0001***	<.0001***	<.0001***	Included
Adj R <sup>2</sup>	17.81%					
<b>Panel B Three-Factor Model</b>						
T-value	6.72	-3.48	-35.41	-3.82	17.62	Included
P-value	<.0001***	0.0005***	<.0001***	0.0001***	<.0001***	Included
Adj R <sup>2</sup>	15.97%					
<b>Panel C Five-Factor Model</b>						
T-value	5.51	-3.12	-35.21	-3.46	17.26	Included
P-value	<.0001***	0.0018***	<.0001***	0.0005***	<.0001***	Included
Adj R <sup>2</sup>	13.94%					
<b>Interaction between fixed assets change rate and the gross profit per employee</b>						
	Change_Fixed_Ratio	Change_Fixed_Ratio* GP_Per_Employee	Size	ROA	LEV	Year
<b>Panel D One-Factor Model</b>						
T-value	5.96	-1.13	-36.6	-6.41	17.01	Included
P-value	<.0001***	0.2585	<.0001***	<.0001***	<.0001***	Included
Adj R <sup>2</sup>	17.75%					
<b>Panel E Three-Factor Model</b>						
T-value	5.66	-1.32	-35.45	-3.8	17.55	Included
P-value	<.0001***	0.1876	<.0001***	<.0001***	<.0001***	Included
Adj R <sup>2</sup>	15.91%					
<b>Panel F Five-Factor Model</b>						
T-value	4.47	-1.01	-35.26	-3.45	17.19	Included
P-value	<.0001***	0.3145	<.0001***	0.0006***	<.0001***	Included
Adj R <sup>2</sup>	13.89%					
*10% significant **5% significant ***1% significant		<b>Change_Fixed_Ratio:</b> Fixed asset change ratio <b>ROA:</b> Return On Asset <b>Size:</b> the scale/size of the company <b>LEV:</b> Debt Ratio <b>GP_Per_Employee:</b> Gross Profit per Employee <b>Year:</b> Sum of i company research period				

Source: Organized by Author

#### **4.4.2 Financial Restrictions**

According to the theory of financing sequence proposed by Myers (1984), the company will first use the internal capital with the least cost to conduct the company's investment behavior. If the company's internal funds are insufficient, the company will switch to debt. Finally, it will issue new shares to raise funds to invest in the company. The limitations of this study are (1) if the company only uses its own funds for factor investment, the company does not need to worry about the problem of adverse selection in information asymmetry. However, if the company's factor investment is too large, it may cause the company's own funds are insufficient and restricted, which in turn results in idiosyncratic risks of investing in the company. (2) If the company raises funds by means of debt to invest in the company's factor investment, it is likely to cause the company to borrow too much, the financial leverage will be unbalanced, and the company must first repay its liabilities when it makes a profit, and investment investors can then enjoy the company's profits, so investors will measure the company's debt ratio and solvency when they invest in the company to avoid idiosyncratic risks when investing in the company. (3) If the company invests in its elements by borrowing and issuing new shares to raise funds, from the perspective of the financing order theory, the cost of raising funds outside is higher than the cost of using internal funds. The reason is that the company has no adverse choice in using internal funds. However, if debt is raised and new shares are raised to raise funds for investment, the company's investment efficiency will be insufficient due to its transaction costs, supervision and restrictions by external investors and the funds will not be used effectively.

### **5. Conclusion**

Fixed assets and human resources play an important role in decision-making of the company. Every decision of purchase and sale on the fixed assets has considerable amount. If the decision is not made carefully, the risks of company will gain and the investors will be affected. Moreover, human resources have always been a company's resource that is difficult to control, due to the uncertainty of human and information asymmetry. Those reasons will cause the company paying a huge cost to control. Therefore, if the company can not accurately grasp the human resources, it will make the risk of the company's operation to increase. Hence, This research discusses whether the company's decision on fixed asset and human resources will affect the company's risk from the perspective of investors, and if it affects, whether the risk will be transferred to investors as idiosyncratic risk.

As results discovered in the research:

1. Fixed assets and idiosyncratic risk shows significant correlation. In terms of inventory, it shows significant negative correlation. In other words, the company can diversify the risk by turning the funds into fixed assets. In terms of changes, it shows significant positive correlation, which means adjusting the amount of fixed assets as operational risks are considered every

- year.
2. Human resources investment is significantly associated to idiosyncratic risk. In terms of the number of employees, it is positively correlated with the idiosyncratic risk. It means that the more employees the company has, the more difficult for the company to control. In other words, if it is based on the net profit of each employee, then the idiosyncratic risk is negatively correlated, which indicates that the more net profit each employee earns, the higher quality of human resources.
  3. Human resources can adjust the effects between fixed assets and idiosyncratic risk.

The meaning of practice in this research is as follows:

1. It is recommended that companies should carefully consider the size of the company when investing in human resources, in order to avoid over hiring and cause the difficulty to manage.
2. It is recommended that the company should invest in new techniques and conduct employee training simultaneously, in order to avoid incompetent employee to operate fixed asset, and then cause the waste of resources.
3. It is recommended that the company should carefully adjust making decisions of investing in fixed assets, in order to avoid the gain of the company's risks.

The limitations of this study are as follows:

1. The data of this research is only based on listed company. It does not include any other non-listed company.
2. The applied factors are fixed assets and human resources of the company's production factors. It never mentions other factors.
3. Human resources contain many other factors. In this study, only the number of employees and net profit per employee are discussed.

## **References**

- [1] Wang, L. J. 2008. Organize the risk of human resources recruitment and preventive countermeasures, *Journal of Shanxi Institute of Economic Management*, 16(4), 7-8.
- [2] Wang, T. H. 2014. The Correlation between the Quality of Financial Statements and the Idiosyncratic Risk – Evidence from the Post-Sabbin Period. Ph.D. Thesis, Institute of Accounting, Feng Chia University, Taichung City.
- [3] Wang, T. S. 2005. An Empirical Study of Taiwan's Human Capital and Per Capita Real GDP: An Empirical Study of Transnational Comparative Regions,

- Unpublished master's thesis at the Institute of Finance, Shih Hsin University, Taipei.
- [4] Wun, H. C. 2006. Research of Enterprise Human Resources and Risk Management, *Business Modernization*, 462, 241-242
  - [5] Chu, C. C. 2009. Common Mistakes and Disadvantages in Enterprise Management of Fixed Assets, *Market Modernization*, 10 (580), 30.
  - [6] Tong, X. 2010. Global Financial Crisis of Systemic and Non-Systemic Risks, *Business Modernization*, 613,1.
  - [7] Li, Q. and Wang, G. S. 2005. Human Resources Risk of Corporate Mergers and Acquisitions, *Hunan Nonferrous Metals*, 21 (6), 57-60.
  - [8] Lin, H. L., Chen, C. T., and Chuang, W. P. 2002. Entry, Exit and Market Contestability Evidence from Taiwan's Manufacturing Sector. *Taiwan Economic Review*, 30(4),491-530
  - [9] Lin, S. H., Chao, Y. I., Cho, T. Y. and Cheng, T. J. 2012. Determinants of Fixed Asset Sales and Its Impact on Performance, *Journal of Accounting and Corporate Governance*, 8(1), 47-76
  - [10] Lin, C. H., Chen, H. M. and Wang, L. H. 2012. The Effects of Corporate Governance Mechanisms on Idiosyncratic Risk, *Journal of Management and Business Research*, 27(5), 409-435
  - [11] Kao, Y. K., Yang, P. L. and Kao, K. L. 1990. Taiwan Enterprise Competitive Behavior, *Management Review*, 9, 5-27
  - [12] Qin, B. K. and Xu, X. 2010. Analysis of Enterprise Fixed Assets Management, *Business Culture*. 2010(1), 25.
  - [13] Chen, C. H. and Ren, Z. L. 2005. Enterprise Human Capital Investment and Control, *Business Modernization*, 450, 320-321.
  - [14] Chen, S. S., Liu, Z. C., Want, M. C. and Huang D. T. S. 2011. Human Capital, Management Quality and Economic Value Added-Evidences from Taiwan Electronic Information Industry, *Journal of Valuation*, 5, 35-56.
  - [15] Chen, X. N. 2010 Discussion on the Issue of Enterprise Fixed Asset Management. *Modern Commerce*, 7B, 112-114.
  - [16] Huang, T. F. 2012. The Financial Crisis Warning of High Fixed Assets Company - The application of Data Envelopment Analysis Method, National Tsing Hua University Institute of Technology Management MBA Unpublished Master Thesis, Hsinchu City.
  - [17] Huang, I. H. 2011, Cause and Consequence of Real Earning Management, Value Relevance of Earnings on Idiosyncratic Risk, Feng Chia University, Master of Accounting Unpublished Master Thesis, Taichung City.
  - [18] Liu, S. F. and Shiu, W. Y. 2006. The Relationship between CEO Compensation and Firm Risk in Taiwan, *Journal of Risk Management*, 8(1), 35-47
  - [19] Guo, D. M. 2010. Discussion on Enterprise Fixed Assets Management, *China Economist*, 2010 (4), 181-183.
  - [20] Liang, T. 2005. On the Risk Management of Human Resources, *Climbing*, 24(3), 66-67.

- [21] Cui, Y. Q. 2010. Discuss the Issue of Enterprise Fixed Asset Management, *Modern Business*, 2009(7B), 129.
- [22] Yang, W. C. 2018. The Impact of Production Factors on Corporate Valuation. Feng Chia University, Master of Accounting Unpublished Master Thesis, Taichung City.
- [23] Zhang, X. L. and Zhong, W. 2010. Discussion of Enterprise Human Resources Risk Management. *SME Management and Technology*, 2010(5C).
- [24] Chang, E. Y. 2011. The Relationship among Production Factors and Economic Development: Highly Competitive Nations as an Example. National Taiwan Normal University Department of Technology Application and Human Resource Development Unpublished Master Thesis. Taipei City.
- [25] Chang, H. C. 2001. Investment Can Affect the Stock Price Discount to Control Profit and Loss - the Impact of Fixed Assets on Stock Prices From the Fourth Job Stoppage. *Accounting Research*. 184, 91-95
- [26] Zhang, Y. 2005. Discussion of the Measurement of Human Resources Value, *Journal of Gui Zhou College of Finance and Economics*.2005(3), 43-45
- [27] Lu, J. J. and Ning, X. X. 2007. The SAVE methods for Human Capital Investment Risk Decision Making, *Business Modernization*, 520. 162-164.
- [28] Ou, C. S., Chen, P. S. and Li, K. F. 2004. The Business Value of Training Activities of Taiwan Information and Electronics Industries, *Journal of Human Resource Management*, 4(4), 51-72
- [29] Ou, C. S., Li, T. T., and Li, K. F. 2016. Interacting Effects of Training Activities, Capital Intensity and Organization Performance: Evidence from Information and Electronics Industries, *Journal of Accounting Review*, 62, 111-142.
- [30] Ashbaugh, H., D. W. Collins & R. LaFond. 2004. Corporate Governance and the Cost of Equity Capital, University of Wisconsin, United States – Wisconsin.
- [31] Barth, M. E., Konchitchki Y. and Landsman W. R. 2013. Cost of capital and earnings transparency, *Journal of Accounting and Economics*, 55(2-3), 206-224.
- [32] Barro, R. J., and Lee J. W. 1993. International comparisons of educational attainment, *Journal of Monetary Economics*, 32, 363-394.
- [33] Barro, R. J. 1990. Government spending in a simple model of endogenous growth, *Journal of Political Economy*, 98(5), 103-125.
- [34] Bai, C. E., Q. Liu, Lu, J., Song, F. M. and Zhang, J. (2004). Corporate Governance and Market Valuation in China, *Journal of Comparative Economics*, 32(4), 599-616.
- [35] Bessant, J., and Buckingham, J. 1989. Implementing integrated technology, *Technovation*, 9(4), 321-333.
- [36] Bartov, E. 1993. The timing of asset sales and earning manipulation, *The Accounting Review*, 68(4), 840-855.
- [37] Beatty, R. P. and Edward J. Z. 1994. Managerial Incentives, Monitoring, and Risk-Bearing: A Study of Executive Compensation, Ownership, and Board

- Structure in Initial Public Offerings, *Administrative Science Quarterly*, 39, 313-335.
- [38] Blose, L. E. and Shieh, J. C. P. 1997, Tobin's Q-Ratio and Market Reaction to Capital Investment Announce, *Financial Review*, 32(2), 449-476.
- [39] Buchanan, B. 1974. Building Organizational Commitment: The Socialization of Managers in Work Organizations, *Administrative Science Quarterly*, 19, 533-546.
- [40] Christoffersen, S., Datta, A. and Malhotra, D. K. 2002. Productivity in the textile industry, Union College, United States – New York.
- [41] Chauvin, W., and Hirschey, M. 1993. Advertising, R&D expenditures and the market value of the firm, *Financial Management*, 2, 128-140.
- [42] Cheng, C. S., and Collins D. and Huang H. H. 2006. Shareholder Rights, Financial Disclosure and the Cost of Equity Capital, *Review of Quantitative Finance and Accounting*, 27(2), 175-204.
- [43] Chen, H. L., and Guo, R. J. 2005. On corporate divestiture, *Review of Quantitative Finance and Accounting*, 24(4), 399-421.
- [44] Delery, J. E., and Doty, D. H. 1996. Modes of theorizing in strategic human resource management: Tests of universalistic, contingency and configurational performance predictions, *Academy of Management Journal*, 39(4), 802-835.
- [45] Datta, D. K., and Guthrie J. P. and Wright, P. M. 2005. Human resource management and labor productivity: Does industry matter?, *Academy of Management Journal*, 48(2), 135-145.
- [46] Diamond, D. W., and Verrecchia R. E. 1991. Disclosure, liquidity, and the cost of capital, *Journal of Finance*, 46(4), 1325–1359.
- [47] Edvinsson, L. and Malone, M. S. 1997. Intellectual capital: realizing your company's true value by finding its hidden roots, New York: Harper Collins.
- [48] Elston, J. A. and Goldberg L. G. 2003. Executive Compensation and Agency Costs in Germany, *Journal of Banking & Finance*, 27(7), 1391 -1410.
- [49] Ferreira, M. A. and Laux, P. A. 2007. Corporate Governance, Idiosyncratic Risk, and Information Flow, *Journal of Finance*, 62(2), 951-990.
- [50] Gaspar, J. M. and Massa, M. 2006. Idiosyncratic Risk and Product Market Competition, *Journal of Business*, 79(6), 3125-3152.
- [51] Gray, S. R. and Cannella, A. A. Jr. 1997. The Role of Risk in Executive Compensation, *Journal of Management*, 23, 4, 517- 540.
- [52] Hansen, D. R. and Mowen, M. M. 2000. Management accounting, South Western College Publishing, United States - Cincinnati Ohio.
- [53] Howell, R. A., and Soucy, S. R. 1987. Capital investments in the new manufacturing environment, *Management Accounting*, 69(5), 26-32.
- [54] Hendricks, J. A. (1988). Applying cost accounting to factory automation, *Management Accounting*, 70(6), 24-30.
- [55] Healy, P., Hutton A. and Palepu, K. 1999. Stock performance and intermediation changes surrounding sustained increases in disclosure, *Contemporary Accounting Research*, 16(3), 485-520.

- [56] Healy, P., and Wahlen, J. 1999. A review of the earnings management literature and its implications for standard-setting, *Accounting Horizons*, 13(4), 365-383.
- [57] Himmelberg, C. P., Hubbard, R. G. and Palia, D. 1999. Understanding the Determinants of Managerial Ownership and the Link between Ownership and Performance, *Journal of Financial Economics*, 53(3), 353-384.
- [58] Herrmann, D., Inoue, T. and Thomas, W. B. 2003. The sale of assets to manage earnings in Japan, *Journal of Accounting Research*, 41 (1), 89-108.
- [59] Hart, O. 1983. The Market Mechanism as an Incentive Scheme, *Bell Journal of Economics*, 14(2), 366-382.
- [60] Jeltjevan der Meer-Kooistra, J., and Zijlstra S. M. 2001. Reporting on intellectual capital, *Accounting, Auditing & Accountability Journal*, 14, 456-476.
- [61] Jin, L. and Myers S. 2006. R2 around the World: New Theory and New Tests, *Journal of Financial Economics*, 79(2), 257-292.
- [62] Jagannathan, R. and Srinivasan, S. B. 2000. Does Product Market Competition Reduce Agency Costs?, *National Bureau of Economic Research, United States – Cambridge*.
- [63] Jensen, M. C. & W. H. Meckling. (1976). Theory of the Firms: Managerial Behavior, Agency Cost, and Ownership Structure, *Journal of Financial Economics*, 3(4), 305-360.
- [64] Koch, M. and McGrath R. G. 1996. Improving labor productivity: HRM policies do matter. *Strategic Management Journal*, 17(5), 335-354.
- [65] Kothari, S.P. 2000. The role of financial reporting in reducing financial risks in the market. *Building an Infrastructure for Financial Stability*, edited by E. S. Rosengren & J. S. Jordan. *Federal Reserve Bank of Boston Conference Series*, 44, 89-102.
- [66] Kerr, J. L. and Kren L. 1992 Effect of Relative Decision Monitoring on Chief Executive Compensation, *Academy of Management Journal*, 35, 2, 370-397.
- [67] Leibenstein, H. 1966. Allocative Efficiency VS. "X-Efficiency", *American Economic Review*, 56(3), 392-415.
- [68] Polakoff, J. C. 1990. Factory floor layout: Catalyst for change, *Management Review*, 79(11), 33-36.
- [69] Mithas, S. and Whitaker, J. 2007. Is the world flat or spiky? Information intensity, skills, and global service disaggregation, *Information Systems Research*, 18(9), 237-259.
- [70] Mainga, W. and Hirschsohn P. and Shakantu, W. 2009. An exploratory review of the relationship between enterprise training and technology upgrading: Evidence from South African manufacturing firms, *International Journal of Human Resource Management*, 20(9), 1879-1895.
- [71] Machlup, F. 1967. Theories of the Firm: Marginalist, Behavioral, Managerial, *American Economic Review*, 57(1), 1-33.
- [72] Meindl, J. R., Ehrlich, S. B. and Dukerich J. M. (1985). The Romance of Leadership, *Administrative Science Quarterly*, 17, 371-381.

- [73] Nickell, S. J. (1996). Competition and Corporate Performance, *Journal of Political Economy*, 104(4), 724-746.
- [74] Qu, W. G., Pinsonneault, A. and Oh, W. 2011. Influence of industry characteristics on information technology outsourcing, *Journal of Management Information Systems*, 27(1), 99-128.
- [75] Richard, O. C. and Johnson, N. B. 2001. Strategic human resource management effectiveness and firm performance, *International Journal of Human Resource Management*, 12(2), 299-310.
- [76] Rajgopal, S. and Venkatachalam M. 2011. Financial reporting quality and idiosyncratic return volatility, *Journal of Accounting and Economics*, 51(1-2), 1-20.