# Effect of Korean Discount factors on Korean stock valuation

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## Abstract

Korean Discount symptom has been a significant issue in Korea for last few decades. Basically, it means that the Korean Stock market is depreciated overall compared to other stock markets. This paper delves into whether there is a statistically significant relationship between the Korean discount factors and the stock market valuation. I use the event study method for finding causality and P/E ratio for the valuation of stock market. There are two datasets, one by comparing few representative companies in countries such as SEC(Samsung Electronics) for Korea, and the other by comparing the component stocks of semiconductor ETF between Korea and US. My paper found that either way there is significant causality between the factor and the valuation. This founding can be important since it could suggest that there is devaluation in Korean stock market and we could make some political actions regarding elimination of the Korean discount factor or at least diminishing the effect.

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# 1 Introduction

## 1.1 Background

Korean stock market has been considered as a typical low-growing market for decades. Korea Composite Stock Price Index(KOSPI) has grown 21.12% for last 5 years which is far below than 79.19% of S&P 500 for the same period(April 12, 2019 ~ April 9, 2024). There has been a controversy about the reason of this phenomenon, but the most plausible opinion was so called “Korean Discount.” It explains by the macroeconomic factors mostly by potential war risk due to North Korea, and microeconomic reasons such as the governance problem. I can specify the reason by low shareholder return, financial properties of each firm, governance structure. I ask to what extent these factors really affect the valuation of Korean stocks, knowing that stock prices, which is the value of firm is based on, is influenced by diverse factors.

## 1.2 Organization of paper

I distinguish Korean discount factors by macro factor, which is North Korea military risk and micro factor, which will be the governance problem of Korean firm. I will use a event study analysis to evaluate the effect of treatment where treatments would be the discount factors. The reason I use this methodology instead of difference-in-difference method is because the number of control group components will be too little for the DiD method. Also, event analysis will be a better method to find the overall trend of the stock values and find the effect of Korea discount factor. The control groups’ stock values should not depend on the factors.

For the control and experimental group, I will compare by using 2 ways, First is

comparing the few companies that represents the whole industry(or maybe country). For example, I will use Samsung Electronics(SEC)' P/E ratio as a representative for Korea Stock Market(specifically it would be Korea semiconductor industry)'s or Korea stock value. The control groups would be companies that SEC declared as their competitors in their Earnings report. These companies will be P/E ratios of Apple, Huawei, Sony, Xiaomi, TCL technology. Secondly, I will consider the semiconductor ETF. To be specific, I will make an index according to the firms that comprises KODEX Semiconductor ETF for Korea and ProShares Ultra Semiconductor ETF for US. So, I will make KSEM(Korea Semiconductor) index by mixing SEC, SK Hynix, HANMI and USEM index by mixing NVDA(Nvidia), AMD(Advanced Micro Devices), INTC(Intel), QCOM(Qualcomm), TXN(Texas Instruments), AMAD(Applied Materials). For the weight when mixing and making an index, I could have considered the weights according to the ETF Fact Sheet. However, I couldn't find the weight at the exact event date(06/20/2020) but only the latest date(12/31/2023). So, I thought using it could be less accurate due to data scarcity and tried to set a more statistical way. I set a new variable to control for each company so that we can find the coefficient of each firm in the model. This will be more specifically mentioned at the **6 Research Design** section since this is also connected to dummy variables in my model.

At first, I was going to divide the treatment/control group, but then it would be hard to compare the effect of each discount factors since it is divided into 2 types. The reason I use specific stock instead of using industry index is that firstly Korean Stock market(KSE) is really a few-company concentrated market so there will be little difference between those two, and secondly it would be easier to evaluate the effect of micro discount factor. Also, I can use this method for other industries such as using

Hyundai Motors. Vs. Toyota, Volkswagen, GM, etc for comparing within automobile industry.

# 2 Literature Review and regarding problems

## 2.1 Literature Review

This paper will be regarding with Korean stock value and Korea's macro/micro events. For macro factor, I will use North Korea risk which can be also called as geopolitical factor. Micro factor will be governance issues like low shareholder return and problems with holding company. There is some suggestion from In-Bong Ha et al.(2000) that sudden decline of Korean stock market is because of fundamental components like earnings and time-varying discount factors rather than non-fundamental factors like Korean discount factors. However, this could be just regarding to unusual situations like the sudden decline in Korea's financial crisis. Also, micro discount factor could be effecting the stock value by harming the fundamentals of stock, such as earnings, number of stocks, etc, and this could effect the valuation in the long term and could be hard to detect.

Jin Park et al.(2019) and Jiyoung Park et al.(2022) both shows that there is clearly a discount factor regarding holding company. To be specific, Jiyoung Park et al.(2022) shows that value of the holding company is smaller than sum of its subsidiaries, which means it is discounted. They also suppose that the discount phenomenon increases as number of listed subsidiaries increases. Taejin Jung et al.(2022) also supposes that governance factor was the only one factor positively correlated with BTM, the index they used as stock valuation. According to Romain Ducret et al.(2020), large conglomerate group owners, also known as 'Chaebols', are not in charge of the

Korean discount, they also say the existence of Korea discount is for real. Although there are some subtle differences in their conclusions, it seems evident that there exists a discount in Korean stock valuation regarding governance issues of each Korea firms.

About the North Korea geopolitical risk, papers are at odds each other. Yun Jung Park et al.(2015) notes that North Korea related news has an impact on both NYSE and KOSPI by machine learning method. They categorized the impact by direct/indirect and found that direct impact on NYSE was laker than indirect effects on KOSPI. Inho Lee et al.(2020) also studied whether there are positive impacts of inter-Korea or North Korea-United States summits on related Korean stocks and found that there Ire some significant effects. They divided their portfolios into 3 groups who Ire related construction of North Korea, inter-Korean economic cooperation, and defense industry. The result was that after the summit announcement, the first two reacted positively while the latter reacted negatively. It was also interesting that the portfolios reacted even before the agreements of summit. On the other hand, Byung-Yeon Kim et al.(2014) points out that North Korean military events have almost no significant effect on Korea’s financial market as a whole. The strongest effect it had was in October 2006, but it only affected the foreign currency market.

On the methodological perspective, I considered a lot from the baseline model made by Romain Ducret et al.(2020). I could have used it because they were also using EP(Earnings-to-price) ratio as a result, which is basically opposite of PE ratio, doing an regression model on it and using a dummy variable for that. Also, Taboga, Marco (2021) brought up the collinearity problem when setting a dummy variable in a econometric baseline model.

## 2.2 Limitation and Problems

One problem with the Korean discount is that it is so hard to evaluate the real value of Korean stocks. It is evident most people use P/E ratio as their index, but there are also some people who studies on other indicators. Jungwon Suh et al.(2006) bases their studies on P/CF ratios because it is not affected by distortions that happen due to difference of accounting system betIen countries. Meeok Cho et al.(2021) points out that the volatility of V/P(Value/Price) ratio decreases after IFRS has been adopted so they suppose IFRS adoption as a resolution of Korea discount.

Another problem is that the causality effect is ambiguous. It firstly happens because the definition of stock value is not clear, but it also happens just because the causality is unclear. This can be happening because I am evaluating value based on KRW(Korean domestic currency). With this literature, I am trying to clarify the existence of Korean discount phenomenon recently and whether the factors really cause undervaluation of Korean stocks.

# 3 Data and Modeling

## 3.1 Data

I am interested in the stock price and earnings so that I can use P/E ratio which will represent the valuation of the firms. For the individual stock price information, I will be using data at S&P Capital IQ(here, for example as Samsung). The interval of the data will be weeks or months since it will take time for the news to get effect on the stock prices. Also, some of the firm's P/E ratio that I use had only recent data since it was founded recently. They are companies like Xiaomi. To solve this problem, I tried to find a date that happened recently. As a result, I used the date, "June 16, 2020", which is the date when the North Korea exploded the liaison office at Kaesong. This was a big issue since the relationship between S.Korea and N.Korea seemed to be getting better at then. I set the one-side interval to be 40 days, which would be 8 weeks not including the weekends. For the dates that has no data, I just got rid of all that date's data so that I can use only the dates that have all firm's P/E.

For specific information about the company, I used DART(Data Analysis, Retrieval and Transfer System, here) for Korea firms and statistica.com(here) for other countries. I needed this data because I had to verify whether one firm can represent one industry in specific country. This is the data I needed for the first method('SEC vs. competitors' framework). For the second methodology(KSEM vs. USEM), I used top 10 data from KODEX Semiconductors ETF from Samsung Asset Management(here) and ProShares Ultra Semiconductors ETF from ProShares(here). The date was as of December 31, 2023.

For the exchange rate data, I will use Global Financial Data(here) if I necessarily need

it. I can also get some data from OECD about Korea's GDP growth rate as a index to show how much KOSPI is doing good compared to Korea's "real growth rate"(here). I will also find some brief number of COVID-19 patients on Our World in Data(here) in order to find the trend of COVID-19 to figure out its effect on stock markets. That kind of effects could have generated errors in the effects that I am trying to find. Further explanation is mentioned in the **5 Personal Approach** section. News about the governance issues of individual firms can be verified in many kinds of journals such as Korean domestic journals(here) or international journals(here).

## 3.2 Personal Approach

As I pointed out above, one problem about the existing literatures is the ambiguity in the valuation of stocks. To solve this kind of problem, I will examine every kind of indexes that represent as a valuation. For example, I will verify not only P/E ratios but also P/CF ratio, BTMs, and P/B ratios. In case of P/CF ratio, the paper has been quite a while(2006) so there could be new thing if I check again with a new recent data to find trend.

Another problem is concerning currency. Since I will be considering the effects of macroeconomic shocks on Korean stock market, I should be careful about currencies. I thought of two ways to solve this problem. One is unifying every currency into USD. For example, Byung-Yeon Kim et al.(2014) noted that the strongest effect of geopolitical risk factor was on foreign currency market, so if I convert the stock prices in KOSPI from KRW to USD, then I can make some new results though it would be same data. Another solution is changing the industry, so just changing both the treatment/control group. I have thought using some data from companies that are dual listed in Korea and US but there were some problems concerning this. Firstly, there

were few companies that are dual listed, and secondly according to the Efficient Market Hypothesis, the discount effect in the data could be reduced because of the arbitrage effect. Lastly, it also has the foreign currency issue since one of the main reasons for Korean discount is restriction of the foreign exchange market(you can check over here). We can solve a little bit by integrating the unit to USD, but I think it will be better to expand the types of industries and find the average between them so that I can calculate the overall effect. Or we can also find that the Korean discount effect varies from industries to industries just like how Inho Lee et al.(2020) divided the treatment groups into three types that are directly connected to N.Korea military risks such as defense industry, construction industry, and others.

There would be another concern about the COVID-19 effect. Since the date I set for the N.Korea military risk event, June 2020, in the COVID-19 period, it seems the COVID-19 effect on the stock market is making some errors in the model. To be specific, if significant COVID-19 event happened in my data period, then it would be making some difference in P/E ratio that would not be because of Korean discount factor. So, if that's the case, I should put COVID-19 factor in my model to control that event effect. For the COVID-19 event, I used number of newly confirmed COVID-19 cases per million people data from Our World in Data(here) and focused on dates when it increased or decreased dramatically. The dates were approximately January 2022(US), February 2022(South Korea) and December 2022(China). My dataset period was exactly April 21, 2020 ~ August, 11 2020. So, the COVID-19 event was not overlapping with my dataset period and I could say I would not need an additional control factor for my model. This is because I am comparing the data within COVID-19 period and its effect on my dataset is not partial and just every data is affected. As

a result, the effect would be naturally erased when analyzing. Also, I think there is no COVID-19 crisis risk affecting the market in this period since it was a recovering period when the number of COVID-19 patients were decreasing(here).

Lastly there would be some problem about the relationship between firms and the industry. If one company represents the whole country's industry, then there would be no need to put an industry factor to control for the industry. If not, we should put a new factor i(industry) in the model to control the effect. I will use the market share index to find the relationship between those two. In case of Korea, I considered that SEC represents the whole semiconductor industry in Korea due to following reasons. Firstly, considering only DRAM, which comprises a lot in semiconductor industry, SEC's market share is over 40% in recent 3 years. Also, this is a market share on a global scale, so it would be more than that if I limit the industry to Korea. However, about other countries like US, Japan or China, I will have to add industry factor in the model so that it can control the industry. Basically, I'm comparing some event effect among countries, so I should control every other factor than that.

What I can derive from our results would be valuable to the Korean stock market. If our result shows that Korean discount factors has significant effects on the Korean stock values, then it means Korean discount exists so I can relieve that effect by trying to solve the discount factors. So, this can give some political implications about supporting finance sector. In contrast, if it shows that there are no significant relations between discount factors and stock valuation, then I can conclude that Korean discount does not exist and support for Efficient Market Hypothesis that Korean stock is just exactly right at its current value. This will mean that what we call 'Korean discount' will be already priced in the valuation so some events which we consider as

Korean discount will not affect the market valuation at that time.

## 3.3 Model Design

For research design, I made an econometric model for event analysis. Models for each method varies, but basically the two are the same.

As for the first method, I have made the basic regression model that follows the following equation:

$$PE_{k,t} = \alpha + \beta Event_t + \varepsilon_{k,t} \quad (1)$$

However, for the second method, I added one dummy variable for each company to the first model and made an advanced model:

$$PE_{k,t} = \alpha + \beta Event_t + \delta_1 Company_{k-1} + \varepsilon_{k,t} \quad (2)$$

where $PE_{k,t}$ stands for the P/diluted EPS before extra of company k at time t. The reason why subscript for company is k-1 is because of technical issue called collinearity. I didn't put the industry variable since I will be comparing between the same industry firms. I would need it only if I were trying to compare among firms that belonged to other industries. For a similar reason, I excluded the "Korea" factor and "COVID-19" factor in the model. Basically, goal of my paper is to find the difference between countries' stock market due to specific event and I'm comparing the difference of shock effects in Korea and US. Therefore, my method is just same as controlling the US firms and having treatment into Korean firms. I don't need COVID-19 factor due to the reason I wrote in the previous section. Also, "$Event_t$" shows the existence of Korean discount shock date, so it will be 1 after and on the shock date and 0 before the shock.

By adding a new dummy Company variable, I am assuming that the P/E ratio of each company is partially constant because I am controlling it. However, in real life we know that P/E ratio and furtherly the value of company is not that much constant. So, by this entity fixed effect setting a dummy variable can decrease the real difference between companies' value and moreover effect of Korean discount factor. One solution can be extending the whole period of dataset I am setting. However, if I lengthen it, then many other problems like COVID-19 effect can happen.

# 4 Empirical Strategy and Results

## 4.1 Empirical Strategy(First framework)

I found the P/E ratio data at S&P Capital IQ(here) specifically by 'Daily P/Diluted EPS Before Extra' index. This shows more accurate view of the company's financial condition or in other words its value since it also considers all kinds of convertible securities. For the date for North Korea military risk, I chose North Korea blowing up the liaison office in Kaesong(here). The reason I selected this event other than so many other events is that it was best for evaluating the effect of Korean discount effect. To be specific, one apparent point of North Korean military risk is that they happen so often that their risk can be already reflected in the market. If that is the case, then I could mistakenly conclude that discount effect exists although they do not exist in reality(Type I error). So, I needed to find one event that happened suddenly and unexpectedly so that it could show the effect of Korea discount. Explosion of liaison office will be a good matter of this since it was suddenly happening in 2020, when the relationship between both Korea was decent back then, having inter-Korean summits in 2018 and 2019. Another good thing about this event was that it is a recent event so that it can reflect the P/E ratio of Xiaomi, which got listed in the Hong Kong stock market at July 2018.

One problem was setting the exact date of the event since the explosion itself happened at June 16, 2020 but there have been some declaration of Kim Yo jong, sister of Kim Jung Un, from June 4$^{th}$ that there can be abolition of the liaison office. Since one characteristic of stock market is that they are so much priced in, the effect could have been happening from June 4$^{th}$. In order to solve this, I set the interval of

each side to 40 days to find the overall effect more clearly instead of setting it as 20 days. The interval was comprised of only the working days, not including weekends, since there is there is no stock prices on weekends. I also got rid of the dates when there were no data because of whatever reasons and did some interpolation on one data since there was only one data missing and other data existed on that day(May 27, 2020). Another problem I consider is about the earning period. Although the earning period in Korea has less meaning than other typical countries like US, there can be some fluctuations of stock prices due to earning shocks in earning periods. This will affect the P/E ratio, which I will consider as the effect of Korea discount factor and make some unexpected errors. As I tried to use interval of each side from the shock date to be 40 days, the period overlaps with the earnings report date. The period is April 21, 2020 ~ August 11, 2020 and the earnings report was declared at May 04, 2020 and August 11, 2020(here). This can be partially solved by my model since I controlled the variable for each firm. It means that my model is controlling the difference between properties that each firm has, and it will include the volatility due to earnings report. However, it will not exclude the whole effect since there are also other properties of each firm that are controlled, and it would be better to set a specific period and eliminate the data around that time to reduce the error generated by earnings report.

## 4.2 Result 1

As a result for the first base regression model, Table 1 presents the results of different estimations according to equation (1). One surprising result was that the only p-value that is under 5%(0.05) was SEC(0.03). This means that the effect of event, which is North Korean military risk, is only statistically significant to Korean stock

value(calculated by SEC P/E). It strongly supports the existence of Korea discount since the purpose of the model was to find the difference between SEC and its competitors by event analysis. We can also find the result in Figure 1 which is the graph of each firm's P/E ratio according to time. Since it is a time series graph, it shows the overall trend that only SEC has a dramatic plunge from the N.Korea military shock date(it is illustrated in the x-axis as number 30)

**Table 1**

*Results of Basic Linear Regression Model Analysis on Samsung Electronics and its competitors by N. Korea military shock*

| | | | 95% CI | | |
|---|---|---|---|---|---|
| *Variable* | *Beta* | *SE* | *LL* | *UL* | *p-value* |
| *SEC constant* | *17.97* | *0.29* | *17.404* | *18.529* | *0.000* |
| *SEC Event* | *-0.89* | *0.30* | *-1.465* | *-0.307* | *0.003* |
| *AAPL constant* | *27.07* | *0.21* | *26.666* | *27.477* | *0.000* |
| *AAPL Event* | *0.28* | *0.26* | *-0.236* | *0.791* | *0.289* |
| *Sony constant* | *16.48* | *0.10* | *16.276* | *16.679* | *0.000* |
| *Sony Event* | *0.03* | *0.20* | *-0.361* | *0.417* | *0.887* |
| *Xiaomi constant* | *33.89* | *0.54* | *32.840* | *34.940* | *0.000* |
| *Xiaomi Event* | *-0.81* | *1.03* | *-2.825* | *1.210* | *0.433* |
| *TCL constant* | *92.14* | *2.29* | *87.659* | *96.627* | *0.000* |
| *TCL Event* | *0.15* | *2.73* | *-5.205* | *5.498* | *0.957* |

Table 1 presents the results of the estimations of the Korea discount factors by using the basic linear regression model approach based on equation (1). The rows show

each company's constant( $\alpha$ ) and Event( $Event_t$ ) and column shows their characteristics. SEC's competitor company from Korea such as LG, SK Hynix were excluded from the data to avoid overlap issues.

One problem regarding the graph is that I deleted all the dates if there was any empty data. For example, if there was no data for only TCL tech's P/E ratio for May 10, 2020, then I just erased the whole row. As a result, there could be some unbalance of the x-axis interval and loss of data. Another problem may be regarding to the method. We can't affirm that the competitors of SEC represent each of the countries they belong to. For example, although the competitors are all big companies with healthy financial statements, it's hard to say SONY represents Japan's semiconductor industry or Apple represents the whole US' semiconductor industry. Therefore, there could be some errors happening due to differences in industry and the firm itself. So, putting a industry and firm dummy variable could solve the problem.

**Figure 1.1**

*Evolution of P/E ratio of each company over time around the North Korean military shock*

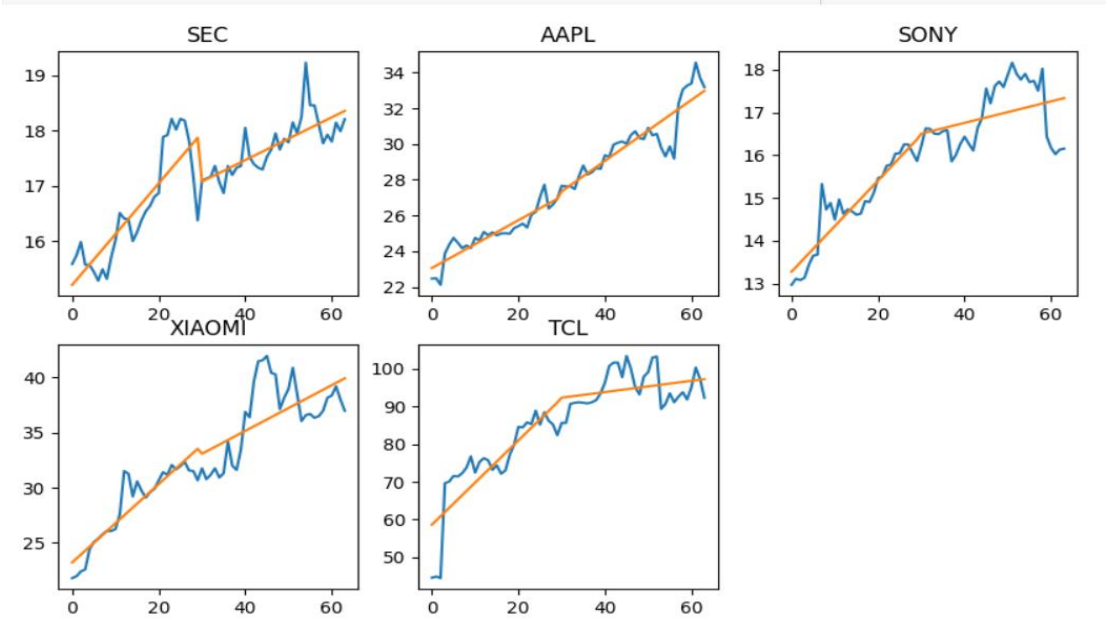


Figure 1.1 presents the trend of each company's P/E ratio according to time. We can also find from this figure that the coefficient of SEC regression line dramatically becomes negative around the N.Korea military shock date.

## 4.3 Empirical Strategy(Second framework)

For the second framework, I added the company dummy variable in the model and integrated the P/E ratios into one index according to the countries and made KSEM, USEM index. Except than that, I used the same method and code for that, and Table 2.1 shows the results.

We can also see from Table 2.1 that the N.Korea military shock event was effective only to the Korea stock market. Regarding to the p-values I presented, KSEM event only has p-value of 0.1% which is far below the standard of 5%, and USEM has p-value of 61.8% which is way bigger than 5%. Therefore, I can deny the null hypothesis for this problem that N.Korea shock was not effective in Korea stock market value. It is surprising that we have the same results as the first framework since second framework has a more statistically precise model so it would be harder to prove the denial of null hypothesis.

**Table 2.1**

*Results of Advanced Linear Regression Model Analysis on KSEM and USEM by N. Korea military shock*

| | | | *95% CI* | | |
|---|---|---|---|---|---|
| *Variable* | *Beta* | *SE* | *LL* | *UL* | *p-value* |
| *KSEM constant* | 19.77 | *0.60* | *18.600* | *20.943* | *0.000* |
| *KSEM Event* | -2.18 | *0.68* | *-3.514* | *-0.851* | *0.001* |
| *USEM constant* | *14.51* | *1.29* | *11.982* | *17.031* | *0.000* |

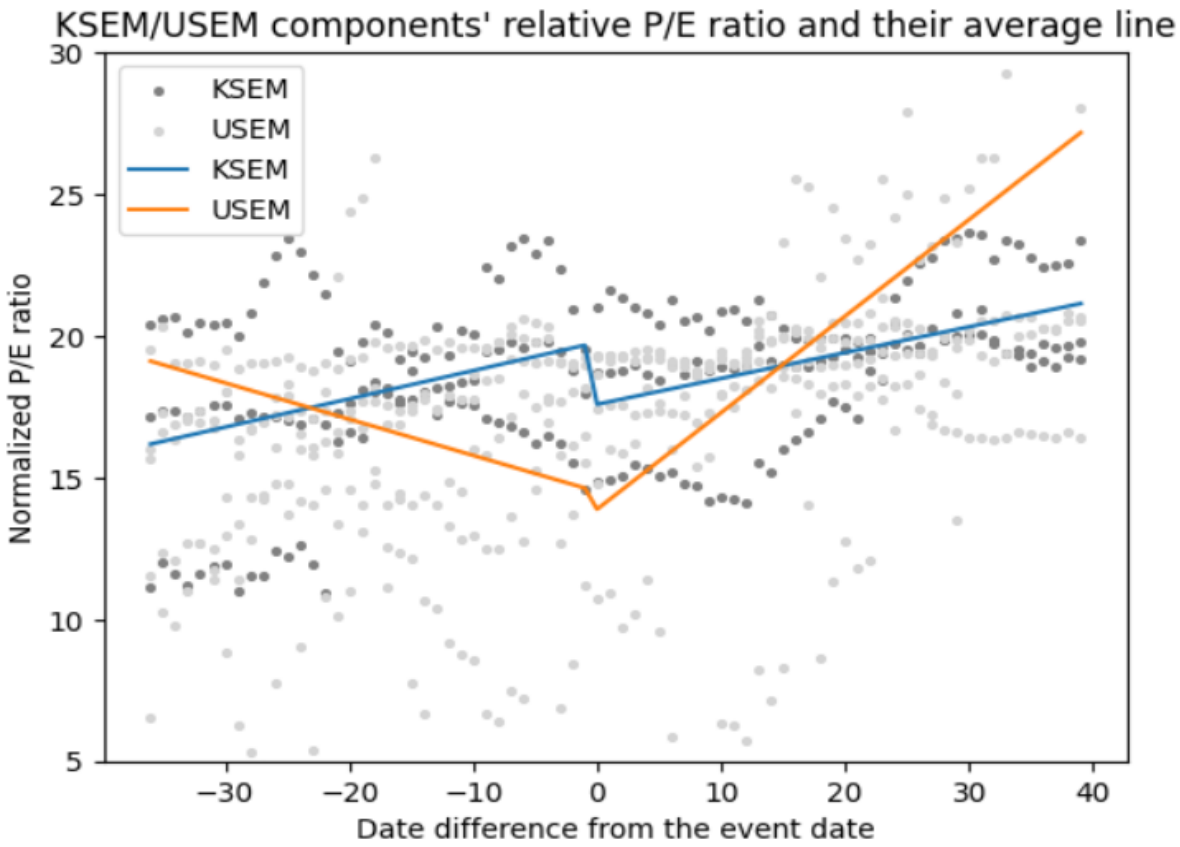
| | | | | | |
|---|---|---|---|---|---|
| *USEM Event* | *-0.62* | *1.24* | *-3.058* | *1.817* | *0.618* |

Table 2.1 shows the basic outcomes of the regression results by indices made on Korea and US semiconductor ETFs. There is no weight between the companies since I am using an econometric model based on dummy variables for each firm.

To get a brief visualization, Figure 2.1 shows a simple overview of how P/E ratio of each index changes as time goes by. This summarizes how KSEM and USEM, or maybe the Korean and US semiconductor stock value changes over time. We can see from the chart that KSEM has a sudden drop at the time 0(event date) and resumes its increase of value and USEM seems to have no significant move at the time. USEM seems to just increase its value after the shock, opposite of what happened to KSEM.

**Figure 2.1**

*Presentation of P/E ratio of KSEM and USEM index around the event*



NOTE: Figure 2.1 shows how each index's P/E ratio changes before and after the N.Korean military event happens. Scale 0 on the x-axis shows the exact date when it happened and 1 value equals to 1 day. The chart exactly shows from 36 days before the event to 39 days after the event. The imbalance is due to eliminating the whole row data when there is some lack of data in it. The y-axis specifically means the normalized P/E ratio by extracting each company's entity fixed effect from each company's P/E ratio. So, basically it means the relative P/E ratio of each company. So this panel shows the difference between average of KSEM and USEM index in one chart. Specific results of each index are shown at Figure 2.1 in the Appendix.

## 4.4 Result 2

I just found that there is statistically and visually a significant change of P/E ratio in KSEM index but not so much in USEM index. Therefore, I can figure out that also works for the firms' stock individually as well. This is basically using the same regression analysis(basic regression model) from the first framework, but the dataset will be different because it's based on the index, not the competitors on SEC's earnings report.

The result is shown at Table 2.2. They show that every KSEM firms show statistically significance in rejecting the null hypothesis, so basically presenting existence of Korean discount effect in Korea semiconductor industry. Also, except QCOM, all the USEM companies show they cannot statistically reject the null hypothesis that the Korean discount effect doesn't exist. So, I can say that the Korean discount effect doesn't work for US semiconductor industry.

**Table 2.2**

*Results of Basic Linear Regression Model Analysis on KSEM and USEM component companies by N. Korea military shock*

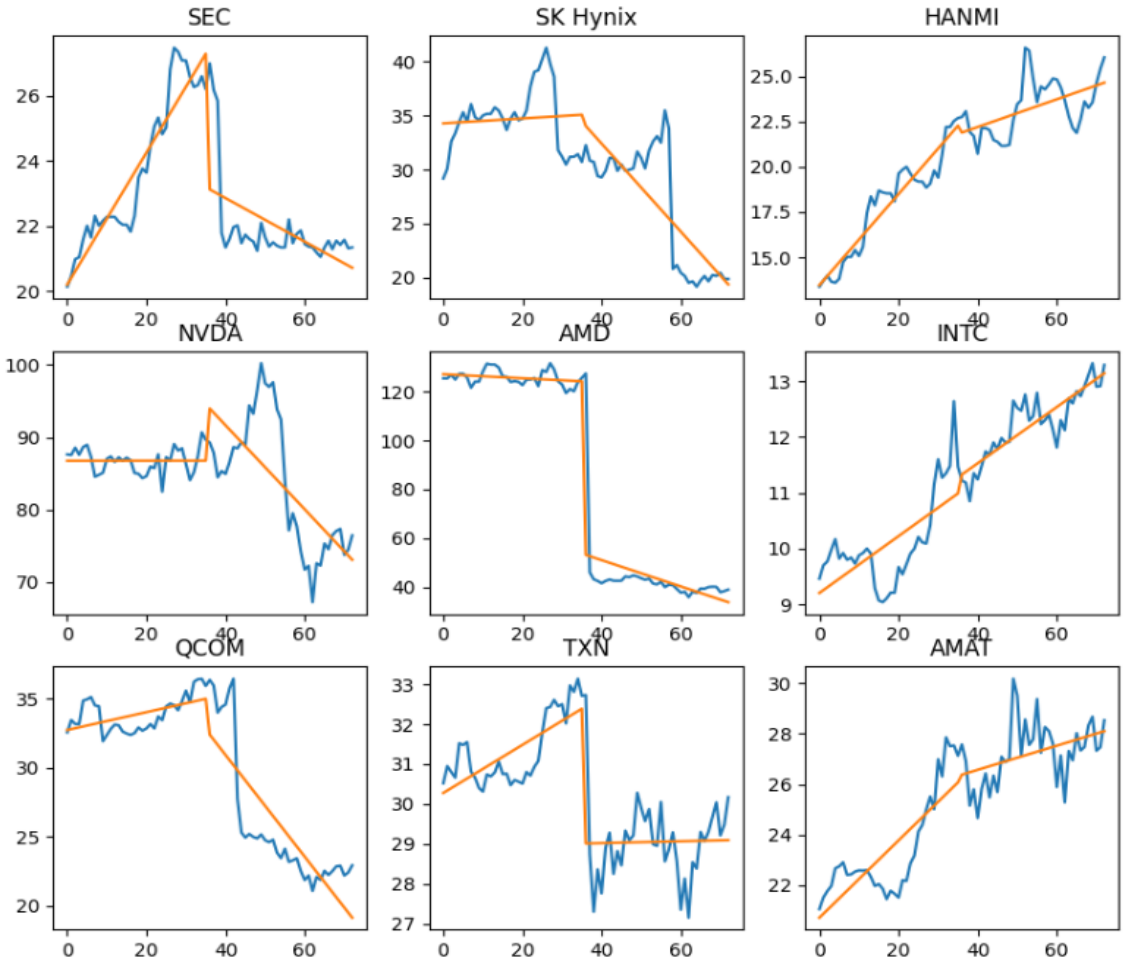
| | | | 95% CI | | |
|---|---|---|---|---|---|
| *Variable* | *Beta* | *SE* | *LL* | *UL* | *p-value* |
| *SEC Event* | *-0.68* | *0.25* | *-1.176* | *-0.188* | *0.007* |
| *SK Hynix Event* | *-3.32* | *0.71* | *-4.709* | *-1.937* | *0.000* |
| *HANMI Event* | *-2.54* | *0.50* | *-3.518* | *-1.569* | *0.000* |
| *NVDA Event* | *-0.55* | *1.08* | *-2.658* | *1.558* | *0.609* |
| *AMD Event* | *1.84* | *5.36* | *-8.659* | *12.332* | *0.732* |
| *INTC Event* | *0.24* | *0.20* | *-0.150* | *0.629* | *0.228* |
| *QCOM Event* | *-5.20* | *1.24* | *-7.642* | *-2.767* | *0.000* |
| *TXN Event* | *-0.38* | *0.34* | *-1.035* | *0.281* | *0.261* |
| *AMAT Event* | *0.33* | *0.23* | *-0.109* | *0.775* | *0.140* |

As for the micro discount factor, I set the date January 25, 2021, when CEO and heir of founder of SEC was confirmed of sentence. I think this incident shows the typical governance issue which CEO ,who is heir of family who owns the conglomerate or also called ‘chaebols’, is having problems because they want to succeed the chief officer position but their need conflicts with the general shareholders’ purpose. Reason why I used the second framework instead of the first framework is that it had more companies, meaning more precise data and result, and it would be better to control the industry by only regarding the semiconductor companies. The result of this shock was surprising since it was so different from the macro discount factor. The p-value of

SEC Event was 0.000, but the problem was that all the other companies in Korea had 0.503 or 0.169 p-values which was higher than 0.05. On top of that, other company's p-value was also lower than the standard 0.05. For example, AMD had a p-value of 0.000 which is just as same as SEC. We can also see the brief presentation of each company's P/E values in Figure 2.3. So, I think the thing that influenced SEC's P/E ratio to suddenly change is not because of micro discount factor but because of some global event. Or discount factor could be affecting in a global scale, but I think that's not the case. Therefore, we can conclude that the micro discount factor is not having a statistically significant result compared to the macro discount factor.

**Figure 2.3**

*P/E ratio of each company before and after SEC having a governance issue*



## 4.5 Limitations and Problems

I made the empirical model and had real data tested, but there are still many problems and limitations regarding both model and data that need to be solved.

First, much more variables are needed for the regression model. Since I am having research about time series data and doing an event analysis, there must be more variable that should be controlled other than the constant. For example, I can set a new variable like industry itself because there can be average differences of P/E ratios between the industries. For example, tech industry companies could have high P/E ratio due to high expectations and bank or insurance industry could have averagely low P/E ratio since they have high dividend and pursue safety rather than risk. I can also set a new variable for eventful periods. Specifically, there are some periods that effect the stock market just like the COVID-19 or GFC(Global Financial Crisis). As the stock valuation can get volatile in these periods, I will need to control the variable by setting the same period for both control/treatment groups in the crisis or out the crisis. I explained the reason for not controlling the COVID-19 event, but I could have done some controlling about the earnings report season since stock price also becomes volatile in these periods too. For the model right now, there will be so many variables that are not controlled so that they would be both directly and indirectly affecting the P/E ratios and I am just evaluating all those errors and concluding discount factor exists or not exists. As a result, there could be big Type I error happening for the model now. Also, although many companies are trying their best to manage their P/E ratio in a decent amount, the ratio becomes significantly volatile when (reverse) stock split happens. I've not considered the stock split and reverse stock split so it could also be a limitation. On top of that, I'm using an entity fixed effect on the data, which means

that it is only considering the entity(company) itself and not considering the relationship between each company. There could be some effect that each company makes to each other, but I haven't controlled that effect. Maybe I can solve the problem by extending the overall period, but that makes some other issues like data omitting issue. Lastly, in the second framework, I set a dummy variable when modeling, but the weight of each company could be a little bit less precise compared to the real weight according to the ETF component.

There were also several problems regarding to the dataset. First, most of the dataset right now have been overlapped with the earnings report period so that the P/E ratio could have been affected by earning shocks or surprises, not by the Korea discount factors. Secondly, I only used the P/E ratio and not used other data such as P/B or P/CF ratio. Since Jungwon Suh et al.(2006) emphasizes the importance of P/CF ratio more than P/E ratio, I tried to use it, but I haven't found a good data for it. That would be one thing I should solve if I need to use it. In that case, I would also need the exchange rate between each country and US. Thirdly, I have a problem with the dataset of Xiaomi and Broadcom's P/E ratio. The dataset I got from S&P Capital IQ for Xiaomi had only data from March 19, 2019, so I couldn't do the event analysis before that date and there was no data I could use for Broadcom. Because there are many macro and micro-Korea discount factors happening as an event before that period, it is a pretty big problem to have less data. I think it's not a problem with the site giving the wrong dataset but just the company got listed on the stock market late. Fourthly, there's the problem of pricing in. As one of the biggest and hardest characteristic of stock market is that every news and public information is priced into the valuation. So, it's hard to measure what date is the precise Korea discount shock date. On one side,

it could be the date when everything has started just like the Kim Jung Un's sister declaring abolition of liaison center before the explosion because the market price in the new information. On the other side, it would be the exact date of the event since similar kinds of events happen every time(N. Korea doing provocation a lot) so it would be hard to expect that stock market will be pricing in the information just by announcement which could also be fake. This is applicable not only to macro discount factor but also the micro factor. Lastly, there is a problem regarding the effect of micro discount factor. In fact, it's hard to choose a precise date for a micro discount factor event because of the pricing in issue. This is harder than macro factor because there is always news before the real thing happens. Also, the result of it is completely different from the result of macro factor(the exact table and figure will be displayed for next submit, sorry there was no more space for them) so I must figure out what's going on about that. Maybe this can be solved by revising the whole model by making some control variables or changing the date for the micro factor shock event.

Lastly, the problem with micro discount factor was also not solved. As I mentioned in the **2.2 Limitations and Problems**, micro discount factor could affect the fundamental factors of the company like earnings and P/E ratio. This is because micro discount factor is more closely related to the company itself and the ownership and management of the firm. If that is the case, it would be nearly impossible to evaluate the only micro discount effect so this could be another problem with this paper.

## 5 Conclusion

The Korean discount symptom was and is still now a big issue regarding to the Korean stock market for decades. However, as the efficient market hypothesis also does, it is always hard to verify the real valuation of stock market and how does it different from

now’s valuation. This paper has used the traditional method of P/E ratio to evaluate the valuation and event study to verify the causality of Korean discount factors on the valuation. I used two datasets and two models to find the causality more precisely by comparing specific firm of each country/industry and comparing the overall average of companies in specific industry ETF in each country.

The result was quite surprising since in either way there was a statistically significant causality happening in Korea. More surprising result was that the sudden decline of stock valuation happened only to the companies in Korea and not to the companies in US or even China and Japan which has similar environment(East Asia, concentrated in technology/semiconductor industry, etc) as Korea. For the micro factor, the paper tested on the second framework in order to verify more precisely but there was no statistically significant effect happening to Korean firms meaning there is less or nearly no micro-Korean discount effect. As a result, I can conclude that there is no micro-Korean discount factor and only macro discount factor statistically.

This result could be useful in policies made for financial sectors since this paper is showing the presence of the Korean discount symptom in Korean stock market and the specific factors for that. Since North Korea military risks are making a big decline in Korean stock market valuation, having a friendly relationship with North Korea could reduce the risk and make a more stabilized stock market for Korea. This could make Korean stock market to find its own value and grow up in a stable pace.

# 6 Appendix

## Figure 2.1

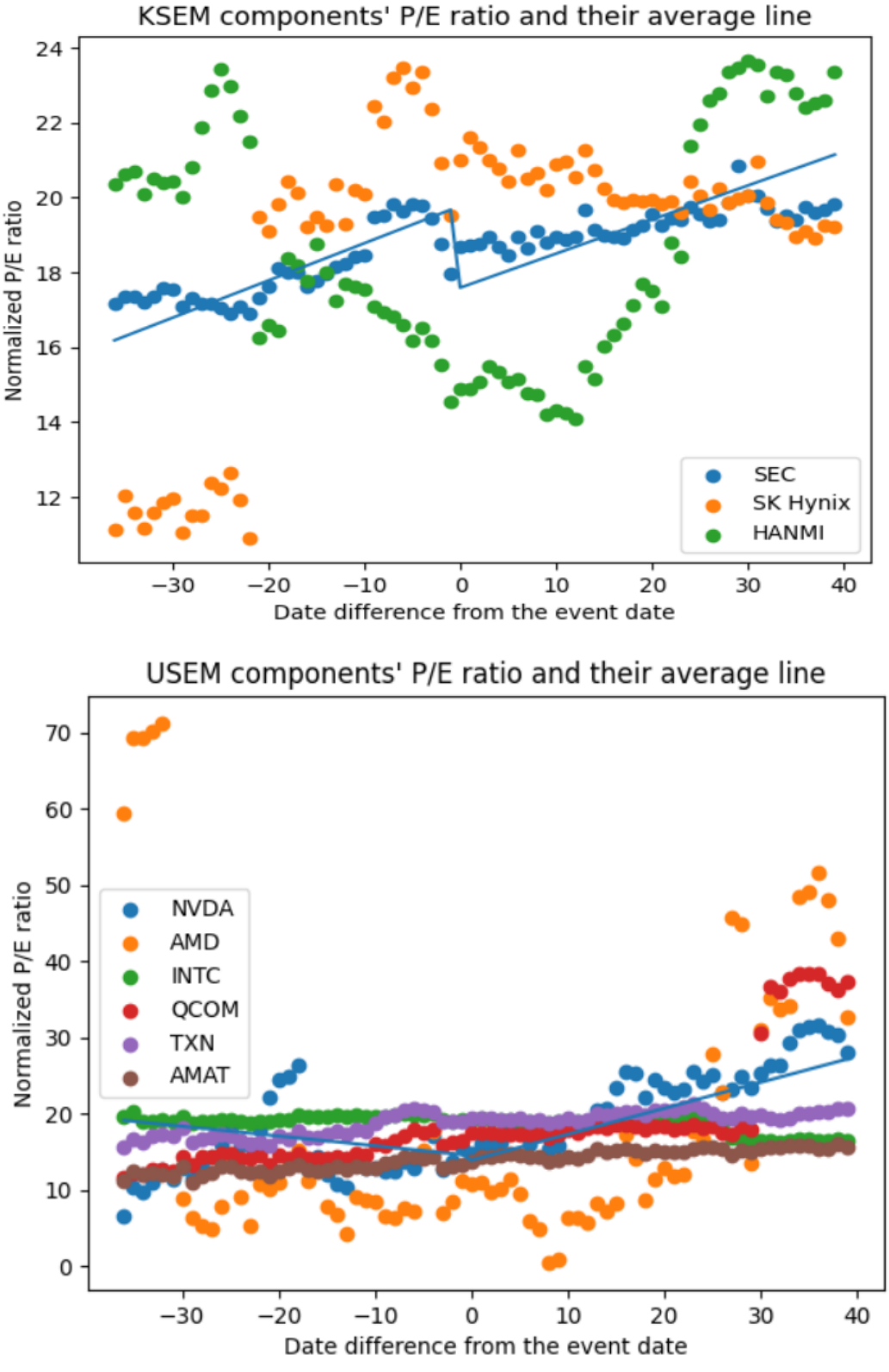
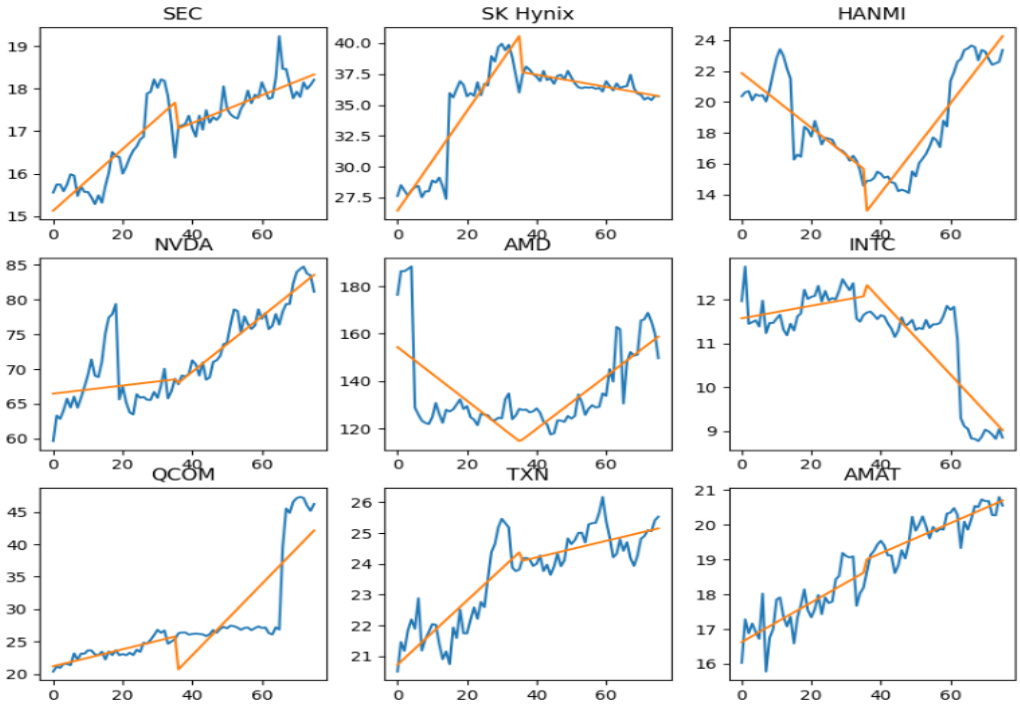


**Figure 2.2**

*Presentation of P/E ratio of each firm that belong to KSEM and USEM index over time*

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