DISCOUNT CASH FLOW VALUATION OF TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LIMITED

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ABSTRACT

This thematic paper aims to value the stock price of Taiwan Semiconductor Manufacturing Company Limited (TSMC), listed on the Taiwan stock market with the ticker 2330, based on the discounted cash flow valuation model using the free cash flow to firm (FCFF) method. This model captures the fundamental value of the firm and considers future performance and free cash flow, providing a forward-looking perspective in the valuation. TSMC operates in the semiconductor foundry business, a sunrise industry due to rapid expansion in the information and technology sector. Semiconductors are essential hardware for the majority of tech products. Additionally, the growing markets for artificial intelligence, mobile phones, computers, and data centers create substantial demand for semiconductors, from which TSMC is poised to benefit for years to come. The target price for TSMC at the end of 2024 is estimated to be approximately 1,252 Taiwan dollars per share, which is 20% higher than the current share price of 1,035 Taiwan dollars per share as of July 9, 2024. Hence, the valuation indicates a BUY recommendation. In conclusion, the valuation suggests that TSMC has a high intrinsic value, but the method requires numerous assumptions. Therefore, the value must be considered carefully, and investors need to account for market volatility.

KEY WORDS: TSMC/ Valuation/ DCF/ Semiconductor

49 pages

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LIST OF ABBREVIATIONS

ADSs	American Depositary Shares
AI	Artificial Intelligence
CAPM	Capital Asset Pricing Model CAPEX Capital Expenditure
DCF	Discounted Cash Flow
DSCR	Debt Service Coverage Ratio
TSMC	Taiwan Semiconductor Manufacturing Company
EBIT	Earnings before Interest and Taxes
EBITDA	Earnings before Interest, Taxes and Depreciation
EPS	Earnings per share
GDP	Gross Domestic Product
IC	Integrated Circuit
NOPAT	Net Operating Profit after Taxes
NOWC	Net Operating Working Capital
NYSE	New York Stock Exchange
Rf	Risk free
ROA	Return on Assets
ROE	Return on Equity
SG&A	Selling, General and Administrative Expense
SOFR	Secure Overnight Financing Rate
TWSE	Taiwan Stock Exchange
WACC	Weighted Average Cost of Capital

CHAPTER I
INTRODUCTION

Taiwan Semiconductor Manufacturing Company (TSMC) is a technology company primarily focused on its foundry business, which includes the manufacturing of advanced semiconductor technology. The company is listed on the Taiwan Stock Exchange (TWSE) and has issued American Depositary Shares (ADSes) in the U.S. market. Based on a discounted cash flow (DCF) analysis, we issue a "Buy" recommendation on TSMC, with a target price of 1,252 Taiwan dollars by the end of 2024. This target price represents a 21% upside from its closing price of 1,035 Taiwan dollars on July 8, 2024.

TSMC boasts a strong financial position, characterized by a high level of cash and cash equivalents and low debt. The company efficiently manages its costs, resulting in a high gross profit margin of approximately 53% while maintaining its operating expenses at 11% from 2019 to 2023. Moreover, the semiconductor industry is a sunrise industry, expected to experience favorable growth in the next five years. TSMC has captured a significant portion of the market share, and past data shows an increasing market share growth rate.

Forecasts indicate high growth potential, with revenue expected to more than double from 2.16 trillion Taiwan dollars in 2023 to 5.11 trillion Taiwan dollars in 2028. Assuming TSMC maintains its operational efficiency, it is expected to generate a high positive free cash flow to the firm. Additionally, by calculating the terminal value of the company using the EBITDA multiple method, considering its rapid growth rate and positive net debt, TSMC has an enterprise value of 32.45 trillion Taiwan dollars. Thus, considering the constant number of shares, the DCF valuation method suggests a share price of 1,252 Taiwan dollars.

TSMC faces risks such as technological unpredictability, supply chain disruptions, and geopolitical tensions. Despite these, the company manages exchange

rate risk effectively and maintains a competitive edge. Based on this analysis, investing in TSMC is recommended.

CHAPTER II
BUSINESS DESCRIPTION

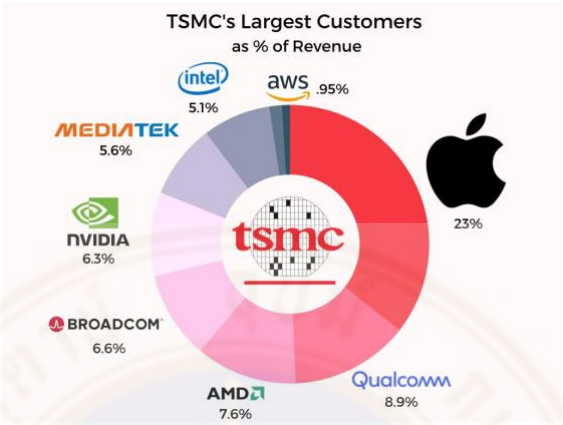
2.1 Company Description and Business Lines

Taiwan Semiconductor Manufacturing Company (TSMC) was created in 1987 to be an integrated circuit (IC) manufacturer by Morris Chang. An integrated circuit (IC) is a semiconductor chip composed of transistors, diodes, and capacitors that are fabricated into a chip format that can produce a processing power that can be used in electronic devices such as home electronics appliances, database centers, phones, computers, satellites, rockets, and advanced military equipment. There are two main types of semiconductor chips. The first type is the logic chip commonly known as the central processing unit (CPU) and the graphics processing unit (GPU). These chips run calculations, process information, and execute the task. Another type is the memory chip, which is used to store data and information. TSMC can manufacture both types of chips efficiently due to large-scale factories, state-of-the-art fabrication centers, technologies, and skilled engineers.

TSMC is focused on being the foundry of semiconductors and is dedicated to producing chips designed by other companies, especially tech enterprises, enabling it to focus entirely on semiconductor manufacturing. Companies such as Apple, Qualcomm, AMD, Nvidia, and Intel became TSMC's largest customers because TSMC can manufacture based on the designs or requirements provided by its customers (see Figure 2.1 for further details). This specialization enhances cost efficiency, performance, and quality as well as assists both small and big corporations to reduce their cost of production because they do not have to invest in machinery, equipment, and fabrication centers. Customers need only to invest in developing the design and then provide it to TSMC for manufacturing, significantly reducing costs. TSMC's fabrication plants are known for their precision, cutting-edge technology, and innovation, making the company preferable for chip designers. The business model and commitment to

manufacturing excellence have established TSMC as a leader in the semiconductor industry.

Figure 2.1 TSMC's largest customers as percentage of revenue

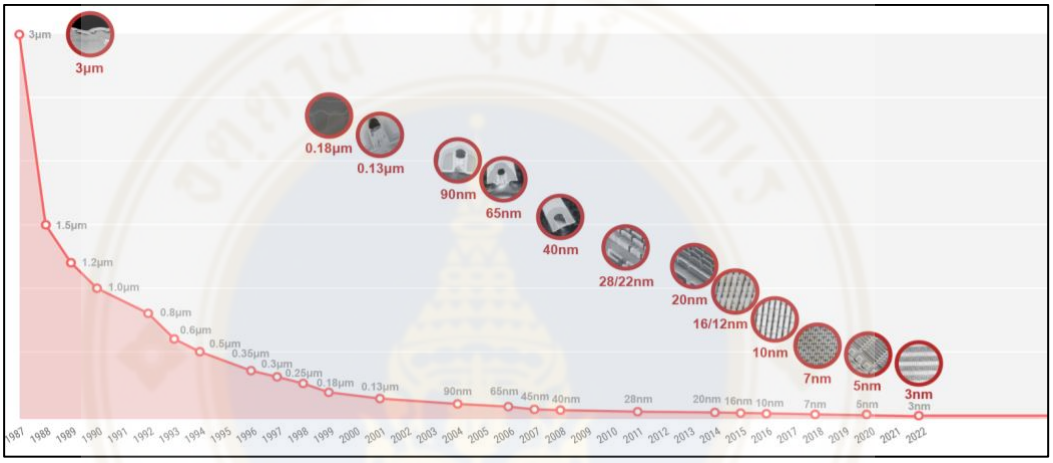


Source: datagravity

From the beginning of TSMC, it has always focused on innovating breakthrough semiconductor technology. In the semiconductor industry, to achieve more efficient and more powerful chips, the transistor needs to be small for more transistors to be placed on the same size chip. Therefore, the density of the transistor is very crucial in semiconductor development. TSMC has a strong R&D team to develop cutting-edge and technologically advanced semiconductors to provide to clients. When TSMC was established in 1987, TSMC was able to manufacture a 3-micron chip which was widely used in all electronics. TSMC continues to develop and improve its microchip technology to produce more precise semiconductors. In 2005, TSMC was able to develop 65nm technology and became the first foundry to manufacture OEM 65nm processors for other companies. The technology is possible due to the advancement in lithography techniques and EUV machines from Advanced Semiconductor Materials Lithography (ASML). TSMC owns over 50% of the EUV machines which are capable of producing 7nm technology to 3 nm technology semiconductors and less. In 2022, TSMC was able to produce the most advanced, powerful silicon microchips utilizing 3mn technology and become the foundry able to do a high volume production which is a crucial supply chain part of the technology industry. According to the Chipspulse website, "TSMC claims that its 3 nm FinFET

chips will reduce power consumption by 25-30% at the same speed, increase speed by 10-15% at the same power, and increase transistor density by about 33% compared to its previous 5 nm FinFET chips. (Chipspulse, 2023). Due to advancements in innovation, technology, and capacity, TSMC accounted for 61% of the global semiconductor foundry revenue in the fourth quarter of 2023, according to Statista website data.

Figure 2.2 TSMC advancement in research and development of semiconductor technology from 1987-2022



Source: TSMC's website

TSMC's primary business activity is semiconductor manufacturing. According to the TSMC 2023 annual report, its revenue model is predominantly based on a single product: wafers, which are silicon or semiconductor materials used in integrated circuits. Wafer sales in 2023 contribute approximately 87.1% of the company's revenue, while the remaining revenue is derived from various other items, including chip design services, consulting, and integrated circuit packaging. The wafer revenue is composed of a range of semiconductor resolutions that TSMC produces and sells to clients, from 0.25 microns and larger to the most advanced 3-nanometer technology. In 2023, 58.1% of the revenue was generated from manufacturing high-resolution semiconductors ranging from 7 to 3 nanometers. These advanced and powerful variations of semiconductors are in high demand due to their applications in smartphones and computers, where they enable efficient task performance. TSMC's focus on producing state-of-the-art semiconductor technologies to match the industry's

demand resulted in establishing its expertise and leadership in semiconductor manufacturing.

Figure 2.3 TSMC's 2023 and 2022 revenue composition (classified by product)

Revenue Structure	Years Ended December 31			
	2022	%	2023	%
Wafer	$1,991,855,947.00	87.98%	$1,882,581,080.00	87.08%
Others	$272,035,345.00	12.02%	$279,217,761.00	12.92%
Total Revenue	$2,263,891,292.00	100.00%	$2,161,798,841.00	100.00%

Note: (Unit In Thousands of New Taiwan Dollars)

Source: TSMC Annual Report 2023

Figure 2.4 TSMC's 2023 and 2022 Wafer revenue composition (classified by resolution)

Resolution	Years Ended December 31			
	2022	%	2023	%
3-nanometer	-		$108,045,275.00	5.74%
5-nanometer	$508,689,811.00	25.54%	$629,300,387.00	33.43%
7-nanometer	$535,153,763.00	26.87%	$357,247,365.00	18.98%
10-nanometer	$24,871.00	0.00%	$23,332.00	0.00%
16-nanometer	$258,544,274.00	12.98%	$191,306,073.00	10.16%
20-nanometer	$8,853,291.00	0.44%	$10,359,042.00	0.55%
28-nanometer	$206,611,955.00	10.37%	$186,924,916.00	9.93%
40/45-nanometer	$145,546,243.00	7.31%	$114,667,360.00	6.09%
65-nanometer	$93,288,614.00	4.68%	$107,425,400.00	5.71%
90-nanometer	$40,184,169.00	2.02%	$25,642,010.00	1.36%
0.11/0.13 micron	$57,992,328.00	2.91%	$47,149,333.00	2.50%
0.15/0.18 micron	$110,571,222.00	5.55%	$86,614,213.00	4.60%
0.25 micron and above	$26,395,336.00	1.33%	$17,813,374.00	0.95%
Wafer	$1,991,855,947.00		$1,882,518,080.00	

Note: (Unit In Thousands of New Taiwan Dollars)

Source: TSMC Annual Report 2023

2.2 Company Strategy

According to the annual report 2023, TSMC's strategy revolves around leveraging its three core competitive strengths: technology leadership, manufacturing excellence, and customer trust. As a technology leader, TSMC consistently pioneers next-generation technologies, maintaining a leadership position not only in cutting-edge

advancements but also in enriching specialty technologies through applied learning. Beyond mere process technology, TSMC integrates frontend and backend capabilities to optimize power, performance, and area, facilitating faster time to production for its customers. This commitment to innovation extends to collaborative efforts like the Open Innovation Platform and the Grand Alliance, which foster industry-wide innovation by bringing together customers, partners, and suppliers.

Central to TSMC's success is its unwavering commitment to customer trust. Since its inception, TSMC has adhered to never competing with its customers, focusing instead on becoming the trusted foundry partner for their semiconductor needs. This commitment underpins the company's reputation and reinforces its position as a reliable and preferred partner in the industry. Looking ahead, TSMC is poised to capitalize on the growth opportunities within the foundry segment, particularly in key markets such as smartphones, high-performance computing, the Internet of Things (IoT), automotive, and digital consumer electronics. Recognizing the shift in customer demand from a process-technology-centric to a product-application-centric approach, TSMC has constructed five corresponding technology platforms. These platforms aim to provide customers with comprehensive solutions, including logic process technologies, specialty technologies, IPs, and packaging and testing technologies, thereby shortening the time to design and time to market for their products. Through these strategic initiatives, TSMC remains well-positioned to thrive in a rapidly evolving semiconductor landscape, driving innovation, and delivering value to its customers and partners alike.

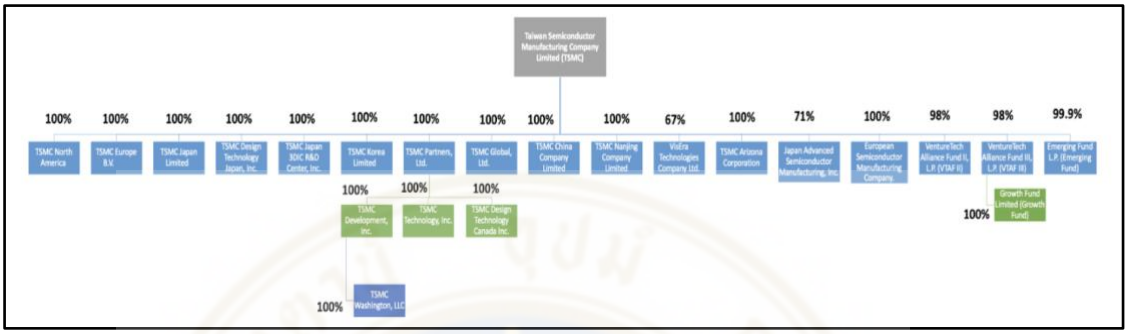
2.3 Company Structure and Major Shareholders

2.3.1 Company Structure

TSMC, a leading semiconductor company, operates through various subsidiaries globally. Its core business includes 1. Manufacturing, sales, and testing of integrated circuits, 2. Investing in semiconductor design and manufacturing companies, 3. Supporting engineering activities, 4. Technology start-up investments, and 4. Color filter development. TSMC focuses on producing high-quality semiconductor devices,

providing customer service, and advancing technology through its diverse range of subsidiaries which are under the group of companies of Taiwan Semiconductor Manufacturing Company.

Figure 2.5 TSMC's subsidiaries



2.3.2 Major Shareholders

TSMC is listed on the Taiwan Stock Exchange (TWSE) under the ticker number 2330 and its American Depositary Shares (ADSs) are traded on the New York Stock Exchange (NYSE) under the symbol TSM.

The top 10 major shareholders include significant institutional investors such as the National Development Fund, Executive Yuan (TSMC was supported in research and development by the previous government of Taiwan), Citibank (Taiwan) Ltd. in custody for the Government of Singapore, and Norges Bank, and various funds managed by JPMorgan Chase Bank and Vanguard. Collectively, these top shareholders hold a substantial portion of TSMC's shares, with the largest single shareholding by ADR-Taiwan Semiconductor Manufacturing Company Ltd. at 20.50%. The major shareholders' details as table below:

Figure 2.6 Major Shareholder (As of 20 December 2023)

Shareholders	Shareholding	Shareholding Percentage
ADR-Taiwan Semiconductor Manufacturing Company Ltd.	5,315,513,063	20.50%
National Development Fund, Executive Yuan	1,653,709,980	6.38%
Citibank (Taiwan) Ltd. in custody for Government of Singapore	816,695,089	3.15%
Citibank (Taiwan) Ltd. in custody for Norges Bank	441,068,838	1.70%
New Labor Pension Fund	340,875,755	1.31%
JPMorgan Chase Bank N.A., Taipei Branch in custody for Vanguard Total International Stock Index Fund, a series of Vanguard Star Funds	326,716,748	1.26%
JPMorgan Chase Bank N.A., Taipei Branch in custody for Vanguard Emerging Markets Stock Index Fund, a series of Vanguard International Equity Index Funds	288,871,605	1.11%
Yuanta/P-shares Taiwan Top 50 ETF	244,819,664	0.94%
iShares Core MSCI Emerging Markets ETF	222,677,000	0.86%
Fubon Life Insurance Co., Ltd.	169,320,221	0.65%

2.4 Corporate Governance

TSMC is dedicated to maintaining operational transparency and safeguarding shareholder rights, which are the cornerstones of its corporate governance. Central to this approach is a robust and effective Board of Directors that delegates responsibilities to three specialized committees: the Audit and Risk Committee, the Compensation and People Development Committee, and the Nominating, Corporate Governance, and Sustainability Committee. These committees ensure thorough oversight and governance, with each chairperson regularly reporting their activities and recommendations to the Board as per 7 sections below refer to TSMC's annual report 2023.

Section 1: Shareholders and Shareholders' Meeting

TSMC prioritizes protecting shareholders' rights and equitable treatment. The company organizes shareholders' meetings according to laws and internal regulations, ensuring transparent and accessible information. Shareholders are encouraged to participate actively, with all meeting details and voting results promptly disclosed online. Board members are encouraged to attend these meetings to engage directly with shareholders. The company provides timely information on financial conditions, operations, and governance while prohibiting insider trading. Procedures for significant transactions are established to safeguard shareholders' interests, and an investor relations webpage is maintained for effective communication.

Section 2: Composition of the Board

The Board's composition and meetings adhere to the Articles of Incorporation, with periodic reviews to ensure optimal size and diversity. Directors are selected based on professional knowledge, experience, commitment to core values, and ethical conduct. The Board values diversity in gender, age, and culture. Directors serve terms as specified by law, with no set tenure limits to benefit from their growing expertise. A majority of the Board aims to be independent, meeting strict criteria. Directors are limited in their service on other company boards, and any significant job changes must be reported to evaluate ongoing appropriateness.

Section 3: Duty of the Board and Board Members

The Board's primary responsibilities include ensuring legal compliance, financial transparency, ethical conduct, and risk management. Directors must perform their duties with care and loyalty, attending all relevant meetings and adhering to company policies. New directors receive orientation, and ongoing education is encouraged. Directors are also encouraged to communicate directly with the management team to enhance their understanding and oversight.

Section 4: Board Committees

TSMC's Board has three standing committees: Audit and Risk, Compensation and People Development, and Nominating, Corporate Governance and Sustainability. These committees operate under Board-approved charters outlining their duties and procedures. The Audit and Risk Committee consists solely of independent directors, while the Board appoints members of other committees. Each committee can engage external experts at the company's expense to support their functions.

Section 5: Performance Evaluation, Compensation, and Succession Planning

The Board and its committees conduct annual performance self-evaluations. The Compensation and People Development Committee reviews executive officer performance, including the CEO, and determines their compensation. The Nominating, Corporate Governance, and Sustainability Committee oversees succession planning for the Chairman and CEO, while the Compensation and People Development Committee handles succession for other executive officers. The Board regularly reviews these plans to ensure sustainable leadership.

Section 6: Information Disclosure

TSMC commits to timely and accurate information disclosure and publishes annual financial reports within two months of the fiscal year-end. The company follows strict procedures for handling internal material information, ensuring all disclosures are made by the spokesperson. A dedicated webpage provides comprehensive information on the company's finances, operations, and governance. Additionally, TSMC holds at

least one investor conference each quarter to maintain transparency and communication with stakeholders.

Section 7: Regulatory Compliance

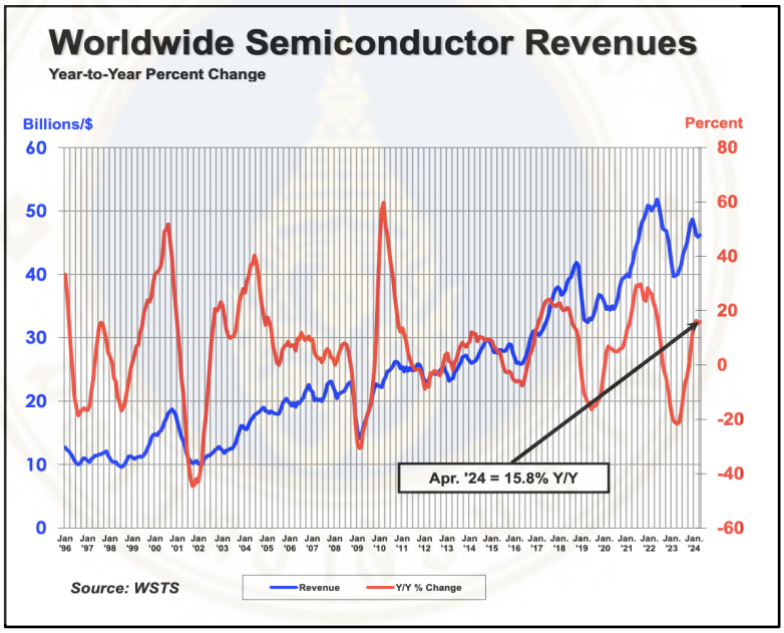
The company maintains open communication channels with stakeholders, including creditors, employees, suppliers, and the community, offering various reporting systems for irregular business conduct. An ESG Steering Committee, reporting to the Nominating, Corporate Governance, and Sustainability Committee, oversees environmental, social, and governance responsibilities, ensuring TSMC's adherence to its corporate values and regulatory obligations.

CHAPTER III
MACRO-ECONOMIC, INDUSTRY AND COMPETITION ANALYSIS

3.1 Macro-Economic Analysis

3.1.1 Global Semiconductor Sales

Figure 3.1 Worldwide Semiconductor Revenue



Global semiconductor sales reached $46.4 billion, marking a 1.1% increase from Q1/2024 and a significant 15.8% rise from 2023, according to the Semiconductor Industry Association (SIA, 2024). This growth indicates the first month-to-month increase of 2024, reflecting positive market momentum. The World Semiconductor Trade Statistics (WSTS) organization projects a strong annual global sales growth of 16.0% for 2024, with sales expected to hit $611.2 billion, a record high for the industry. This growth is anticipated to continue into 2025, with a forecasted 12.5% increase, bringing sales to $687.4 billion. Regionally, the Americas led the growth with a 32.4%

year-over-year increase, followed by China (23.4%) and Asia Pacific/All Other (11.1%), while Europe and Japan saw declines. The SIA, representing the majority of the U.S. and significant non-U.S. chip firms, endorsed the WSTS forecast, underscoring robust growth prospects for the semiconductor industry.

3.1.2 Global GDP

The World Bank's latest Global Economic Prospects report, 2024, indicates that while the global economy is expected to stabilize in 2024, the growth rate will remain weak compared to pre-COVID levels. Projected global growth is 2.6% for 2024, rising slightly to 2.7% for 2025-26, which is below the pre-pandemic decade average of 3.1%. Over 80% of the world's population and GDP will experience slower growth than in the pre-COVID decade. Developing economies are projected to grow at 4% on average over 2024-25, slightly slower than in 2023, with low-income economies expected to see a growth acceleration to 5% in 2024. Advanced economies will see steady growth at 1.5% in 2024, increasing to 1.7% in 2025. Despite some positive signs, including a moderation in global inflation and a modest increase in public investment, significant challenges remain for the world's poorest economies, particularly those in conflict-affected situations, with widening income gaps and high debt levels continuing to constrain growth prospects.

3.1.3 Exchange rate

Regarding the annual report 2023, TSMC's financial performance is significantly influenced by foreign currency exchange rates due to its global operations. The company's sales are predominantly in U.S. dollars, while a substantial portion of its capital expenditures and equity investments are in other currencies, notably U.S. dollars, Japanese yen, and Euros. Fluctuations in exchange rates, particularly a weakening of the U.S. dollar against the NT dollar, could negatively impact TSMC's revenue and operating profit when expressed in NT dollars. To mitigate this risk, TSMC employs foreign currency derivative contracts and non-derivative financial instruments like currency forwards, currency swaps, and foreign currency-denominated bank loans. While these hedging strategies help reduce the impact of exchange rate movements, the company does not completely eliminate the risk. Sensitivity analysis for 2023 and 2022

indicates that a hypothetical adverse 10% change in exchange rates would have reduced net income by only 0.087% and 0.16%, respectively. Hence, TSMC has been aware of the exchange rate risk and utilized the effects of hedging and offsetting positions. Its management strategy is able to effectively minimize the impact of the exchange rate volatility. This underscores the importance of effective currency risk management in maintaining TSMC's financial stability amidst global currency fluctuations.

3.2 Industry Analysis

The semiconductor industry is experiencing substantial growth, driven by increasing demands across various high-impact sectors, notably automotive, artificial intelligence (AI), and high-performance computing. The rapid advancements and growing requirements in these sectors have positioned microprocessors as the leading product with the highest growth potential, marking a significant shift in the industry landscape (KPMG, 2024).

Microprocessors: Leading the Growth

Microprocessors have surged to the forefront of growth opportunities in the semiconductor industry, reflecting the heightened processing requirements of AI applications, automotive technologies, and high-performance computing devices. The rising demand for advanced driver-assistance systems (ADAS), which is the largest segment of the automotive semiconductor market, underscores this trend. With a projected compound annual growth rate of nearly 20% by 2027 for ADAS, the long-term demand for microprocessors and other semiconductor units is expected to remain robust.

Memory Market Dynamics

The memory market, which had been in a prolonged downturn due to oversupply and declining demand, is showing signs of recovery. Average selling prices for memory products began to fall in Q4 of 2022 and continued on this trajectory for most of 2023. Despite being the lowest-ranked product last year, memory has risen to fourth place, indicating a positive shift towards overcoming overcapacity and inventory

issues. This recovery is crucial for the overall health of the semiconductor industry, as memory components are integral to a wide range of electronic devices and applications.

Automotive Sector: A Major Revenue Driver

The automotive industry continues to be a major driver of semiconductor revenue, fueled by the ongoing trends toward vehicle electrification, advanced driver-assistance systems (ADAS), and autonomous driving technologies. While the global automotive sales growth rate for 2024 is projected to be a modest 2.8%, semiconductor leaders still recognize automotive as the most important application driving revenue growth for the second consecutive year. Despite easing chip shortages, automotive companies remain concerned about the continuity of semiconductor supply, prompting them to establish their chip divisions and secure long-term supply agreements with semiconductor manufacturers to mitigate potential disruptions.

AI's Ascendant Role

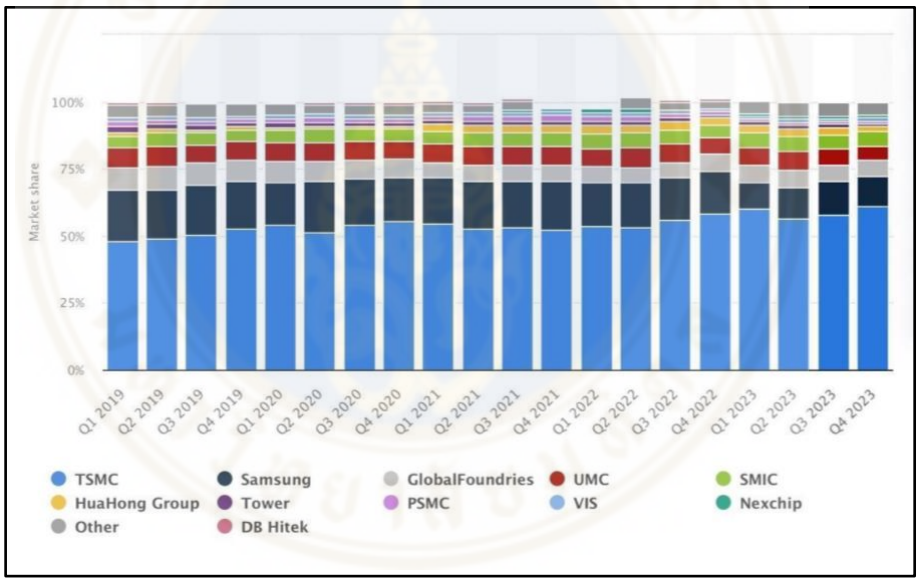
Artificial intelligence has climbed to the number two spot in terms of growth importance, reflecting its expanding influence on semiconductor demand. The heavy usage of GPUs in AI models underscores the strong correlation between AI advancements and the growth of microprocessors. This enthusiasm for AI aligns with broader optimistic views on AI-related opportunities and may reflect tempered expectations for automotive sales in the coming year. Conversely, European and ASPAC respondents placed AI lower in their growth priorities, highlighting regional variations in industry focus.

The growth drivers for the semiconductor industry exhibit significant variation across regions and sectors. While automotive remains the top revenue driver globally, the importance of other sectors such as cloud/data centers, Internet of Things (IoT), and wireless communications cannot be overlooked. Wireless communications, which previously held the top spot for several years, has now slipped to third place, tied with cloud/data centers and IoT. This shift highlights the evolving industry dynamics, where emerging technologies like AI and high-performance computing are reshaping the semiconductor landscape.

3.3 Competitor Analysis

The semiconductor manufacturing industry plays a crucial role in the technological advancements that drive various sectors such as electronics, automotive, and telecommunications. At the forefront of this industry is Taiwan Semiconductor Manufacturing Co. (TSMC), which dominates the market with significant market share and technological advancements. Alongside TSMC, several other key players contribute to the dynamic and competitive landscape of semiconductor manufacturing. TSMC and its four major competitors: United Microelectronics Corporation (UMC), Semiconductor Manufacturing International Corporation (SMIC), GlobalFoundries, Tower Semiconductor Ltd. (Marketchameleon, 2024)

Figure 3.2 Semiconductor foundries revenue share worldwide from 2019 - 2023



Source: Statista

TSMC is the world's largest dedicated chip foundry, holding nearly 60% of the global market share. Founded in 1987, TSMC has consistently led the industry with its cutting-edge technology and high production capacity. The company's dominance in advanced node manufacturing, particularly its 3nm and 5nm processes, has attracted major clients such as Apple, Nvidia, and AMD. TSMC's extensive investment in research and development, including a $28 billion plan for expanding its EUV (extreme-ultraviolet lithography) capabilities, ensures its continued leadership in the market.

Despite facing challenges in meeting the growing demand, TSMC's strategic expansions and technological advancements position it to maintain its market dominance.

UMC, established in 1980, is the world's second-largest dedicated chip foundry, with a 13% market share. UMC's strength lies in its focus on legacy process nodes (40nm and above), which has enabled it to secure a diverse customer base including Texas Instruments, MediaTek, and Qualcomm. With 12 fabs across Taiwan, Mainland China, Japan, and Singapore, UMC is well-positioned to serve a wide range of applications in communications, display, memory, and automotive sectors. Employing about 20,000 people, UMC's extensive manufacturing footprint and strategic investments have solidified its position as a key player in the semiconductor industry.

SMIC, headquartered in Shanghai, China, is a leading foundry with an 11% market share. Despite its advanced 7nm process node, SMIC faces significant challenges due to its addition to the U.S. Government's entity list, which restricts its access to critical technology and components. This geopolitical tension poses a risk to SMIC's prospects, potentially forcing it to divest assets like Huawei to remain viable. Nevertheless, SMIC's manufacturing capabilities and scale, supported by its facilities in Shanghai, Beijing, Tianjin, and Shenzhen, position it as a crucial player in the Chinese and global semiconductor markets.

GlobalFoundries, originally the manufacturing arm of Advanced Micro Devices, has evolved into one of the top-five contract semiconductor manufacturers globally, with a 7% market share. The company's focus on more mature process technologies has allowed it to cater to a range of end markets including smartphones, PCs, IoT, data centers, and automotive industries. GlobalFoundries' strategic acquisitions, such as Chartered Semiconductor Manufacturing and IBM's chip-making business, have bolstered its capabilities and market reach. Headquartered in Malta, New York, and employing about 12,000 people, GlobalFoundries continues to play a significant role in the semiconductor landscape.

Tower Semiconductor Ltd is a specialty foundry that focuses on producing integrated circuits (ICs) based on customer design specifications. As a pure-play foundry, Tower Semiconductor caters to a wide range of markets, including consumer

electronics, personal computers, communications, automotive, and medical devices. With fabrication facilities in Japan and an integrated team offering design and technical support, Tower Semiconductor ensures a quick and accurate design cycle for its clients. This specialization and customer-centric approach have positioned Tower Semiconductor as a key player in the specialty foundry segment of the semiconductor industry.

CHAPTER IV
FINANCIAL ANALYSIS

4.1 TSMC Financial analysis

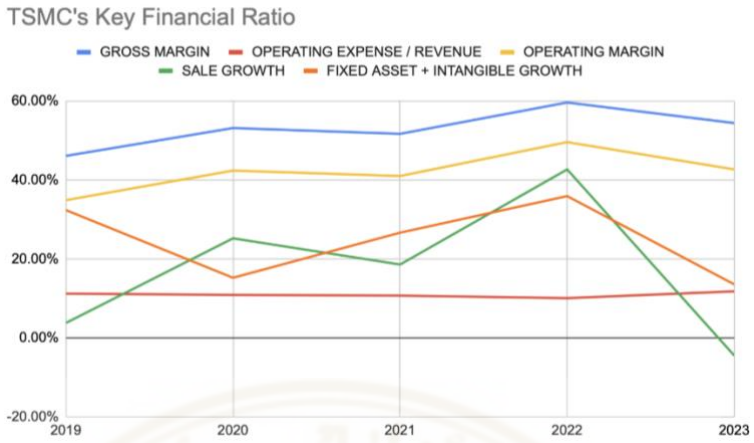
TSMC has a strong financial position, impressive growth as well as considerably efficient capital management. From TSMC's consolidated financial report, the gross margin is around 53% with approximately a 7% deviation due to the cost of raw materials such as silicon which is the main material of semiconductors. Moreover, TSMC's operating margin has an upward trend similar to gross margin from 34.83% in 2019 to 42.63% in 2023 with a peak of 49.53% in 2022. As for operating expenses, it increases every year because more capital is allocated to research and development followed by general and administrative. However, the revenue of TSMC also increased over the period resulting in the operating expense being around 11% of the revenue. This strong financial performance highlights TSMC's effective capital management and strategic investments, ensuring sustained growth and industry leadership.

Additionally, sales growth increased rapidly from year 2019 to year 2020 due to 7-nanometer and 5-nanometer semiconductor resolutions being ordered by smartphone companies as well as widely used in high-performance computing resulting in 25.17% sales growth in one year. In 2021, TSMC was able to maintain a sales growth of 18.53%. Despite the exceptional growth in the past year, in 2022, TSMC achieved a peak sales growth of 42.61%. There are 4 main areas with intensive use of semiconductors which are smartphones, high-performance computing (HPC), internet of things (IoT), and automotive. Due to the AI trend that affects several industries, 5-nanometer semiconductor demand has been increasing especially in smartphone and high-performance computing (HPC). The COVID-19 pandemic affects human behavior resulting in a change of lifestyle in which the Internet of Things (IoT) became crucial to each individual. Applications such as health monitoring, home utilities, smart devices, and connectivity are more widely used. TSMC provides the industry's cutting-edge technologies including ultra-low power chips (ULP) to meet market requirements. In

addition, electric vehicles (EVs), advanced driver assistance systems (ADAS), smart cockpit/infotainment systems, networking, sensors, and power management ICs increase the silicon content in cars and boost demand for semiconductors. TSMC provides diverse technologies, empowering customers to produce competitive automotive products. (TSMC 2022 Annual Report) These factors enable TSMC to have an outstanding performance in 2022. On the other hand, sales growth had a decline of 4.51% in 2023 due to lower demand from the smartphone and IoT sectors. With the announcement of the new 3-nanometer technology on December 29, 2022, there was a significant decrease in 7-nanometer wafer revenue. However, demand for the 3-nanometer technology increased from TSMC's top three clients which include Apple, Intel, and AMD (Trendforce, 2023). Despite the decline in sales growth in 2023, TSMC's strategic advancements and strong client demand for 5-nanometer and 3-nanometer technology emphasize its dominance in the semiconductor industry.

Furthermore, TSMC had expanded its fabrication of semiconductors capacity by investing in fixed assets such as a fabrication factory and research and development center. The growth in fixed assets and intangible assets shows significant investments, especially in 2019 and 2022 with growth rates of 32.21% and 35.86% respectively. As of the year ended 2023, TSMC runs four 12-inch wafer GIGAFAB facilities, four 8-inch wafer plants, and one 6-inch wafer plant, all located in Taiwan. (TSMC, 2023). It also possessed one GIGAFAB, one 8-inch fab in China, another 8-inch fab in the USA, and one in Japan as well as development centers and backend fabs all around the world. From these expansions and the acquisition of PPE, fixed assets increased every year from 2019 to 2023.

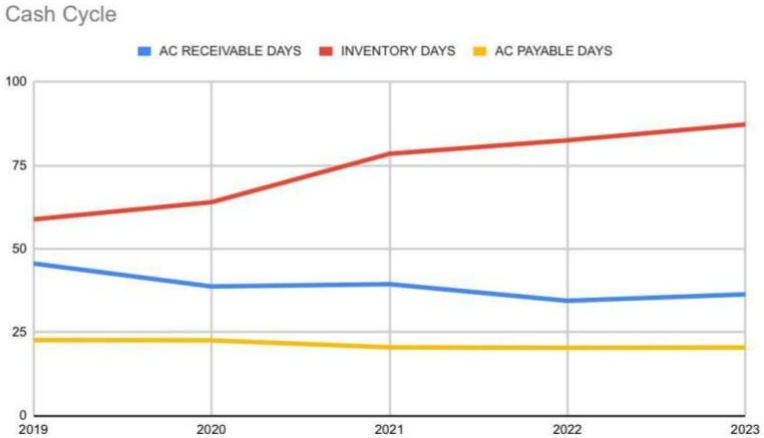
Figure 4.1 TSMC's Key Financial Ratios from 2019-2023



Source: TSMC Annual Report 2019-2023

TSMC maintained a positive cash conversion cycle (CCC) from 2019 to 2023, gradually increasing from 82 days to 103 days due to a rise in inventory days over the period. In response to the uncertainties brought about by COVID-19 and technological trends, TSMC stocked up on additional inventory to safeguard against potential supply chain disruptions. This inventory accumulation occurred primarily between 2020 and 2021, with TSMC planning to address inventory levels starting in 2022 and initiate an inventory correction plan. The company anticipates being able to sell this surplus inventory, driven by expectations of increased demand due to artificial intelligence (AI) technologies.

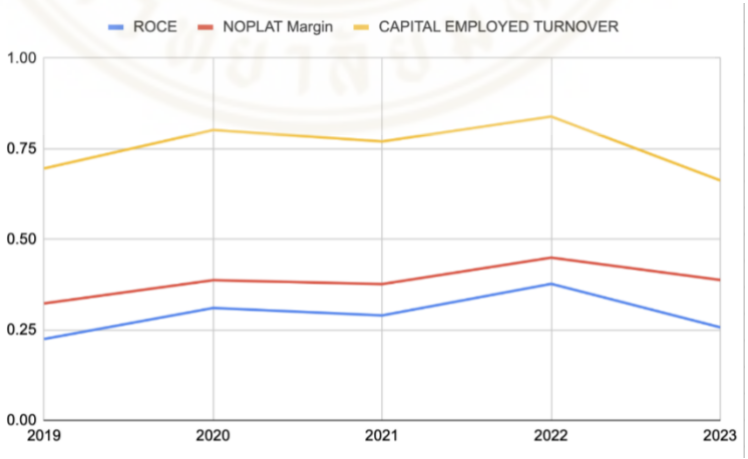
Figure 4.2: TSMC's Cash Cycle from 2019-2023



Source: TSMC Annual Report 2019-2023

In terms of capital management, TSMC has efficiently managed its return on capital employed (ROCE), ranging from 22.45% in 2019 to a peak of 37.68% in 2022, before a slight decrease to 25.67% in 2023. This metric reflects the company's ability to generate profits relative to the capital employed. Additionally, its Net Operating Profit Less Adjusted Taxes (NOPLAT) fluctuated between 32.28% and 44.92% over the past five years due to changes in revenue, indicating TSMC's capability to generate high operating profits. Similarly, the capital employed turnover has followed a comparable trend. Given the nature of the advanced manufacturing business, which requires significant capital investment in PPE, TSMC's capital employed turnover ranged from 0.66 to 0.84. With additional investments in fabs and EUV machinery, TSMC's capital expenditure (CAPEX) increased from approximately 469 billion Taiwanese dollars in 2019 to around 1 trillion Taiwanese dollars in 2022, with a slight decrease in 2023. Despite the high CAPEX, TSMC was able to generate a free cash flow of 172 billion Taiwanese dollars in 2019, which gradually increased to 404 billion Taiwanese dollars in 2023. In summary, TSMC has demonstrated efficient capital management. These metrics collectively indicate the company's ability to effectively utilize its capital resources to generate profits and maintain competitiveness in the semiconductor manufacturing industry.

Figure 4.3 TSMC's Capital Management Ratios from 2019-2023



Source: TSMC Annual Report 2019-2023

TSMC maintains a healthy debt level. Its net debt-to-equity ratio is negative, indicating that TSMC has sufficient cash and cash equivalent to pay off all interest-

bearing debt. Additionally, its earnings before interest, tax, depreciation, and amortization (EBITDA) can cover more than 100 times its interest payments from 2019 to 2023, partly due to high depreciation, which is a non-cash expense. This demonstrates TSMC's high level of solvency. Hence, TSMC has a strong debt position and cash on hand.

Table 4.1 TSMC's Debt Ratios from 2019-2023

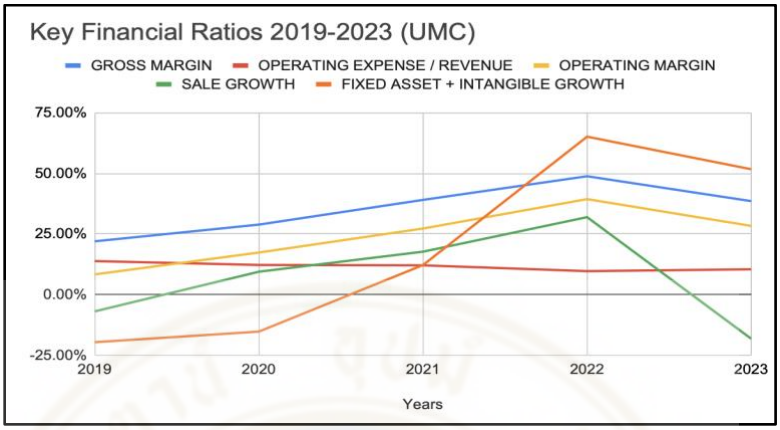
DEBT	2019	2020	2021	2022	2023
NET DEBT / EQUITY	-16.33%	-15.80%	-14.34%	-15.36%	-14.62%
DEBT / EQUITY	11.74%	19.87%	34.72%	30.00%	27.45%
EBITDA	674,508,015	911,397,078	1,082,728,232	1,584,438,881	1,514,103,355
INTEREST EBITDA COVER	207.49	437.87	199.98	134.85	126.18

Source: TSMC Annual Report 2019-2023

As for shareholders of TSMC, the company has been successful in managing business in the past. The retained earnings of TSMC from 2019 to 2023 had increased from 1.3 trillion Taiwanese dollars to 3.1 trillion Taiwanese dollars respectively. In addition, considering economic value added (EVA) which is the residual value paid to capital holders including both creditors and shareholders, TSMC had an exponential increase of estimated EVA from 150 billion Taiwanese dollars in 2019 to a peak of 588 billion Taiwanese dollars in 2022. In 2023, EVA decreased to 333 billion Taiwanese dollars due to increases in the weighted average cost of capital (WACC). (GuruFocus Researcher, 2024). Lastly, the return on equity (Dupont ROE) of TSMC had a gradual increase from 2019 to 2023 with 21.29% to 39.64% respectively due to increases in net income, revenue, and leverage. However, in 2023, ROE decreases to 26% mainly because of decreases in sales of 7-nanometer technology. These figures provide an overview of TSMC's significant value to shareholders over the past five years of operations.

4.1.1 Financial Analysis Compare with peer – UMC

Figure 4.4: UMC's Key Financial Ratios from 2019-2023



Source: UMC Annual Report 2019-2023

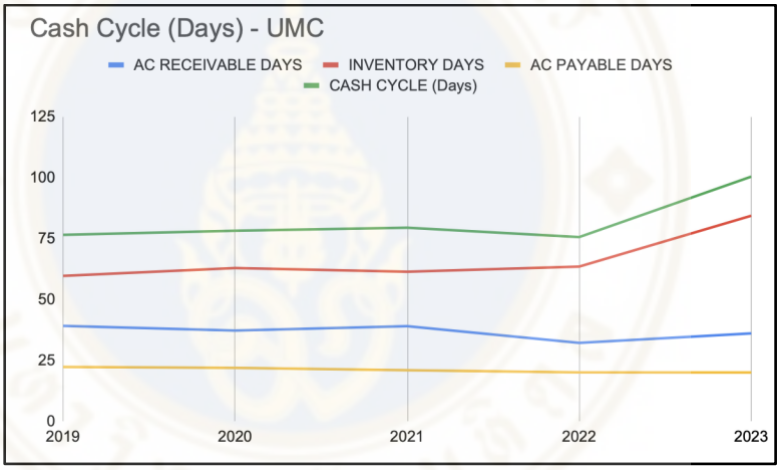
From 2019 to 2023, UMC's financial performance showcased significant shifts as illustrated by its key financial ratios. The gross margin saw a notable increase from 21.97% in 2019 to a peak of 48.82% in 2022, before declining to 38.55% in 2023. This improvement indicates enhanced efficiency and cost management over the years, although the dip in 2023 suggests possible challenges in maintaining these gains. Concurrently, the operating expense margin decreased from 13.81% in 2019 to a low of 9.67% in 2022, reflecting better control over operating expenses relative to revenue growth. However, it slightly increased to 10.43% in 2023, indicating a slight rise in operational costs.

The operating margin exhibited a remarkable rise from 8.32% in 2019 to 39.38% in 2022, demonstrating robust profitability improvements, likely driven by cost efficiencies and higher selling prices. However, this margin dropped to 28.32% in 2023, signaling potential profitability pressures. Sales growth fluctuated significantly, with a notable decline of 6.94% in 2019, followed by growth spurts of 9.43%, 17.70%, and 31.94% from 2020 to 2022, respectively. The sharp sales growth in 2022 likely reflects increased customer demand and higher average selling prices. However, a significant decline of 18.23% in 2023 indicates a substantial reduction in sales, possibly due to market saturation or reduced demand.

According to UMC's annual report for 2022, The 30.8% significant increase in operating revenues from NT$213,011 million in 2021 to NT$278,705 million in 2022 was driven by a 21.3% rise in the average selling price and a modest increase in wafer demand, further bolstered by favorable currency depreciation. Despite these gains, the 2023 financial ratios hint at emerging challenges that UMC must navigate to sustain its growth trajectory and market position.

Fixed asset and intangible growth displayed considerable variability, with declines in 2019 and 2020, but substantial growth of 65.14% and 51.71% in 2022 and 2023, respectively. These increases suggest significant capital investments aimed at expanding UMC's production capabilities and technological advancements.

Figure 4.5 UMC's Cash Cycle from 2019-2023



Source: UMC Annual Report 2019-2023

From 2019 to 2023, UMC's financial ratios related to its cash cycle reflect significant trends in its operational efficiency and liquidity management. The average collection receivable (AC receivable) days fluctuated slightly, starting at 39 days in 2019, dipping to 37 days in 2020, then stabilizing around 39 days in 2021, before improving to 32 days in 2022 and rising again to 36 days in 2023. This suggests some variability in how quickly UMC is able to collect payments from customers, with notable efficiency in 2022.

Operating costs for UMC also saw significant changes. The company reported NT$135,856 million in operating costs in 2021, which increased to

NT$145,979 million in 2022 before slightly decreasing to NT$136,902 million in 2023. Inventory management posed challenges, as evidenced by the reversal of NT$426 million in inventory write-downs in 2021, compared to write-downs of NT$98 million in 2022 and a substantial NT$1,148 million in 2023. These write-downs suggest issues with inventory valuation, reflecting potential overestimations in demand or a decrease in the value of held inventory. Inventory days remained relatively stable from 2019 to 2021, ranging between 60 and 63 days, but saw a significant increase to 84 days in 2023. This jump indicates that UMC held onto its inventory longer.

Accounts payable days were consistently around 20-22 days throughout the period, indicating stable payment terms with suppliers. It started at 76 days in 2019, peaked at 79 days in 2021, returned to 76 days in 2022, and surged to 100 days in 2023. This increase in the cash cycle is primarily driven by the rise in inventory days, indicating that UMC's cash was tied up in inventory for longer periods in 2023.

Table 4.2 UMC's Dupont Analysis from 2019-2023

ROE	2019	2020	2021	2022	2023
Dupont ROE	**4.70%**	**13.19%**	**21.59%**	**28.31%**	**17.57%**
NET INCOME/REVENUE	0.08	0.22	0.35	0.42	0.36
REVENUE/TOTAL ASSET	0.41	0.44	0.44	0.47	0.34
Leverage (TOTAL ASSET/TOTAL EQUITY)	1.46	1.40	1.40	1.45	1.46

UMC's financial performance from 2019 to 2023, analyzed through the DuPont framework, shows significant changes. The Return on Equity (ROE) increased sharply from 4.70% in 2019 to a peak of 28.31% in 2022, before declining to 17.57% in 2023. This growth was primarily driven by improvements in profitability, with the net income to revenue ratio rising from 0.08 in 2019 to 0.42 in 2022, though it dropped slightly to 0.36 in 2023. The revenue to total assets ratio (asset turnover) also improved from 0.41 in 2019 to 0.47 in 2022, indicating better asset utilization, but then decreased to 0.34 in 2023, suggesting reduced efficiency. Leverage, measured as total assets to total equity, remained relatively stable around 1.40-1.46, indicating consistent use of equity to finance assets. Overall, UMC demonstrated strong profitability and efficiency gains up to 2022, with some challenges in maintaining these levels in 2023.

Table 4.3 UMC's Debt Structure from 2019-2023

DEBT	2019	2020	2021	2022	2023
NET DEBT / EQUITY	-9.07%	-16.02%	-16.25%	-26.21%	-4.14%
DEBT / EQUITY	23.10%	13.28%	17.08%	10.34%	17.97%
EBITDA	42,636,140	60,194,804	87,727,568	125,171,385	96,231,626
INTEREST EBITDA COVER	49.48	98.76	141.74	176.92	107.60
DEBT SERVICE COVERAGE RATIO (DSCR)	**11.54**	**2.81**	**22.71**	**6.37**	**13.85**

The net debt-to-equity ratio improved, turning from -9.07% in 2019 to a low of -26.21% in 2022, before rising to -4.14% in 2023, indicating a strong cash position relative to debt. The debt-to-equity ratio fluctuated, decreasing from 23.10% in 2019 to 10.34% in 2022, and then increasing to 17.97% in 2023, reflecting variability in debt levels relative to equity.

Sufficient debt service coverage ratio (DSCR) displayed variability, peaking at 22.71 in 2021 and then dropping to 6.37 in 2022 before rising to 13.85 in 2023, highlighting fluctuations in UMC's ability to meet debt obligations.

Table 4.4 TSMC's Free Cash Flow compared with peer

CASHFLOWS	2019	2020	2021	2022	2023
FREE CASH FLOW (TSMC)	172,748,337	265,187,740	63,467,943	303,149,738	404,806,031
FREE CASH FLOW (UMC)	29,915,400	33,005,654	24,059,919	17,979,674	62,121,629

TSMC consistently generated significantly higher free cash flow compared to UMC, reflecting its dominant position in the semiconductor industry. TSMC's free cash flow grew from NT$172.75 billion in 2019 to NT$404.81 billion in 2023, peaking at NT$303.15 billion in 2022. This growth was supported by substantial net profits and substantial depreciation figures, despite heavy capital expenditures. In contrast, UMC's free cash flow was much lower, starting at NT$29.92 billion in 2019 and ending at NT$62.12 billion in 2023, with a notable dip to NT$17.98 billion in 2022. UMC's lower free cash flow is due to smaller net profits and high depreciation rates relative to fixed assets, combined with less dramatic but still significant capital expenditures. Overall, TSMC's stronger financial performance and investment capacity underline its leading market position over UMC.

Table 4.5 TSMC's liquidity compared with peer

Liquidity Ratio	2019	2020	2021	2022	2023
Current Ratio (UMC)	2.46	4.15	2.55	2.08	1.77
Current ratio (TSMC)	1.39	1.77	2.17	2.17	2.4

TSMC's current ratio showed a consistent improvement, starting at 1.39 in 2019 and gradually increasing to 2.40 in 2023. Comparing the liquidity ratios of UMC reveals differing trends in their ability to meet short-term obligations. UMC's current ratio started strong at 2.46 in 2019 and peaked at 4.15 in 2020, indicating excellent liquidity. However, it declined steadily to 1.77 by 2023, suggesting a reduction in its short-term financial flexibility. This steady rise reflects TSMC's enhanced liquidity and stronger capability to cover its short-term liabilities, positioning it more favorably compared to UMC, whose liquidity has weakened over the same period.

In conclusion, from 2019 to 2023, UMC's financial performance improved significantly in efficiency and profitability, peaking in 2022 before facing challenges in 2023. The gross margin increased substantially, and operating expenses were better controlled, leading to a higher operating margin. However, a decline in these metrics in 2023 indicated emerging difficulties. Sales growth was strong until 2022 but dropped sharply in 2023, suggesting market saturation or reduced demand. In comparison, TSMC consistently outperformed UMC in free cash flow, reflecting its dominant market position. TSMC's free cash flow rose from NT$172.75 billion in 2019 to NT$404.81 billion in 2023, while UMC's was significantly lower, ending at NT$62.12 billion in 2023. TSMC's liquidity also improved steadily, with a current ratio increasing to 2.40 in 2023, contrasting with UMC's declining ratio, which dropped to 1.77. Overall, while UMC showed strong financial performance and growth up to 2022, it faced several challenges in 2023. In contrast, TSMC maintained stronger financial stability and growth, underscoring its superior market position.

4.2 Financial Forecast

For the TSMC financial forecast analysis, we will project the company's performance over the next five years, from 2024 to 2028. This period is chosen because it is long enough to observe trends while maintaining a certain level of accuracy with

the data currently available. A longer forecast would not be valid due to the potential need to incorporate new information. Therefore, a five-year forecast period is selected for the model.

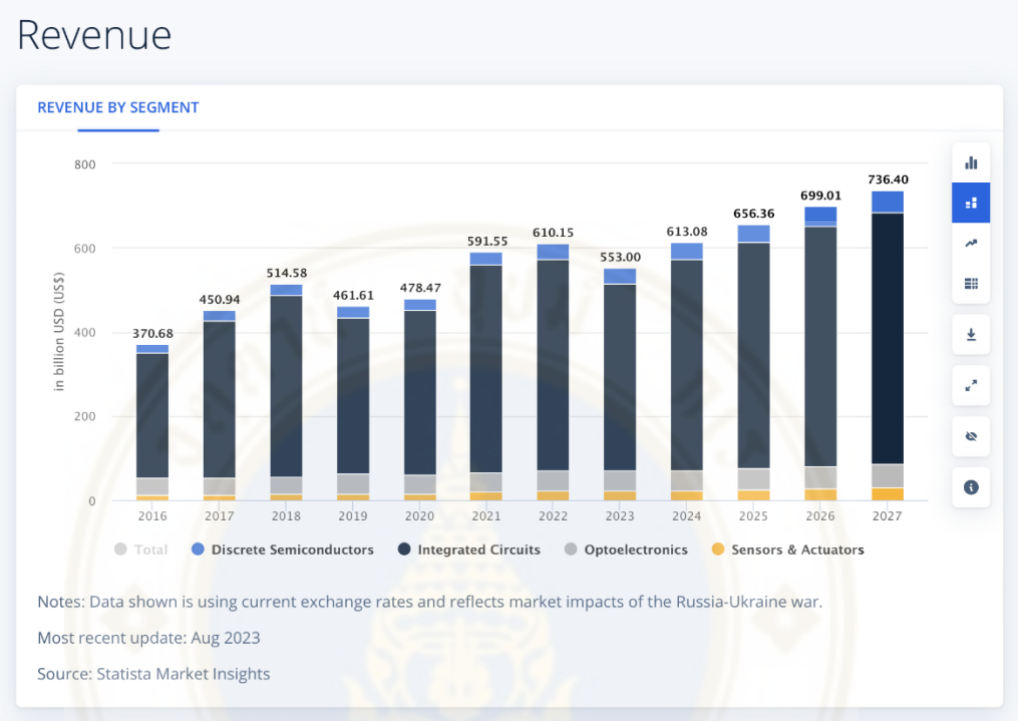
The main key variable to forecast is the revenue of TSMC. There are 2 methods that we used to project the revenue which use industry forecast, and regression model using quarterly data.

4.2.1 Forecast based on industry growth

From Statista market insight analysis, the semiconductor market is driven by the automotive, consumer electronics, telecommunications, and industrial equipment sectors, experiencing cycles of growth and decline due to demand fluctuations. Over the last twenty years, the market share has transitioned from American and European regions to Asian countries, with China now the largest consumer of semiconductors. "The market will continue to be cyclical for the next few years due to major swings in the demand and supply capabilities caused by the ongoing war, energy crisis, and inflation. The market is expected to experience a downturn in 2023 and significant growth in the following years." (Statista Market Insights, 2023). The semiconductor industry revenue from 2024-2027 is forecast by utilizing various forecasting techniques tailored to the specific market behavior. The primary factors taken into account are GDP and the level of digitization. According to Statista's forecast methodology, the data is composed of B2B, B2G, and B2C enterprises. Additionally, figures are based on the capital spent at the manufacturer price level (excluding VAT). Moreover, the modeling market sizes are determined by using a top-down approach, validated by bottom-up analysis, tailored to each market's unique characteristics. The evaluations rely on annual financial reports from leading companies and insights from our primary research. In addition, it incorporates key market indicators and country-specific data to estimate the market size for each country individually. As for the 2028 semiconductor industry revenue forecast. We use CAGR from 2023-2028 of 3.42% to calculate the revenue growth. (Technavio, 2024). In addition, TSMC revenue market share and market share growth are calculated. In 2016, TSMC had a revenue market share of 7.89% but the TSMC market share growth fluctuated from negative 15% to positive 38%. Therefore, the assumption of market share growth is determined by the moving average of TMSC's

market share in the semiconductor industry sale of the past 7 years of data. Hence, the revenue from 2024 to 2028 can be forecast by semiconductor industry revenue growth.

Figure 4.6 Revenue of Semiconductor Industry from 2016-2027F



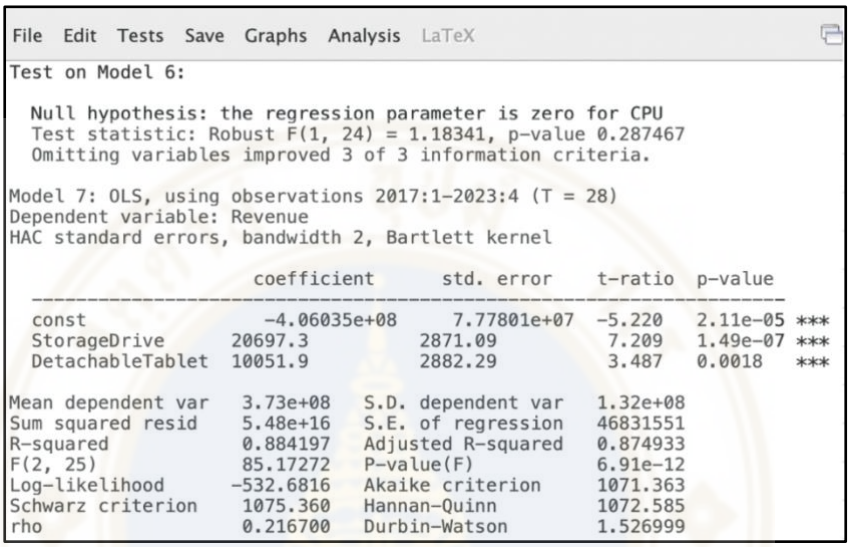
Source: Statista

4.2.2 Forecast based on monthly regression

The regression model is constructed using past and forecast data from 2017 to 2028 of the world export revenue of CPU, storage drives, notebooks-mobiles, detachable tablets, and desktops-datacenters. The data is extracted from the Bloomberg data terminal. TSMC's yearly revenue is set as a dependent variable. From the regression analysis, the p-value shows that storage drives, notebooks-mobiles, and detachable tablets are significant. However, CPU and desktops-data centers are 2% more than the confidence interval of 90% but having these 2 variables improved the adjusted R-squared value. This model can explain 93.8% of the variation but the fact that we have small data points which could lead to overfitting. Therefore, we divided the data into quarterly data and ran a regression model with the quarterly revenue of TSMC. The data set now has 28 data points. With the adjustment of the robust standard error to solve for the heteroskedasticity problem and omit insignificant variables, the

model was left with storage drives and detachable tablets as a regressor (see Figure 4.13). The regression model has an adjusted R-squared of 87.5% and variables are significant. Hence, this model can be used to forecast TSMC revenue from 2024 to 2028.

Figure 4.7 The quarterly regression model using Bloomberg and TSMC revenue data from 2017Q1-2023Q4



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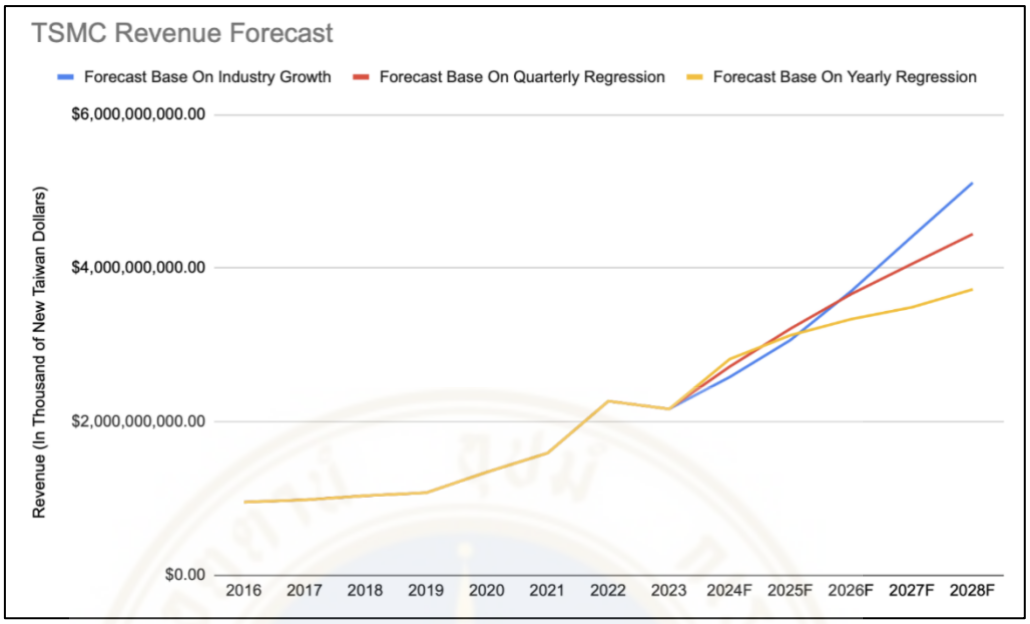
```
Test on Model 6:

  Null hypothesis: the regression parameter is zero for CPU
  Test statistic: Robust F(1, 24) = 1.18341, p-value 0.287467
  Omitting variables improved 3 of 3 information criteria.

Model 7: OLS, using observations 2017:1-2023:4 (T = 28)
Dependent variable: Revenue
HAC standard errors, bandwidth 2, Bartlett kernel

                     coefficient      std. error    t-ratio  p-value
  ------------------------------------------------------------------
  const               -4.06035e+08     7.77801e+07  -5.220   2.11e-05 ***
  StorageDrive       20697.3          2871.09         7.209   1.49e-07 ***
  DetachableTablet   10051.9          2882.29         3.487   0.0018   ***

Mean dependent var   3.73e+08   S.D. dependent var   1.32e+08
Sum squared resid    5.48e+16   S.E. of regression   46831551
R-squared            0.884197   Adjusted R-squared   0.874933
F(2, 25)             85.17272   P-value(F)           6.91e-12
Log-likelihood      -532.6816   Akaike criterion     1071.363
Schwarz criterion    1075.360   Hannan-Quinn         1072.585
rho                  0.216700   Durbin-Watson        1.526999
```

By comparing the 3 methods of revenue forecast (see Figure 4.15), a forecast based on the industry growth method is chosen for several reasons. Firstly, from Statista's latest 2023 update, TSMC comprised 9% of the world semiconductor revenue. Additionally, TSMC has the second largest market capitalization in the semiconductor industry with $909.59 billion US dollars as of June 2024. Therefore, forecast sales in the semiconductor industry are valid. Secondly, regression models heavily rely on past data, and with very high adjusted R-squared the model might be prone to overfitting. Lastly, since the only main source of TSMC revenue is wafer manufacturing, the data and items suitable to explain TSMC revenue are very limited. Therefore, with insufficient regressors, it might overlook certain aspects that contribute to growth opportunities and not take into account the new implications of semiconductors in the near future. Hence, forecasting based on an industry-wide perspective appears to be more logical and comprehensive.

Figure 4.8 TSMC revenue forecast using 3 methods 2024F-2028F

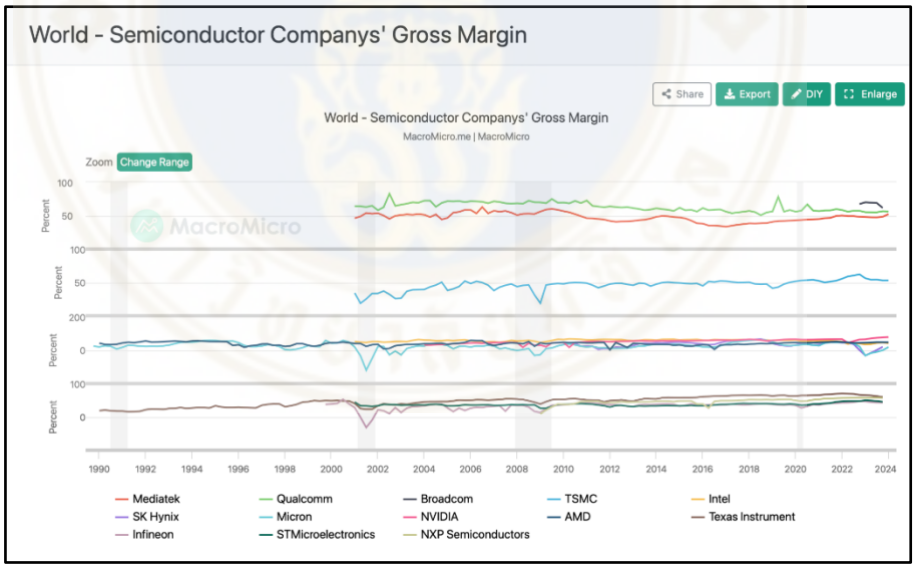


TSMC revenue is forecast to increase in the next 5 years from 2.58 billion Taiwanese dollars to 5.11 billion Taiwanese dollars in 2028 with a gross margin of 52.94%. Gross margin is calculated by taking the average of the past 5 years; because in the past decade, the gross margin of TSMC has remained quite stable as long as no financial crisis or pandemic disrupted the supply chain (see figure 4.15). The operating expense of TSMC's revenue is around 11% with a 1% deviation. So, we will use the 2023 value of 11.74% for the 5-year forecast. Moreover, 72% of operating expenses will be allocated to research and development, 24% to general and administrative, and 4% to marketing. As for the non-operating income and expense forecast, we assumed that all items apart from interest income stay the same as of 2023. From TSMC's annual report, interest income comes from investing cash or cash equivalent at the 3-Month London Interbank Offered Rate (LIBOR) of which the 2024 LIBOR rate is 5.6%. However, as of 30th June 2023, LIBOR is no longer available. Therefore, the underlying assumption is that TSMC invested cash and cash equivalent in the Secured Overnight Financing Rate (SOFR) of 5.33% in the following years within the forecast period.

Cash and cash equivalents of TSMC increase rapidly every year from 455 billion Taiwan dollars in 2019 to 1.46 trillion Taiwan dollars with a sharp increase of 61.32% in 2021 due to post-COVID-19 growth. Therefore, we are going to assume that cash and cash equivalents will increase using the average growth of the normal operation

period from 2022 to 2023 which results in a growth rate of 17.61%. Non-operating income of TSMC is forecast to increase from 79 billion Taiwan dollars in 2024 to 146 billion Taiwan dollars in 2028 (see Figure 4.16). Furthermore, the forecast of EBIT for 2024 to 2028 is calculated which resulted in significant growth in net income and EBIT. TSMC EBIT increased from 393.1 billion Taiwan dollars in 2019 to 991.2 billion Taiwan dollars in 2023, with an expected increase to 2.26 trillion Taiwan dollars by 2028. Tax is calculated using the 2023 effective tax rate of 14.27%. As for the interest, the effective interest rate as of June 2024 of 1.09% is used in the forecast. Hence, net income increased from 345.3 billion Taiwan dollars in 2019 to 837.8 billion Taiwan dollars in 2023, with projections reaching 1.92 trillion Taiwan dollars by 2028. This strong upward trend reflects TSMC's strong financial performance and growth, driven by increasing demand for semiconductor technologies and effective operational strategies.

Figure 4.9 World - Semiconductor Companies' Gross Margin



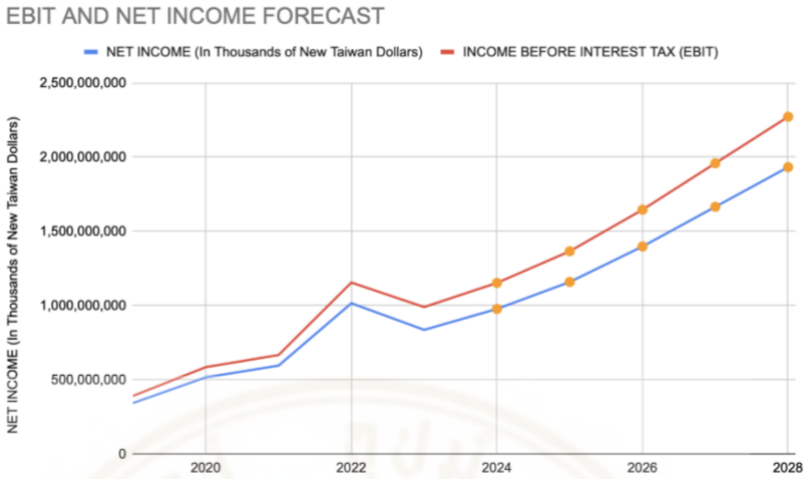
Source: Macromicro

Table 4.6 TSMC's Financial forecast from 2024F to 2028F

(In Thousands of New Taiwan Dollars, Except Earnings Per Share)	2024F	2025F	2026F	2027F	2028F
NET REVENUE	**2,578,558,945**	**3,060,236,727**	**3,697,890,809**	**4,408,637,938**	**5,110,310,082**
COST OF REVENUE	**1,213,509,120**	**1,440,194,021**	**1,740,283,746**	**2,074,772,171**	**2,404,989,771**
GROSS PROFIT	**1,365,049,826**	**1,620,042,706**	**1,957,607,063**	**2,333,865,766**	**2,705,320,310**
OPERATING EXPENSES					
Research and development	217,999,875	258,722,503	312,631,881	372,720,787	432,042,464
General and administrative	72,666,625	86,240,834	104,210,627	124,240,262	144,014,155
Marketing	12,111,104	14,373,472	17,368,438	20,706,710	24,002,359
Total operating expenses	302,777,604	359,336,810	434,210,946	517,667,760	600,058,977
OTHER OPERATING INCOME AND EXPENSES, NET	-	-	-	-	-
INCOME FROM OPERATIONS	**1,062,272,221**	**1,260,705,896**	**1,523,396,117**	**1,816,198,006**	**2,105,261,333**
NON-OPERATING INCOME AND EXPENSES					
Share of profits of associates	4,655,098	4,655,098	4,655,098	4,655,098	4,655,098
Interest income	**82,063,954**	**91,861,248**	**108,037,136**	**127,061,443**	**149,435,749**
Other income	479,984	479,984	479,984	479,984	479,984
Foreign exchange gain (loss), net	(2,685,484)	(2,685,484)	(2,685,484)	(2,685,484)	(2,685,484)
Finance costs (Interest expense)	**(11,999,360)**	**(11,999,360)**	**(11,999,360)**	**(11,999,360)**	**(11,999,360)**
Other gains and losses, net	6,961,579	6,961,579	6,961,579	6,961,579	6,961,579
Total non-operating income and expenses	79,475,771	89,273,065	105,448,953	124,473,260	146,847,566
INCOME BEFORE INTEREST TAX (EBIT)	**1,153,747,353**	**1,361,978,321**	**1,640,844,430**	**1,952,670,626**	**2,264,108,259**
INCOME TAX EXPENSE	**164,597,552**	**194,304,495**	**234,088,490**	**278,574,684**	**323,005,444**
INTEREST EXPENSE	**10,853,740**	**11,750,364**	**12,721,058**	**13,771,940**	**14,909,636**
NET INCOME	**978,296,061**	**1,155,923,462**	**1,394,034,882**	**1,660,324,002**	**1,926,193,179**

In conclusion, TSMC's financial outlook for the next five years demonstrates a strong growth trajectory, with revenue expected to nearly double by 2028, maintaining a stable gross margin. Operating expenses will remain controlled, with significant investment in research and development. The transition from LIBOR to SOFR for interest income calculations will slightly impact financial forecasts, but overall non-operating income is projected to rise significantly. Cash and cash equivalents will continue to grow steadily, further boosting non-operating income. EBIT and net income are set to experience substantial growth, reflecting TSMC's robust financial health and strategic positioning to capitalize on the increasing demand for semiconductor technologies.

Figure 4.10 TSMC's EBIT and NET income from 2019-2028F



CHAPTER V
VALUATION

5.1 Valuation of TSMC by using the Discounted Cash Flow method (DCF)

Using an appropriate discount rate, the enterprise value can be estimated using the discounted cash flow (DCF) method of valuation. This method considers the future cash flow of the company and discounts it back to its current value. Next, it can be used to compute the equity value and approximate the suitable share price for the company. The process of performing a DCF analysis involves estimating future cash flows, determining the terminal value, calculating the discount rate, summing up free cash flow to the firm in each period, and discounting each projected cash flow to its present value.

TSMC is appropriate for DCF valuation due to several factors. Firstly, TSMC is able to constantly generate cash flows due to its established market position as well as long-term contracts with major clients such as Apple, Nvidia, and Intel which provide a reliable basis for forecasting. Secondly, TSMC's strong financial growth performance reflected in revenue, EBIT, and net income, allows for good estimation of future projections. The semiconductor industry has significant growth potential due to the rising demand for technology and semiconductor products which can be captured in DCF's cash flow projections. Additionally, TSMC's capital-intensive nature due to investment research and development as well as the expansion of fabrication centers and equipment, will be captured and taken into account for future capital expenditures in the DCF model. Furthermore, the company's operational stability, reflected in stable gross margins and controlled operating expenses further supports the use of DCF. Companies with less volatile operations provide more reliable data for projections. Therefore, TSMC's predictable cash flows, strong financial performance, growth prospects, capital-intensive nature, operational stability, and the ability to estimate its cost of capital make it suitable for DCF valuation.

5.2 Free Cash Flow to Firm

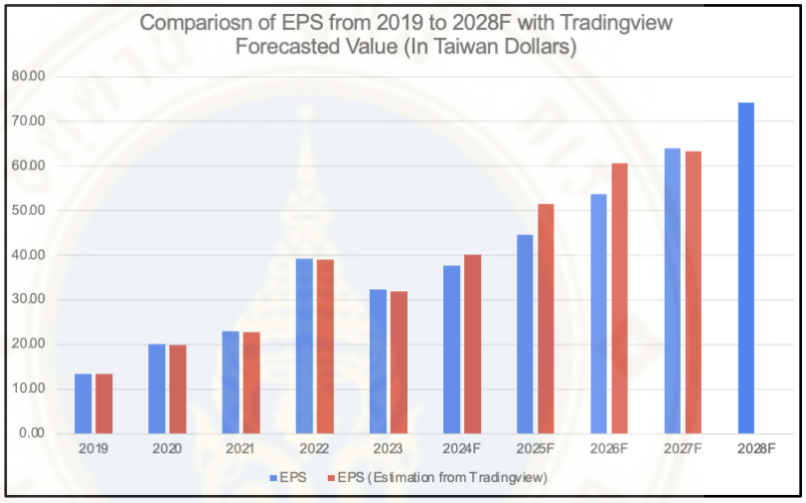
Free Cash Flow to Firm (FCFF) represents the residual value after cash outflow which implies the value for stakeholders. FCFF is calculated as follows:

FCFF = EBIT - TAX + Depreciation Minus (-) Working Capital Minus (-) Capital Expenditure

To calculate the FCFF of TSMC, these parameters need to be calculated and assumptions have to be made. Firstly. EBIT can be taken from TSMC's financial forecast and tax is calculated using the 2023 effective tax rate of 14.27%. There are several underlying assumptions of the EBIT forecast. First, the revenue forecast for the years 2024 to 2028 is computed by assuming that TSMC's market share growth rate is the moving average of the past seven years. This period is chosen because it covers both the time before and after the COVID-19 pandemic, thereby reducing bias. Second, since the forecast of the semiconductor industry data is in USD, it is assumed that the exchange rate remains fixed at 32.39 Taiwan dollars per USD throughout the forecasted period. The gross profit margin of TSMC is assumed to be the average of the past five years, which is 52.94%, given that this value fluctuated within an approximate 8% boundary. This margin is expected to stay constant until 2028. For operating expenses, the operating expense as a percentage of revenue is assumed to remain approximately constant over the five years. Hence, the forecast model uses the 2023 data of 11.47% of revenue as the operating expenses. Additionally, no other operating income and expenses are assumed to occur. Lastly, to forecast non-operating income and expenses, it is assumed that these remain the same as in 2023, except for interest income. Interest income has been increasing over the last five years and has significantly contributed to non-operating income. According to TSMC's financial statements, interest income comes from investing cash and cash equivalents at the 3-month LIBOR rate, which has been discontinued. Therefore, it is assumed that after 2024, TSMC will invest cash using the SOFR. Cash and cash equivalents are assumed to increase by 17.16% per year, based on the average growth rate observed after the COVID-19 recovery period. With these underlying assumptions, it enables to make a forecast. Overall, these assumptions provide a comprehensive basis for forecasting TSMC's financial performance from 2024 to 2028.

To validate the revenue forecast and assumptions that translate to EBIT, we compare our forecasted EPS value with the analyst estimates. Assuming no change in the number of common stocks, the TSMC EPS value is forecasted to increase from 32.31 Taiwan dollars in 2023 to 74.29 in 2028. The Tradingview analysis forecast also presents a very similar result and EPS projection (See Figure 5.1). Hence, our forecast of future revenue and income is aligned with the analyst projections.

Figure 5.1 Comparison of TSMC's EPS from 2019 to 2028F with Tradingview forecasted value



Since depreciation is a non-cash item, it must be included. We compute the percentage of depreciation to fixed assets with intangible assets to forecast the depreciation. Therefore, in this case, we assume the 2023 depreciation rate of 18.01% of fixed assets and intangible assets for our forecast. As for fixed assets and intangible assets forecast, TSMC is in a sunrise industry in which in the next 5 years it will most likely continue its expansion. Hence, we used a 5-year CAGR of 17.59% as the growth rate for fixed and intangible assets of TSMC for the 2024 to 2028 forecast. Depreciation of TSMC has been increasing every year from 281 billion Taiwanese Dollars in 2019 to 522 billion Taiwanese Dollars in 2023 and it is expected to reach 1.15 trillion Taiwanese Dollars by the end of 2028. Next, change in working capital is calculated using accounts payable (A/P), accounts receivable (A/R), and inventories. From the analysis of cash cycles, A/P days and A/R days remain constant at around 20 days and 26 days respectively. However, inventory level suffers from COVID-19 economic uncertainty

which led to TSMC stocking up too much excess inventory. From TSMC's 2023 financial report and news from the Supply Chain Drive website, TSMC is planning to stabilize the inventory but with the rapid development of semiconductor technology; there will be fewer demand for outdated chips. Hence, we assume the inventory level will remain similar as of 2023 at 87 inventory days. According to the CCC assumption, we can calculate the working capital and compute the change year by year. Lastly, capital expenditure (CAPEX) is forecast using an indirect method as follows: Capital Expenditure (CAPEX) = Ending PP&E – Beginning PP&E + Depreciation. From the calculation, the CAPEX of TSMC will gradually increase from 955 billion Taiwanese Dollars in 2023 to 2.18 trillion Taiwanese Dollars in 2028 indicating that the company will constantly invest to expand. Using the FCFF formula, TSMC's free cash flow to the firm is estimated to increase steadily and it is expected to have a free cash flow of 779 billion Taiwanese Dollars by the end of 2028. These assumptions and calculations enable to forecast of the FCFF of TSMC and are used to evaluate the value of the firm.

Figure 5.2 TSMC's Depreciation and CAPEX growth from 2019 to 2028F

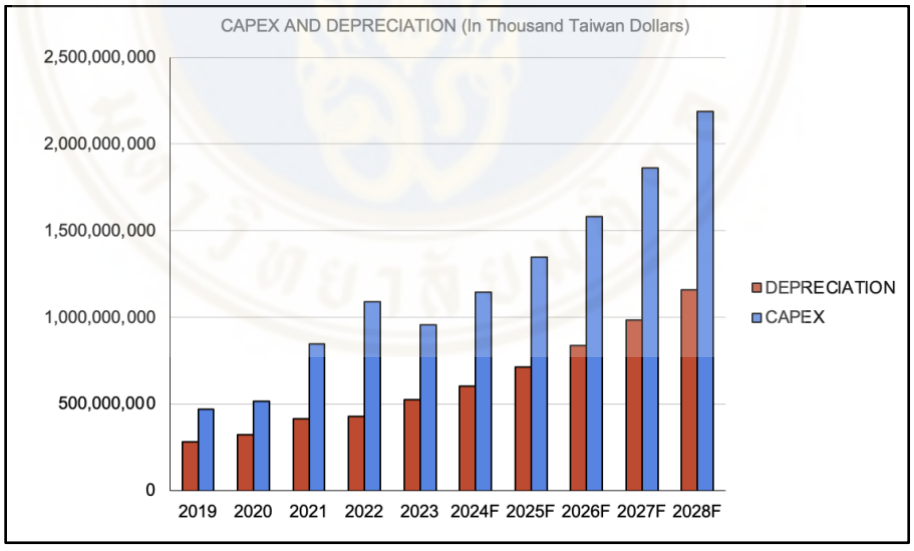


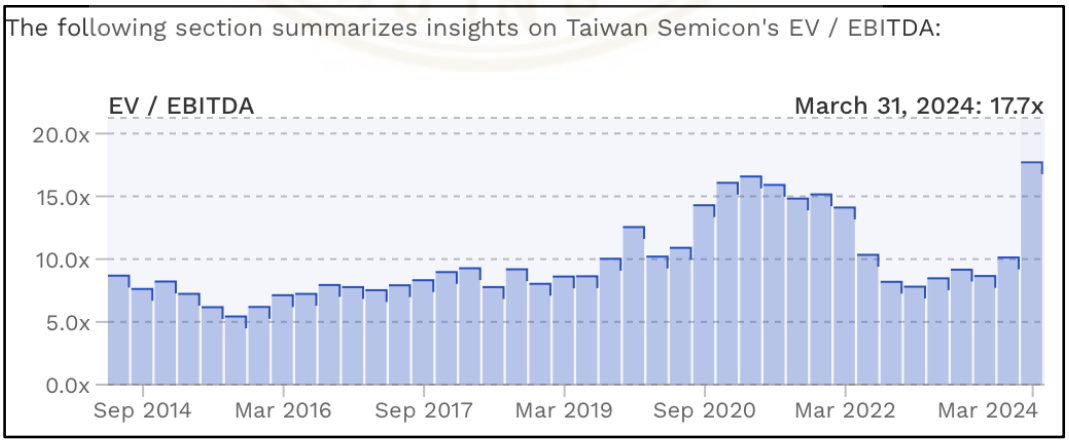
Table 5.1 TSMC's FCFF from 2019 to 2028F

CASHFLOWS (TSMC)	2019	2020	2021	2022	2023	2024F	2025F	2026F	2027F	2028F
NET PROFIT (EBIT)	393,096,183	586,858,635	668,540,532	1,155,940,702	991,170,684	1,153,747,353	1,361,978,321	1,640,844,430	1,952,670,626	2,264,108,259
TAX	(44,501,527)	(66,619,098)	(66,053,180)	(127,290,203)	(141,403,807)	(164,597,552)	(194,304,495)	(234,088,490)	(278,574,684)	(323,005,444)
ADD DEPRECIATION	281,411,832	324,538,443	414,187,700	428,498,179	522,932,671	604,925,453	711,344,459	836,484,788	983,639,911	1,156,682,690
Depreciation / Fixed Assets	20.50%	21.97%	23.12%	18.15%	18.01%	18.01%	18.01%	18.01%	18.01%	18.01%
ADD/MINUS WORKING CAPITAL CHANGE	15,744,715	(60,727,676)	(99,556,432)	(52,622,500)	(558,918)	(82,849,466)	(89,558,770)	(118,559,579)	(132,149,833)	(130,462,513)
ADD/MINUS CAPEX	(469,752,019)	(516,781,109)	(848,236,459)	(1,089,626,456)	(955,335,239)	(1,144,030,528)	(1,345,289,362)	(1,581,953,823)	(1,860,252,500)	(2,187,509,719)
FREE CASHFLOW	175,999,184	267,269,195	68,882,161	314,899,722	416,805,391	367,195,261	444,170,154	542,727,326	665,333,521	779,813,273

5.3 Terminal Value

The terminal value of TSMC is calculated using the EBITDA multiple method. This method is more suitable for TSMC because it is still in a rapid growth period. Therefore, the forecast period needs to be longer for TSMC to reach its steady growth state in which the terminal growth rate can be calculated and applied. In addition, TSMC's earnings growth rate has been around 22.5% annually in the past years. Hence, the growth rate is more than WACC which means the perpetuity method is invalid. We focus on TSMC which is listed on the Taiwan stock exchange due to the fact that TSMC is a Taiwanese company and the value in the report and calculator is in Taiwanese Dollars and its main currency. We will use the EBITDA multiple related to the Taiwan market accordingly. From the Finbox website, ticker TWSE:2330 has EV/EBITDA of 10.1x which is calculated on 31st December 2023 using 12-month trailing data. However, with a massive demand for semiconductors due to the announcement of AI capabilities from every major tech company, the EBITDA multiple increased significantly to 17.7x as of the calculation on 31st March 2024 with 12-month trailing data. (See Figure 5.4) Moreover, the average EV to EBITDA from 2019 to 2023 TSMC is 12.3x which is close to the Taiwan IT sector multiple of 12.4x since TSMC by market capitalization is the biggest company Taiwan market. Hence, we will use 12.3x for the TSMC EBITDA multiple because it is the normalized ratio.

Figure 5.3 TSMC's ticker TWSE:2330 EBITDA multiple data



Source: Finbox

5.4 Discount rate: WACC

For the valuation model, we will use the weighted average cost of capital (WACC) of TSMC as a discount rate. In order to get WACC, we need to calculate the cost of equity, the cost of debt, and the weighted debt and equity of TSMC.

Firstly, to compute the cost of equity, we use the capital asset pricing model CAPM formula: Cost of equity = Risk-free(Rf) + Beta*Market-risk-premium(MRP). Since TSMC is listed in Taiwan as their main market, we will use a 10-year Taiwan government bond return of 1.72% as Rf. Moreover, TSMC which is listed in the Taiwan market has a beta of 1.53. Risk-free rate and beta information will be captured on 9th July 2024. Furthermore, we can use the implied market risk premium of Taiwan's equity market which includes future volatility into consideration from the market-risk-premia website as a market risk premium. As of 31st May 2024, the IMRP of Taiwan's equity market is 5.04%. According to the CAPM formula, the cost of equity for TSMC is 9.43%. As for the cost of debt, we assume that its cost is the same as the effective interest rate going forward into the forecast period. The data as of March 2024, the effective interest rate of TSMC is at 1.09% according to the Gurufocus website. An effective tax rate is applied to get the cost of debt after tax of 0.93%.

TSMC's financial debt mostly comprises bond payables. The financial debt is at 956 billion Taiwan dollars whereas the market value of equity on the 9th of July 2024 is at 26.84 trillion Taiwan dollars. Therefore, the weight of debt and the weight of equity is 3.44% and 96.56% respectively. This variable is used to calculate the WACC of TSMC resulting in 9.14% as the discount rate for the valuation.

Table 5.2 TSMC's Weighted Average Cost of Capital breakdown

WACC	
RISK FREE (Taiwan 10-Y Gov.Bond)	1.72%
TAIWAN EQUITY RISK PREMIUM	5.04%
BETA (TSMC in Taiwan market)	1.53
COST OF EQUITY	**9.43%**
COST OF DEBT	1.09%
TAX	14.27%
AFTER TAX COST OF DEBT	**0.93%**
WACC	**9.14%**

5.5 Enterprise value

Enterprise value can be calculated by discounting the forecasted cash flows back to their present value using the Weighted Average Cost of Capital (WACC) as the discount rate. This approach provides an estimate of TSMC's value. According to the valuation equation, Enterprise Value = Net Debt + Equity. Thus, the equity value can be determined by subtracting net debt from the enterprise value.

TSMC has an enterprise value of 31.94 trillion Taiwan dollars. (see Figure 5.6) The value is calculated by computing the present value of the firm and multiplying it by 1 plus the WACC, to get forward-looking valuation. This means the value will represent the price at the year ended of 2024. Moreover, given its substantial cash and cash equivalents, TSMC can pay off all its interest-bearing debt and still have a cash surplus, resulting in negative net debt. This surplus of non-operating assets is then added to the enterprise value to obtain the present value of equity of 32.45 trillion Taiwan dollars. Lastly, the estimated share value is calculated by dividing the equity value by number of shares. From the calculations and assumptions in the forecast valuation analysis, the estimated share value of TSMC is 1,252 Taiwan dollars per share. The current share price as of 8kth July 2024 is 1,035 Taiwan dollars per share. This means that the estimated share value is 20.96% higher than the current share price. Hence, it is considered undervalued compared with the valuation from the DCF method.

Table 5.3 TSMC's Discounted Cash Flow Valuation Method

Period	1	2	3	4	5
(Unit In Thousand of Taiwan Dollars)	**2024F**	**2025F**	**2026F**	**2027F**	**2028F**
EBIT	1,153,747,353	1,361,978,321	1,640,844,430	1,952,670,626	2,264,108,259
TAX	(164,597,552)	(194,304,495)	(234,088,490)	(278,574,684)	(323,005,444)
EBIT AFTER TAX	989,149,801	1,167,673,826	1,406,755,940	1,674,095,942	1,941,102,815
ADD DEPRECIATION	604,925,453	711,344,459	836,484,788	983,639,911	1,156,682,690
WORKING CAPITAL CHANGE	(82,849,466)	(89,558,770)	(118,559,579)	(132,149,833)	(130,462,513)
CAPEX	(1,144,030,528)	(1,345,289,362)	(1,581,953,823)	(1,860,252,500)	(2,187,509,719)
FREE CASHFLOW TO THE FIRM	367,195,261	444,170,154	542,727,326	665,333,521	779,813,273
Terminal Value (EBITDA multiple)					42,075,728,678
SUM CASHFLOW	367,195,261	444,170,154	542,727,326	665,333,521	42,855,541,951
PV OF FIRM VALUE	31,947,307,236				
NET DEBT	(509,169,844)				
PV OF EQUITY VALUE	32,456,477,080				
# OF SHARES (In Thousand)	25,929,223				
EST. SHARE VALUE	**1,252**				

5.6 Sensitivity Analysis

Sensitivity analysis is conducted to evaluate how WACC and EBITDA multiple affect the estimated share value. EBITDA multiple incorporates the aspect of TSMC's financial performance in terms of growth potential and profitability before the deduction of non-operating expenses. It can be observed that if we used the 2023 EBITDA multiple of 10.1x the estimated share price will be at 1,047 Taiwan dollars per share means that the current price of 1,035 Taiwan dollars per share is at its fair value range. On the other hand, by taking the latest data of March 2024 into account, the EBITDA multiple of TSMC increases significantly to 17.7x (see Figure 5.4), the fair share price will be at 1,753 Taiwan dollars per share. However, when we take the 5-year average of TSMC EBITDA multiple of 12.3x, TSMC's fair value will be around 1,250 Taiwan dollars per share which implies that the current price is undervalued. This significantly affects the valuation of TSMC's share price. The potential for growth and profitability over the next five years suggests that TSMC's share price should range from 1,097 to 1,370 Taiwan dollars per share (see Figure 5.7). Considering these varying EBITDA multiples and their impact on TSMC's share valuation, looking at TSMC's current and future market positioning, the current price seems to be undervalued compared with the fair share value range from the DCF valuation method.

Table 5.4 TSMC's share price in Taiwan dollars sensitivity analysis with WACC and EBITDA Multiple

	Sensitivity Analysis							
1,251.73	7.00%	8.00%	**9.14%**	10.00%	11.00%	12.00%	13.00%	14.00%
8.00	917.16	885.85	851.86	827.36	800.03	773.90	748.89	724.95
9.00	1,017.80	982.82	944.84	917.47	886.94	857.74	829.80	803.06
10.10	1,128.52	1,089.49	**1,047.12**	1,016.59	982.53	949.97	918.81	888.99
11.00	1,219.10	1,176.76	1,130.81	1,097.68	1,060.75	1,025.43	991.63	959.29
12.30	1,349.94	1,302.82	**1,251.69**	1,214.83	1,173.72	1,134.42	1,096.82	1,060.83
13.00	1,420.39	1,370.70	1,316.77	1,277.90	1,234.56	1,193.11	1,153.46	1,115.51
14.00	1,521.04	1,467.67	1,409.76	1,368.01	1,321.46	1,276.95	1,234.37	1,193.62
15.00	1,621.69	1,564.65	1,502.74	1,458.12	1,408.37	1,360.80	1,315.29	1,271.74
16.00	1,722.34	1,661.62	1,595.72	1,548.23	1,495.27	1,444.64	1,396.20	1,349.85
17.70	1,893.44	1,826.47	**1,753.79**	1,701.41	1,643.01	1,587.17	1,533.76	1,482.64
18.00	1,923.63	1,855.56	1,781.69	1,728.44	1,669.08	1,612.32	1,558.03	1,506.07
19.00	2,024.28	1,952.53	1,874.67	1,818.55	1,755.99	1,696.17	1,638.94	1,584.18
20.00	2,124.92	2,049.50	1,967.65	1,908.66	1,842.89	1,780.01	1,719.86	1,662.30

5.7 Recommendation

The recommendation for TSMC is “Buy”. Several factors contribute to this conclusion. Firstly, TSMC has a robust fundamental operations and business strategy which is focused on expanding its fabrication center and semiconductor manufacturing capacity to match the demand of the market and satisfy its main customers which include big tech giant companies. Its continuous innovation and investment in cutting-edge technology such as EUV machines allows TSMC to be a leading semiconductor company. Secondly, the semiconductor is a sunrise industry with high growth opportunities. Semiconductor is very crucial to the economy due to its being a hardware that the technology industry relies on. TSMC's current position enables the company to capitalize on industry growth. Moreover, in the past 5 years, we can see an increase in retained earnings, cash on hand, and EBIT growth. Additionally, it can maintain a low level of debt with a Debt Service Coverage Ratio (DSCR) in 2023 of 1.64 which indicates a strong financial position. Furthermore, based on the Discounted Cash Flow valuation analysis, which incorporates forecasted data to estimate the future value of the firm, the current price of 1,035 Taiwan dollars (as of July 8, 2024) is considered undervalued compared to the DCF estimated share value of 1,252. This conclusion is further supported by the sensitivity analysis, indicating potential for growth and value realization beyond the current market price. Hence, given the reasons outlined above; as of July 2024, it is recommended to buy TSMC.

CHAPTER VI
RISK

TSMC has several risk factors. The company is in a technology industry that is very volatile due to rapid changes and disruption from innovations. From the macro point of view, the use of semiconductors in products such as smartphones and computers can change depending on economic factors that pose a threat to TSMC. As demand for these items decreases, main customers such as Apple, Qualcomm, Intel, and other companies will cut back their semiconductor orders. Additionally, when a breakthrough semiconductor chip is established, demand for an older version will drastically drop. TSMC's high risk and volatility is captured and reflected in the estimated beta of 1.53.

Moreover, semiconductors are made from silicon as a main component. If there is a disruption or shortage in the supply chain as well as direct material price fluctuations, it would affect the capacity of TSMC and the cost structure which affects the gross profit margin. Next, TSMC's weakness can come from the fact that the ability to manufacture advanced chips is limited to the EUV machines from ASML. So, it has to rely on ASML which creates a bottleneck in TSMC capacity. However, the company tried its best to acquire more EUV machines every year.

China Geopolitics Risk

As of May 2024, TSMC accrued 56% of the global EUV installed base. Recently, geopolitics also induced a higher risk for TSMC. TSMC is a Taiwanese company that is listed on the Taiwan market as well as on NewYork Stock Exchange. From the historical background between China and Taiwan, according to the "One China" policy, China wants to govern Taiwan. This creates a potential risk for TSMC. If China invades Taiwan, TSMC will need to follow the mainland regulations and investors' confidence might drop due to uncertainty. However, the probability seems to be quite small due to the implicit security guarantees by the USA. Nonetheless, this matter exposes TSMC to geopolitical risk. These risk factors highlight the need for TSMC to consistently innovate, expand its supply chain, and manage geopolitical

complexities in order to maintain its market leadership and profitability.

US Political Risk

TSMC faces significant risks from the upcoming U.S. presidential election in 2024, particularly due to recent comments from candidate Donald Trump. In an interview, Trump criticized Taiwan for taking America's chip business and receiving subsidies to build new factories in the U.S., suggesting that Taiwan should pay the U.S. for its defense. This marks a potential shift from the current administration's support for Taiwan, raising concerns about the future of U.S.-Taiwan relations. TSMC, a dominant player in the global semiconductor industry, is highly vulnerable to geopolitical tensions, especially between Washington and Beijing. Trump's comments come at a delicate time when tensions between Taiwan and China are escalating, and any change in U.S. policy could have severe implications for TSMC. TSMC's ambitious global expansion, including building factories in the U.S. with substantial subsidies, adds to the complexity, as Trump's rhetoric on tariffs and subsidies could disrupt these plans. Consequently, TSMC's future is increasingly uncertain, with the U.S. election adding a layer of risk that could affect its market position and strategic decisions.

CHAPTER VII
CONCLUSION

To conclude, TSMC is a well-established company with a strong business model and vision to be the leading semiconductor foundry. The main key success factor is innovation in advanced chip manufacturing with high efficiency. This quality attracts both small and big tech companies to be their customers resulting in TSMC capturing 61.7% of the semiconductor foundries revenue market share as of Q1 2024. From 2019 to 2023, it demonstrated great financial performance. Not only does it have good fundamentals, but also is able to convert the operational activities into a business with high profitability. Past performance indicates a good expansion strategy, effective cost management, strong financial position due to cash on hand and maintaining a low level of debt, as well as high revenue growth. From the forecast analysis of TSMC financial, the company has the advantage of operating in a sunrise industry and its performance also indicates the potential capability to capture more market share of the semiconductor industry. As a result, the forecast model predicts that TSMC's revenue and EBIT will continue to rise, with net income projected to more than double, reaching 1.92 trillion Taiwan dollars by 2028.

The valuation of TSMC enterprise's value and share price using the DCF model suggests that the current price of 1,035 Taiwan dollars (as of July 8, 2024) is undervalued considering the future free cash flow to firm and terminal value from EBITDA multiple of 12.3x. The estimated DCF share price at 1,252 Taiwan dollars is 20.96% higher than the current market price of 1,035 Taiwan dollars (as of July 8, 2024). We can also estimate the value of the TSMC at the end of 2024 by using FY(1) = V0 * (1+ WACC) formula which results in the target estimated share price of 1,366 Taiwan dollars. This indicates that the anticipated return by the end of the year will reach 32%, if the DCC estimate is accurate.

TSMC also faces multiple risks, including technological volatility, supply chain disruptions, and geopolitical tensions. Despite systematic risk factors that relate

to the semiconductor industry and political risk, the company effectively manages its exchange rate risk and maintains its competitive position over the competitors. Based on the comprehensive information and analysis, it is recommended to buy and invest in TSMC.

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