Unveiling the Significance of the Semiconductor Industry in Capital Markets: An in-depth examination of Industry dynamics and event-driven stock movements

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Abstract:

This thesis investigates the impact of events on the stock prices of semiconductor companies, employing a multiple regression model. Analyzing 53 events, it reveals that capital inflows generally positively affect share prices, while outflows have a negative impact. Key drivers include Investments, Innovations, M&A, and Restriction events. Earnings calls significantly influence stock movements. Despite the cyclicality of the industry, strategic investments during capital inflow events are suggested. Recommendations emphasize the importance of diverse collaborations, strategic positioning, and a vigilant approach to earnings calls. Future studies should adopt a longer-term perspective, exploring varied industries for a comprehensive understanding of stock dynamics.

Keywords:

Semiconductor Industry, Capital Markets, Investment Recommendations, Expert Insights

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Chapter 1: Introduction – Group Part

1.1 Preface

In the expansive landscape of global industries, few exert as much influence and significance as the semiconductor industry. This dynamic sector, characterized by rapid technological advancements and relentless innovation, serves as the backbone for a multitude of essential applications, from the devices used daily to the machinery powering diverse sectors (BIS Research n.d.). The semiconductor industry's colossal size, projected to reach approximately US-Dollars (USD) 1.09 trillion by 2028. A compound annual growth rate of 10.86% (Mordor Intelligence n.d.), underscores its pervasive impact on both technological progress and economic expansion. The rise or fall of semiconductor companies, resonates far beyond their individual domains, sending shockwaves through interconnected supply chains and markets. This study embarks on the ambitious mission of unraveling the interplay between public event announcements and stock movements within the semiconductor industry. An understanding of what drives the stock reactions of semiconductor companies is not only critical for investors navigating the financial landscape but also holds the key to decoding the broader economic implications that cascade across diverse sectors. Through empirical analysis and insightful exploration, this research endeavors to shed light on the pivotal question: What events wield the most profound influence on the stocks of semiconductor companies, shaping the destiny of industries that rely on their technological competencies? This study aims to provide clarity in a landscape where every market shift carries consequences that resonate far beyond the confines of a single industry.

1.2 Organization of the Study

This study unfolds with an introduction, providing a brief overview of the semiconductor industry's global significance and highlighting the dynamic nature of stock movements influenced by various events. It addresses the specific problem of understanding the impact of event announcements on stock movement, stating clear study objectives. The scope and limitations were defined, including the chosen period, geographical focus, and semiconductor companies, while acknowledging potential constraints. The methodology outlines the research design, hypotheses, data sources, and statistical techniques, justifying the inclusion of control variables. The literature review summarizes key theories and methodologies related to the semiconductor industry's relationship with public event announcements, emphasizing the study's unique contribution. An overview of the industry explores technological advancements, major players, and detailed company overviews. The section on stock market movements delves into the correlation between chip industry performance and stock market movements, presenting results given from linear regression models. The conclusion recaps findings, identifies patterns, and discusses implications, providing recommendations and integrating insights from an expert interview with Andreas Randebrock, Executive Vice President of a semiconductor manufacturer from the United States (US). This organizational flow ensures a concise and logical exploration of the semiconductor industry's complexities.

1.3 Background and Rationale

The semiconductor industry is a critical player in the global market, propelling both technological progress and economic expansion (Deloitte Insights 2021). However, the industry faces the challenge of cyclic, fluctuating stock movements, which are influenced by a variety of events and announcements, creating a complex environment for stakeholders (Investopedia 2022).

The objective of this research was to explore the pivotal question: How do event announcements influence the stock prices of semiconductor firms? Gaining an understanding of this correlation is vital as it can offer significant insights for investors, policymakers, and industry leaders. For example, a combination of factors such as escalating interest rates, high inflation, diminished consumer confidence, and tech-led stock market retreats resulted in a substantial decrease in market capitalization for the top 10 global chip companies (Deloitte 2023). Likewise, the supply situation and the ongoing recession were contributing factors to the downturn of semiconductor stocks in 2022 (Baqui S. & Fish D. n.d.). Addressing these relationships is crucial for navigating the complexities of the semiconductor market and facilitating informed decision-making in the face of dynamic economic and industry-specific challenges.

The goal of this study was to provide a comprehensive analysis of the influence of various factors, such as political events, company announcements, and macroeconomic indicators, on stock movements. These factors were categorized as capital inflows and outflows. In the context of this study, capital inflow refers to the movement of financial resources into a company, through activities such as Mergers and Acquisitions (M&As), Investments, or Innovations. Opposite, capital outflow signifies the movement of financial resources out of a company, in this study associated with Restrictions and Crises - conditions that limit the company's access to capital, potentially impacting its financial health and stock price.

1.4 Research Questions and Hypotheses

This research contributes to the academic field by providing empirical evidence on the relationship between event announcements and stock price movements in the semiconductor industry. Additionally, it provides tangible benefits for industry stakeholders by offering guidance on investment decisions and strategic planning through a combination of statistical findings and insights from an industry expert. The specific research questions this study aims to answer were:

Research question 1: *What type of events have the most significant impact on the stock prices of semiconductor companies?*

Research question 2: *How do these events influence the overall industry's stock movements?*

Research question 3: *What strategies can stakeholders adopt to mitigate the impact of these events on stock prices?*

The subsequent chapters will delve deeper into these questions, providing a thorough analysis backed by rigorous research and data.

Two null hypotheses (H0) and two alternative hypotheses (H1) were formulated, which were examined in this paper. H0 indicates the case that the investigated model has no effect. H1 contradicts H0. If H1 is accepted, there are indications that the belief is true. In this case, it would mean that the investigated model has a certain effect (Turney 2022).

Hypothesis 1:

H0#1: There is no significant relationship between events that lead to capital inflow and positive reactions in the stock prices of the examined companies.

H1#1: Events that result in a capital inflow are significantly associated with an increase in the stock prices of the examined companies.

Hypothesis 2:

H0#2: There is no significant relationship between events that lead to capital outflow and negative reactions in the stock prices of the examined companies.

H1#2: Events that result in a capital outflow are significantly associated with a decrease in the stock prices of the examined companies.

1.5 Scope and Limitations

The scope of this study spans the period from 2015 to the present day. It aims to comprehensively analyze the impact of various events, including political and corporate announcements, on the stock prices of selected semiconductor companies. However, it is important to note that the semiconductor industry is constantly evolving, and the findings of the study may not apply to future events. Geographically, the study focuses on the USA, Asia, and Europe. Three major companies of the industry - NVIDIA from the USA, Taiwan

Semiconductor Manufacturing Company (TSMC) from Asia, and Advanced Semiconductor Materials Lithography (ASML) from Europe - were chosen based on their significant market capitalization, providing insights into how events affect entities of varying sizes and geographical origins. The examined companies are integrated at different points in the semiconductor processing value chain. Based on their business models, companies can be assigned to the following steps in the value chain that is discussed in more detail in Chapter 3.1: NVIDIA operates primarily in the first two steps, "Developing chip IPs" and "Designing chips" of the value chain (BBC News 2023). TSMC, on the other hand, essentially generates its main revenue in "IC Manufacturing" (Taipei Times 2023). ASML primarily works in “IC Manufacturing” as well, but also operates in "Silicon Wafer Manufacturing" (Timings J. 2021). In general, companies today exert a certain influence on several areas of the value chain due to their size and relevance in the market. However, a general allocation to the areas of the value chain can be made. Comparability of these three companies is crucial for this study and while all three companies are semiconductor manufacturers the differentiation in core activities needs to be handled with caution. Future research could potentially delve deeper into certain parts of the value chain and compare companies with the exact same activities.

The diverse geographical representation allows for a more global perspective on the relationships between events and stock price movements within the industry. If alternative semiconductor companies had been chosen, the outcomes would naturally vary, providing potential paths for further investigation. Exploring different companies in future studies could strengthen the overall robustness of the results obtained in this study.

The study concentrates on events falling into specific categories, including M&A activities, Innovations, Restrictions, Crises, and Investments. While these categories offer a structured framework for analysis, it's important to note that some relevant events might be excluded, and the categorization might not capture the full spectrum of factors influencing stock prices.

The stock market can be simplified as a nexus where investors trade shares of publicly listed companies as well as trading through Over the counter (OTC) marketplaces (Davis & Taube 2023). Its sheer size with trading volumes around USD 500 billion per day, makes it a large ecosystem within the global financial landscape (Taylan 2022). Therefore, the market has a far-reaching complexity that cannot be explained using solely one statistical model. The events examined in Chapter 4 have a certain impact on the market, which should be verified, but a context-independent effect is impossible. The events are considered according to the ceteris paribus principle - each event and its effects are considered in isolation, while all other factors remain the same (Think about Gen Y 2023). However, many factors and synergy effects in the real world influence the events or are created by them. The corresponding statements and assumptions made in this master's thesis should therefore be treated with caution.

Considerable attention should be drawn to annual and quarterly earnings calls. Moreover, analysts play a pivotal role in evaluating companies and stocks. This study dedicates an entire chapter to elaborate these prominent factors impacting overall stock performances. For an in-depth examination of each aspect, please refer to the dedicated Chapter 4.3.

If selected events took place on the weekend or on a public holiday, when the stock market is closed for trading, the trading volume of the next trading day was considered. For example, looking at the fourth event in Appendix 1, where Softbank took over ARM Holdings the event took place on the 5th of September 2016. Since the 5th of September was a holiday (Labor Day), no trading happened at the stock market. Therefore, the next trading day, the 6th of September was included in the analysis.

The analysis of stock prices was conducted for the week the announcement happened. However, this may not account for delayed responses or longer-term impacts on stock prices. Additionally, the study incorporates the VanEck Semiconductor Exchange-Traded Fund (ETF)

(SMH US Equity) and the iShares MSCI World ETF (URTH US Equity) as benchmarks. While these ETFs provide a broader market context, their performance may not precisely mirror the selected semiconductor companies, introducing a level of abstraction in the analysis. The ETFs were included instead of the underlying index itself, since it has a better comparability and is publicly traded at the stock market. Additionally, there are more information provided about the ETF, by VanEck itself. at the Data limitations are inherent in the study, relying on news scanning for event identification and stock market data for price movements. Potential inaccuracies or omissions in news sources and stock market data could impact the robustness of the findings. Furthermore, the findings may not be fully generalizable to the entire semiconductor industry, as the analysis was limited to three specific companies and a predefined set of event categories. Understanding and acknowledging these limitations is crucial for interpreting the study's results and contextualizing the findings within the parameters set by the chosen period, geographical focus, and selected semiconductor companies.

1.6 Methodology

Given the nature of the research questions, which seek to understand the impact of specific events on stock movements, a quantitative approach allows for a systematic examination of numerical data to identify patterns and trends. Data for political events, company announcements, and stock movements were collected through a comprehensive review of news sources starting from 2015 to the present day. This period was chosen to roughly cover the change over the last ten years. In this period, the semiconductor industry has experienced a strong upswing. However, the pre- and post-pandemic years have given the industry a new form of relevance (Fortune Business Insight 2022). This was also in line with the discussion that was held with the expert, Andreas Randebrock, interviewed for the purpose of this study (Chapter 5).

To enhance the data set, company data as well as stock movements were taken from either Bloomberg or Refinitiv. These two sources can be considered as a general source for all financial data (stock movements, trading volumes as well as performance data), offering a quantitative assessment of the influence of political and corporate developments on the respective stocks. Although data from events is immediately processed and implemented on the capital market, a so-called stock rally or a downward trend in shares is often only fully processed on the stock market after a few months (Ji & Bu 2022). In addition, even the smallest indications are perceived on the capital market and understood as signals to which various types of traders react (Blystone 2023). This means that in the run-up to earnings calls, close attention is paid to major trade movements in a share. This leads to speculation in the run-up to events as well as to a certain delay after events until the effect is visible on the market. Various announcements such as M&A deals as well as significant Innovations are presented as part of quarterly figures. As the chosen companies for this study have their headquarters on different continents, the quarterly figures are announced at different times of the day (pre-market or post-market). For the above reasons, a longer period was analyzed, rather than just capturing share movements on the day of the event. A range of approximately one trading week was chosen, in which the analyzed event lies roughly in the middle. Example 1st event: On May 29, 2015, it was announced that Avago was buying Broadcom, thereby forming Broadcom Inc. As May 29, 2015, was a Friday, the trading week, starting off on May 27 was used as the date of the announcement. This approach made sure to count in any possible leaked information to the market beforehand and considered not only the direct reactions but also the reactions of the market sometime after the event. All events and the associated weekly price movements can be viewed in Appendix 1.

The geographical diversification of the selected companies and their shares means that they are primary listings made in different currencies on their home stock exchanges (Bloomberg n.d.). For example, NVIDIA is primarily listed as USD on the American NASDAQ in New York. TSMC, on the other hand, is primarily listed on the Taiwan Stock Exchange in Taipei in Taiwan-Dollar (TWD). Whereas ASML, as a Dutch company, is primarily listed in Euro (EUR) on Euronext in Amsterdam. To ensure sufficient comparability, all prices, company data, and other financial factors should be quoted in a single currency. There were two conceivable ways to handle this: First, the data could have been converted using a currency exchange rate. However, utilizing at least a daily conversion rate could have been prone to errors and inaccuracies due to the substantial volume of data required for 53 events. For this reason, an alternative quotation was chosen. Since NVIDIA is already listed in USD and ASML also has a secondary listing on the NASDAQ in USD, the decision was made to quote all data in USD. In the case of TSMC, an American Depositary Receipt (ADR) was chosen for this purpose. ADRs are certificates that securitize the right to an underlying asset (share). ADRs are issued by American banks and enable investors to buy shares in foreign companies indirectly without trading on the relevant domestic stock exchanges (Fidelity n.d.). ADRs are particularly popular for Asian stocks, as foreign investors are not permitted to trade directly in many Asian countries (e.g. China) (TopForeignStock.com 2023). Like the shares of the companies described above, TSMC's ADR is listed in New York, but on the New York Stock Exchange (NYSE) and not on the NASDAQ (Taiwan Semiconductor Manufacturing Company Limited n.d.). The ADRs are listed in USD (Fidelity n.d.). Nevertheless, it should be considered that the listings described here are only primary or secondary listings. They therefore comprise most of the shares traded on the stock exchange. However, the companies are traded on many stock exchanges due to their size. The shares are then traded in the respective domestic currency on these stock exchanges (GFH Financial Group 2022).

1.7 Classifications, Variables, and Regression Analysis

As previously noted, while the classifications M&A, Innovation, and Investment are indicators of capital inflows, Restriction and Crises are classified as events signaling capital outflows.

This categorization allowed for a focused analysis on the most relevant factors influencing stock movements, capturing the dynamics between positive and negative financial influences. (Equirus Wealth 2023). Stock movements were tracked for NVIDIA, TSMC, and ASML. Benchmark ETF data (VanEck Semiconductor ETF - SMH US Equity and iShares MSCI World - URTH US Equity) were also analyzed for a broader market context. To conduct a thorough statistical analysis, several variables were defined as follows:

Geographical Allocation (IV1): This variable categorizes events based on their geographical location, encompassing eight values representing specific countries - "USA," "Japan," "Netherlands," "Taiwan," "Germany," "South Korea," "China," and "Europe." Allocation was made at the country level, offering insights into the impact of events in different regions on semiconductor stock prices. The geographical events were classified according to the country or region most affected by the event in the long term. For example, if NVIDIA acquired a European company as part of an M&A transaction, this event was geographically assigned to the USA and not Europe.

In total, the effect of 53 events in the period from May 29, 2015, to October 26, 2023, was examined. Most of the events examined (30) were assigned to the category "USA". In addition, two events could be assigned to "China", a further three events to "Europe", one event to "Germany", seven events to "Japan", two events to "The Netherlands", one event to "South Korea" and the remaining seven events to "Taiwan" (Appendix 1).

Event Classification (IV2): This variable classifies events into five categories. Events can be labeled as "M&A," "Innovation," and "Investment" or as "Restriction" and "Crisis". This variable enables an analysis of the financial implications of diverse event types on semiconductor companies. The detailed classification of the events was based on the topic to which the event could best be assigned. In the case of M&As, Innovations, and Restrictions, this classification was extremely specific. In the case of Investments and Crises, the events examined could only be classified more vaguely due to the nature of the event.

Most events (24) were assigned to the "Investment" characteristic. In addition, four events were assigned to "Crisis", seven events to "Innovation", nine events to "M&A" and a further nine events to "Restrictions" (Appendix 1). The dependent variables consist of share price movements for the three semiconductor companies NVIDIA, TSMC, ASML and the VanEck Semiconductor ETF:

Share Price Movements of NVIDIA (DV1): This variable reflects the share price movement of NVIDIA in the calendar week corresponding to the event. The specific dating details are available in Appendix 1, column 7, providing insights into how events impact the stock prices of NVIDIA.

Share Price Movements of TSMC (DV2): This variable represents the share price movement of TSMC in the corresponding calendar week of the event, with temporal details outlined in Appendix 1, column 8. DV2 facilitates an understanding of the relationship between events and stock movements for TSMC.

Share Price Movements of ASML (DV3): This variable signifies the share price movement of ASML in the corresponding calendar week of the event, with specific dating details available in Appendix 1, column 9. DV3 contributes to the analysis of how events influence the stock prices of ASML, providing comprehensive insights into semiconductor market dynamics.

Share Price Movements of VanEck Semiconductor ETF (DV4): This variable signifies the index movement of the VanEck Semiconductor ETF in the corresponding calendar week of the event, with specific dating details available in Appendix 1, column 10. DV4 contributes to the analysis of how events influence the movement of the VanEck Semiconductor ETF, providing comprehensive insights into semiconductor market dynamics. This variable differs from the previous ones. The dependent variable (DV4) is not one company as before, but several companies combined in an ETF. The companies represented in the index can be viewed under Appendix 2. As the ETF tracks the largest representatives of the semiconductor industry, the previously analyzed companies NVIDIA, TSMC and ASML are also represented here. The ETF tracks NVIDIA at around 18.51%, TSMC at around 12.40% and ASML at around 6.10%.

Before conducting the regression analysis, a comparison was made between the trading volumes on days of selected events and those on typical days. The volumes on event days were found to be higher than on regular days, leading to the continuation of the regression analysis. Details about this analysis can be found in Chapter 3.2.

The described variables collectively form the foundation for the linear regression analysis, allowing for a detailed exploration of the relationships between geographical allocation, event classification, and share price movements for NVIDIA, TSMC, ASML, and the VanEck Semiconductor ETF in the semiconductor industry. Using these independent and dependent variables, the following equation for the single regression was defined:

$$DV_x = ß_0 + ß_1 IV_2 + \varepsilon$$

And for the multiple regression as followed:

$$DV_x = ß_0 + ß_1 IV_1 + ß_2 IV_2 + \varepsilon + CV_1$$

In the equations, DV_x is the dependent variable that is to be explained by the model, which is equal to one of the companies described above or the VanEck ETF. The respective "IVs" comprise the independent variables, $ß_0$ is the intercept of the model, while $ß_1$ and $ß_2$ are the coefficients of the independent variables. ε is the error term of the model, which represents the difference between the predicted value and the actual observed value of the dependent variable (Penn State University n.d.). Finally, CV_x is the added control variable, which is supposed to be independent of the model to emphasize the effect of the independent variable (Bhandari 2023).

A statistical analysis was performed using the programming language "R" and opted for linear regression for the analysis. To verify or falsify the previously stated hypothesis, the model needs to be statistically significant, indicating if the observed relationships are likely to be true relationships in the population instead of random variation or chance (Feldman 2018). A significance level of 0.05 (p-value), denoted as the alpha level, was selected for this analysis, aligning with the conventional practice in statistical research. A lower p-value would indicate stronger evidence against the null hypothesis while a higher p-value than 0.05 would indicate weaker evidence against the null hypothesis. However, effects with a p-value of above 0.05 can be considered if attention is paid to the context. The relevant data material can also provide an indication. This should be considered with caution, but not completely disregarded (Bevans 2020). In the upcoming analysis, an exploration of p-values ranging from above 0.05 up to 0.20 will be conducted when applicable.

The following statistical instruments of the models will be analyzed: The intercept which represents the predicted value of the DV1, when all IVs are zero (Statology 2021). The multiple R-squared measures the proportion of variance in the dependent variable explained by the independent variables (Frost n.d.) The coefficients of the variables used in the model, which allows to compare the variables, by showing the results of increasing the predictor by one standard deviation (Bring 1994). Finally, the residuals and their distribution will also be analyzed, which provide information about the fit of the model. To clarify, the difference between the observed data and the predicted data (Statology 2019).

In addition, the regression carried out was split in two parts. First, a single linear regression was performed, in which only one independent variable was used to test the effect of it. Since the main target was to determine the extent to which various events influence the stock market, IV2 was used. All dependent variables (NVIDIA, TSMC, ASML and the VanEck Semiconductor ETF) were set to this factor.

In a second step, a multiple regression was carried out, where both independent variables were set in relation to the dependent variables. A control variable in form of the Gross Domestic Product (GDP) Growth per Quarter per Region was added. A multiple regression to study the effect of publicly announced events was used for several reasons:

1. **Accounting for Multiple Factors:** Stock movements are influenced by diverse factors, such as economic indicators, industry trends, M&As within the industry, political Investments, and Innovations, but also Restrictions and Crises. Multiple regression allows for the consideration of multiple variables simultaneously, which is needed to examine how different events or factors impact stock prices (Investopedia 2023).
2. **Quantifying Relationships:** Through the assignment of coefficients to the independent variables, it is possible to see the impact of each variable on the stock price and how significant each impact is (Sonawane 2023).
3. **Enabling the Possibility of Isolation:** Even though stock prices are influenced by many factors, a multiple regression helps in isolating the effects of specific events and measuring the given impact of a certain variable (Weedmark 2018).

For the mentioned reasons, a multiple regression model was sufficient for the research. It should however be noted that no statistical method is universally superior (see Scope & Limitation).

To emphasize the cyclical nature of the semiconductor industry, the "iShares MSCI World ETF" was included in the analysis alongside the "VanEck Semiconductor ETF". The performance of both ETFs was measured within the event week for all events analyzed to relate the sensitivity of the semiconductor industry to the market (Appendix 3).

For linear regressions it was necessary to test for normality, linearity, multicollinearity, and homoscedasticity – all of the performed tests were additionally tested for these assumptions and none of the results indicated any significant wrong models or weak data. For that reason, these tests won't be further described in this work. References can be found in Appendix 13 – 23.

Chapter 2: Literature Review – Julius Reich

2.1 Semiconductor Industry Dynamics and Cyclical Trends

The semiconductor industry's growth trajectory is inherently volatile, as evidenced by the findings of Aubry and Renou-Maissant (2012). They highlight the market's susceptibility to significant deviations from its long-term trends, exemplified by the pronounced bust cycles. For instance, annual growth rates in the semiconductor market can experience remarkable shifts, ranging from a 37% in 2000 to a substantial contraction of -32% the following year. These strong fluctuations underline the industry's dynamic nature, where rapid expansions are met with swift contractions, reflecting the challenges and uncertainties of the semiconductor market (Aubry & Renou-Maissant 2012). Aligned with the insights of Aubry and Renou-Maissant (2012), Rapp and Möbert from Deutsche Bank Research emphasize the industry's high level of innovation, resulting in short production life cycles. Despite experiencing remarkable turnover growth, these brief cycles contribute to a notable sales decline occurring approximately every third year. Both perspectives collectively underscore the cyclical nature of the semiconductor industry, where rapid innovations and subsequent short cycles contribute to periodic declines in sales, reflecting the inherent volatility and complexities within the market dynamics. Rapp and Möbert explain that semiconductor cycles are triggered by various factors. The semiconductor industry experiences cyclical patterns due to the substantial influence of economic factors, particularly during recessions, which exert a significant negative impact on turnover (Rapp & Möbert). Additionally, the tendency of clients to defer demand, especially before the launch of new chip generations, contributes to the industry's periodic sales declines (Rapp & Möbert). Furthermore, the extended lead times resulting from the intricate process of transforming raw wafers into integrated circuits (ICs) plays a role in shaping the industry's cyclicality (Rapp & Möbert). B. Bagley (2016) highlights the significant evolution of the semiconductor industry from a period of robust growth to its current status as a mature industry. Contrary to previous decades, the industry now faces a substantial slowdown in overall market growth, projected at a mere 0.3%, contrasting sharply with a compounded annual growth rate of 7.6% from 1990 to 2015. Notably, the transition to maturity has raised the barriers for entry, with high capital investment requirements making it increasingly challenging for start-ups to thrive (Bagley 2016). Despite these obstacles, certain segments, such as power, sensors, and automotive, exhibit resilience and continued growth, driven by demand for increased efficiency and compact form factors in the power semiconductor market. Bagley (2016) emphasizes the necessity for new financing models to support innovation in the semiconductor industry amid these changing dynamics.

2.2 Factors Influencing Stock Movements in the Semiconductor Industry

The landscape of literature on factors influencing stock movements in the semiconductor industry is relatively sparse, with limited dedicated research in this specific domain. Nevertheless, among the studies encountered, a few have delved into the intricate dynamics of stock movements within this sector. For instance, Triebell (2015) focused on the U.S. semiconductor industry and attempted to establish connections between M&A activities and stock price movements, investment return, return on equity (ROE), and net income. The findings revealed no statistically significant correlations among these aspects. Notably, the sole significant correlation identified was amid total revenue and the overall value of M&As completed. In the study by Sher and Yang (2004), the investigation into innovative capabilities within Taiwan's semiconductor industry unveils a compelling relationship between these capabilities and firm performance, particularly as measured by returns on assets (ROA) – notably, there has not been a focus on stock price movements, specifically. Nonetheless, the empirical findings underscore a predominantly positive correlation, emphasizing the pivotal role of innovative capabilities in driving enhanced financial performance. This aligns with one goal of the study, where the impact of new innovative technology announcements on the stock prices of companies was sought.

2.3 Influence of Public Information on Stock Market Dynamics

In consonance with the research findings, which illuminate a discernible connection between selected events and subsequent stock market developments, the insights gleaned from "The Impact of Public Information on the Stock Market" by Mitchell and Mulherin (1994) align with observed patterns. Their study reveals a direct correlation between the number of Dow Jones announcements and market activity, establishing a robust relationship between the two variables. Mitchell and Mulherin's findings underscore the significance of external information and its consequential influence on stock market behavior. This convergence of outcomes lends further credence to the interconnectedness identified in this study between pertinent events and subsequent market responses. This reinforces the notion that external stimuli play a pivotal role in shaping stock market trends. Within the broader landscape of financial research, the interplay between news publications and market dynamics has been a subject of exploration. While Mitchell and Mulherin (1994) identified a relationship between news and market activity, certain nuances within this connection became apparent. Their observation highlighted that the overall relationship lacked considerable strength, with patterns in news announcements failing to reveal day-of-the-week seasonality in market activity. These findings resonate with experiences encountered in similar studies, where, despite the identification of relevant coefficients in the models, significance often remained elusive, as reflected by high p-values. Mitchell and Mulherin's acknowledgment of the challenges in linking volume and volatility to observed measures of information from the Dow Jones database serves as a pertinent reminder of the intricate nature of discerning meaningful connections in financial data. Against this backdrop, the insights provided by Chandra, Procassini, and Waymire (2010) in their examination of the semiconductor industry's response to trade association disclosures offer a compelling perspective. Their evidence points towards statistically significant stock price movements, particularly in response to the disclosure of forward-looking indicators such as the BB ratio, underscoring the nuanced challenges and potential impact of industry-specific news on stock behavior.

2.4 Literature Gaps and Unique Value Propositions from this Study

In the context of the extensive literature on semiconductor industry dynamics and cyclical trends, this study distinguishes itself by focusing on the underexplored realm of stock movements within this sector. While existing research, exemplified by Aubry and Renou-Maissant (2012), Rapp and Möbert from Deutsche Bank Research, and Bagley (2016), delves into the cyclical nature and challenges faced by the semiconductor industry, this study takes a unique angle by examining how specific factors, such as M&As, Investments, Innovations, Restrictions, and Crises, influence stock movements. While Triebell (2015) and Sher and Yang (2004) touch upon aspects related to the U.S. semiconductor industry, including M&As and innovative capabilities, this study directly addresses the impact of new innovative technology announcements on stock prices. Furthermore, in the exploration of the influence of public information on stock market dynamics, this study builds upon Mitchell and Mulherin's (1994) insights, offering a nuanced perspective by acknowledging the complexities of establishing robust relationships between news and market activity. Drawing parallels with Sher and Yang's insights, this study will explore innovative advancements in technology within the semiconductor sector and how such announcements might positively influence the financial dynamics of the companies under examination. By incorporating evidence from Chandra, Procassini, and Waymire's (2010) study on the semiconductor industry's response to trade association disclosures, valuable insights into the statistically significant stock price movements triggered by industry-specific news are contributed to the following. While previous literature has frequently homed in on specific markets, such as the US or Taiwan, like Triebell (2015) and Sher and Yang (2004), respectively, this study distinguishes itself by adopting a notably global perspective. In contrast to the predominantly regional focus of existing research, the emphasis lies on a broader, worldwide outlook that underscores the industry's evolving significance on a global scale. This distinctive approach serves as a key differentiator, providing a comprehensive understanding of stock movements in the semiconductor sector across diverse international landscapes.

Furthermore, this study enriches the existing literature by shedding light on the interplay between specific events, innovation, and external information, offering a more comprehensive understanding of stock movements in the semiconductor industry.

Chapter 3: Semiconductor Industry Overview – Julius Reich

3.1 Technological Advancements in the Semiconductor Industry

Semiconductors have established themselves as key elements in today's technological world and the foreseeable future due to their reliability, power efficiency, and compactness. They are widely used, especially in electronic systems, signal processing, and serving communications (Britannica 2023).

The history of semiconductors dials back to the 1940s, but the first significant breakthroughs were in the late 1950s with the discovery of ICs by Jack Kilby and Robert Noyce. This allowed multiple transistors to be integrated into a single silicon wafer, paving the way for more complex and smaller electronic devices (Belli 2017). Semiconductors are made from crystalline materials. Back in the 1950s, it tended to be germanium but was switched to silicon in the early 1960s, due to much lower leakage currents and the ease of creating silicon dioxide as a high-quality insulator (Britannica 2023). In simplicity, the task of semiconductors is explicitly to conduct or not to conduct electricity; they are used as electronic switches based on the binary code (0s and 1s) (BBC 2023). The increase in computing power through shrinking transistors drove the tech sector forward in the 1960s (Hughes 2020). In 1965, Gordon Moore, co-founder of Intel, formulated Moore`s Law, stating that the number of transistors on a chip will double approximately every two years. Moore’s Law developed into the defining paradigm of the industry. To illustrate how exponential the technical progress predicted by Moore's Law is, the following example is given: If the automotive industry had achieved a similar optimization within the last 30 years, a Rolls-Royce would now only cost USD 40 and could circle the globe eight times with one gallon of gas (Heck Kaza & Pinner 2011).

In the 1970s microprocessors were introduced, which paved the way for the rise of consumer electronics in the 1980s. Apart from that the first Semicon Trade Show, a worldwide trade fair for the semiconductor sector was held at the beginning of the 1970s (Semi 1980). In addition, many notable consumer electronics companies were founded in the 1980s, which relied primarily on semiconductor technology. Among them were Apple, and Microsoft. A couple of years later, the companies that will be examined in more detail in Chapter 3.2 were founded. ASML was founded in 1984, TSMC in 1987, and NVIDIA in 1992. The concept of semiconductor foundries, pioneered by companies like TSMC, gained prominence in the 1990s. Foundries provided manufacturing, allowing other companies to focus on design and innovation while outsourcing production. This business model significantly accelerated innovation and reduced costs (AnySilicon n.d.).

In addition to Graphic Processing Units (GPUs), Intel’s Pentinum processors were introduced in 1993, which led to a revolution in the home computer sector (Sexton 2018). This laid the foundation for the digital revolution in the 2000s (Carvalho 2023). This revolution included the introduction of Multi-Core Processors to improve performance and multitasking by companies like AMD and Intel (Bio 2021). Additionally, the Smartphone rose, represented by the flagship “iPhone” in 2007 (Apple 2007). Graphic content in computers also became more relevant. In October 1999, NVIDIA launched its GeForce series, which is still the best-known representative of graphics today (NVIDIA Corporation n.d.). Since then, the semiconductor industry experienced significant diversification. One of these diversified strategies is the System-on-chip (SoC) design. It allows multiple circuits and subsystems to be combined onto one chip (Matsuzwa 2004). Here, GPUs and central processing units (CPUs) are no longer separated from each other but integrated on a single chip. This allows SoCs to be used in a wide range of products, especially in the consumer electronics sector, where both GPUs and CPUs are required within one device (LinMicroSystems 2023). Today, the semiconductor value chain can be broadly divided into the following seven process steps:

1. Developing chip intellectual property ("IP") cores: This method became popular in the 1990s because chips are not built from scratch, but chipmakers can build on IPs with the help of licenses and patents (Zaman 2022).
2. Designing chips: With the help of so-called Electronic Design Automation ("EDA") tools, chip designers can bring their specialized design to the previously purchased IP core (Zaman 2022).
3. Supplying specialized materials: The two steps mentioned above produce software chips, to make them physical, chip factories are needed. Factories further process the raw materials with specialized materials and chemicals. This includes the production of wafers and the use of gases. Over 100 gases are used in the factories (Zaman 2022).
4. Silicon Wafer Manufacturing Equipment: Physical manufacturing processes require sophisticated equipment. As work is carried out at the atomic level and any contamination would destroy the wafer, the processes are extremely elaborate, complex, time-consuming, and cost-intensive. For example, the ASML machine used in EUV technology costs around USD 150 million and comprises more than 100,000 individual parts (Zaman 2022).

5. IC Design: The production of IC design drawings, which are the blueprint for the chips. Before the manufacturing process can be started, engineers must plan the functions that need to be included in the chip and which requirements need to be matched to achieve those functions. This is the upstream of semiconductor production (Market Prospects 2021).
6. IC Manufacturing: After the IC design is completed, the manufacturing stage starts, where the designed circuit diagram must be transferred onto the wafer. In the manufacturing process, various stages diverge from the specific functionalities required for the chip. This is the midstream of semiconductor production (Market Prospects 2021).
7. IC Packaging and Testing: When the design is successfully placed onto the wafer to form the IC, it needs to be tested if the ICs work as planned. If the testing is successful, the IC is wrapped into the Chip to produce the final chip that is fixed onto a carrier. This carrier is needed to connect the final chip to the surroundings where it is needed later. This is the downstream of semiconductor production (Market Prospects 2021).

3.2 Major Players:

To shed light on the top companies in the semiconductor industry a closer look was taken at the Standard & Poor’s (S&P) Global Semiconductor Index. It comprises the world's semiconductor industry by measuring the performance of 50 global companies within the industry. The USA is represented with around 62.4%, followed by Taiwan with 13% and the Netherlands with 8.4%. The index only lists ASML as a European company among the ten largest companies in the index. In Asia, there are two representatives among the ten largest companies in the index, TSMC and Samsung. All the remaining large companies in the index are from the USA (S&P Global 2023). To highlight more than just the US market, for this study the top major player of each area, was chosen.

To provide a comprehensive overview of the major players in the USA, Europe, and Asia, it is essential to establish the criteria for identifying significant entities. This entails defining the parameters of major players, elucidating the characteristics of large-cap stocks, outlining the criteria employed in selecting companies for emphasis in this study based on core business considerations, and articulating the methodology for assessing the factor of "relevance on the capital market."

Major players in capital markets are characterized by size, called “large-cap stocks”. A large-cap stock is supposed to have a market capitalization of at least 10 bn USD (Forbes Advisory 2022). All companies that were shortlisted for this study fulfill this criterion. Another common standard that needs to be matched to be considered a “major player”, is the relevance of semiconductors to the core business of the company. The major players should generate at least 50% of their revenue from activities related to semiconductors. Samsung is a mixed consumer and, relatively speaking, only generates a small part of its sales from the semiconductor industry (Approximately 28%), most of the group's sales come from the smartphone division and its accessories (Reuters n.d.). Therefore, Samsung was not to be considered a "major player" in this study. Nevertheless, several US companies fulfill the criteria. Moreover, major players in the market must demonstrate their relevance in the capital market and underscore their competitiveness over an extended duration. This can be significantly influenced by the performance of a company (Investopedia 2021). The major players chosen for this study were NVIDIA from the U.S., TSMC from Asia, and ASML from Europe.

A comparative index should be used as the last dependent variable. The S&P Global Semiconductor Index mentioned above would naturally have been suitable for this. However, there were various reasons for not choosing an index, but rather an ETF. Unlike ETFs, indices are not traded on the stock exchange, meaning that the immediate reaction to an event cannot be determined. An ETF, on the other hand, is traded daily on the market like a share, meaning that reactions to events can be measured (Pearler 2023). Furthermore, an ETF is backed by an underlying asset - an ETF mirrors the fluctuations of the underlying asset as closely as possible. An ETF therefore ensures far better comparability (Financial Times 2020).

All the companies named so far were large-cap companies, as mentioned above. Due to their significant size, the ETF used for comparison should also be as large as possible. In the case of an ETF, there are several ways to determine whether an ETF is large or not. The more assets are under management, the larger is the ETF (Seeking Alpha 2022). The largest ETF on the market that tracks companies in the semiconductor industry is the VanEck Semiconductor ETF. It has assets under management of around USD 10.5 bn (ETF Database 2023).

3.2.1 NVIDIA

NVIDIA was founded in 1992 by Stanford-trained engineer Jen-Hsun Huang and introduced graphics processors that set a new industry standard for speed in 1997. The company is now operating in the mainstream personal computer market, designing, developing, and marketing 3D graphic processors and related software. NVIDIA has leveraged its graphic processing units (GPUs) architecture to create platforms for Artificial Intelligence (AI), scientific computing, data science, autonomous driving, robotics, and 3D internet applications. Its operations can be divided into two segments Compute & Networking (accountable for 55% of revenue) and Graphics (accountable for 45% of revenue) (Appendix 4). The company has outsourced its manufacturing of Semiconductors to TSMC and Samsung Electronics Co. Ltd. The assembly, testing, and packaging work is done by independent subcontractors such as BYD Auto.

NVIDIA has almost multiplied tenfold in their Market Capitalization since 2020 until the present year. This is due to their significant stock relay, especially in 2023 with a performance of 211.19% YTD (Appendix 6). With that, NVIDIA is the stock with the best performance in the S&P 500 (YTD perspective) which can be considered the most important index of the US (Povey 2023). Thanks to this performance, NVIDIA now has the sixth-largest market capitalization in the index, at around USD 1.12 trillion (Reuters n.d.). The revenue of NVIDIA is expected to rise from 26.91 bn USD in 2022 to 26.97 bn USD annualized in 2023 and is mainly coming from the business unit related to semiconductors as mentioned before (Appendix 4). The company's largest sales market is the USA which is accountable for about 30.7% of the revenue. Additionally, the net Income of NVIDIA fell from 9,81 bn USD in 2022 to 6,13 bn USD in 2023, making it a decrease of about 37.50% Year over Year (YoY) (Appendix 6). NVIDIA has an average daily trading volume of 50,740,249 shares on the day of significant events. In comparison, the company had a trading volume of 48,880,918 shares on a normal trading day (daily average since May 29, 2015) during the same period. Thus, on average, about 3.8% more NVIDIA shares were traded on the day of an event.

3.2.2 TSMC

TSMC was founded in 1987 as the world’s first dedicated contract semiconductor manufacturer and remains the largest manufacturer in the world to this day, with roughly 30% market share. The company manufactures and markets ICs and provides services such as wafer manufacturing, wafer probing, assembly, testing, and design services. TSMC makes up more than 85% of its sales through wafer manufacturing. The five major markets the company operates in are high-performance computing, IoT, Automotive, and digital consumer electronics (Appendix 7). It handles manufacturing for semiconductor and integrated device companies that do not have their manufacturing facilities. Since 2019 the company has almost doubled its market capitalization, rising from 8.58 bn USD in 2019 to 14.13 bn USD in 2023. When looking at this year, TSMC has a performance of 23.22% (Appendix 8). Additionally, the company was able to increase its revenues from 1.07 bn USD in 2019 to 2.23 bn USD in 2023 while also increasing its net income from 347.25 million USD to 960.12 million USD equaling a relative increase of 176% (Appendix9). TSMC’s stock has a daily average trading volume of 10,678,566 shares on event days. Compared to an average trading day (daily average since May 29, 2015) in the same period, the share had an average trading volume of 9,062,903. The trading volume on the day of an event is around 17.8% higher than on a normal trading day.

3.2.3 ASML

ASML was founded in 1984 and can be described as a global innovation leader in the chip industry that provides chipmakers with hardware, software, and services to mass-produce patterns on silicon through lithography. It's based in the Netherlands (Amsterdam) and is specified on semiconductor manufacturing equipment with the usage of lithography. ASML is therefore part of the semiconductor hardware segment, in which it generates all its sales (Appendix 10). ASML`s products include extreme ultraviolet (EUVs) lithography systems, deep ultraviolet (DUV) lithography systems, refurbished systems, and metrology and inspection systems.

The company has more than doubled its market capitalization since 2019 up to the present year. In the most recent year, ASML has had a YTD performance of approximately 10.67% (Appendix 11). The revenue is expected to rise from 21,17 bn USD in 2022 to 25,86 bn USD annualized in 2023. Additionally, the net Income of ASML is expected to rise from 5,65 bn USD in 2022 to 7,43 bn USD in 2023, representing a rise of 31.50% YoY (Appendix 12). ASML records an average daily trading volume of 1,012,030 shares on days when events occur. In contrast, on an average trading day (daily average since May 29, 2015), the share has an average trading volume of 920,009 shares. Thus, like the other companies' shares, the relative trading volume is on average around 10.0% higher on a day on which an event has taken place.

3.2.4 VanEck Semiconductor ETF (SMH US Equity)

The VanEck Semiconductor UCITS ETF with ISIN IE00BMC38736 is one of the largest ETFs in the semiconductor sector. It was launched on December 1, 2020, and has fund assets of around USD 1,017 million as of the report date. The ETF is based on the MVIS® US Listed Semiconductor 10% Capped Index, which it aims to track as closely as possible. The fund comprises 25 positions, none of which should exceed a weighting of 10% for a longer period. All positions include companies active in semiconductor production and equipment. The five largest positions at the time of writing are Broadcom, TSMC, ASML, NVIDIA, and AMD. The geographic distribution, is 75% in the USA, followed by around 11.8% in the Netherlands and 10.3% in Taiwan. The YTD return of the fund is currently around 35%, while the one-year return is around 46%.

Chapter 4: Stock Market Movements – Niklas Volk

4.1 Correlation between Chip Industry Performance and Stock Market

As highlighted in previous chapters, the relevance of the semiconductor industry is unmistakable. To measure this relevance, 53 event announcements that affect the industry were selected (Appendix 1). The performance of the previously named major players was analyzed in the week of the event. The semiconductor industry is considered cyclical (see 2.1). It is presumed that a general inflow of capital has a positive effect on the share prices of companies, while an outflow of capital causes a negative price movement (Seitz 2021).

Preliminary, a simple linear regression was performed and served as a structure for the multiple regression carried out subsequently. For reference and the following chapters, the following equation for the single regression were defined:

$$DV_x = ß_0 + ß_1 IV_2 + \varepsilon$$

4.1.1 Event Classification IV2 & NVIDIA

As can be seen in Appendix 13, in the simple regression model, the intercept is 0.0329 and can be classified as non-significant due to the high p-value of 0.3590. The residuals range from -0.1604 to 0.1742. The median of the residuals is 0.001 and therefore close to 0. It can be assumed that the model generally predicts accurately. The multiple R-squared value is 0.153, explaining 15.3% of the variance within the model. Additionally, the model's p-value of 0.0868 is close to the threshold of 0.05, suggesting significance.

Furthermore, only "IV2 Restriction" shows significance with a p-value of 0.0468. The standard deviation of the coefficient is -0.0871, implying a negative impact of events for the NVIDIA share classified as a Restriction, aligning with the established belief H1#2.

4.1.2 Event Classification IV2 & TSMC

The intercept for the simple regression model in Appendix 14 is -0.0270, showing no significance given its p-value of 0.165. The residuals range from -0.1045 to 0.0869. The median of the residuals is 0.001, indicating a fairly accurate model. The multiple R-squared value is 0.1547, explaining 15.47% of the variance within the model. Additionally, the model's p-value of 0.0836 is close to the threshold of 0.05 and ca be considered meaningful. No variable has a p-value below 0.05, though some p-values are below 0.20. The p-value of "IV2 Innovation" is 0.118, with a coefficient of 0.0382, suggesting a possibility, that events classified as "Innovations" have a positive impact on the stock movement. The p-value of "IV2 Investments" is 0.175, with a coefficient of 0.0285, suggesting a potential positive correlation between stock movements and events classified as "Investments". Both statements would be in line with H1#1.

4.1.3 Event Classification IV2 & ASML

The simple regression model in Appendix 15, with the intercept of -0.0025 with a p-value of 0.112 is considered non-significant. The residuals range from -0.1147 to 0.1420. With a median of the residuals of -0.0036, indicating accurate predictions by the model. The multiple R-squared has a value of 0.1419, which means that the model explains 14.19% within itself. Additionally, the model's p-value of 0.112 is close to the threshold of 0.05, suggesting potential significance. However, no independent variable has a p-value below 0.20, indicating relatively low expressiveness. Due to their high p-values, these statements are not further included in the analysis.

4.1.4 Event Classification IV2 & VanEck Semiconductor ETF

In the simple regression model (Appendix 16), the intercept is -0.3325, deemed non-significant due to a high p-value of 0.882. The residuals range from -9.3822 to 8.5362. The median of the residuals is -0.2614, which, although is close to zero, is not as close as observed in previous models, indicating potential accuracy but with some exceptions. The multiple R-squared is 0.137, explaining approximately 13.7% of its variance. Additionally, the model's p-value is 0.1248, relatively low, but still above the threshold of 0.05.

Furthermore, “IV2 Restriction” has the lowest p-value of 0.211, with a clear negative coefficient of -3.3853. This suggests a negative relationship between the dependent variable and Restrictions, aligning with H1#2. However, the p-value remains above 0.2 and should be interpreted accordingly.

4.2 Multiple Regression Results

To increase the significance of the models, a multiple regression was performed to test the effects of two independent variables on the dependent variables. For reference again, this is the formula for the multiple regression:

$$DV_x = ß_0 + ß_1 IV_1 + ß_2 IV_2 + \varepsilon + CV_1$$

4.2.1 NVIDIA regressed as DV1

The following results come from a multiple regression analysis, where DV1 is regressed on IV1 and IV2 and the control variable is added as CV1. In the model, the intercept is 0.0880, while it can be considered not significant due to its high p-value of 0.2423. The residuals range from -0.1585 to 0.1486, and a median of 0.0025 leads to the interpretation that the predictions are close to the observed values on average. However, the range from -0.1585 to 0.1486 still indicates some instances where the model's predictions deviate significantly from the actual values. In the model, the multiple R squared is 0.2379, which suggests that the model explains about 23.79% of the variance. Moreover, it is notable that the p-value of the overall model is 0.4998 and therefore relatively high compared to the threshold of 0.05 (Appendix 17). The result of the statistical tests of the coefficients suggests that "IV1Japan" with a p-value of 0.1169, could have a statistically significant impact on NVIDIA's stock price (Appendix 17). According to the model, this influence is negative on the stock price, with a coefficient of -0.1162. This implies a negative relationship between events in Japan and DV1. Therefore, NVIDIA's stock price, on average, decreases by 0.1162 after each event in Japan affecting the semiconductor industry. However, since the p-value of 0.1169 is still above the threshold of 0.05 for significance the trend that the variable is indicating needs to be treated with caution. In addition, all other geographical variables have a p-value above the defined 0.20. For this reason, the events of the other countries were to be classified as insignificant for the dependent variable (Appendix 17).

One possible explanation for this is that NVIDIA, as described in Chapter 3.2.1. generates most of its sales in the USA. Since the identified events from Japan essentially comprise investments, the events could therefore mean a promotion of NVIDIA's competition, which can have a negative impact on NVIDIA on the capital market. This would be somewhat in line with H1#2, stating that capital outflows on the market lead to an average price loss.

When looking at the second independent variable, the events "IV2Restriction" can be highlighted. According to the model, these events harm the dependent variable and therefore NVIDIA's share price. Restrictions have a coefficient of -0.0960, which means that NVIDIA's share price falls on average by 0.0960 units after an event occurs which results in a Restriction for the semiconductor industry. The p-value of these events is 0.0634 which is slightly above the threshold of 0.05. The influence of Restrictions therefore needs to be treated with caution as well (Appendix 17). However, this result would be in line with H1#2. In the case of a Restriction, it is to be expected that capital will be withdrawn from the semiconductor industry (Kemna 2015).

Moreover, all other IV2s in the model have a p-value above 0.20. For this reason, they were not examined in more detail. A statement about H1#1 cannot be made using this dataset.

4.2.2 TSMC regressed as DV2

In the model, the intercept is -0.0155, while it can be considered as not significant due to its high p-value of 0.6840. The range of the residuals varies from -0.0887 to 0.0689, a median of 0.0026 leads to the interpretation that the predictions are close to the observed values on average. However, the range from -0.0887 to 0.06889 still indicates some instances where the model's predictions deviate significantly from the actual values. In the model, the multiple R squared is at 0.3245, which suggests that the model explains about 32.45% of the variance. Moreover, it should be noted that the overall p-value of the model is 0.1753, which is relatively high compared to the threshold of 0.05 (Appendix 18). The result of the statistical tests of the coefficients suggests that "IV1 Japan" with a p-value of 0.2042, could have a statistical impact on the movement of the DV2. The effect of the events in Japan would therefore be negative by 0.0476, on average, per unit (Appendix 18). However, since the p-value of 0.2042 is above the threshold of 0.05 for significance, the trend that the variable is indicating needs to be treated with caution. Due to the inflow of capital to Japan and the resulting lower availability of capital in Asia, this is in line with H1#2. With this p-value, "IV1 Japan" is the only geographical variable with a p-value below 0.20 in the model under observation. The statements of the coefficients of the remaining geographical variables were therefore not considered significant.

When looking at the second independent variable, "IV2 Investment" with a p-value of 0.0397, has a significant impact on TSMC's stock price (Appendix 18). The coefficient of 0.0501 further implies that Investments have a positive impact on the stock movements of

TSMC. Therefore, TSMC’s share price increases by 0.0501 units after each Investment event on average affecting the semiconductor industry. In addition, the variable "IV2 Innovation" also has a relatively low p-value of 0.1161. Its coefficient of 0.0387 is therefore included in the analysis. Accordingly, the events examined in which an Innovation takes place in the semiconductor industry have a positive effect on the movement of TSMC's share price on average. Nevertheless, the interpretation of this variable should be treated with caution due to the p-value above the threshold. The last event to be examined in more detail is "IV2 M&A", which has a p-value of 0.1303 in the model. The coefficient of "IV2 M&A" is 0.0405, which implies that Mergers & Acquisitions have a positive effect on TSMC's share price on average. Like the previously observed variables, these should be treated with caution due to the p-values above the threshold.

All three variables indicate a positive reaction of TSMC’s shares to capital inflow. This is in line with the stated H1#1. The remaining variables have a p-value above 0.2, which is why their statements cannot be considered significant.

4.2.3 ASML regressed as DV3

In the model, the intercept is 0.0351, while it can be considered as not significant due to its high p-value of 0.5064. The range of the residuals varies from -0.0987 to 0.1073. A median of -0.0047 leads to the interpretation that the predictions are close to the observed values on average. However, the range from -0.0987 to 0.1073 still indicates some instances where the model’s predictions deviate significantly from the actual values. In the model the multiple R squared is 0.2824, which suggests that the model explains about 28.24% of the variance. Moreover, it is notable that the p-value of the overall model is relatively high at 0.3107 (Appendix 19).

In the dataset, the variable "IV1 Japan" with a p-value of 0.0689 could have a significant impact on the share price of ASML. According to the model, the stocks of ASML react negatively on average with a decrease of 0.0959 per unit to events in Japan that affect the semiconductor industry (Appendix 19). Even if the p-value is above the threshold of 0.05 and should therefore be treated with caution, one possible interpretation could be that events in Japan tie up capital in the Asian region which is therefore withdrawn from the European region. This interpretation would be somewhat in line with the previously established hypotheses H1#2. The remaining variables have a p-value above 0.2, which is why their statements cannot be considered significant.

4.2.4 VanEck Semiconductor ETF regressed as DV4

In the model, the intercept is 3.8353, while it can be considered as not significant due to its high p-value of 0.3831. The range of the residuals varies from -8.0334 to 7.8087, indicating that most of the residuals are within this range from the fitted regression line. A median of 0.0076 leads to the interpretation that the model predicts accurately on average. In the model, the multiple R squared is 0.3117, which suggests that the model explains about 31.17% of the variance. Which is the second highest value of the models tested related to the adjusted R-square (Appendix 20). Moreover, it is notable that the model has a p-value of 0.2113, which is above the threshold of 0.05. “IV 1Japan” has a coefficient of -8.8911 at a p-value of 0.0433, indicating a clear negative impact of events in Japan for the movement of the ETF at the stock market. According to the model, the price of the ETF reacts negatively on average with -8.8911 units to events in Japan that affect the semiconductor industry (Appendix 20). As with the companies discussed above, a reason for this could be the ETF's positions, which are mostly located in the USA (around 75%, see 3.2.4). This would be in line with H1#2, as events shift capital to Japan. Furthermore, “IV1 USA” also tends to harm the VanEck Semiconductor ETF at the capital markets according to the model. The events have a coefficient of –4.88046 at a p-value of 0.1862. The p-value is significantly above the threshold of 0.05 and this result should be treated with caution. “IV2 Restrictions” has a coefficient of -3.8973 at a p-value of 0.1939.

Assuming that this variable is significant, it would mean that Restrictions harm the ETF's movements at the capital market, which would be in line with H1#2. The remaining variables have a p-value above 0.2, which is why their statements cannot be considered significant.

4.2.5 NVIDIA regressed as DV1 including TSMC and ASML

The following results come from a multiple regression analysis where NVIDIA (DV1) is regressed on IV1 and IV2 simultaneously (Appendix 21). DV1 would be the stock movement of NVIDIA, while DV2 would be the stock movement of TSMC and DV3 would be the stock movement of ASML. The range of the residuals varies from -0.0761 to 0.0671, with a median of 0.0009. The residual standard error is 0.0384, which can be considered as low. This means that the model's predictions are closer to the observed values. In the model, the intercept is 0.0604, while it can be considered as rather not significant due to its p-value of 0.1310. The multiple R squared is at 0.812, which suggests that the model explains about 81.20% of the variance, which is the highest value of the models tested. The p-value of the overall model is below 0.01 and has the greatest significance compared to all other models. In addition, the model explains a large part of the model (>0.80). Of course, this is merely an observation within a model, which is why the statements should still be treated with caution (see Scope & Limitations).

When analyzing the coefficient variables, all geographical variables have a p-value above 0.2 and can be considered non-significant. When looking at the classification variables there are several variables with a p-value below 0.2. "IV2 Innovation" has a coefficient of -0.0459, indicating a negative impact on the dependent variables at a p-value of 0.0853. Nevertheless, the result should be treated with caution since the p-value is still slightly above the threshold of 0.05. Apart from that, "IV2 Investment" also has a negative coefficient of -0.0532, indicating a negative influence on the dependent variable at a p-value of 0.0421. Which is below the threshold of 0.05. Looking further into the model, "IV2 M&A" has another negative coefficient of -0.0728, even at a lower p-value of 0.0126. Since the p-value is below the threshold of 0.05 it can be considered significant, which means that M&A Events tend to harm the stock movements of the three dependent variables. However, this wouldn't be in line with either H1#1 or H1#2. "IV2 Restriction" is another independent variable with a relatively low p-value of 0.0547. The coefficient of "IV2 Restriction" is negative at -0.0522. The p-value is slightly above the threshold and should be treated with caution. However, this result is in line with H1#2, as Restrictions were associated with a general outflow of capital on the capital market. When looking at the control variable, the control variable "Real GDP Growth (Q/Region) has a relatively low p-value of 0.1017. Nevertheless, the coefficient is marginal at -0.0013. When examining the effects of the dependent variables, both dependent variables tend to influence DV1. While the effect of DV2 (TSMC) is much more insignificant at a p-value of 0.1065 than the effect of DV3 (ASML) at a p-value of below 0.01. The coefficient of DV2 is 0.4298, indicating a positive effect of DV2 for DV1. The coefficient of DV3 is even more positive at 0.9725, indicating a strong positive relationship with the dependent variable, DV1.

4.2.6 TSMC regressed as DV1 including NVIDIA and ASML

The following results come from a multiple regression analysis where TSMC (DV1) is regressed on IV1 and IV2 simultaneously (Appendix 22). DV1 would be the stock movement of TSMC, while DV2 would be the stock movement of NVIDIA and DV3 would be the stock movement of ASML. The range of the residuals varies from -0.0448 to 0.0419, with a median of 0.0008. The residual standard error is 0.0241, which can be considered as low. This means that the model's predictions are closer to the observed values. In the model, the intercept is -0.0427, while it can be considered as somewhat significant due to its p-value of 0.0879. The multiple R squared is at 0.7471, which suggests that the model explains about 74.71% of the variance. The p-value of the overall model is below 0.01 which can be considered as highly significant. In addition, the model explains a large part of the model (>0.70). Of course, this is merely an observation within a model, which is why the statements should still be treated with caution (see Scope & Limitations).

When analyzing the coefficient variables, only one geographical variable, "IV1Europe" has a p-value below 0.2. The coefficient is at -0.0345, indicating a negative impact of Events that take place in Europe. This could be somewhat in line with H1#2 since capital is tied up in Europe. However, the p-value is still rather high at 0.1775. When looking at the classification variables there were several variables with a p-value below 0.2. "IV2 Innovation" has a coefficient of 0.0420, indicating a positive impact on the dependent variables at a p-value of 0.0101. This would be in line with H1#1 since Innovations lead to a capital in flow and can be considered as statistically significant. Apart from that, "IV2 Investment" also has a positive coefficient of 0.0380, indicating a positive influence on the dependent variable at a p-value of 0.0197. Which is again below the threshold of 0.05 and in Line with H1#1 since Investments lead to a capital inflow at the stock market. Looking further into the model, "IV2 M&A" has another positive coefficient of 0.0432, even at a similar low p-value of 0.0190. It can therefore be considered significant, which means that M&A Events tend to have a positive impact on the stock movement of TSMC. This would again be in line with H1#1 just like the previously made observations. When looking at the control variable, the control variable "Real GDP Growth (Q/Region) has a relatively low p-value of 0.0904. Nevertheless, the coefficient is marginal at 0.0008. When examining the effects of the dependent variables, both dependent variables tend to influence DV1. While the effect of DV3 (ASML) is much more significant at a p-value of 0.0203 than the effect of DV2 (NVIDIA) at a p-value of below 0.1065. The coefficient of DV2 is 0.1693, indicating a positive effect of DV2 for DV1. The coefficient of DV3 is even more positive at 0.3512, indicating a strong positive relationship with the dependent variable, DV1.

4.2.7 ASML regressed as DV1 including NVIDIA and TSMC

The following results come from a multiple regression analysis where ASML (DV1) is regressed on IV1 and IV2 simultaneously (Appendix 23). DV1 would be the stock movement of ASML, while DV2 would be the stock movement of NVIDIA and DV3 would be the stock movement of TSMC. The range of the residuals varies from -0.0475 to 0.0546, with a median of 0.0000. The residual standard error is 0.0261, which can be considered as low. This means that the model's predictions are closer to the observed values. In the model, the intercept is -0.0020, while it can be considered as insignificant due to its high p-value of 0.9418. The multiple R squared is 0.8367, which suggests that the model explains about 83.67% of the variance. The p-value of the overall model is below 0.01 which can be considered as highly significant. In addition, the model explains a large part of the model (>0.80). Of course, this is merely an observation within a model, which is why the statements should still be treated with caution (see Scope & Limitations).

When analyzing the coefficient variables, all geographical variables have a p-value above 0.2 and can be considered non-significant. When looking at the classification variables there is again no variable with a p-value below 0.2. Thus, no reliable statement can be made about the independent variables, or H1#1 or H1#2, based on the model. When looking at the control variable, the control variable "Real GDP Growth (Q/Region) has a relatively high p-value of 0.6905 and can be considered insignificant. When examining the effects of the dependent variables, both dependent variables have an influence on DV1. While the effect of DV2 (NVIDIA) is more significant at a p-value below 0.01 than the effect of DV3 (TSMC) at a p-value of below 0.0203. The coefficient of DV2 is 0.4486, indicating a positive effect of DV2 for DV1. The coefficient of DV3 is in a similar range at 0.4114, indicating a positive relationship as well with the dependent variable, DV1.

4.3 Further Drivers for Movements at the Stock Market

Considerable attention should be given to annual and quarterly earnings calls. The influence of quarterly results on share prices can be regarded as one of the most important indicators of share price performance. Investors pay close attention to whether companies meet or miss their previously forecasted targets (Real Finance People 2019). In addition, quarterly figures must always be placed in context (McKinsey 2023). Even in a persistent bear market, good quarterly figures are not usually a decisive impulse to reverse the trend. The same applies to poor quarterly figures in an ambitious bull market (Corporate Finance Institute n.d.). The relevance of quarterly figures is illustrated in Appendix 24. The table clearly shows that NVIDIA's share price is extremely volatile with strong fluctuations on the day of publication and during the week of publication. The average daily trading volume of the share on the days of the quarterly figures is 87,924,793, while the historical average of a normal trading day (average of all trading days since August 2015) is 49,246,015. The trading volume on the day of the quarterly figures is on average 43.99% higher than on a "normal" trading day.

For TSMC there were similar effects to be identified (Appendix 25). Even if the swings at TSMC are much smaller than at NVIDIA, there is a deviation from the norm. The average trading volume effect is even more prominent compared to NVIDIA. While on an average day (average of all trading days since July 2015) their share has a trading volume of 9,017,238, the average trading volume of the share on days of earnings calls is 23,437,087. TSMC's trading volume on earnings call days is on average 159.9% higher than on normal trading days.

ASML (Appendix 26) shows similar performances on days of their earnings calls. The volatility is roughly between that of TSMC and NVIDIA. Furthermore, the average trading volume of ASML on an average day (average of all trading days since July 2015) is around 919,191. In comparison, the average trading volume on the day of the earnings calls observed is 1,924,802. This means that the trading volume on the day of the published earnings calls is also relatively low.

Another crucial driver for the movement of share prices are the ratings of analysts (Brav & Lehavy 2003). Stock market analysts cover certain companies and closely examine their performance in a financial and strategic context. They interact with company representatives and use this as a basis for making buy or sell assessments for companies' stocks. These differ depending on the rating agency/bank. They generally vary between "buy", "hold" and "sell", however, some agencies may also include "underperform" and "overperform" as a softer indication for "sell" and "buy" (Grant 2022). The market usually reacts more strongly to analysts' recommendations and comments than to management's own recommendations (Chen, Nagar & Schoenfeld 2018). Analysts also set target prices for shares, which depend on the respective rating. Target prices are generally higher than the current market price in the case of a buy rating and lower than the current market price in the case of a sell rating (Brav & Lehavy 2003). The analysts' assessments of the analyzed companies in the semiconductor segment and their consensus target price can be seen in Appendix 27.

Chapter 5: Expert Interview – Group Part

Andreas Randebrock attained the role of Executive Vice President of Global Human Resources on July 1, 2020 (Vishay Intertechnology n.d.). He has been a part of Vishay since 2015, initially serving as Senior Vice President for Employee Development (Vishay Intertechnology n.d.). Before joining Vishay, Mr. Randebrock spent over 20 years as a management consultant specializing in leadership, human resources, and organizational consulting (Vishay Intertechnology n.d.). From 1998 to 2015, he was associated with the global human resources consultancy Hay Group, later acquired by Korn Ferry, where he held various roles of growing responsibility and eventually became a partner (Vishay Intertechnology n.d.).

For the purposes of this study, his profile was exceptionally well-suited for an interview. Acquiring insights from experts consistently yields valuable information, contributing not only to a more profound understanding but also introducing novel ideas and considerations to the research. Given the intricate nature of the semiconductor industry, condensing all pertinent discussions into a single interview proved challenging. However, it was imperative for this study to delve into specific areas and, notably, yielded significant findings.

Vishay was founded in 1962 by Dr. Felix Zandman and manufactures a broad line of discreet active electronic components, such as resistors, inductors and transistors. Vishay is based in the US (Pennsylvania) and is positioned at the forefront of technology, The company has a comprehensive product portfolio which forms the foundation of modern electronic devices, contributing to daily life across various sectors (Bloomberg n.d.). As a key player in R&D, manufacturing, engineering, and sales, Vishay supports macroeconomic growth drivers like sustainability, connectivity, and mobility (Vishay Intertechnology n.d.). The company collaborates with industry leaders to drive Innovations in automation, automotive electrification, 5G technology, and IoT connectivity, reflecting its commitment to shaping a safer, sustainable, and more productive future. Vishay can be assigned to the Semiconductor Hardware Segment where the company generates all its sales (Appendix 28).

Vishay has increased its market capitalization by about 8.77% since 2019. In the recent year, the company had a YTD Performance of about 10.52% (Appendix 29). However, the revenue is expected to decrease from 3,50 bn USD in 2022 to 3,47 bn USD in 2023 annualized. Additionally, the Net Income of Vishay is expected to decrease from 422.5 bn USD in 2022 to 363.1 bn USD in 2023. Relatively speaking this equals a decrease of 14.06% YoY (Appendix 30).

Throughout the interview, three pivotal topics surfaced, offering valuable insights into the semiconductor industry and its correlation with stock prices amid specific events. Firstly, an exploration of the prevailing trends in Europe's semiconductor market provided a nuanced understanding of its current dynamics. Secondly, attention shifted towards the major challenges

Vishay has encountered in recent years, offering a comprehensive view of the company's strategic responses. Lastly, from an executive perspective, the discussion provided valuable insights into the critical factors influencing the impact of events on stock developments within the semiconductor industry.

Inquiring about the prevailing trend in Europe's semiconductor market, Mr. Randebrock highlighted geopolitical factors as a key aspect, and it was unsurprising given their influential role. The decision-making process for companies regarding investments in new technology, plants, or fabs is notably influenced by subsidiaries. It's crucial to note that differences in company sizes impose limitations on investments. Top-performing companies like Intel exhibit significantly larger investment volumes compared to Vishay. In Vishay's case, the predominant strategy involves acquiring older fabs from companies like Intel.

In the discussion on the significant challenges faced by Vishay in the semiconductor industry during the recent chip war spanning the past few years, Mr. Randebrock shared insightful observations. He highlighted the nature of meeting demands, particularly in the face of supply chain disruptions and evolving market needs. Throughout the pandemic, Vishay and other industry players encountered difficulties in allocating products to customers, exacerbated by customer concerns about potential semiconductor shortages. Faced with the fear of running out of crucial supplies, customers opted to make advance purchases, leading to uncertainties in production predictions. Price sensitivity emerged as a key challenge for Vishay, influenced by product availability and shortages. As previously explored in the industry analysis and chip production overview, the semiconductor industry operates with extended lead times. Post-crisis scenarios, such as the COVID-19 pandemic, witnessed customers either stockpiling or underestimating their semiconductor requirements, adding complexity to the production finalization process.

Given the overarching theme of this thesis, which predominantly centers around the impact of events on the stock price movements of semiconductor companies, it was imperative to seek Mr. Randebrock's insights on the matter. Specifically, his perspective on the factors most influencing stock movements at Vishay was inquired. Mr. Randebrock underscored the paramount importance of quarterly earnings calls, noting their substantial impact and significant contribution to trading volumes. While on an average day (average of all trading days since July 2015) their share has a trading volume of 919,191 the average trading volume of the share on days of earnings calls is 1,924,802. Vishay's trading volume on earnings call days is on average 41.81% higher than on normal trading days. A closer examination of these calls revealed that top-line growth and gross margin hold pivotal roles in shaping the decisions of shareholders and potential buyers, as previously elucidated in the section titled "Further Drivers for Movements in the Stock Market." Notably, when questioned about the relative significance of the categories under study, Mr. Randebrock couldn't provide a definitive answer with absolute certainty.

Chapter 6: Conclusion – Group Part

6.1 Summary of Findings

The following section summarizes the highlights of the findings that were found in this work. Given the inadequacies highlighted in Chapter 4 regarding the strength of the results obtained from individual regressions, the decision was made to employ multiple regressions. This methodological shift yielded more robust and improved outcomes. All in all, this thesis should serve to provide a better understanding of the semiconductor industry and its relevance for the capital market. Additionally, it should be explored, how event announcements influence the stock prices of those semiconductor firms. For this purpose, a statistical model in the form of a multiple regression was set up to test the two beliefs H1#1 (*Events that result in a capital inflow are significantly associated with an increase in the stock prices of the examined companies.*) and H1#2 (*Events that result in a capital outflow are significantly associated with a decrease* *in the stock prices of the examined companies.*) that were stated in Chapter 1.4. The model should also measure how strongly the respective independent variables react to the dependent variable.

The results of the models can be summarized as followed: Looking at all models in which both independent variables and the control variable were included, seven different models emerge. In these models, a total of 21 independent variables were analyzed in more detail because they were considered significant. These items were variables that had a p-value of less than 0.20. Of these variables, seven variables had a p-value below the threshold of 0.05. When looking at these seven variables, four can be considered in line with H1#1 while two were not in line with H1#1. Only one variable can be assigned to H1#2. However, this variable is in line with the belief. When looking at the broader observation of 21 variables, seven variables can be considered in line with H1#1, while four variables were not in line with H1#1. Additionally, eight variables were in line with H2#2, while none of the variable were not in line with H2#2. The remaining two variables with a p-value below 0.20 were independent from the model. Therefore, their impact is not measured on either H1#1 or H2#2.

Thus, it can be stated that most of the monitored results were consistent with the alternative hypothesis. This suggests that the formulated belief can be considered true to a certain extent. In general, H0 cannot be accepted for either hypothesis. Under this assumption events in the semiconductor industry that result in an inflow of capital generally have a positive impact on the share prices of the major players. Furthermore, events that result in an outflow of capital generally have a negative impact on the share prices of the observed major players.

When answering previously set research questions (1. *What types of events have the most significant impact on the stock prices of semiconductor companies?* 2. *How do these events influence the overall industry's stock movements?* 3. *What strategies can stakeholders adopt to mitigate the impact of these events on stock prices?*) it can be stated that: The most significant events with the greatest impact of the belief stated in H1#1 were, on average, Investments, Innovations, and M&A events. These variables were found to be significant with a positive correlation in two models and with a negative correlation in one model. The most significant events with the greatest impact in relation to H1#2 were the events in Japan for the first independent variable. This variable was found to be significant in three models, with a negative correlation to the dependent variable. In addition, for the second independent variable, the events that resulted in a Restriction were also found to be significant in three models, with a negative correlation to the dependent variable. The impact (positive or negative) on the semiconductor industry is therefore highly dependent on the type of event and the associated capital flow.

However, it is difficult to derive strategies for stakeholders. Every investor has an individual risk/return profile and pursues different objectives when investing, to which strategies must be adapted. Nevertheless, investors should invest when an event is announced that will result in an inflow of capital under the assumptions made. Investors should also tend not to invest if an event is announced that will result in an outflow of capital. However, financial achievements of companies are more important for investment decisions. Earnings calls are most likely the ones with the highest significant impact, which was confirmed by this study and by the experts interviewed.

Thus, the complexity of the capital market cannot be overcome by this work and is only partially reduce. Future studies could take up other aspects of the capital market and reduce the complexity of the capital market further. However, the capital market will not become completely tangible, as the environment is too fast-moving, and preferences are too individual. Due to this setting, it is important to pay attention to the limitations described in this paper.

6.2 Implications and Final Recommendations

It is vital to translate the insights and findings into practical implications and recommendations for investors, policymakers, and industry leaders. These implications extend to the landscape and sensitivity of the semiconductor industry, addressing its developmental forecast. The final recommendations provide a guidance on specific actions to navigate and anticipate the semiconductor market effectively. The aim is to put theoretical understanding into actionable directives, facilitating informed decision-making and proactive engagement with the evolving semiconductor landscape. Final recommendations should additionally include suggestions for future studies with a longer-term focus, encompassing a diverse range of industries and companies of varying sizes.

While emphasizing the need for a vigilant approach to quarterly and annual earnings calls and analyst recommendations, it is crucial not to solely rely on these aspects. This study reveals compelling evidence indicating substantial stock movements contingent upon capital inflows and outflows. An analysis of trading volume further elucidates the discernible impact of the event categories under scrutiny in this thesis. Consequently, a comprehensive examination of potential events influencing the stocks of semiconductor companies is warranted. Beyond the purview of the semiconductor industry, implications extend to other sector leaders, emphasizing the acute sensitivity of the semiconductor landscape. Noteworthy studies by Hermann P. Rapp and Jochen Möbert (2022), along with insights from Mr. Randebrock, underscore the potential ramifications of variations in customer orders, triggering feedback loops within the supply chain and contributing to forecast deviations that may, in turn, lead to production bottlenecks or overcapacities. The 2020 chip shortages were caused by a combination of factors set off by the COVID-19 pandemic's impact on multiple industries. Lockdowns initially increased the demand for work-from-home technology, creating a surge in the need for semiconductor chips. This heightened demand led to a competition for chips, particularly among automakers, who were all vying for the same resources. Despite its notable sensitivity, the semiconductor industry flourishes amidst robust demand, offering secure investments for investors. The positive outlook for the industry's future is boosted by the ongoing construction of many semiconductor factories and government support through subsidies to different companies. This confirms a bright path for the industry's success.

Deriving final recommendations from the findings and implications poses challenge, contingent upon the perspective of the recipient seeking guidance. For individual investors, a definitive recommendation emerges: the semiconductor market stands as a prominent and robust sector, hosting major players globally. Given its critical role in various industries, the semiconductor industry promises a favorable future. A comprehensive analysis of factors affecting market and stock movements is advised, with discernment placed on events that exert more significant influence. Semiconductor companies must strategically enhance their revenues and profits to yield returns for investors and achieve improved fundamental valuations, subsequently fostering an increase in stock prices within the market. Diverse types of semiconductor companies exist, requiring strategic positioning for sustained competitiveness, minimizing reliance on specific customers, and navigating geopolitical constraints as illustrated by Mr. Randebrock's example involving Huawei. A direct avenue for semiconductor firms to enhance competitiveness is through "coopetition," a term exemplified by research collaborations among large multinational companies in the sector, as demonstrated by Andrenelli et al. (2019). Noteworthy partnerships between ASML and Intel, as well as TSMC and various suppliers, underscore the efficacy of collaborative efforts in technological advancements. Amid the current chip shortage, intensified collaborations between car manufacturers and semiconductor companies aim to preempt future bottlenecks, reinforcing the importance of strategic alliances in navigating industry challenges.

In concluding this study, it is imperative to underscore that the recommendations put forth extend beyond the immediate scope of the study, aiming to guide and inspire prospective research initiatives. The suggested future investigations should adopt a larger temporal horizon, strategically positioned to unravel the complexities of the subject matter over an extended period. This recommendation was also emphasized by Mr. Randebrock, who underscores the significance of appraising stock movements not merely within short-term intervals but over an extended temporal horizon. While acknowledging the importance of post-earnings call stock movements, he advocates for an examination of a more protracted duration following such calls. This approach is recommended to ascertain enduring trends in stock prices and discern the underlying factors influencing sustained variations in stock values. Encouraging a broader exploration, subsequent studies are advised to traverse diverse industry landscapes, incorporating companies of varying sizes and comparable scales. Delving deeper into specific segments of the value chain and conducting comparisons among companies with identical activities in future research could enhance the overall robustness of the results obtained in this study. This holistic approach is envisioned to enrich the understanding of the intricate dynamics within the capital market, offering nuanced insights into a myriad of organizational contexts. Consequently, it is anticipated that these endeavors will contribute substantively to the development of a more robust and comprehensive knowledge base, fostering the advancement of scholarship in this critical domain.

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Glossary

Abbreviation	Written out
OEM	Original Equipment Manufacturer
bn	billion
YoY	Year over Year
YTD	Year To Date
EUV	Extreme Ultraviolet
DUV	Deep Ultraviolet
TSMC	Taiwan Semiconductor Manufacturing Company
ASML	Advanced Semiconductor Materials Lithography
Co.	Compagnie
Ltd.	Limited
BYD	Build Your Dreams
AI	Artificial Intelligence
ETF	Exchange Traded Fund
ICs	Integrated Circuit
DV	Dependent Variable
IV	Independent Variable
IP	Intellectual Property
EDA	Electronic Design Automation
GPU	Graphic Processor Unit
CPU	Central Processing Unit
OTC	Over the counter
ADR	American Depositary Receipt
GDP	Gross Domestic Product
ROE	Return On Equity
ROA	Return On Assets
Capex	Capital Expenditure
TWD	Taiwan-Dollar
S&P	Standard & Poor’s

Appendices

Appendix 1 – Overview of the 53 monitored Events and their effect on the Major Players

Date	Location	Announcement Type	What happened?	Week	Stock Movement NVIDIA	Stock Movement TSMC	Stock Movement ASML	VanEck Semiconductor ETF (SMH US Equity)
29-May-15	USA	M&A	Avago Technologies acquired Broadcom in a deal valued at over $37bn USD, forming Broadcom Inc.	27.05.-03.06.2015	-0,64%	-3,82%	-0,72%	-1,90%
28-Sep-15	USA	Innovation	GlobalFoundries introduces ist 14nm FinFET manufacturing process.	23.09.-30.09.2015	7,17%	3,70%	4,89%	2,36%
6-May-16	USA	Innovation	NVIDIA announces the launch of the Pascal architecture.	03.05.-10.05.2016	1,10%	0,30%	-1,13%	0,33%
5-Sep-16	Japan	M&A	Softbank completes its acquisition of ARM Holdings.	02.09.-09.09.2016	-4,81%	-1,89%	-5,70%	-4,46%
22-Nov-16	Netherlands	M&A	ASML acquires Hermes Microvision Inc. a leading supplier of e-beam metrology tools.	18.11.-25.11.2016	1,01%	0,64%	-0,43%	1,96%
5-Oct-17	Taiwan	Innovation	TSMC began the production of chips with their 7nm process technology, marking a significant advancement in semiconductor manufacturing.	03.10.-10.10.2017	5,33%	1,38%	0,42%	1,91%
16-May-19	USA	Restriction	The US added Huawei to its Entity List, further emerging the Tech War between China and the US.	14.05.-21.05.2019	-4,31%	-6,36%	-2,17%	-4,16%
31-May-19	China	Restriction	China announces the introduction of an "Unreliable Entity List" which may list foreign entities or individuals as "unreliable entities".	29.05.-05.06.2019	0,67%	1,43%	0,45%	2,51%
3-Jun-19	Germany	M&A	Announcement of the Merger between Infineon Technologies and Cypress Semiconductor worth about $10bn USD.	29.05.-05.06.2019	0,67%	1,43%	0,45%	2,51%
7-Jul-19	Taiwan	Innovation	TSMC began the production of chips with their 5nm process technology, marking a significant advancement in semiconductor manufacturing.	03.07.-10.07.2019	-1,65%	0,94%	-2,67%	0,30%
23-Oct-19	USA	Innovation	Google announced that its quantum computer achieved qunatum supremacy.	21.10.-28.10.2019	5,50%	2,62%	2,33%	3,67%
27-Apr-20	USA	M&A	NVIDIA completes the acquisition of Mellanox for a transaction value of $7bn USD.	24.04.-30.04.2020	-2,35%	-3,09%	-4,38%	1,38%
15-May-20	USA	Investment	The Chips for America Act is firstly presented to secure the on-shore supply of semiconductors for the US.	13.05.-20.05.2020	15,30%	1,81%	10,68%	8,18%
15-Sep-20	USA	Innovation	IBM presents its 65-qubit quantum computer at CES, showcasing advancements in quantum computing.	11.09.-18.09.2020	0,20%	2,33%	1,98%	1,33%
19-Sep-20	China	Restriction	The chinese "Unreliable Entity List" is approved by the State Council and is effective as of the date of the promulgation.	16.09.-23.09.2020	-3,12%	-5,77%	-1,33%	-3,15%
27-Oct-20	USA	M&A	Merger between AMD and Xilinx for about $35 bn USD.	26.10.-02.11.2020	-4,27%	-1,18%	-0,24%	-2,08%
10-Feb-21	USA	M&A	Apple partners with TSMC to develop ultra-advanced displays	08.02.-12.02.2021	3,62%	4,16%	6,03%	4,73%
17-Feb-21	Japan	Investment	Renesas saddled with $10bn in goodwill after acquiring Dialog. Investors skittish about Japanese chipmaker shares despite booming demand	12.02.-19.02.2021	-0,23%	-1,01%	-0,60%	-0,28%
12-Mar-21	Netherlands	Investment	ASML to recruit 600 engineers in Taiwan. Dutch chipmaking machinery builder to boost staff 20% in key market	10.03.-17.03.2021	7,00%	4,72%	6,92%	7,27%
24-Mar-21	USA	Investment	Intel challenges Taiwan's TSMC in chip foundry business. US tech titan earmarks $20bn for plants in Arizona to woo Apple and Qualcomm	22.03.-29.03.2021	1,80%	-2,38%	5,56%	-0,62%
1-Apr-21	Taiwan	Investment	TSMC cancels chip price cuts and promises $100bn investment surge. Taiwan chipmaker outlines 3-year spending plan through 2023 to meet higher demand	29.03.-05.04.2021	8,03%	8,84%	5,34%	8,15%
2-Apr-21	USA	Investment	Japan and US aim for chip supply chain deal in April summit. Working group on strategic technologies planned ahead of Suga-Biden meeting	31.03.-07.04.2021	5,96%	1,36%	1,49%	3,90%
8-Apr-21	USA	Crisis	MacBook and iPad production delayed as supply crunch hits Apple. US tech giant's headaches suggest even worse chip shortages lie ahead	06.04.-12.04.2021	8,73%	-2,89%	-1,57%	-0,21%
15-Apr-21	Taiwan	Crisis	Global chip shortage could persist until 2022, TSMC warns. Net profit for Taiwan chipmaker rises 20% amid unprecedented demand	12.04.-19.04.2021	1,00%	-4,55%	-0,05%	-2,75%
20-Apr-21	USA	M&A	Acquisition of Inphi by Marvell for about $10 bn USD.	19.04.-26.04.2021	0,76%	5,30%	6,40%	2,97%
1-May-21	USA	Crisis	Apple and Ford latest victims of global chip shortage. US auto industry does not see semiconductor crunch unwinding until next year	28.04.-05.05.2021	-5,36%	-3,58%	-3,25%	-3,91%
14-May-21	South Korea	Investment	South Korea joins global chipmaking race with $450 bn spending plan.	12.05.-19.05.2021	2,23%	3,87%	4,80%	4,45%
2-Jun-21	USA	Investment	TSMC starts construction of $12bn Arizona chip plan. Taiwan company's first US factory in 20 years set to begin production by 2024	28.05.-04.06.2021	8,21%	1,83%	1,16%	0,92%
2-Jul-21	USA	Investment	Apple and Intel become first to adopt TSMC's latest chip tech. Taiwanese company remains vital partner for American tech giants	30.06.-07.07.2021	1,85%	-1,59%	-0,10%	-2,33%
19-Jul-21	Europe	Investment	The EU forms the Alliance on Processors and Semiconductor technologies.	14.07.-22.07.2021	-1,25%	-6,29%	1,87%	-1,46%
29-Oct-21	Taiwan	Crisis	Top U.S. diplomat in Taiwan stresses supply chain cooperation. Head of de facto embassy repeats 'rock solid' support amid China tensions	27.10.-03.11.2021	8,78%	0,23%	3,89%	5,54%
26-Nov-21	Japan	Investment	Japan approves $6.8 bn boost for domestic chip industry.	24.11.-01.12.2021	-3,78%	-0,07%	0,20%	-1,47%
22-Jan-22	USA	Investment	Intel plans $20bn 'megasite' in Ohio in chip race with TSMC. 1,000-acre plot has potential for 8 factories, CEO Gelsinger says	19.01.-26.01.2022	-9,16%	-6,05%	-6,52%	-5,94%
8-Feb-22	USA	M&A	NVIDIA's acquisition of Arm fails to happen.	07.02.-14.02.2022	-1,86%	-2,08%	-3,40%	-2,89%
15-Mar-22	Europe	Investment	Intel announces the first phase of its investment plans in Europe, planning to invest €80 bn to stabilize the semiconductor supply chain.	11.03.-18.03.2022	19,70%	5,71%	16,05%	9,52%
4-May-22	Japan	Investment	In a first meeting between the US and Japan the Impact of the Semiconductor Industry for Japan is realized.	02.05.-09.05.2022	-13,76%	-6,89%	-9,62%	-6,62%
20-May-22	Taiwan	Restriction	Taiwan sets 12-year prison term for stealing tech secrets. Taipei bolsters protection of critical semiconductor industry	18.05.-25.05.2022	0,22%	-0,13%	3,74%	0,26%
15-Jun-22	Japan	Investment	Japan seeks to produce cutting-edge 2-nm chips as soon as 2025. In race with TSMC, Tokyo and Washington partner on R&D and manufacturing	13.06.-21.06.2022	4,90%	2,19%	0,16%	0,05%
28-Jul-22	USA	Investment	U.S. Senate passes bill to boost computer chip production	26.07.-02.08.2022	12,05%	1,93%	7,90%	6,84%
29-Jul-22	USA	Investment	U.S. Congress passes CHIPS Act to boost semiconductor sector	26.07.-02.08.2022	12,05%	1,93%	7,90%	6,84%
9-Aug-22	USA	Investment	The US introduces the Chips and Science Act, allocating $52.7 billion to support domestic semiconductor production, emphasizing national security, economic competitiveness, and technological leadership.	05.08-12.08.2022	-1,47%	1,21%	-0,22%	0,72%
10-Aug-22	USA	Investment	Biden signs CHIPS Act into law as tech arms race with China heats up	08.08.-15.08.2022	7,17%	4,13%	0,38%	2,95%
26-Aug-22	USA	Investment	Biden signs order on $52bn U.S. chips law implementation	24.08.-31.08.2022	-12,36%	-2,58%	-6,76%	-5,94%
30-Aug-22	Taiwan	Innovation	TSMC says 3-nm chip production to start soon amid supply chain woes	29.08.-06.09.2022	-13,87%	-3,40%	-5,99%	-5,97%
1-Sep-22	USA	Restriction	U.S. tightens chip export rules to China, hitting Nvidia and AMD	29.08.-06.09.2022	-13,87%	-3,40%	-5,99%	-5,97%
7-Oct-22	USA	Restriction	The US issues two additional rules amending the Export Administration Rules (EAR) to expand export controls on chinese semiconductor and supercomputer items.	05.10.-12.10.2022	-12,94%	-13,92%	-15,12%	-13,10%
15-Dec-22	USA	Restriction	U.S. blacklists China chipmaker YMTC, AI champion Cambricon, others	13.12-20.12.2022	-10,99%	-5,53%	-10,36%	-7,75%
24-Aug-23	USA	Investment	U.S. to extend China chip export waivers for Taiwan, Korea chipmakers	21.08.-28.08.2023	-0,28%	1,56%	-0,53%	-0,73%
21-Sep-23	Europe	Investment	The European Chips Act entered into force resulting in additional public/private investments of more than €15 billion.	18.09.-25.09.2023	-3,97%	-2,92%	-1,94%	-2,95%
23-Sep-23	USA	Restriction	U.S. finalizes rules to keep China from cashing in on chip funding	22.09.-29.09.2023	4,54%	1,47%	0,27%	2,13%
17-Oct-23	USA	Restriction	US announcement of new round of restrictions aimed at thwarting China's access to advanced artifical intelligence chips and leading-edge semiconductor production equiptment.	13.10.-20.10.2023	-8,96%	0,94%	-3,28%	-4,23%
21-Oct-23	Japan	Investment	Western Digital, Kioxia secure $13bn in financing for chipmaking merger.	18.10.-25.10.2023	-0,99%	-2,19%	0,02%	-4,59%
26-Oct-23	Japan	Investment	Toyota supplier Denso to invest $3.3bn in chips business	23.10.-30.10.2023	-4,22%	-5,54%	0,19%	-3,25%

Appendix 2 – Dedicated View of the VanEck Semiconductor ETF

Name	# Port	Port↓
VANECK VECTORS SEMICONDUCT...	26	100.00
▾ Equity	25	100.00
▾ Information Technology	25	100.00
NVIDIA CORP		18.51
TAIWAN SEMICONDUCTO...		12.40
BROADCOM INC		7.40
ASML HOLDING NV-NY ...		6.10
ADVANCED MICRO DEVI...		5.67
INTEL CORP		5.00
QUALCOMM INC		5.00
APPLIED MATERIALS INC		4.24
LAM RESEARCH CORP		4.12
ANALOG DEVICES INC		4.02
TEXAS INSTRUMENTS I...		4.02
KLA CORP		3.22
SYNOPSYS INC		3.20
MICRON TECHNOLOGY I...		3.20
CADENCE DESIGN SYS I...		2.79
NXP SEMICONDUCTORS ...		2.12
MICROCHIP TECHNOLOG...		1.94
MARVELL TECHNOLOGY ...		1.57
STMICROELECTRONICS ...		1.33
ON SEMICONDUCTOR		1.16
MONOLITHIC POWER SY...		1.04
SKYWORKS SOLUTIONS ...		0.70
TERADYNE INC		0.51
QORVO INC		0.39
UNIVERSAL DISPLAY CO...		0.33
▸ Cash	1	0.00

Appendix 3 -Overview of the 53 monitored Events and their effect on both ETFs

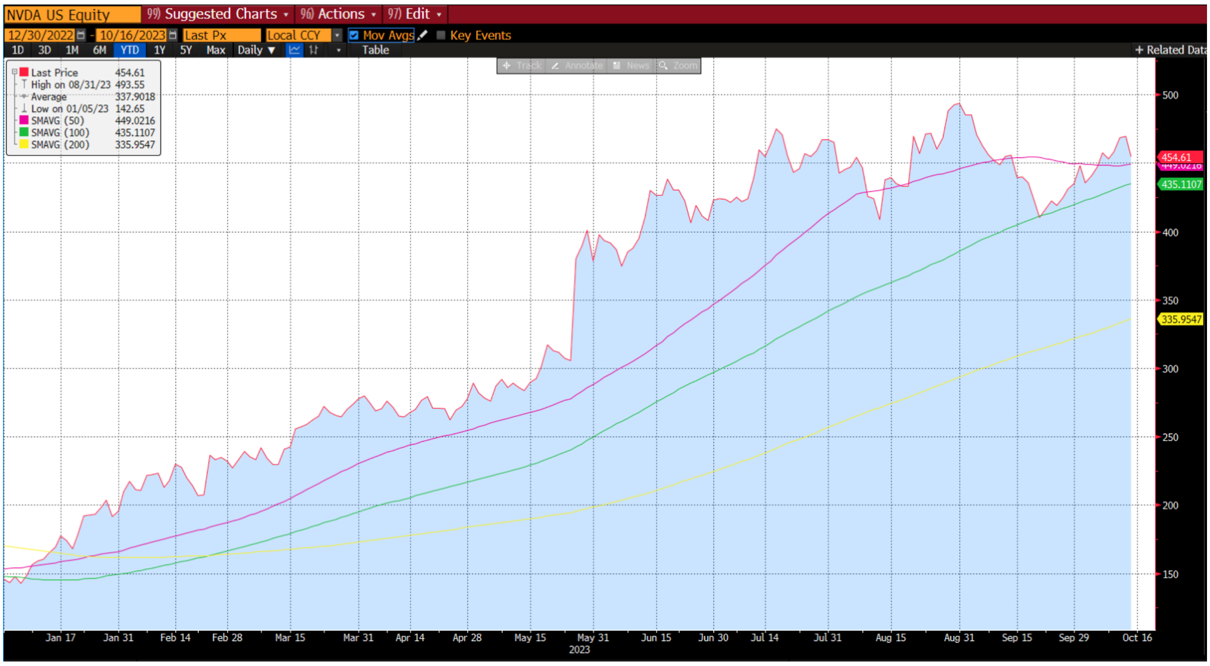
Date	What happened?	Week	VanEck Semiconductor ETF (SMH US Equity)	iShares MSCI World (URTH US Equity)
29-May-15	Avago Technologies acquired Broadcom in a deal valued at over $37bn USD, forming Broadcom Inc.	27.05.-03.06.2015	-1,90%	-0,72%
28-Sep-15	GlobalFoundries introduces ist 14nm FinFET manufacturing process.	23.09.-30.09.2015	2,36%	-0,34%
6-May-16	NVIDIA announces the launch of the Pascal architecture.	03.05.-10.05.2016	0,33%	0,40%
5-Sep-16	Softbank completes its acquisition of ARM Holdings.	02.09.-09.09.2016	-4,46%	-2,01%
22-Nov-16	ASML acquires Hermes Microvision Inc. a leading supplier of e-beam metrology tools.	18.11.-25.11.2016	1,96%	1,09%
5-Oct-17	TSMC began the production of chips with their 7nm process technology, marking a significant advancement in semiconductor manufacturing.	03.10.-10.10.2017	1,91%	0,59%
16-May-19	The US added Huawei to its Entity List, further emerging the Tech War between China and the US.	14.05.-21.05.2019	-4,16%	0,99%
31-May-19	China announces the introduction of an "Unreliable Entity List" which may list foreign entities or individuals as "unreliable entities".	29.05.-05.06.2019	2,51%	1,57%
3-Jun-19	Announcement of the Merger between Infineon Technologies and Cypress Semiconductor worth about $10bn USD.	29.05.-05.06.2019	2,51%	1,57%
7-Jul-19	TSMC began the production of chips with their 5nm process technology, marking a significant advancement in semiconductor manufacturing.	03.07.-10.07.2019	0,30%	-0,36%
23-Oct-19	Google announced that its quantum computer achieved qunatum supremacy.	21.10.-28.10.2019	3,67%	0,97%
27-Apr-20	NVIDIA completes the acquisition of Mellanox for a transaction value of $7bn USD.	24.04.-30.04.2020	1,38%	2,99%
15-May-20	The Chips for America Act is firstly presented to secure the on-shore supply of semiconductors for the US.	13.05.-20.05.2020	8,18%	4,95%
15-Sep-20	IBM presents its 65-qubit quantum computer at CES, showcasing advancements in quantum computing.	11.09.-18.09.2020	1,33%	0,12%
19-Sep-20	The chinese "Unreliable Entity List" is approved by the State Council and is effective as of the date of the promulgation.	16.09.-23.09.2020	-3,15%	-4,39%
27-Oct-20	Merger between AMD and Xilinx for about $35 bn USD.	26.10.-02.11.2020	-2,08%	-2,79%
10-Feb-21	Apple partners with TSMC to develop ultra-advanced displays	08.02.-12.02.2021	4,73%	1,00%

17-Feb-21	Renesas saddled with $10bn in goodwill after acquiring Dialog. Investors skittish about Japanese chipmaker shares despite booming demand	12.02.-19.02.2021	-0,28%	-0,46%
12-Mar-21	ASML to recruit 600 engineers in Taiwan. Dutch chipmaking machinery builder to boost staff 20% in key market	10.03.-17.03.2021	7,27%	1,96%
24-Mar-21	Intel challenges Taiwan's TSMC in chip foundry business. US tech titan earmarks $20bn for plants in Arizona to woo Apple and Qualcomm	22.03.-29.03.2021	-0,62%	0,20%
1-Apr-21	TSMC cancels chip price cuts and promises $100bn investment surge. Taiwan chipmaker outlines 3-year spending plan through 2023 to meet higher demand	29.03.-05.04.2021	8,15%	2,60%
2-Apr-21	Japan and US aim for chip supply chain deal in April summit. Working group on strategic technologies planned ahead of Suga-Biden meeting	31.03.-07.04.2021	3,90%	2,28%
8-Apr-21	MacBook and iPad production delayed as supply crunch hits Apple. US tech giant's headaches suggest even worse chip shortages lie ahead	06.04.-12.04.2021	-0,21%	1,12%
15-Apr-21	Global chip shortage could persist until 2022, TSMC warns. Net profit for Taiwan chipmaker rises 20% amid unprecedented demand	12.04.-19.04.2021	-2,75%	1,18%
20-Apr-21	Acquisition of Inphi by Marvell for about $10 bn USD.	19.04.-26.04.2021	2,97%	0,43%
1-May-21	Apple and Ford latest victims of global chip shortage. US auto industry does not see semiconductor crunch unwinding until next year	28.04.-05.05.2021	-3,91%	-0,72%
14-May-21	South Korea joins global chipmaking race with $450 bn spending plan.	12.05.-19.05.2021	4,45%	1,51%
2-Jun-21	TSMC starts construction of $12bn Arizona chip plan. Taiwan company's first US factory in 20 years set to begin production by 2024	28.05.-04.06.2021	0,92%	0,78%
2-Jul-21	Apple and Intel become first to adopt TSMC's latest chip tech. Taiwanese company remains vital partner for American tech giants	30.06.-07.07.2021	-2,33%	1,09%
19-Jul-21	The EU forms the Alliance on Processors and Semiconductor technologies.	14.07.-22.07.2021	-1,46%	-0,32%
29-Oct-21	Top U.S. diplomat in Taiwan stresses supply chain cooperation. Head of de facto embassy repeats 'rock solid' support amid China tensions	27.10.-03.11.2021	5,54%	2,25%
26-Nov-21	Japan approves $6.8 bn boost for domestic chip industry.	24.11.-01.12.2021	-1,47%	-4,06%
22-Jan-22	Intel plans $20bn 'megasite' in Ohio in chip race with TSMC. 1,000-acre plot has potential for 8 factories, CEO Gelsinger says	19.01.-26.01.2022	-5,94%	-4,05%
8-Feb-22	NVIDIA's acquisition of Arm fails to happen.	07.02.-14.02.2022	-2,89%	-1,52%
15-Mar-22	Intel announces the first phase of its investment plans in Europe, planning to invest €80 bn to stabilize the semiconductor supply chain.	11.03.-18.03.2022	9,52%	6,59%
4-May-22	In a first meeting between the US and Japan the Impact of the Semiconductor Industry for Japan is realized.	02.05.-09.05.2022	-6,62%	-4,47%
20-May-22	Taiwan sets 12-year prison term for stealing tech secrets. Taipei bolsters protection of critical semiconductor industry	18.05.-25.05.2022	0,26%	0,38%
15-Jun-22	Japan seeks to produce cutting-edge 2-nm chips as soon as 2025. In race with TSMC, Tokyo and Washington partner on R&D and manufacturing	13.06.-21.06.2022	0,05%	0,24%
28-Jul-22	U.S. Senate passes bill to boost computer chip production	26.07.-02.08.2022	6,84%	3,43%
29-Jul-22	U.S. Congress passes CHIPS Act to boost semiconductor sector	26.07.-02.08.2022	6,84%	3,43%
9-Aug-22	The US introduces the Chips and Science Act, allocating $52.7 billion to support domestic semiconductor production, emphasizing national security, economic competitiveness, and	05.08-12.08.2022	0,72%	3,10%
10-Aug-22	Biden signs CHIPS Act into law as tech arms race with China heats up	08.08.-15.08.2022	2,95%	3,25%
26-Aug-22	Biden signs order on $52bn U.S. chips law implementation	24.08.-31.08.2022	-5,94%	-5,11%
30-Aug-22	TSMC says 3-nm chip production to start soon amid supply chain woes	29.08.-06.09.2022	-5,97%	-3,36%
1-Sep-22	U.S. tightens chip export rules to China, hitting Nvidia and AMD	29.08.-06.09.2022	-5,97%	-3,36%
7-Oct-22	The US issues two additional rules amending the Export Administration Rules (EAR) to expand export controls on chinese semiconductor and supercomputer items.	05.10.-12.10.2022	-13,10%	-3,70%
15-Dec-22	U.S. blacklists China chipmaker YMTC, AI champion Cambricon, others	13.12-20.12.2022	-7,75%	-4,48%
24-Aug-23	U.S. to extend China chip export waivers for Taiwan, Korea chipmakers	21.08.-28.08.2023	-0,73%	0,87%
21-Sep-23	The European Chips Act entered into force resulting in additional public/private investments of more than €15 billion.	18.09.-25.09.2023	-2,95%	-2,51%
23-Sep-23	U.S. finalizes rules to keep China from cashing in on chip funding	22.09.-29.09.2023	2,13%	-0,83%
17-Oct-23	rictions aimed at thwarting China's access to advanced artifical intelligence chips and leading-edge	13.10.-20.10.2023	-4,23%	-3,26%
21-Oct-23	Western Digital, Kioxia secure $13bn in financing for chipmaking merger	18.10.-25.10.2023	-4,59%	-2,74%
26-Oct-23	Toyota supplier Denso to invest $3.3bn in chips business	23.10.-30.10.2023	-3,25%	-0,41%

Appendix 4 - Revenue Segments of NVIDIA

Hierarchy	Rev	% Rev
▾ Technology		
▾ Tech Hardware & Semiconductors		
▾ Semiconductors		
▾ Semiconductor Devices		
▾ Logic, Processors & App Specific	25.71B	100.00
*App Specific Multimedia	11.35B	44.14

Appendix 5 - YTD Performance of NVIDIA on 16.10.2023 with relevant moving averages in USD



Appendix 6 - Financial Analysis of NVIDIA

NVDA US Equity | 96) Actions | 97) Export | 98) Settings

39) ADJ NVIDIA Corp ASC 842 Periodicity Annuals Cur FRC (USD)

1) Key Stats | 2) I/S | 3) B/S | 4) C/F | 5) Ratios | 6) Segments | 7) Addl | 8) ESG | 9) Custom

11) BBG Adj Highlights | 12) BBG GAAP Highlights | 13) Company Model | 14) Earnings | 15) Enterprise Value | 16) EV Ex Operating Leases | 17)

In Millions of USD	2020 Y~	2021 Y	2022 Y	2023 Y	Current/LTM	2024 Y Est	2025 Y Est
12 Months Ending	01/26/2020	01/31/2021	01/30/2022	01/29/2023	07/30/2023	01/31/2024	01/31/2025
Market Capitalization	153,293.8	322,015.9	572,370.4	502,200.9	1,122,886.7		
- Cash & Equivalents	10,897.0	11,561.0	21,208.0	13,296.0	16,023.0		
+ Preferred & Other	0.0	0.0	0.0	0.0	0.0		
+ Total Debt	2,643.0	7,718.0	11,831.0	12,031.0	10,954.0		
Enterprise Value	145,039.8	318,172.9	562,993.4	500,935.9	1,117,817.7		
Revenue, Adj	10,918.0	16,675.0	26,914.0	26,974.0	32,681.0	54,548.4	81,252.0
Growth %, YoY	-6.8	52.7	61.4	0.2	9.9	102.2	49.0
Gross Profit, Adj	6,782.0	10,859.0	17,828.0	15,827.0	21,256.0	38,810.1	58,947.5
Margin %	62.1	65.1	66.2	58.7	65.0	71.1	72.5
EBITDA, Adj	3,386.0	6,649.0	12,028.0	8,065.0	13,162.0	30,968.2	48,806.9
Margin %	31.0	39.9	44.7	29.9	40.3	56.8	60.1
Net Income, Adj	2,836.5	5,079.2	9,811.7	6,134.1	10,712.5	26,501.9	41,706.0
Margin %	26.0	30.5	36.5	22.7	32.8	48.6	51.3
EPS, Adj	0.29	2.03	3.87	2.44	4.30	10.81	17.13
Growth %, YoY	-81.0	607.5	91.0	-36.9	20.0	342.2	58.5
Cash from Operations	4,761.0	5,822.0	9,108.0	5,641.0	11,899.0		
Capital Expenditures	-489.0	-1,128.0	-976.0	-1,833.0	-1,576.0	-1,317.3	-1,977.9
Free Cash Flow	4,272.0	4,694.0	8,132.0	3,808.0	10,323.0	23,074.7	37,009.9

Appendix 7 - Revenue Segments of TSMC

Hierarchy	Rev	% Rev
▾ Technology		
▾ Tech Hardware & Semiconductors		
▾ Semiconductors		
▾ Semiconductor Mfg		
*Foundry Services	71.98B	100.00

Appendix 8 - YTD Performance of TSMC on 16.10.2023 with relevant moving averages in USD

Appendix 9 – Financial Analysis of TSMC

TSM US Equity | 96) Actions | 97) Export | 98) Settings

39) ADJ Taiwan Semiconductor Manufacturing Co Ltd IFRS 16 ? Acct Consolidated Periodicity Annuals Cu

1) Key Stats | 2) I/S | 3) B/S | 4) C/F | 5) Ratios | 6) Segments | 7) Addl | 8) ESG | 9) Custom

11) BBG Adj Highlights | 12) BBG GAAP Highlights | 13) Company Model | 14) Earnings | 15) Enterprise Value | 16) EV Ex Operating Leases | 17)

In Millions of USD	2019 Y~	2020 Y	2021 Y	2022 Y	Current/LTM	2023 Y Est	2024 Y Est
12 Months Ending	12/31/2019	12/31/2020	12/31/2021	12/31/2022	09/30/2023	12/31/2023	12/31/2024
Market Capitalization	286,949.8	489,182.8	576,251.5	378,450.2	424,055.5		
- Cash & Equivalents	19,499.0	28,092.0	42,938.6	50,778.2	48,113.5		
+ Preferred & Other	22.9	34.3	88.4	482.8	758.9		
+ Total Debt	6,443.8	13,156.6	27,311.1	28,987.2	29,150.5		
Enterprise Value	273,917.5	474,281.7	560,712.4	357,142.1	405,844.9		
Revenue, Adj	34,634.9	45,487.2	56,834.8	75,986.0	69,634.3	66,341.2	80,576.7
Growth %, YoY	3.7	25.2	18.5	42.6	-3.1	-12.7	21.5
Gross Profit, Adj	15,948.5	24,153.2	29,342.2	45,256.6	39,702.4	35,919.1	43,028.7
Margin %	46.0	53.1	51.6	59.6	57.0	54.1	53.4
EBITDA, Adj	21,371.4	30,516.2	38,399.2	52,337.3	47,526.5	44,810.1	54,943.7
Margin %	61.7	67.1	67.6	68.9	68.3	67.5	68.2
Net Income, Adj	11,240.2	17,327.7	21,590.8	34,169.3	28,799.6	25,278.1	29,901.1
Margin %	32.5	38.1	38.0	45.0	41.4	38.1	37.1
EPS, Adj	0.43	0.67	0.83	1.32	1.11	0.98	1.16
Growth %, YoY	-4.6	54.2	24.6	58.2	-6.7	-26.0	18.8
Cash from Operations	20,407.5	28,331.4	39,985.8	54,356.8	44,132.7		
Capital Expenditures	-14,903.6	-17,387.5	-30,089.0	-36,339.2	-36,017.6	-30,882.5	-28,596.4
Free Cash Flow	5,503.9	10,943.9	9,896.8	18,017.6	8,167.8	10,352.9	21,254.6

Appendix 10 – Revenue Segments of ASML

Hierarchy	Rev	% Rev
▾ Technology		
▾ Tech Hardware & Semiconductors		
▾ Semiconductors		
▾ Semiconductor Mfg		
*Front End Capital Equipment	21.17B	100.00

Appendix 11 - YTD Performance of ASML on 16.10.2023 with relevant moving averages in USD

Appendix 12 - Financial Analysis of ASML

ASML US Equity | 96) Actions | 97) Export | 98) Settings

39) ADJ ASML Holding NV ASC 842 Periodicity Annuals Cur USD

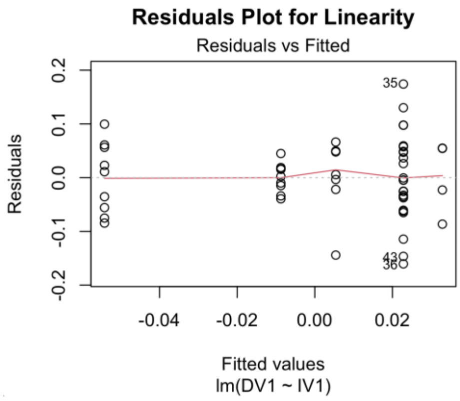
1) Key Stats | 2) I/S | 3) B/S | 4) C/F | 5) Ratios | 6) Segments | 7) Addl | 8) ESG | 9) Custom

11) BBG Adj Highlights | 12) BBG GAAP Highlights | 13) Company Model | 14) Earnings | 15) Enterprise Value | 16) EV Ex Operating Leases

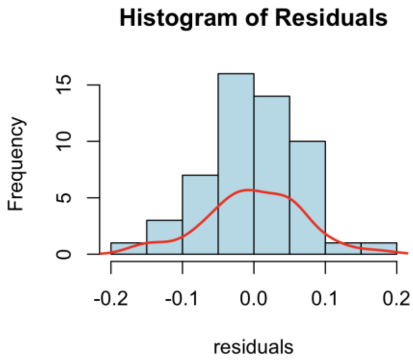
In Millions of USD	2019 Y	2020 Y	2021 Y	2022 Y	Current/LTM	2023 Y Est	2024 Y Est
12 Months Ending	12/31/2019	12/31/2020	12/31/2021	12/31/2022	10/01/2023	12/31/2023	12/31/2024
Market Capitalization	124,309.6	202,427.9	323,952.8	212,928.4	239,625.2		
- Cash & Equivalents	5,298.0	8,987.3	8,642.3	7,900.4	5,268.8		
+ Preferred & Other	0.0	0.0	0.0	0.0	0.0		
+ Total Debt	3,725.4	5,775.9	5,403.6	4,563.3	4,783.7		
Enterprise Value	122,737.1	199,216.5	320,714.1	209,591.3	239,128.7		
Revenue, Adj	13,232.3	15,959.7	22,012.5	22,301.5	28,568.7	28,833.7	28,984.8
Growth %, YoY	8.0	18.3	33.1	13.8	33.6	29.3	0.5
Gross Profit, Adj	5,910.7	7,271.2	11,601.8	11,270.2	14,662.3	14,743.0	14,937.3
Margin %	44.7	45.6	52.7	50.5	51.3	51.1	51.5
EBITDA, Adj	3,635.1	5,900.1	8,269.3	7,811.0	10,465.4	10,201.1	10,279.8
Margin %	27.5	37.0	37.6	35.0	36.6	35.4	35.5
Net Income, Adj	2,908.6	4,225.5	6,754.8	5,954.6	8,141.5	8,088.0	8,053.9
Margin %	22.0	26.5	30.7	26.7	28.5	28.1	27.8
EPS, Adj	6.90	10.08	16.46	14.96	20.61	20.65	20.68
Growth %, YoY	-7.9	46.1	63.3	-9.1	39.6	38.0	0.2
Cash from Operations	3,667.9	6,058.7	12,828.0	9,937.6	9,125.4		
Capital Expenditures	-858.2	-1,098.3	-1,065.3	-1,350.1	-2,166.5	-2,120.7	-1,786.6
Free Cash Flow	2,809.7	4,960.4	11,762.7	8,587.5	6,962.6	4,318.9	6,513.7

Appendix 13 – Code used in R - One variable - NVIDIA

```
Call:
lm(formula = DV1 ~ IV1, data = data)

Residuals:
      Min        1Q    Median        3Q       Max
-0.160425 -0.035422 -0.000525  0.048875  0.174175

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)     0.03287    0.03550   0.926   0.3590
IV1Innovation  -0.02747    0.04450  -0.617   0.5398
IV1Investment  -0.01005    0.03834  -0.262   0.7943
IV1M&A         -0.04162    0.04266  -0.976   0.3342
IV1Restriction -0.08705    0.04266  -2.041   0.0468 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.07099 on 48 degrees of freedom
Multiple R-squared:  0.153,  Adjusted R-squared:  0.08245
F-statistic: 2.168 on 4 and 48 DF,  p-value: 0.08678
```

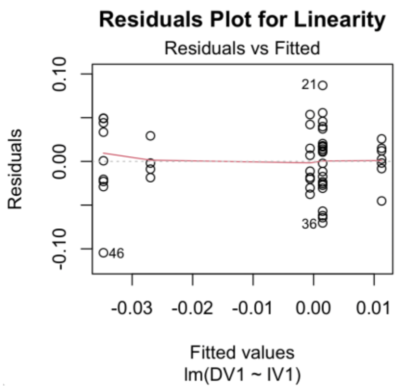



```
> # Linearity test: Residuals plot
> plot(model, which = 1, main = "Residuals Plot for Linearity")
>
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 5.2548, df = 4, p-value = 0.2621

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```

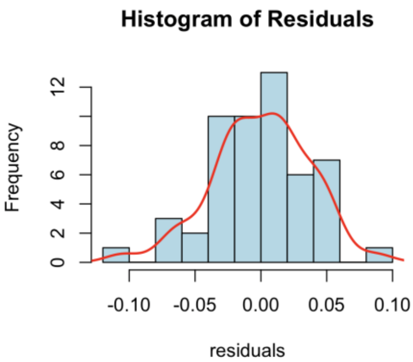


Appendix 14 – Code used in R – One variable - TSMC

```
Call:
lm(formula = DV1 ~ IV1, data = data)

Residuals:
      Min        1Q    Median        3Q       Max
-0.104456 -0.022956  0.000744  0.020408  0.086908

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)    -0.026975   0.019154  -1.408    0.165
IV1Innovation   0.038218   0.024011   1.592    0.118
IV1Investment   0.028467   0.020689   1.376    0.175
IV1M&A          0.026386   0.023021   1.146    0.257
IV1Restriction -0.007769   0.023021  -0.337    0.737

Residual standard error: 0.03831 on 48 degrees of freedom
Multiple R-squared:  0.1547, Adjusted R-squared:  0.0842
F-statistic: 2.195 on 4 and 48 DF,  p-value: 0.08357
```

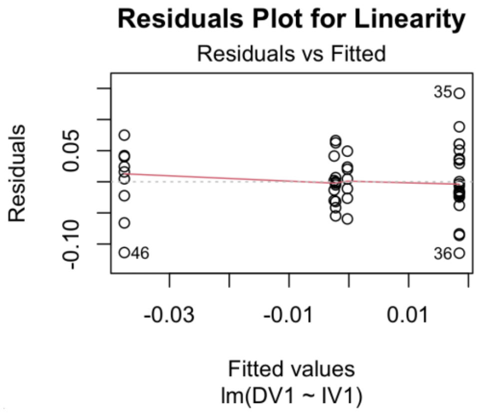



```
> # Linearity test: Residuals plot
> plot(model, which = 1, main = "Residuals Plot for Linearity")
>
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 5.2324, df = 4, p-value = 0.2643

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```

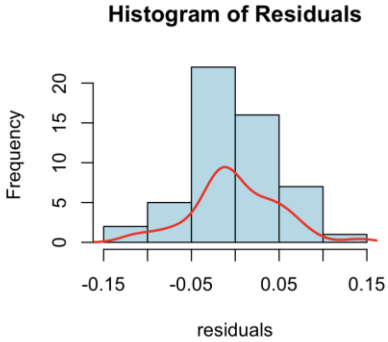


Appendix 15 – Code used in R – one variable - ASML

```
Call:
lm(formula = DV1 ~ IV1, data = data)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.114671 -0.023771 -0.003571  0.034929  0.142029 

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)   -0.0024500  0.0256241  -0.096    0.924
IV1Innovation  0.0022071  0.0321215   0.069    0.946
IV1Investment  0.0209208  0.0276772   0.756    0.453
IV1M&A         0.0002389  0.0307964   0.008    0.994
IV1Restriction -0.0350944  0.0307964  -1.140    0.260

Residual standard error: 0.05125 on 48 degrees of freedom
Multiple R-squared:  0.1419,	Adjusted R-squared:  0.07034 
F-statistic: 1.984 on 4 and 48 DF,  p-value: 0.112
```

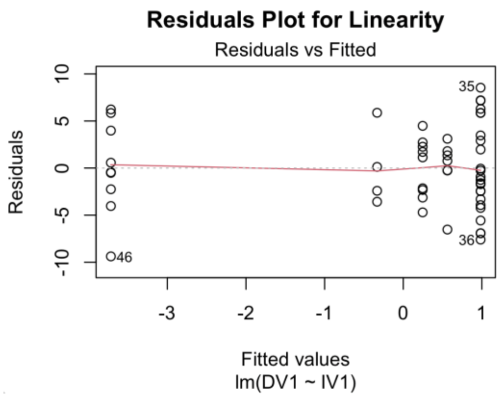



```
> # Linearity test: Residuals plot
> plot(model, which = 1, main = "Residuals Plot for Linearity")
> 
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 3.0133, df = 4, p-value = 0.5556

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```

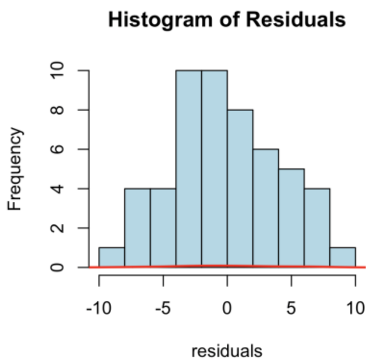


Appendix 16 – Code used in R – one variable – VanEck Semiconductor ETF

```
Call:
lm(formula = DV1 ~ IV1, data = data)

Residuals:
    Min      1Q  Median      3Q     Max 
-9.3822 -2.4537 -0.2614  2.9163  8.5363 

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)     -0.3325     2.2206  -0.150    0.882
IV1Innovation    0.8939     2.7836   0.321    0.749
IV1Investment    1.3162     2.3985   0.549    0.586
IV1M&A           0.5792     2.6688   0.217    0.829
IV1Restriction  -3.3853     2.6688  -1.268    0.211

Residual standard error: 4.441 on 48 degrees of freedom
Multiple R-squared:  0.137,	Adjusted R-squared:  0.06513 
F-statistic: 1.906 on 4 and 48 DF,  p-value: 0.1248
```

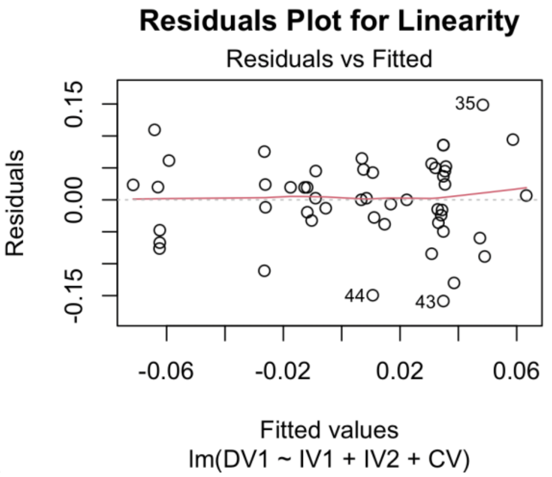



```
> # Linearity test: Residuals plot
> plot(model, which = 1, main = "Residuals Plot for Linearity")
+ 
> 
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 5.3679, df = 4, p-value = 0.2516

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```

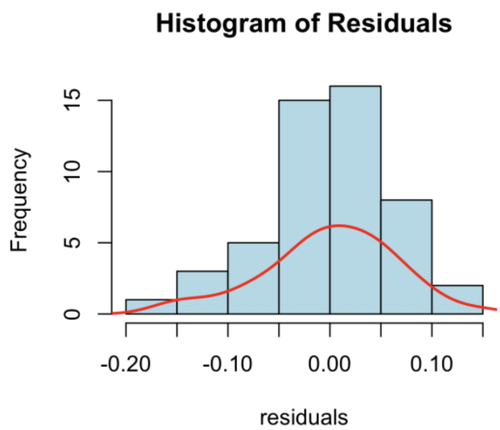


Appendix 17 – Code used in R – multiple Regression – NVIDIA + Control Variable

```
Call:
lm(formula = DV1 ~ IV1 + IV2 + CV, data = data)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.158454 -0.035062  0.002535  0.045047  0.148604 

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)  
(Intercept)       0.0879497  0.0740112   1.188   0.2423  
IV1Europe        -0.0402992  0.0779181  -0.517   0.6081  
IV1Germany       -0.0382524  0.1011807  -0.378   0.7075  
IV1Japan         -0.1162077  0.0723798  -1.606   0.1169  
IV1Netherlands   -0.0268127  0.0833599  -0.322   0.7495  
IV1South Korea   -0.0619683  0.0993263  -0.624   0.5365  
IV1Taiwan        -0.0488910  0.0683779  -0.715   0.4791  
IV1USA           -0.0522878  0.0617320  -0.847   0.4024  
IV2Innovation    -0.0261567  0.0472257  -0.554   0.5830  
IV2Investment     0.0012893  0.0461073   0.028   0.9778  
IV2M&A           -0.0426866  0.0514073  -0.830   0.4117  
IV2Restriction   -0.0960056  0.0501727  -1.914   0.0634 .
CV               -0.0007767  0.0014474  -0.537   0.5948  
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.07518 on 37 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.2379,	Adjusted R-squared:  -0.009259 
F-statistic: 0.9625 on 12 and 37 DF,  p-value: 0.4998
```

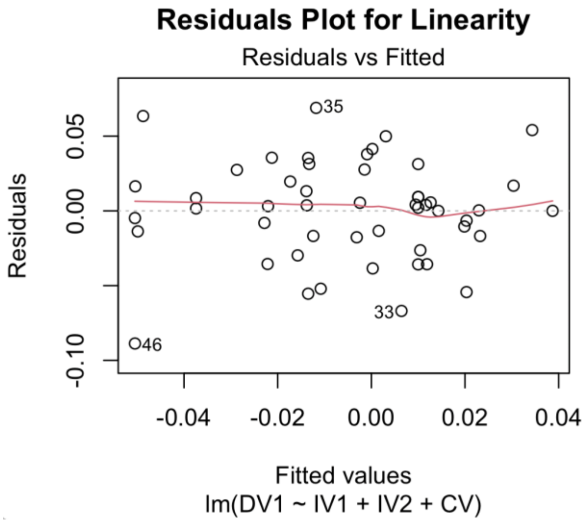


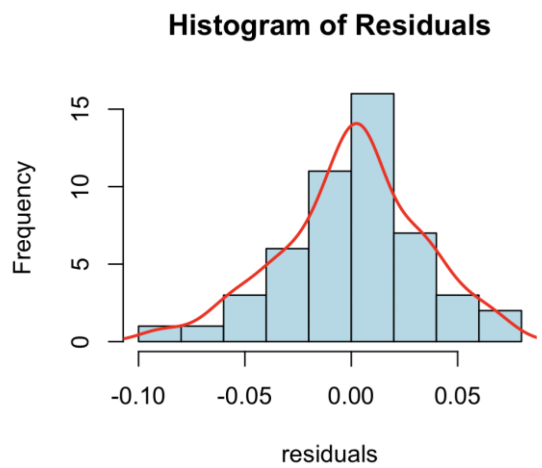

```
> # Linearity test: Residuals plot
> residuals_plot <- plot(model, which = 1, main = "Residuals Plot for Linearity")
> 
> # Multicollinearity test: VIF values
> vif_values <- car::vif(model)
> print("VIF Values:")
[1] "VIF Values:"
> print(vif_values)
        GVIF Df GVIF^(1/(2*Df))
IV1 2.387538  7        1.064134
IV2 2.634472  4        1.128721
CV  1.171757  1        1.082477
> 
> # Check for high VIF values (common threshold is 10)
> if (any(vif_values > 10)) {
+   print("Warning: High VIF values indicate potential multicollinearity.")
+ } else {
+   print("No significant multicollinearity detected.")
+ }
[1] "No significant multicollinearity detected."
> 
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 10.827, df = 12, p-value = 0.5438

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```



Appendix 18 – Code used in R – multiple Regression – TSMC + Control Variable

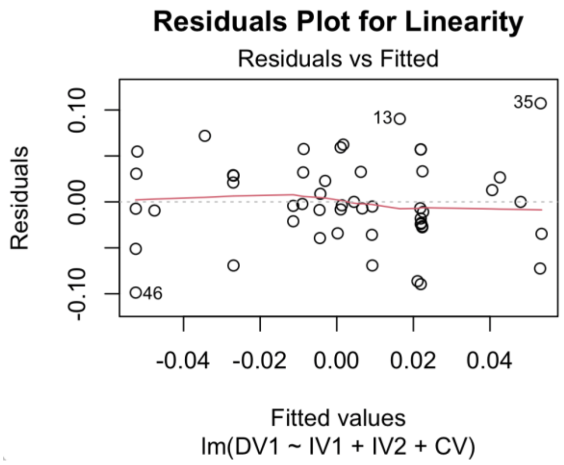
```
Call:
lm(formula = DV1 ~ IV1 + IV2 + CV, data = data)

Residuals:
     Min       1Q   Median       3Q      Max 
-0.08872 -0.01683  0.00263  0.01893  0.06889 

Coefficients:
                     Estimate Std. Error t value Pr(>|t|)  
(Intercept)       -0.0154664  0.0376994  -0.410   0.6840  
IV1Europe         -0.0469379  0.0396895  -1.183   0.2445  
IV1Germany        -0.0110587  0.0515389  -0.215   0.8313  
IV1Japan          -0.0476479  0.0368685  -1.292   0.2042  
IV1Netherlands -0.0034139  0.0424614  -0.080   0.9364  
IV1South Korea -0.0007674  0.0505943  -0.015   0.9880  
IV1Taiwan         -0.0051165  0.0348300  -0.147   0.8840  
IV1USA            -0.0266595  0.0314447  -0.848   0.4020  
IV2Innovation      0.0387063  0.0240556   1.609   0.1161  
IV2Investment      0.0500805  0.0234859   2.132   0.0397 *
IV2M&A             0.0405218  0.0261856   1.547   0.1303  
IV2Restriction -0.0103286  0.0255567  -0.404   0.6884  
CV                 0.0007583  0.0007373   1.029   0.3104  
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.0383 on 37 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.3245,	Adjusted R-squared:  0.1055 
F-statistic: 1.482 on 12 and 37 DF,  p-value: 0.1753

> # Linearity test: Residuals plot
> residuals_plot <- plot(model, which = 1, main = "Residuals Plot for Linearity")
> 
> # Multicollinearity test: VIF values
> vif_values <- car::vif(model)
> print("VIF Values:")
[1] "VIF Values:"
> print(vif_values)
        GVIF Df GVIF^(1/(2*Df))
IV1 2.387538  7        1.064134
IV2 2.634472  4        1.128721
CV  1.171757  1        1.082477
> 
> # Check for high VIF values (common threshold is 10)
> if (any(vif_values > 10)) {
+   print("Warning: High VIF values indicate potential multicollinearity.")
+ } else {
+   print("No significant multicollinearity detected.")
+ }
[1] "No significant multicollinearity detected."
> 
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

    studentized Breusch-Pagan test

data:  model
BP = 8.9236, df = 12, p-value = 0.7094

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```



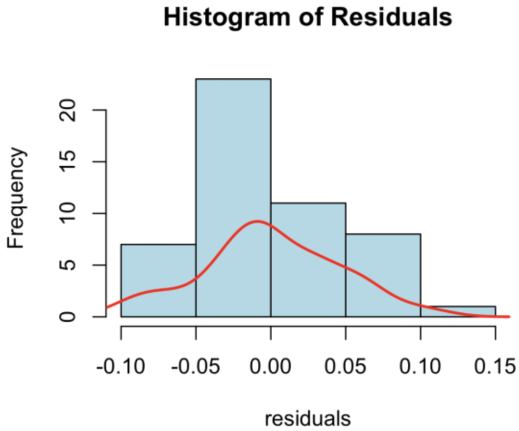


Appendix 19 – Code used in R – multiple Regression – ASML + Control Variable

```
Call:
lm(formula = DV1 ~ IV1 + IV2 + CV, data = data)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.098714 -0.025985 -0.004704  0.030245  0.107263 

Coefficients:
                     Estimate Std. Error t value Pr(>|t|)  
(Intercept)         0.0351126  0.0523322   0.671   0.5064  
IV1Europe          -0.0159187  0.0550947  -0.289   0.7742  
IV1Germany         -0.0437422  0.0715434  -0.611   0.5447  
IV1Japan           -0.0958863  0.0511787  -1.874   0.0689 .
IV1Netherlands     -0.0262400  0.0589426  -0.445   0.6588  
IV1South Korea     -0.0221713  0.0702322  -0.316   0.7540  
IV1Taiwan          -0.0295964  0.0483490  -0.612   0.5442  
IV1USA             -0.0475868  0.0436498  -1.090   0.2827  
IV2Innovation       0.0032454  0.0333926   0.097   0.9231  
IV2Investment       0.0339184  0.0326018   1.040   0.3049  
IV2M&A              0.0130583  0.0363494   0.359   0.7215  
IV2Restriction     -0.0404748  0.0354764  -1.141   0.2612  
CV                  0.0001782  0.0010235   0.174   0.8627  
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.05316 on 37 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.2824,	Adjusted R-squared:  0.04967 
F-statistic: 1.213 on 12 and 37 DF,  p-value: 0.3107
```

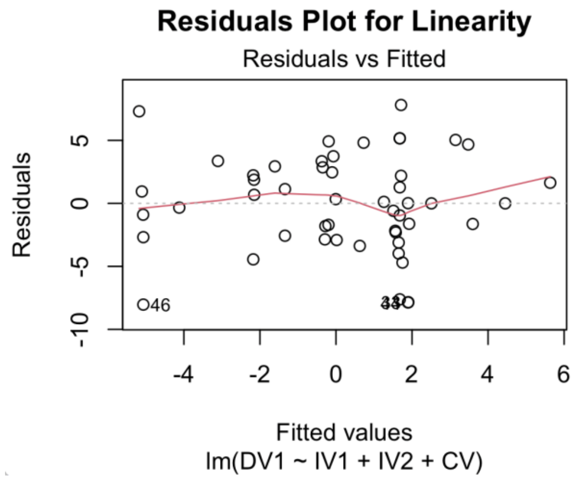



```
> # Linearity test: Residuals plot
> residuals_plot <- plot(model, which = 1, main = "Residuals Plot for Linearity")
> 
> # Multicollinearity test: VIF values
> vif_values <- car::vif(model)
> print("VIF Values:")
[1] "VIF Values:"
> print(vif_values)
       GVIF Df GVIF^(1/(2*Df))
IV1 2.387538  7        1.064134
IV2 2.634472  4        1.128721
CV  1.171757  1        1.082477
> 
> # Check for high VIF values (common threshold is 10)
> if (any(vif_values > 10)) {
+   print("Warning: High VIF values indicate potential multicollinearity.")
+ } else {
+   print("No significant multicollinearity detected.")
+ }
[1] "No significant multicollinearity detected."
> 
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 15.963, df = 12, p-value = 0.1929

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```

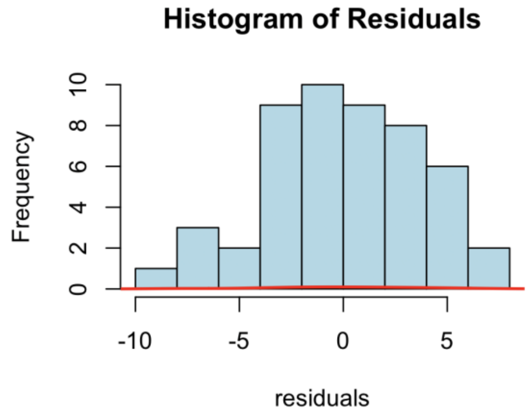


Appendix 20 – Code used in R – multiple Regression - VanEck Semiconductor ETF + Control Variable

```
Call:
lm(formula = DV1 ~ IV1 + IV2 + CV, data = data)

Residuals:
    Min      1Q  Median      3Q     Max 
-8.0334 -2.5021  0.0076  2.7596  7.8087 

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)  
(Intercept)       3.83537    4.34462   0.883   0.3831  
IV1Europe        -4.94239    4.57397  -1.081   0.2869  
IV1Germany       -2.27353    5.93953  -0.383   0.7041  
IV1Japan         -8.89109    4.24886  -2.093   0.0433 *
IV1Netherlands -1.10599    4.89341  -0.226   0.8224  
IV1South Korea -1.93128    5.83068  -0.331   0.7423  
IV1Taiwan        -2.90331    4.01394  -0.723   0.4740  
IV1USA           -4.88046    3.62380  -1.347   0.1862  
IV2Innovation     1.10134    2.77225   0.397   0.6934  
IV2Investment     2.85177    2.70660   1.054   0.2989  
IV2M&A            0.96727    3.01773   0.321   0.7504  
IV2Restriction -3.89731    2.94525  -1.323   0.1939  
CV               -0.04779    0.08497  -0.562   0.5772  
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 4.413 on 37 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.3117,	Adjusted R-squared:  0.08847 
F-statistic: 1.396 on 12 and 37 DF,  p-value: 0.2113
```

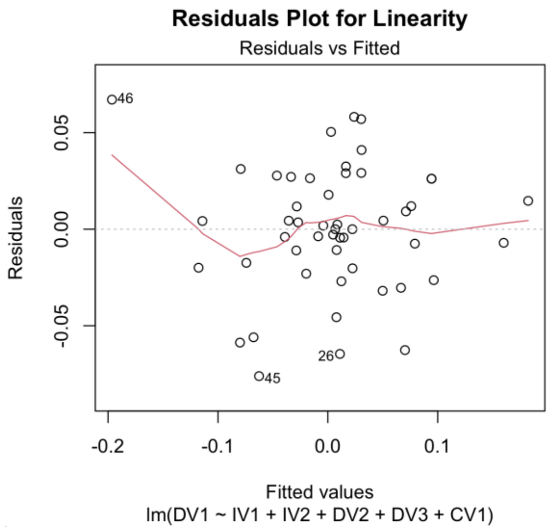



```
> # Linearity test: Residuals plot
> residuals_plot <- plot(model, which = 1, main = "Residuals Plot for Linearity")
> 
> # Multicollinearity test: VIF values
> vif_values <- car::vif(model)
> print("VIF Values:")
[1] "VIF Values:"
> print(vif_values)
        GVIF Df GVIF^(1/(2*Df))
IV1 2.387538  7        1.064134
IV2 2.634472  4        1.128721
CV  1.171757  1        1.082477
> 
> # Check for high VIF values (common threshold is 10)
> if (any(vif_values > 10)) {
+   print("Warning: High VIF values indicate potential multicollinearity.")
+ } else {
+   print("No significant multicollinearity detected.")
+ }
[1] "No significant multicollinearity detected."
> 
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 9.2805, df = 12, p-value = 0.6788

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```

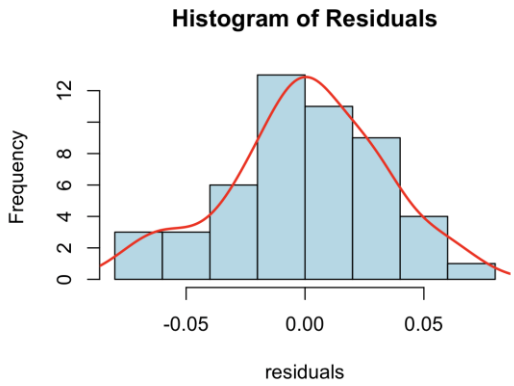


Appendix 21 - Code used in R – multiple Regression – three dependent variables + Control Variable, where NVIDIA is regressed as DV1

```
Call:
lm(formula = DV1 ~ IV1 + IV2 + DV2 + DV3 + CV1, data = data)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.076083 -0.019314  0.000925  0.026143  0.067096 

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)    
(Intercept)     0.0604490  0.0390943   1.546   0.1310    
IV1Europe      -0.0046440  0.0410430  -0.113   0.9106    
IV1Germany      0.0090412  0.0520460   0.174   0.8631    
IV1Japan       -0.0024764  0.0387052  -0.064   0.9493    
IV1Netherlands  0.0001738  0.0427831   0.004   0.9968    
IV1South Korea -0.0400761  0.0508814  -0.788   0.4362    
IV1Taiwan      -0.0179085  0.0352193  -0.508   0.6143    
IV1USA          0.0054500  0.0320281   0.170   0.8659    
IV2Innovation  -0.0459488  0.0259502  -1.771   0.0853 .  
IV2Investment  -0.0532217  0.0252230  -2.110   0.0421 *  
IV2M&A         -0.0728024  0.0276775  -2.630   0.0126 *  
IV2Restriction -0.0522035  0.0262602  -1.988   0.0547 .  
DV2             0.4297962  0.2593762   1.657   0.1065    
DV3             0.9725308  0.1868510   5.205 8.63e-06 ***
CV1            -0.0012759  0.0007590  -1.681   0.1017    
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.03839 on 35 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.812,	Adjusted R-squared:  0.7368 
F-statistic:  10.8 on 14 and 35 DF,  p-value: 7.181e-09
```

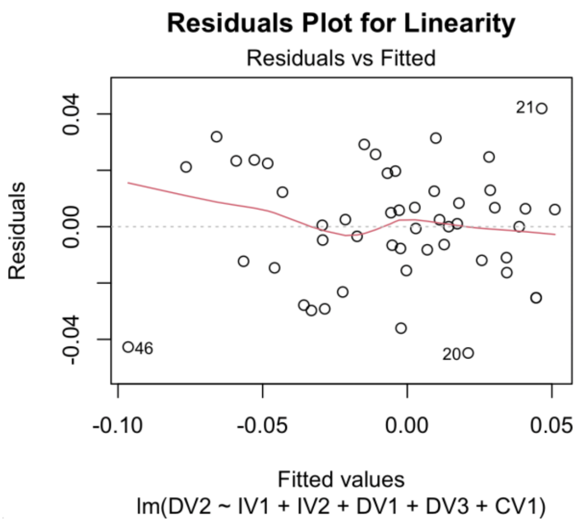



```
> # Linearity test: Residuals plot
> residuals_plot <- plot(model, which = 1, main = "Residuals Plot for Linearity")
> 
> # Multicollinearity test: VIF values
> vif_values <- car::vif(model)
> print("VIF Values:")
[1] "VIF Values:"
> print(vif_values)
        GVIF Df GVIF^(1/(2*Df))
IV1 3.551569  7        1.094752
IV2 3.933573  4        1.186720
DV2 3.666345  1        1.914770
DV3 3.451000  1        1.857687
CV1 1.235416  1        1.111493
> 
> # Check for high VIF values (common threshold is 10)
> if (any(vif_values > 10)) {
+   print("Warning: High VIF values indicate potential multicollinearity.")
+ } else {
+   print("No significant multicollinearity detected.")
+ }
[1] "No significant multicollinearity detected."
> 
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 11.695, df = 14, p-value = 0.6308

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```

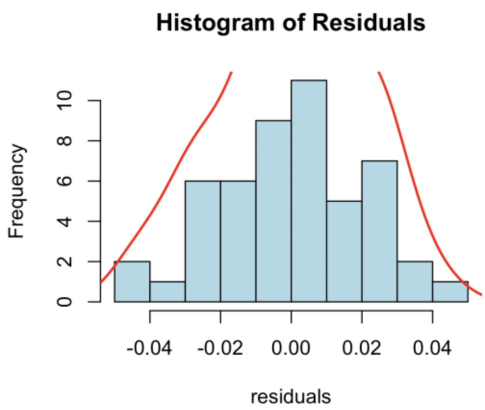


Appendix 22 - Code used in R – multiple Regression – three dependent variables + Control Variable, where TSMC is regressed as DV1

```
Call:
lm(formula = DV2 ~ IV1 + IV2 + DV1 + DV3 + CV1, data = data)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.044843 -0.012209  0.000761  0.012844  0.041942 

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)  
(Intercept)     -0.0426826  0.0243089  -1.756   0.0879 .
IV1Europe       -0.0345270  0.0250907  -1.376   0.1775  
IV1Germany       0.0107765  0.0326238   0.330   0.7431  
IV1Japan         0.0056929  0.0242711   0.235   0.8159  
IV1Netherlands   0.0103390  0.0267908   0.386   0.7019  
IV1South Korea   0.0175068  0.0320752   0.546   0.5887  
IV1Taiwan        0.0135518  0.0220641   0.614   0.5431  
IV1USA          -0.0010986  0.0201061  -0.055   0.9567  
IV2Innovation    0.0419937  0.0154453   2.719   0.0101 *
IV2Investment    0.0379511  0.0155323   2.443   0.0197 *
IV2M&A           0.0431610  0.0175520   2.459   0.0190 *
IV2Restriction   0.0201341  0.0170482   1.181   0.2456  
DV1              0.1692521  0.1021413   1.657   0.1065  
DV3              0.3511704  0.1444540   2.431   0.0203 *
CV1              0.0008272  0.0004750   1.742   0.0904 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02409 on 35 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.7471,	Adjusted R-squared:  0.6459 
F-statistic: 7.385 on 14 and 35 DF,  p-value: 8.104e-07
```

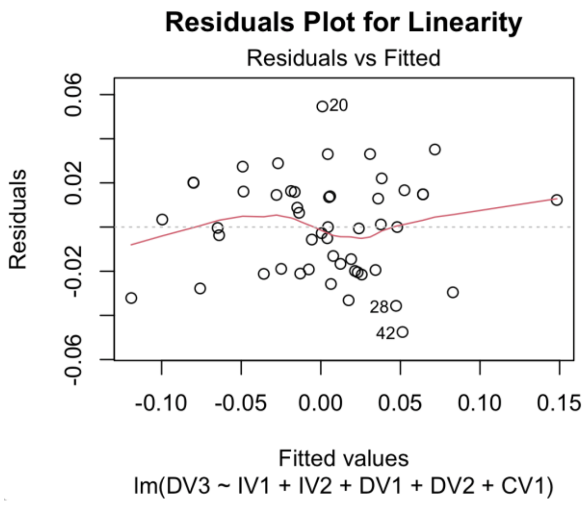



```
> # Linearity test: Residuals plot
> residuals_plot <- plot(model, which = 1, main = "Residuals Plot for Linearity")
> 
> # Multicollinearity test: VIF values
> vif_values <- car::vif(model)
> print("VIF Values:")
[1] "VIF Values:"
> print(vif_values)
        GVIF Df GVIF^(1/(2*Df))
IV1 3.072383  7        1.083477
IV2 3.671089  4        1.176520
DV1 4.931912  1        2.220791
DV3 5.237711  1        2.288605
CV1 1.228688  1        1.108462
> 
> # Check for high VIF values (common threshold is 10)
> if (any(vif_values > 10)) {
+   print("Warning: High VIF values indicate potential multicollinearity.")
+ } else {
+   print("No significant multicollinearity detected.")
+ }
[1] "No significant multicollinearity detected."
> 
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 18.086, df = 14, p-value = 0.2029

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```

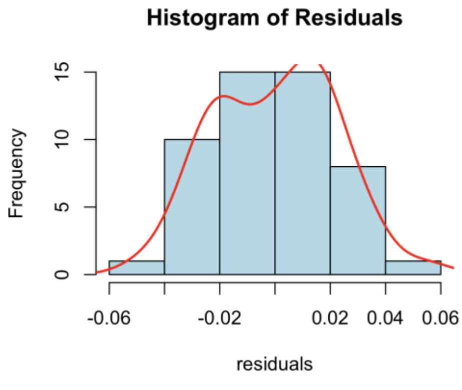


Appendix 23 - Code used in R – multiple Regression – three dependent variables + Control Variable, where ASML is regressed as DV1

```
Call:
lm(formula = DV3 ~ IV1 + IV2 + DV1 + DV2 + CV1, data = data)

Residuals:
     Min       1Q   Median       3Q      Max 
-0.04753 -0.01939  0.00000  0.01563  0.05460 

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)    
(Intercept)     0.0020182  0.0274423   0.074   0.9418    
IV1Europe       0.0214694  0.0276440   0.777   0.4426    
IV1Germany     -0.0220318  0.0351678  -0.626   0.5351    
IV1Japan       -0.0241513  0.0259709  -0.930   0.3588    
IV1Netherlands -0.0128067  0.0289772  -0.442   0.6612    
IV1South Korea  0.0059451  0.0348487   0.171   0.8655    
IV1Taiwan      -0.0055577  0.0239904  -0.232   0.8181    
IV1USA         -0.0131621  0.0216482  -0.608   0.5471    
IV2Innovation  -0.0009425  0.0183969  -0.051   0.9594    
IV2Investment   0.0127384  0.0180604   0.705   0.4853    
IV2M&A          0.0155394  0.0204042   0.762   0.4514    
IV2Restriction  0.0068450  0.0187801   0.364   0.7177    
DV1             0.4486294  0.0861946   5.205 8.63e-06 ***
DV2             0.4113684  0.1692164   2.431   0.0203 *  
CV1             0.0002147  0.0005347   0.401   0.6905    
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.02608 on 35 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.8367,	Adjusted R-squared:  0.7713 
F-statistic: 12.81 on 14 and 35 DF,  p-value: 7.242e-10
```




```
> # Linearity test: Residuals plot
> residuals_plot <- plot(model, which = 1, main = "Residuals Plot for Linearity")
> 
> # Multicollinearity test: VIF values
> vif_values <- car::vif(model)
> print("VIF Values:")
[1] "VIF Values:"
> print(vif_values)
        GVIF Df GVIF^(1/(2*Df))
IV1 3.235560  7        1.087489
IV2 4.548789  4        1.208473
DV1 2.998189  1        1.731528
DV2 3.382780  1        1.839233
CV1 1.329039  1        1.152840
> 
> # Check for high VIF values (common threshold is 10)
> if (any(vif_values > 10)) {
+   print("Warning: High VIF values indicate potential multicollinearity.")
+ } else {
+   print("No significant multicollinearity detected.")
+ }
[1] "No significant multicollinearity detected."
> 
> # Homoskedasticity test: Breusch-Pagan test
> bp_test <- lmtest::bptest(model)
> print("Breusch-Pagan Test for Homoskedasticity:")
[1] "Breusch-Pagan Test for Homoskedasticity:"
> print(bp_test)

	studentized Breusch-Pagan test

data:  model
BP = 9.1845, df = 14, p-value = 0.8191

> if (bp_test$p.value > 0.05) {
+   print("No evidence of heteroskedasticity (homoskedasticity).")
+ } else {
+   print("Significant evidence of heteroskedasticity.")
+ }
[1] "No evidence of heteroskedasticity (homoskedasticity)."
```



Appendix 24- Earnings Calls NVIDIA

NVIDIA				
Quarter	**Date**	**Volume on the specific date**	**Performance on the specific day**	**Performance in the specific week**
Q2 2015	06. Aug 15	140.524.684	12,20%	16,15%
Q3 2015	05. Nov 15	117.227.108	13,86%	8,14%
Q2 2016	11. Aug 16	142.574.568	5,52%	6,33%
Q3 2016	10. Nov 16	217.534.532	29,85%	21,14%
Q4 2016	09. Feb 17	165.109.364	-2,42%	-8,71%
Q4 2017	08. Feb 18	167.460.308	6,32%	3,14%
Q2 2019	15. Aug 19	80.125.904	7,18%	7,54%
Q2 2019	15. Aug 19	80.125.904	7,18%	7,54%
Q2 2019	15. Aug 19	80.125.904	7,18%	7,54%
Q3 2019	14. Nov 19	105.421.636	-2,72%	-0,77%
Q4 2019	13. Feb 20	104.192.372	7,02%	10,71%
Q2 2020	20. Aug 20	99.986.952	4,42%	3,99%
Q2 2020	20. Aug 20	99.986.952	4,42%	3,99%
Q3 2020	19. Nov 20	34.108.980	-2,67%	-3,43%
Q3 2020	19. Nov 20	34.108.980	-2,67%	-3,43%
Q4 2020	24. Feb 21	82.443.604	-8,26%	-3,61%
Q1 2021	26. Mai 21	58.147.520	-1,46%	4,07%
Q1 2021	26. Mai 21	58.147.520	-1,46%	4,07%
Q1 2021	26. Mai 21	58.147.520	-1,46%	4,07%
Q1 2021	26. Mai 21	58.147.520	-1,46%	4,07%
Q2 2021	18. Aug 21	76.655.477	4,04%	10,03%
Q2 2021	18. Aug 21	76.655.477	4,04%	10,03%
Q2 2021	18. Aug 21	76.655.477	4,04%	10,03%
Q2 2021	18. Aug 21	76.655.477	4,04%	10,03%
Q2 2021	18. Aug 21	76.655.477	4,04%	10,03%
Q2 2021	18. Aug 21	76.655.477	4,04%	10,03%
Q2 2021	18. Aug 21	76.655.477	4,04%	10,03%
Q2 2021	18. Aug 21	76.655.477	4,04%	10,03%
Q3 2021	17. Nov 21	78.171.075	8,28%	6,30%
Q3 2021	17. Nov 21	78.171.075	8,28%	6,30%
Q4 2021	16. Feb 22	81.059.508	-7,57%	-2,53%
Q4 2021	16. Feb 22	81.059.508	-7,57%	-2,53%
Q1 2022	25. Mai 22	99.657.452	5,17%	11,43%
Q1 2022	25. Mai 22	99.657.452	5,17%	11,43%
Q1 2022	25. Mai 22	99.657.452	5,17%	11,43%
Q2 2022	24. Aug 22	77.069.133	4,11%	-7,29%
Q2 2022	24. Aug 22	77.069.133	4,11%	-7,29%
Q2 2022	24. Aug 22	77.069.133	4,11%	-7,29%
Q3 2022	16. Nov 22	71.089.356	-1,66%	-6,13%
Q3 2022	16. Nov 22	71.089.356	-1,66%	-6,13%
Q3 2022	16. Nov 22	71.089.356	-1,66%	-6,13%
Q3 2022	16. Nov 22	71.089.356	-1,66%	-6,13%
Q3 2022	16. Nov 22	71.089.356	-1,66%	-6,13%
Q3 2022	16. Nov 22	71.089.356	-1,66%	-6,13%
Q3 2022	16. Nov 22	71.089.356	-1,66%	-6,13%
Q4 2022	22. Feb 23	111.799.541	13,79%	9,86%
Q4 2022	22. Feb 23	71.089.356	13,79%	9,86%
Q3 2023	21. Nov 23	90.064.233	-2,56%	-3,12%
Q3 2023	21. Nov 23	90.064.233	-2,56%	-3,12%
Q3 2023	21. Nov 23	90.064.233	-2,56%	-3,12%

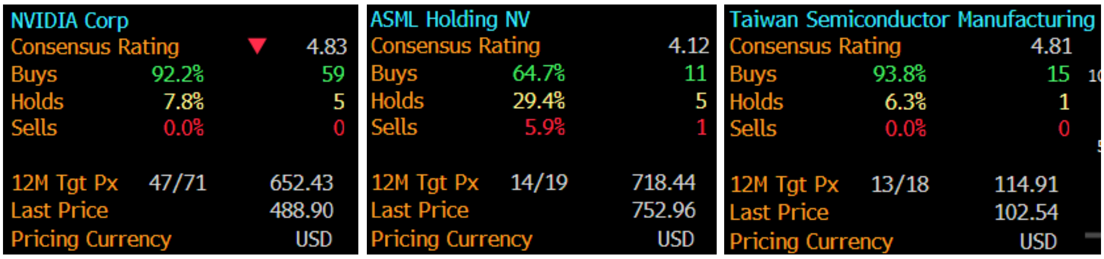
Appendix 25 - Earnings Calls TSMC

TSMC				
Quarter	**Date**	**Volume on the specific date**	**Performance on the specific day**	**Performance in the specific week**
Q2 2015	16. Jul 15	29.850.787	1,28%	0,35%
Q3 2015	15. Okt 15	17.867.334	1,05%	1,69%
Q2 2016	14. Jul 16	12.145.058	-0,37%	1,15%
Q3 2016	13. Okt 16	17.322.963	0,46%	0,46%
Q4 2016	12. Jan 17	13.032.233	0,58%	-1,36%
Q4 2017	18. Jan 18	11.866.214	0,25%	9,59%
Q2 2019	18. Jul 19	11.262.042	3,67%	7,89%
Q2 2019	18. Jul 19	11.262.042	3,67%	7,89%
Q2 2019	18. Jul 19	11.262.042	3,67%	7,89%
Q3 2019	17. Okt 19	12.420.079	-0,94%	0,20%
Q4 2019	16. Jan 20	11.215.740	-0,29%	-2,46%
Q2 2020	16. Jul 20	15.709.371	-0,26%	2,78%
Q2 2020	16. Jul 20	15.709.371	-0,26%	2,78%
Q3 2020	15. Okt 20	10.335.225	-1,65%	-1,73%
Q3 2020	15. Okt 20	10.335.225	-1,65%	-1,73%
Q4 2020	14. Jan 21	37.125.416	-0,88%	2,21%
Q1 2021	15. Apr 21	18.709.052	0,39%	-4,60%
Q1 2021	15. Apr 21	18.709.052	0,39%	-4,60%
Q1 2021	15. Apr 21	18.709.052	0,39%	-4,60%
Q1 2021	15. Apr 21	18.709.052	0,39%	-4,60%
Q2 2021	15. Jul 21	23.734.491	-1,40%	-5,97%
Q2 2021	15. Jul 21	23.734.491	-1,40%	-5,97%
Q2 2021	15. Jul 21	23.734.491	-1,40%	-5,97%
Q2 2021	15. Jul 21	23.734.491	-1,40%	-5,97%
Q2 2021	15. Jul 21	23.734.491	-1,40%	-5,97%
Q2 2021	15. Jul 21	23.734.491	-1,40%	-5,97%
Q2 2021	15. Jul 21	23.734.491	-1,40%	-5,97%
Q2 2021	15. Jul 21	23.734.491	-1,40%	-5,97%
Q3 2021	14. Okt 21	16.930.481	2,03%	4,60%
Q3 2021	14. Okt 21	16.930.481	2,03%	4,60%
Q4 2021	13. Jan 22	52.019.992	1,06%	12,58%
Q4 2021	13. Jan 22	52.019.992	1,06%	12,58%
Q1 2022	14. Apr 22	17.828.483	-3,09%	1,22%
Q1 2022	14. Apr 22	17.828.483	-3,09%	1,22%
Q1 2022	14. Apr 22	17.828.483	-3,09%	1,22%
Q2 2022	14. Jul 22	23.377.014	2,36%	5,55%
Q2 2022	14. Jul 22	23.377.014	2,36%	5,55%
Q2 2022	14. Jul 22	23.377.014	2,36%	5,55%
Q3 2022	13. Okt 22	36.639.339	-4,14%	-3,96%
Q3 2022	13. Okt 22	36.639.339	-4,14%	-3,96%
Q3 2022	13. Okt 22	36.639.339	-4,14%	-3,96%
Q3 2022	13. Okt 22	36.639.339	-4,14%	-3,96%
Q3 2022	13. Okt 22	36.639.339	-4,14%	-3,96%
Q3 2022	13. Okt 22	36.639.339	-4,14%	-3,96%
Q3 2022	13. Okt 22	36.639.339	-4,14%	-3,96%
Q4 2022	12. Jan 23	36.086.750	-0,18%	8,14%
Q4 2022	12. Jan 23	36.086.750	-0,18%	8,14%
Q3 2023	19. Okt 23	22.751.595	-1,71%	-0,12%
Q3 2023	19. Okt 23	22.751.595	-1,71%	-0,12%
Q3 2023	19. Okt 23	22.751.595	-1,71%	-0,12%

Appendix 26 - Earnings Calls ASML

ASML				
Quarter	**Date**	**Volume on the specific date**	**Performance on the specific day**	**Performance in the specific week**
Q2 2015	15. Jul 15	2.298.683	-5,90%	-2,23%
Q3 2015	14. Okt 15	3.118.233	1,41%	-1,16%
Q2 2016	20. Jul 16	1.642.096	-2,46%	3,27%
Q3 2016	19. Okt 16	1.109.898	-0,48%	4,05%
Q4 2016	18. Jan 17	4.391.958	-0,90%	5,98%
Q4 2017	17. Jan 18	2.653.357	2,06%	13,65%
Q2 2019	17. Jul 19	2.050.484	4,15%	10,20%
Q2 2019	17. Jul 19	2.050.484	4,15%	10,20%
Q2 2019	17. Jul 19	2.050.484	4,15%	10,20%
Q3 2019	16. Okt 19	1.731.682	-0,30%	-0,50%
Q4 2019	22. Jan 20	1.108.613	-0,73%	-5,22%
Q2 2020	15. Jul 20	1.640.262	2,72%	0,68%
Q2 2020	15. Jul 20	1.640.262	2,72%	0,68%
Q3 2020	14. Okt 20	954.948	-2,93%	-3,38%
Q3 2020	14. Okt 20	954.948	-2,93%	-3,38%
Q4 2020	20. Jan 21	1.122.141	3,82%	7,48%
Q1 2021	21. Apr 21	2.160.897	-1,22%	6,39%
Q1 2021	21. Apr 21	2.160.897	-1,22%	6,39%
Q1 2021	21. Apr 21	2.160.897	-1,22%	6,39%
Q1 2021	21. Apr 21	2.160.897	-1,22%	6,39%
Q2 2021	21. Jul 21	1.281.696	1,29%	10,14%
Q2 2021	21. Jul 21	1.281.696	1,29%	10,14%
Q2 2021	21. Jul 21	1.281.696	1,29%	10,14%
Q2 2021	21. Jul 21	1.281.696	1,29%	10,14%
Q2 2021	21. Jul 21	1.281.696	1,29%	10,14%
Q2 2021	21. Jul 21	1.281.696	1,29%	10,14%
Q2 2021	21. Jul 21	1.281.696	1,29%	10,14%
Q2 2021	21. Jul 21	1.281.696	1,29%	10,14%
Q3 2021	20. Okt 21	1.894.907	2,52%	0,10%
Q3 2021	20. Okt 21	1.894.907	2,52%	0,10%
Q4 2021	19. Jan 22	1.593.207	1,01%	-7,57%
Q4 2021	19. Jan 22	1.593.207	1,01%	-7,57%
Q1 2022	20. Apr 22	1.857.880	-2,20%	-0,96%
Q1 2022	20. Apr 22	1.857.880	-2,20%	-0,96%
Q1 2022	20. Apr 22	1.857.880	-2,20%	-0,96%
Q2 2022	20. Jul 22	2.294.895	5,41%	13,88%
Q2 2022	20. Jul 22	2.294.895	5,41%	13,88%
Q2 2022	20. Jul 22	2.294.895	5,41%	13,88%
Q3 2022	19. Okt 22	2.435.199	3,10%	20,62%
Q3 2022	19. Okt 22	2.435.199	3,10%	20,62%
Q3 2022	19. Okt 22	2.435.199	3,10%	20,62%
Q3 2022	19. Okt 22	2.435.199	3,10%	20,62%
Q3 2022	19. Okt 22	2.435.199	3,10%	20,62%
Q3 2022	19. Okt 22	2.435.199	3,10%	20,62%
Q3 2022	19. Okt 22	2.435.199	3,10%	20,62%
Q4 2022	25. Jan 23	1.569.162	0,38%	-3,83%
Q4 2022	25. Jan 23	1.569.162	0,38%	-3,83%
Q3 2023	18. Okt 23	2.401.708	0,71%	-2,65%
Q3 2023	18. Okt 23	2.401.708	0,71%	-2,65%
Q3 2023	18. Okt 23	2.401.708	0,71%	-2,65%

Appendix 27 – Analysts' Recommendations and Target Prices of the Major Players

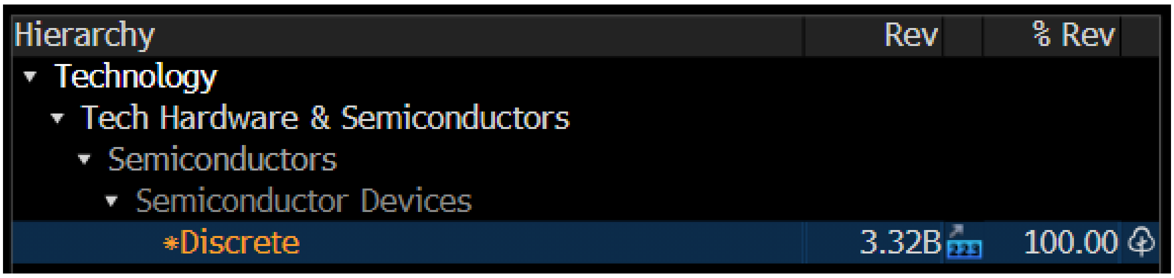


NVIDIA Corp		
Consensus Rating		4.83
Buys	92.2%	59
Holds	7.8%	5
Sells	0.0%	0
12M Tgt Px	47/71	652.43
Last Price		488.90
Pricing Currency		USD

ASML Holding NV		
Consensus Rating		4.12
Buys	64.7%	11
Holds	29.4%	5
Sells	5.9%	1
12M Tgt Px	14/19	718.44
Last Price		752.96
Pricing Currency		USD

Taiwan Semiconductor Manufacturing		
Consensus Rating		4.81
Buys	93.8%	15
Holds	6.3%	1
Sells	0.0%	0
12M Tgt Px	13/18	114.91
Last Price		102.54
Pricing Currency		USD

Appendix 28 - Revenue Segments of Vishay



Hierarchy	Rev	% Rev
Technology		
Tech Hardware & Semiconductors		
Semiconductors		
Semiconductor Devices		
*Discrete	3.32B	100.00

Appendix 29 - YTD Performance of Vishay on 16.10.2023 with relevant moving averages in USD

Appendix 30 - Financial Analysis of Vishay

VSH US Equity 96) Actions ▾ 97) Export ▾ 98) Settings

39) ADJ Vishay Intertechnology Inc ASC 842 ? Periodicity Annuals ▾ Cur USD ▾

1) Key Stats 2) I/S 3) B/S 4) C/F 5) Ratios 6) Segments 7) Addl 8) ESG 9) Custom

11) BBG Adj Highlights 12) BBG GAAP Highlights 13) Company Model 14) Earnings 15) Enterprise Value 16) EV Ex Operating Leases 17

In Millions of USD	2019 Y~	2020 Y	2021 Y	2022 Y	Current/LTM	2023 Y Est	2024 Y Est
12 Months Ending	12/31/2019	12/31/2020	12/31/2021	12/31/2022	09/30/2023	12/31/2023	12/31/2024
Market Capitalization	3,075.3	2,995.9	3,166.9	3,127.8	3,345.0		
- Cash & Equivalents	803.0	778.4	920.9	916.1	1,174.1		
+ Preferred & Other	2.5	2.8	3.0	3.9	4.2		
+ Total Debt	597.9	503.2	579.0	634.7	946.6		
Enterprise Value	2,872.7	2,723.5	2,828.1	2,850.4	3,121.7		
Revenue, Adj	2,668.3	2,501.9	3,240.5	3,497.4	3,472.1	3,407.8	3,305.5
Growth %, YoY	-12.1	-6.2	29.5	7.9	-0.4	-2.6	-3.0
Gross Profit, Adj	671.2	581.9	887.9	1,059.0	1,022.9	979.5	890.1
Margin %	25.2	23.3	27.4	30.3	29.5	28.7	26.9
EBITDA, Adj	473.1	400.2	659.4	804.6	747.0	664.3	572.0
Margin %	17.7	16.0	20.3	23.0	21.5	19.5	17.3
Net Income, Adj	176.8	131.8	297.7	422.5	363.1	336.3	271.7
Margin %	6.6	5.3	9.2	12.1	10.5	9.9	8.2
EPS, Adj	1.22	0.91	2.05	2.94	2.58	2.44	2.02
Growth %, YoY	-42.2	-25.3	125.1	43.3	-5.1	-16.7	-17.4
Cash from Operations	296.4	314.9	457.1	484.3	525.9		
Capital Expenditures	-156.6	-123.6	-218.4	-325.3	-337.2		
Free Cash Flow	139.8	191.3	238.7	159.0	188.7		