


**Recommendation**
**Buy Maintaining Market Dominance**
**Analysts**

Soh De Wei	Lead Analyst, Equity Research
Samuel Tan	Analyst, Equity Research
Wang Zuo Han, Alvin	Analyst, Equity Research
Giovanna Lim	Analyst, Equity Research

**Basic Information**

Current Price	USD\$94.59
Target Price	USD\$109.07
+/- Potential	+15.31%
Exchange	NYSE
Ticker	TSM
Market Capitalisation	USD 482.41B
Shares Outstanding	5.19M
52-Week Trading	USD 59.43 to 105.57
Average Volume	13.16M
Fiscal Year End	31 December 2022
Short Interest	0.32%

**1Y Price vs S&P 500 (Rebased)**


Source: Yahoo Finance

**Company Description**

TSMC is a leading global semiconductor foundry that specialises in the manufacturing and designing of semiconductor chips, wafers, and devices. TSMC's advanced manufacturing capabilities has enabled them to retain and gain a highly diversified customer base.

**Key Executives**

Mark Liu	Chairman
C. C. Wei	CEO
Wei-Jen Lo	Vice President

**Major Shareholders**

Sanders Capital, LLC	0.81%
JP Morgan Chase	0.66%
Morgan Stanley	0.63%

We initiate coverage of Taiwan Semiconductor Manufacturing Company (NYSE: TSM) with a BUY rating and a \$109.07 target price, representing an upside potential of +15.31%. Our target price was derived using the Discounted Cash Flow (DCF) approach with Relative Valuation as our second method for a sanity check.

**Investment Thesis**

**TSMC's Technological Advancement and Expansion:** TSMC's advanced technology have attracted big players such as Apple and Qualcomm. They are heavily investing in R&D to advance their chip manufacturing capabilities, and have a dominant market share in 7nm and 5nm chips.

**Fortified Market Dominance through Key Strategic Partnerships:** TSMC has established itself as a leading manufacturer of semiconductors, serving a wide range of industries.

**Financial Takeaways**

**Revenue Strength supported by Industry Growth:** TSMC's revenue growth has been impressive, reaching US\$47bn in 2021 with a CAGR of 13%, despite industry volatility. TSMC has a dominant market share of over 50% and the ability to deliver high-performance semiconductors to leading companies globally.

**Strengthening Profit Margins:** TSMC's EBITDA margin is expected to grow in the coming years due to increased operational efficiency and the release of their 3nm chip. Their EBITDA margin is projected to reach 48% by 2026. Despite significant capital expenditures, TSMC's extended asset life and projected EBIT margin of 37% keep them ahead of competitors.

**Ample Cash Reserve and Capacity for Debt Leveraging:** TSMC has a strong liquidity position shown by healthy ratios, indicating its capacity to repay short-term debts. The company's cash reserve is growing at an impressive rate, reinforcing its financial strength. TSMC's low debt-to-equity ratio reflects its conservative approach, allowing for flexibility for expansion plans.

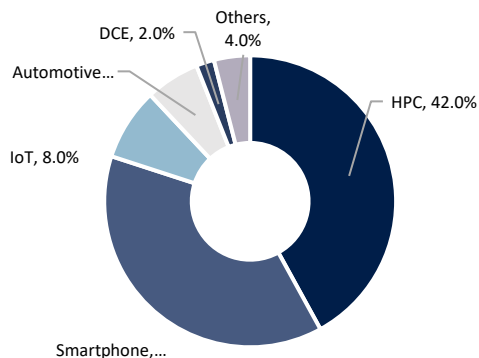
**Investment Risks**

**International Political Tension:** TSMC is affected by tensions between China, and the U.S. Tariffs, trade barriers, and compliance with regulations have caused TSMC to discontinue shipments to Huawei. Recent sanctions related to the Russia-Ukraine war have also led to decreased sales.

**Expansion Risk:** TSMC's expansion plans require substantial investments in building new facilities, equipment, and hiring and training employees, increasing their exposure to economic and foreign exchange volatilities. Fluctuations in interest rates and exchange rates may impact their cash flow.

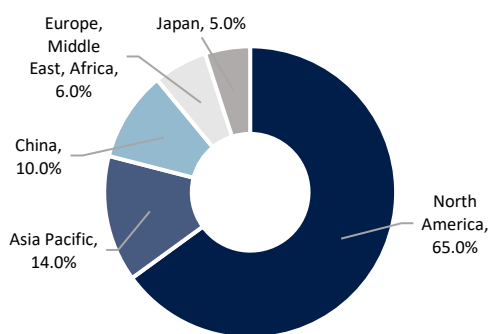
**Vulnerable Cyclical Nature:** The Semiconductor Industry is high risk due to its cyclical nature driven by technology, competitors, and economic conditions. Demand for semiconductors is expected to decrease in 2023 due to a contracting economy.

Fig 1.1: TSMC's Revenue Breakdown by Products



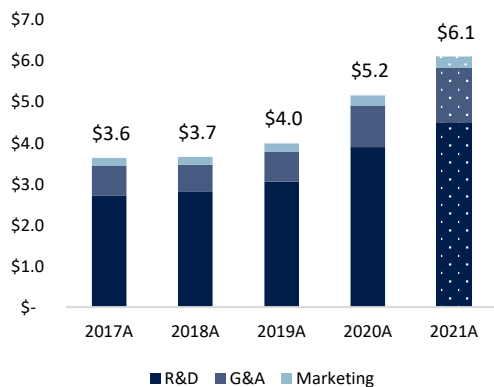
Source: Company Filings

Fig 1.2: TSMC's Revenue Breakdown by Geography



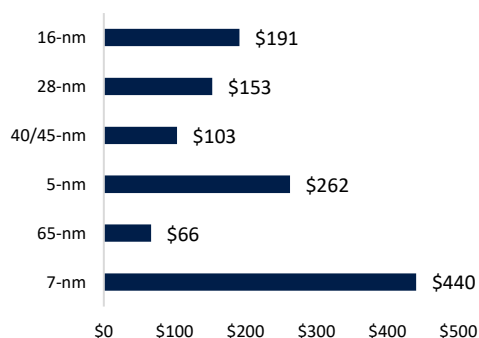
Source: Company Filings

Fig 1.3: TSMC's Historical Expenses (US\$bn)



Source: Company Filings

Fig 1.4: TSMC's Revenue Breakdown by Major Chip Types (NT\$mn)



Source: Company Filings

## Business Description

### Business Description

Headquartered in Hsinchu City, Taiwan and incorporated in 1987, Taiwan Semiconductor Manufacturing Company is a semiconductor pureplay foundry that expertise in manufacturing advanced chips for a range of applications such as smartphones, computers, and electronics systems used in vehicles.

TSMC's customers include some of the world's largest fabless companies such as Apple, Qualcomm, and Nvidia. By investing heavily in R&D, TSMC has been able to stay at the forefront of semiconductor technology and maintain a competitive edge. TSMC has also recently announced that in the next 3 years, it will invest US\$100bn in Capex.

### Revenue Breakdown

TSMC's two biggest revenue streams for FY22 were derived from high performance computing (HPC) and smartphones, contributing 41% and 39% respectively. 9% of revenue came from Internet of Thing (IoT). By geography, 65% of TSMC's revenue came from North America, 14% coming from Asia Pacific (excluding China and Japan), 10% coming from China, while the rest are divided among Europe, Middle East and Africa, and Japan.

### High performance computing (HPC)

High-performance computing refers to the processors that are present in desktop or laptop computers, which necessitate higher clock speeds and, consequently, consume more power. TSMC serves several HPC clients, including Apple's M1 Series of Apple Silicon SoCs for its Macbooks, AMD with their Ryzen desktop and laptop CPUs, as well as their Radeon GPUs, and Nvidia with their MX and GTX range of affordable to mid-range dedicated graphics cards. HPC client revenue rose 26% quarter-on-quarter for 2022 Q1, making it one of the highest growing industry clients for the company.

### Smartphones

TSMC produces a wide range of components for smartphones, including system-on-chips (SoCs), Application Processor (AP), Baseband, memory chips, and radio frequency (RF) components. TSMC's SoCs are used in many popular smartphones, including Apple's A-series chips, which power the iPhone and iPad. These chips are designed to provide high performance, low power consumption, and advanced features such as artificial intelligence (AI). TSMC's 7-nanometer (nm) and 5nm manufacturing processes have helped to push the boundaries of what is possible with smartphone SoCs, enabling more power-efficient and powerful device. As of Q1 2022, TSMC controls 70% of the global smartphone chip production.

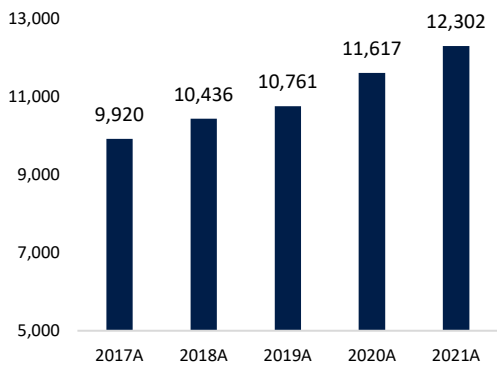
### Cost drivers

TSMC's biggest cost drivers are their materials and supplies which makes up 48% of their revenue and includes silicon wafers, chemicals and gasses used in the manufacturing process. The price availability and volatility of these materials can also impact the company's production costs as the 3nm wafer is expected to reach \$20,000 which is an increase in price of 25% over the 5nm wafer. As its materials increase in prices per unit, their cost of revenue will increase regardless of their operating output. The labour costs of TSMC makes up 2% of their revenue and it adds to their operating expense as the company consistently ensures that its employees are kept up to date with the latest technological and manufacturing processes.

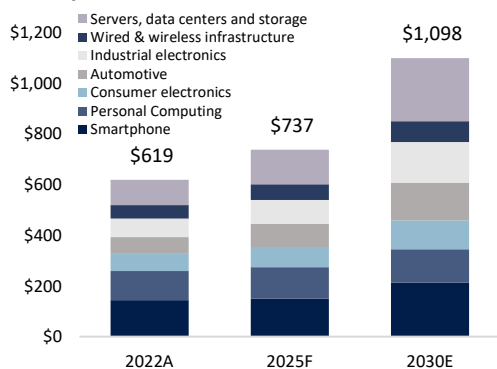
## Industry Overview & Competitive Positioning

### Industry Overview

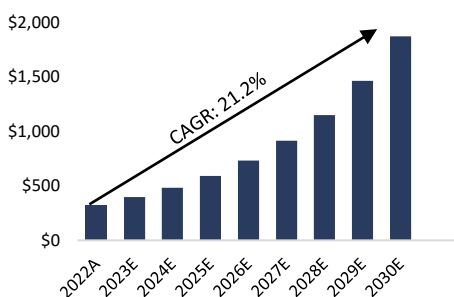
Semiconductors serves as the foundation and brain power to a wide array of electronics and technology such as smartphones, computers, vehicle electronics, AI, IoT, 5G and more. Nothing is not in some way related to semiconductors. They serve as a backbone for present-day technology and are a prerequisite when it comes to ventures in emerging technologies.

**Fig 1.5: Historical Number of Products Sold by TSMC**

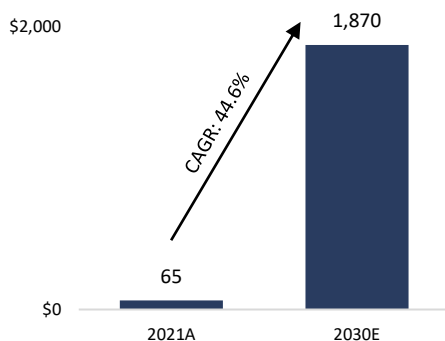
Source: Company Filings

**Fig 2.1: Market Size of Semiconductor Industry (US\$bn)**

Source: Statista

**Fig 2.2: Forecasted Market Size of Global Electric Vehicles (US\$bn)**

Source: Statista

**Fig 2.3: Forecasted Global Market Size of 5G Technology (US\$bn)**

Source: Precedence Research

Due to the Covid-19 lockdown, countries and organisations worldwide started to close their borders and enter the lockdown phase. This caused “WFH” to be the norm and consumers worldwide began purchasing computers. This surging demand allowed semiconductor companies worldwide to grow at an exponential rate throughout the pandemic. The growth of the industry will begin to flat line as demand for PCs worldwide begin to saturate. In 2020, 932bn chips were produced worldwide, this number grew to 1.15tn in 2021 and is estimated to grow by another 9% in 2022 to 1.25tn chips.

#### Existing Government Initiatives

Government initiatives have been announced worldwide to increase the manufacturing output of the semi-conductor industry. The EU has announced the “Chips Act” that will mobilize EUR 43bn in funding for the semiconductor industry to double the EU’s current share of global chip production to 20% in 2030. Part of the funding is also directed at research and innovation activities to increase capacity building activities. The US has also invested US\$52bn to strengthen the industry by pushing US\$39bn of the funding towards manufacturing incentives to increase production capacity and US\$13bn for R&D as well as workforce training. With the government initiatives pushing production capacity and workforce output, the industry is set to build an increment in manufacturing plants and jobs.

#### Rising Electric Vehicle demand leading the Autonomous Industry Growth

The global electric vehicle (EV) semiconductor market is estimated to experience an approximate 28% CAGR from 2021 to 2026, and the usage of advanced semiconductor technologies are crucial to enhance EVs and make it more efficient with longer driving range and faster charging times. Due to the potential of EVs becoming fully autonomous, the automotive industry is expected to grow at a CAGR of 23% and has powered the growth of the semiconductor industry, reaching a valuation of US\$1,034bn in 2031.

The rising demand for EVs in China is also expected to have a significant impact on the global demand for semiconductor chips. Since EVs depend heavily on semiconductor chips for critical functions like power management, communication, and safety features, the increase in EV adoption is projected to significantly boost the demand for these chips.

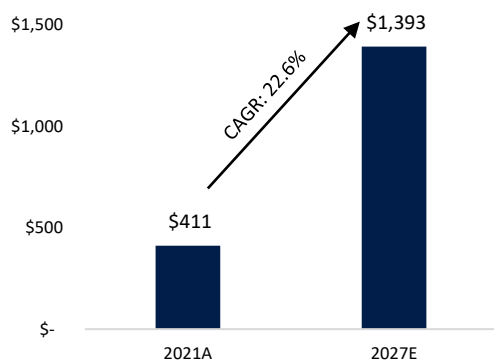
Furthermore, the adoption of EVs is not limited to China, with many countries worldwide promoting their use to reduce carbon emissions and meet environmental goals. For example, the European Union aims to cut CO2 emissions by 55% by 2030, which then pushes for aggressive EV adoption to reach this goal while cutting down combustible vehicles.

#### Future 5G Technology

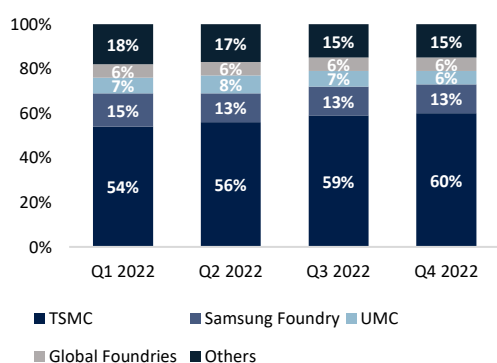
5G technology has a tremendous impact on the semiconductor industry. 5G technology is extremely energy demanding and its utilisation is reliant on the speed of data transfer. As such, more advanced semiconductors are needed to process and transfer larger amounts of data at higher speeds, all while being energy efficient, stable, and secure. Globally, 5G services markets size is expected to grow to US\$1.8tn by 2030 by way of increased usage of 5G networks and devices such as mobile networks, data centres and supply chain management systems. The application of 5G technology is growing, with its utility and implementation quickening in pace. This sets up the semiconductor industry to experience exponential growth in the coming years.

#### Competitive positioning Technology leadership

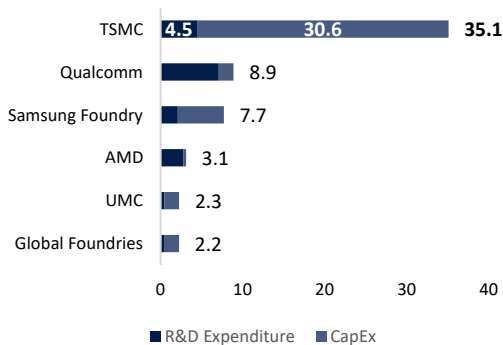
TSMC has seen significant growth rates in 2022 and continued to improve their market share over the year as it rose from 53% in Q1 2022 to 60% in Q4 2022. The growth was partially attributed to the release of Apple’s iPhone 14 in September, in which TSMC is the sole supplier of the A16 processor, which is used in the released series of phones. This growth was further propelled by their production of 5nm wafers which have allowed them to gain additional market share whilst their competitors either flat lined or declined.

**Fig 2.4: Forecasted Global Market Size for Electric Vehicles (US\$bn)**

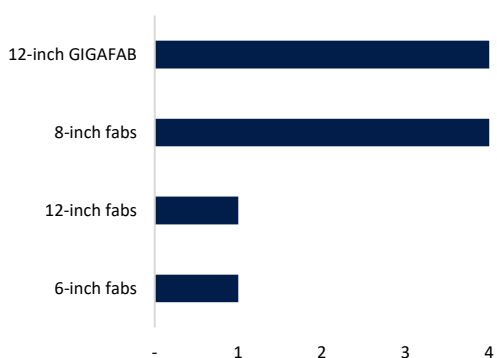
Source: Mordor Intelligence

**Fig 2.5: Market Share of Semiconductor Industry**

Source: Counterpoint Research

**Fig 3.1: TSMC and Competitors R&D and Capex (US\$bn)**

Source: Capital IQ

**Fig 3.2: Current Number of TSMC Foundries**

Source: Company Filings

TSMC is set to produce 3nm chips for Apple's line of iPhone 15 and MacBook in 2023. The A17 chips that will be used in iPhones, will be mass produced and available for Apple products at the second half of 2023. The process in which the chips are produced is called N3E, which is TSMC's latest 3nm production technology, an improvement from the previous N3 version. This new process is said to produce chips that have greater performance and better power efficiency of up to 35%. The M3 chip for MacBook is also set to use 3nm chips from this process.

### Manufacturing Excellence

TSMC foundry has a capacity that is more than 2x bigger than Samsung's foundry. With the new Arizona fab, it will expand TSMC's capacity at the site to around 50,000 Wafer Starts Per Month (WSPM).

TSMC's Open Innovation Platform and Grand Alliance Initiative differentiate themselves from their competitors. To maximize efficiency in their customer's manufacturing process, OIP provides its customers with a range of services, such as design libraries and consulting, technical support, and an ecosystem forum to initiate collaboration and ideation. Logic processing technologies enhance chip performance for smartphone semiconductors, while 3DFabric™ packaging and TSMC-SolCTM enable homogeneous chip integration for high performance computing and IoT platforms.

GAI brings together a large group of industry leaders in electronic design automation, IP partners, and key equipment and material suppliers for their customers to leverage on. Such partnerships and programs provide value to customers by accelerating their research, design, and fabrication process to stay ahead of the market and their competitors. Interest in these services is extremely high, substantiated by TSMC's November 2022 revenue surging 50% y-o-y to NTD 223bn, mainly attributed to Apple and Qualcomm.

### Customer Trust

Ever since its founding, TSMC never competed with its customers but instead focuses all its efforts on become the trusted foundry for its customers. They value their relationships with them and drives their efforts towards customer retention and building brand loyalty. Furthermore, TSMC builds its customer trust by ensuring customer satisfaction and providing world-class customer service. They have a dedicated team to provide support in product design, mask making, wafer manufacturing and backend services to increase customer satisfaction. TSMC-Online™ provides customer support so that customers have 24-7 access to information. Since the online database facilitates design collaboration, it ensures smooth integration for customer's frontend and backend process which speeds up manufacturing and design.

In addition to their in-house services, TSMC appoints third-party consulting firms to conduct annual customer satisfaction surveys (ACCS) and conducting quarterly business reviews to collect feedback. The collected feedback allows TSMC to understand their customer needs and close the gap on customer interaction.

### Investment Thesis

#### Thesis 1: TSMC's Technological Advancement and Expansion

##### Superior offerings attracting big players

With Apple designing their new chips, they have signed a contract with TSMC to build chips for their phones and laptops. This led to Apple emerging as TSMC's biggest customer, accounting for 26% of TSMC 2021 revenue which is approximately NTD 405bn (US\$14bn). With TSMC expanding operations into Arizona to meet the demand of Apple's iPhone 15 and other devices, Apple will continue to demand for TSMC's chips.

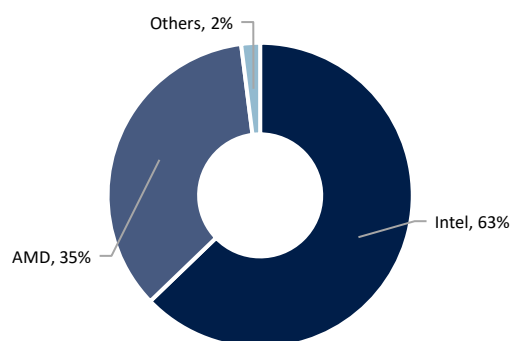
Qualcomm, Samsung's biggest customers, manufactures both Snapdragon 8 Gen 2 and Snapdragon 8cx Gen 3 which are used in Samsung phones and Microsoft SQ laptop models respectively. However, due to Samsung's lack of capacity and instable supply of chips, Qualcomm outsourced to TSMC produce their chips,



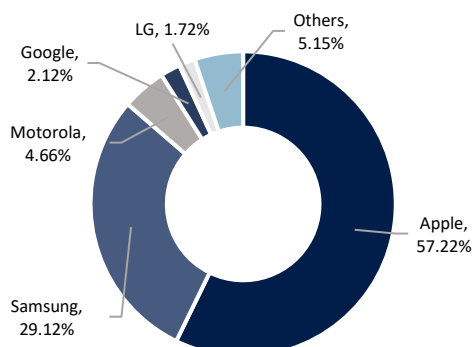
**Fig 3.3: TSMC's Top 10 Customers**

Company	Revenue Contribution
Apple, Inc.	23.9%
Advanced Micro Devices, Inc.	10.2%
QUALCOMM, Inc.	8.2%
MediaTek, Inc.	8.1%
NVIDIA Corp.	7.6%
Broadcom, Inc.	6.6%
Intel Corporation	5.0%
Will Semiconductors Corp.	1.9%
NXP Semiconductors N. V.	1.6%
Marvell Technology, Inc.	1.6%

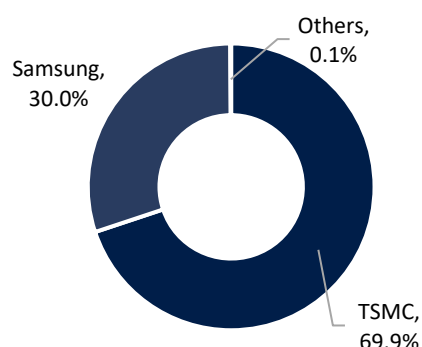
Source: Company Filings

**Fig 3.4: Market Share of CPU Industry**

Source: Statista

**Fig 3.5: Market Share of Mobile Phone Industry**

Source: Counterpoint Research

**Fig 3.6: Global Smartphone Chipset Shipment Market Share in FY2022**

Source: Counterpoint Research

resulting in Samsung losing about 50% of their orders. With TSMC's manufacturing capacity, advanced technology, and low cost, TSMC was able to increase their top line growth. Gaining Qualcomm's trust, TSMC have entered contract to manufacture Qualcomm's next-generation Snapdragon 8 Gen 3 chipsets.

Since TSMC is at the forefront of technology and can develop high quality 3nm faster, Intel have outsourced to TSMC to create their N3 next-generation graphic processors (GPUs) instead of building it themselves. TSMC's supply of chips and GPUs to main competitors Samsung and Intel has given the company a competitive advantage, enabling TSMC to capture a larger market share and maintain its position as a leading foundry service provider.

#### Steering ahead in technology

TSMC has been heavily investing in Fully Depleted Silicon-on-Insulator (FDSOI) technology that helps create low-power chips. Additionally, TSMC has harnessed the Integrated Fan-Out Silicon interposer that helps to increase electrical performance. As a pure-play business, TSMC is committed to acquiring more Extreme Ultraviolet Lithography machines from ASML in FY24. EUV technology is pertinent to create extremely complex foundation layers during the mass-production of chips. Such technologies are unique to TSMC, making their semiconductors superior to its competitors.

Further advancement of technologies can be supported by TSMC's enormous Capex and R&D expenditure. In FY21, TSMC spent US\$5bn on R&D (8% of revenue), and US\$30bn in Capex (54% of revenue). Huge R&D expenditure was focused on investing into technologies to further improve their chip advancement and manufacturing capabilities, while its Capex was mainly driven by their global expansion and foundry setup in USA and Japan.

The continuous pouring of funds into accelerating the company's growth and production capacity has led to its current 90% market share in 7nm and 5nm chips and are on track to dominate the entire semiconductor industry.

TSMC's has recently pledged \$100bn over the next three years to upgrading its semiconductor manufacturing and research capabilities. This continuous pouring of funds into accelerating its growth and production capacity has led to its current 90% market share in 7nm and 5nm chips and are on track to dominate the entire semiconductor industry.

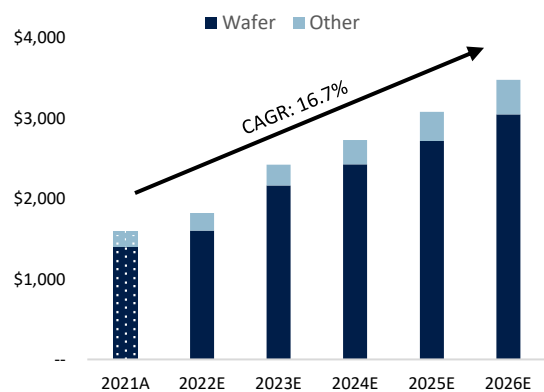
#### Expansion of foundries into US

TSMC will expand their foundries into the US market. They have heavily invested their Capex into 2 new foundries opening in 2024 and 2026. Their US\$12bn plant in Arizona launching in 2024 will offer advanced 4nm and 3nm chips. This allows them to make 20,000 wafers per month and Apple will use about a third of their output for the upcoming iPhone 15 and other devices. A follow up foundry is expected in 2026 and combined, is expected to make approximately 600,000 chips wafers per year. TSMC is expected to spend US\$40bn on both foundries, with an estimate an annual revenue of US\$10bn once they are operational. With the US government supporting their expansion, they will be partly subsidized through the CHIPS and Science Act meant to incentivize US semiconductor manufacturing. TSMC presence in US will allow them to alleviate chips shortage by supplying more chips to US companies.

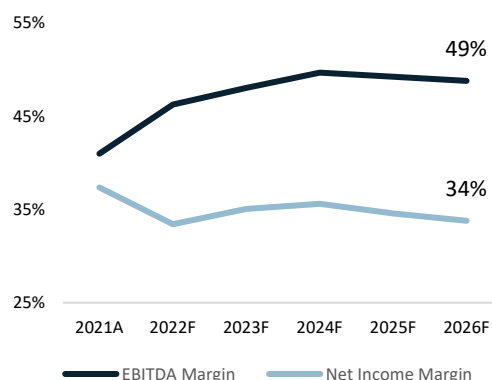
#### Thesis 2: Fortified Market Dominance through Key Strategic Partnerships

##### Grand Alliance Ecosystem to reduce supply chain risks

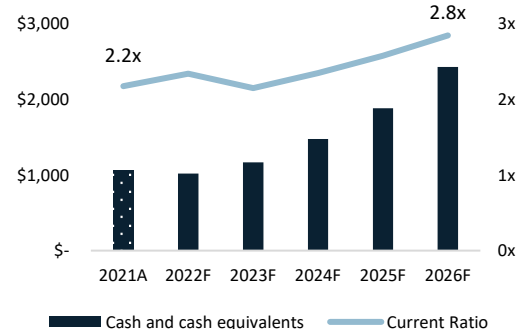
TSMC generated an Ecosystem through their Grand Alliance by bringing together their Electronic Design Automation (EDA) Partners, Intellectual Property (IP) partners, and key equipment and materials suppliers together, forming a higher level of collaboration. TSMC stressed that all parties need to work together to stay competitive and win. This level of collaboration starts with reducing security risks from the top.

**Fig 4.1: TSMC's Revenue Forecast (NT\$mn)**

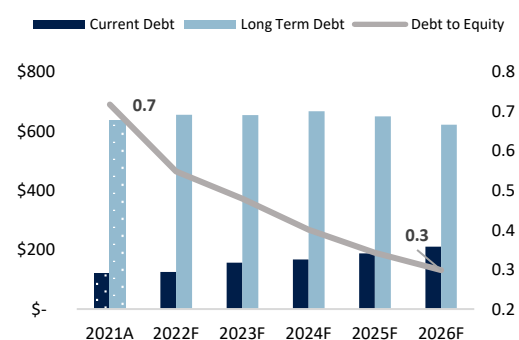
Source: Company Filings, Team Analysis

**Fig 4.2: TSMC's Forecasted EBITDA and Net Income Margin**

Source: Company Filings, Team Analysis

**Fig 4.3: TSMC's Liquidity Positioning (NT\$mn)**

Source: Company Filings, Team Analysis

**Fig 4.4: TSMC's Forecasted Debt Positioning (NT\$mn)**

Source: Company Filings, Team Analysis

TSMC collaborates with their major suppliers to improve their security maturity and share industry security events and best practices. Furthermore, TSMC helped to improve the resilience of their supply chain by leading the SEMI standard taskforce to formulate and release information security standards for semiconductor equipment (SEMI E187). With these enhancements to improve the company's supply chain security, TSMC has also implemented their own cybersecurity measure to eliminate harm caused by cyberattacks. In addition to the collaboration with its suppliers, TSMC's expansion into Arizona has led some suppliers to follow them into the US and set up production facilities there. The formation of this ecosystem has allowed them to ensure high quality materials and ultimately high-quality chips are released. Thus, by reducing supply chain risks with a high level of collaboration with its suppliers, TSMC can ensure optimal production and delivery functions, which eventually leads to customer satisfaction.

#### Collaboration with Customers as a Pureplay Business

TSMC collaborates with companies of various sizes, from start-ups to mature companies. For example, TSMC's partnership with NVIDIA began since the company's early stages in which TSMC aided in overcoming challenges such as lowering design barriers and implementing strategies so that NVIDIA was able to achieve silicon success.

Additionally, TSMC does not manufacture any chips under its own name. It is a pureplay foundry designed to assist other companies achieve their technological objectives. The nature of the business means that they are not a competitor and allows TSMC to provide both the product and the service. As they can be flexible and customize the chips according to the customer's goals and needs, the customer can ensure the chip will be designed to better suit their product. For example, Apple M1 chips are specifically designed to be more compatible to Apple Products. However, Intel customers will have to design their products around their chips.

Additionally, their investment into R&D and Capex has allowed them to ensure they are continuously at the forefront of the industry in terms of technology advancement and production capabilities. Their ability to pioneer the production of latest chips consistently, in mass amounts and compliment the needs of customers by forming a strategic partnership has allowed them to retain major customers such as Apple, Qualcomm, Intel and AMD.

#### Diversified Customer Base within Leading Rivals

TSMC supplies chips to both Intel and AMD; positioning themselves to dominate the CPU industry as both Intel and AMD have a combined market share of 99%. This move allows TSMC to secure their profits as they supply the essential materials for chip production, eliminating the systematic risk that TSMC possesses if either company were to fail. This is further underscored by TSMC's position in the mobile phone industry with strategic partnerships with Apple and QUALCOMM. TSMC manufactures the A16 chips for iPhone and the Snapdragon 8 Gen 3 chips for Samsung phones, which collectively captures 75% of the mobile phone industry.

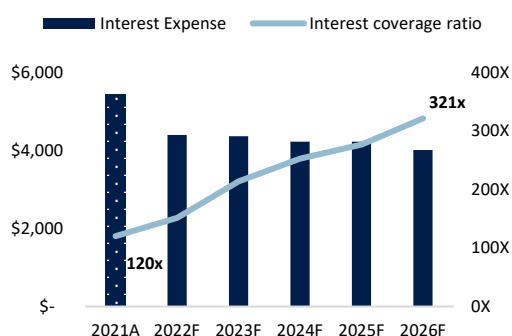
Furthermore, this move provides TSMC a hedge against fluctuations in market share and enables TSMC to come out ahead of any situation. Most importantly, TSMC's diverse partnerships are strategically placed to ensure that the company is not overly reliant on a single entity but instead balanced out with a diverse stake to hedge against uncertainty.

### Financial Analysis

#### Revenue Strength supported by Industry Growth

TSMC recently outperformed their forecasted revenue for 2022 by 10%, which is a strong indicator of their growth momentum. Looking back, TSMC's revenue has grown from US\$31bn in 2017 to US\$47bn in 2021, representing a CAGR of 13%. This growth trajectory is impressive, considering the volatility of the semiconductor industry. TSMC's net income has also been consistently increasing, reaching US\$18bn in 2021, up from \$12bn in 2017.

**Fig 4.5: TSMC's Forecasted Interest Expenditure (NT\$mn)**



Source: Company Filings, Team Analysis

**Fig 5.1: WACC Calculation**

Risk-free Rate	3.38%
Equity Risk Premium	6.21%
Unlevered Beta	1.22
Re-levered Beta	1.27
<b>Cost of Equity</b>	<b>11.24%</b>

Pre-tax Cost of Debt	0.77%
Country Risk Premium	0.34%
Corporate Tax Rate	24.03%
<b>After-tax Cost of Debt</b>	<b>0.85%</b>

Market D/E	0.054
Proportion of Equity	94.90%
Proportion of Debt	5.10%
<b>WACC</b>	<b>10.71%</b>

Source: Team Analysis

**Fig 5.2: Sensitivity Analysis (Exit Multiple)**

		Exit Multiple				
		24.4x	25.4x	26.4x	27.4x	28.4x
WACC	9.71%	105.15	109.06	112.93	116.88	120.79
	10.21%	103.35	107.19	110.99	114.87	118.70
	10.71%	101.58	105.35	109.07	112.89	116.66
	11.21%	99.86	103.56	107.23	110.97	114.67
	11.72%	98.16	101.79	105.39	109.07	112.70

Source: Team Analysis

**Fig 5.3: Sensitivity Analysis (Perpetual Growth Method)**

		Perpetual Growth Rate				
		1.50%	2.85%	3.10%	3.35%	3.60%
WACC	9.71%	39.05	44.83	45.25	47.77	49.92
	10.21%	36.78	41.78	42.99	44.29	45.68
	10.71%	34.75	39.11	40.16	41.27	42.47
	11.21%	32.94	36.77	37.68	38.65	39.68
	11.72%	31.29	34.68	35.47	36.32	37.21

Source: Team Analysis

As the world's largest semiconductor foundry with a market share of over 50% in 2021, TSMC is well-positioned to capitalize on emerging markets such as IoT/5G and autonomous driving. TSMC's dominance in the industry is driven by its ability to deliver high-performance, advanced semiconductors that meet the requirements of the leading tech companies globally. This presents significant growth opportunities for TSMC in the years ahead. Furthermore, TSMC will be introducing new products such as the 3nm chip that will be included in apple's new iPhone and MacBook lines, adding into TSMC's already growing segments of revenues.

### Strengthening Profit Margins

TSMC's sound and healthy EBITDA margin is projected to demonstrate further growth in the forthcoming years, as the company advances its operational efficiency and fortifies its earning capacity. We anticipate that the release of TSMC's 3nm chips will contribute to revenue growth and margin expansion, thereby supporting the forecasted growth of the company's robust EBITDA margin in the coming years. Based on historical data, TSMC has maintained an average EBITDA margin of 39%. Our analysis indicates that this figure is projected to increase to 49% by 2026.

Despite our projection that TSMC will be making substantial investments in their capital expenditures over the next few years to capitalize on the growth of IoT, 5G, AI, and Autonomous Vehicle industries, the extended useful life of these assets allows for the depreciation cost to be spread out, thus enabling the company to maintain a robust EBIT margin. Even with these anticipated investments, TSMC's EBIT margin is expected to average around 38%, which remains ahead of its competitors in the industry.

### Ample Cash Reserve and Capacity for Debt Leveraging

TSMC's strong liquidity position which is evident through their current ratio, which averages at 2.24, and cash ratio, which averages at 1.42 provides a solid foundation for the company's future growth prospects. The company has consistently maintained healthy ratios, which suggest that it has the capacity to repay its short-term debts. Additionally, TSMC's cash reserve is growing at an impressive 19% CAGR, indicating the company's continued financial strength and ability to generate cash from its operations, which further reinforces its liquidity position.

Moreover, TSMC's low debt-to-equity (D/E) ratio of 0.35 reflects the company's conservative approach to financing. This allows TSMC greater flexibility in terms of leveraging debt to finance future expansion plans while still maintaining a safe financial position.

Overall, TSMC's strong liquidity position and low reliance on debt put it in a favourable position to continue pursuing international growth opportunities. With proper financing and strategic planning, the company is well-positioned to capitalize on emerging trends in the technology industry and sustain its long-term growth trajectory.

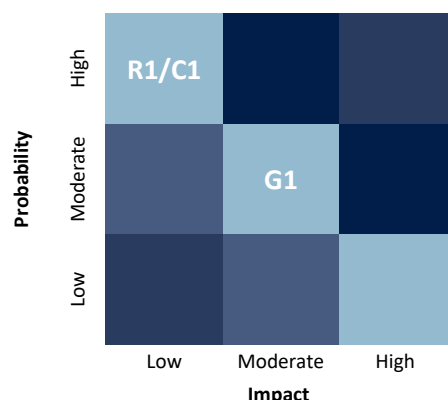
## Valuation

We reiterate our **BUY** recommendation for TSMC with a target price of **USD \$109.07**, presenting a **+15.31%** upside potential based on the closing price of **USD \$94.59** on 24/03/2023.

### Revenue Forecast

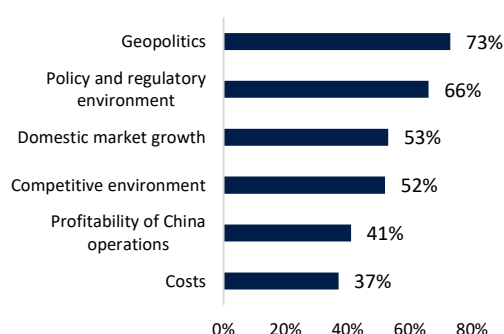
We forecasted our revenue growth analysis using a bottom-up approach where we researched the units sold of each product and multiplied it by the price of each product. Using the 5nm wafers as an example, we forecasted the units sold of each product using a Y-o-Y approach with a growth percentage of 27.45%, 28.82% and 24.71% for the base case, bull case and bear case respectively. We then forecasted the price of each wafer using the same method with a growth percentage of 0.85%, 0.81% and 0.88% for the base case, bull case and bear case respectively. By multiplying the price of each type of wafer with the forecasted units sold, we will get the overall revenue of the product of each year. We then sum the revenue of each product from the 5nm to the 65nm to get the overall revenue of all wafer products sold in that year. We then add the forecasted revenue of the wafer

Fig 6.1: TSMC's Risk Matrix



Source: Team Analysis

Fig 6.2: Leading Issues Impacting Businesses Due to U.S.-China Tensions



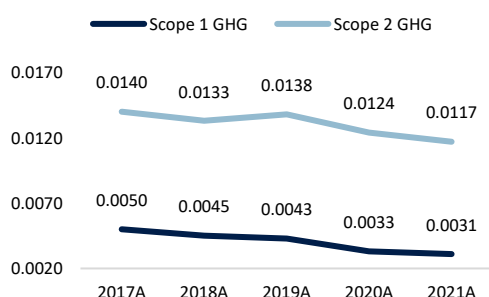
Source: US China Business Council

Fig 7.1: Sustainability ESG Risk Ratings

<b>TSMC</b>	<b>14.3</b>
Advanced Micro Devices, Inc.	20.4
Analog Devices, Inc.	24.4
NVIDIA Corp.	13.6
Texas Instruments Incorporated	21.8
Broadcom, Inc.	22.2
Intel Corporation	18.5
QUALCOMM, Inc.	18.5
NXP Semiconductors N. V.	21.5
<b>Peer's Mean</b>	<b>18.6</b>

Source: Sustainalytics

Fig 7.2: Scope 1 and 2 GHG Emission Intensity (tCO2e/12' wafer-layer)



Source: Company Filings

products with its other revenue to get the revenue forecast of each year moving forward.

### Sensitivity Analysis

In our sensitivity analysis, we refer to figure 5.2 and figure 5.3 where we compare the exit multiple method with the perpetual growth method. It can be seen in figure 5.3 that the perpetual growth averages around 3.10% annually however, the CAGR of TSMC is 13%, thus using a perpetual growth rate of 3.10% is not accurate. Furthermore, as the market leader in its industry, the exit multiple method will closely mimic its share price performance when compared to the 90<sup>th</sup> percentile of its peers, however we adopted the value in the 75<sup>th</sup> percentile to come up with the exit multiple of 26.4x to produce a conservative approach. The calculated WACC has been included in both perpetual growth and exit multiple methods to illustrate an accurate implied share price.

### DCF Valuation

We adopted a 5-year DCF analysis with the exit multiple method. We chose this as TSMC is a market leader and we chose the exit multiple of 26.4x which is in the 75<sup>th</sup> percentile of the industry. Furthermore, we developed our calculations along with the thesis of TSMC's market leading dominance and being the foundation of a global supplier to all competitive tech companies in mature industries, thus current multiples are accurate in reflecting TSMC's valuation.

### Discount Rate (WACC)

We calculated a WACC of 10.71%. The Cost of Equity was calculated by multiplying the re-levered Beta with the Equity Risk Premium (ERP) and then adding it to the Risk-free Rate. Furthermore, the ERP was calculated by blending the ERP from different geography using Damodaran's research. The cost of equity was calculated to be 11.24% with a pre-tax cost of debt of 0.77% which was computed using the weighted average interest rate of existing debt. We then added the country blended risk premium of 0.34% and the corporate tax rate of 24.03%. Both values have been blended by region using Damodaran's research.

### Relative Valuation (Comparable Companies Analysis)

We performed a relative valuation based on the comparable companies of TSMC's peers and derived the exit multiples to calculate our terminal value which was used to develop our share price. We screened for peers in the semi-conductor industry as not all of the semi-conductor companies own their own foundries on a competitive level or possess manufacturing and supplying capabilities that rival TSMC. We analysed their revenue breakdowns and market share of its peers and compared TSMC against the most suitable companies. We then used the LTM of EV/EBITDA as the most appropriate multiple given it considers its peers varying growth rates as well as TSMC's earning power and future potential in the upcoming global expansion. The comparable companies' analysis also further emphasises the market leading position of TSMC as we used a high exit multiple in the 75<sup>th</sup> percentile to consider its dominance in the market but also conservative enough to hedge against any potential risks and prevent an over-optimistic approach.

## Investment Risks

### Geopolitical Risk

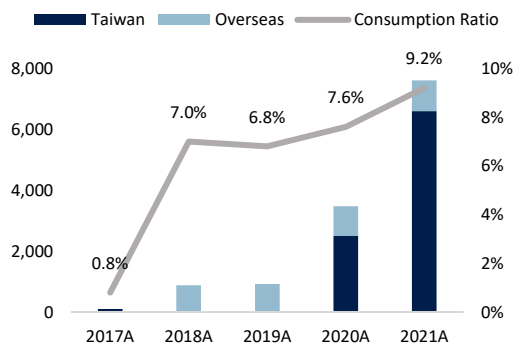
#### G1 | International Political Tension

**Probability:** Moderate | **Impact:** Moderate

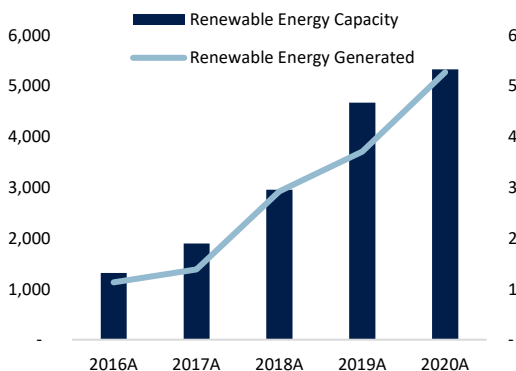
Tensions between Taiwan and China and U.S. and China has proven to be a problem for TSMC as the increase of tariffs, implementation of import and export controls, or the adoption of other trade barriers – could affect TSMC sales or those of its customers and thereby affect the Company's operating results. Previous issues and compliance with relevant laws and regulations, have led to TSMC discontinuing their shipment of products to Huawei. Recent tensions with the Russia-Ukraine war have also created sanctions that led to decreased sales of TSMC.

**G1 | Mitigation:** To hedge against China's aggressive stance, TSMC is furthering their expansion plans to different regions to ensure sales will not be affected by political tensions. To have production plants in neutral countries like Singapore,

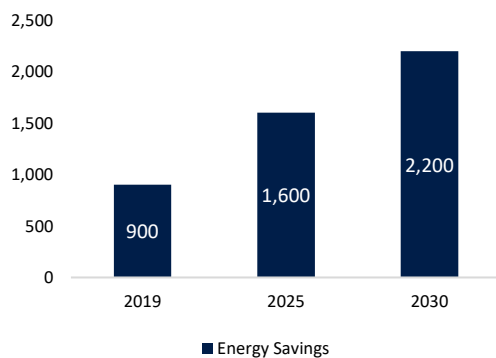


**Fig 7.3: TSMC Renewable Energy and Consumption Ratio (GWh)**

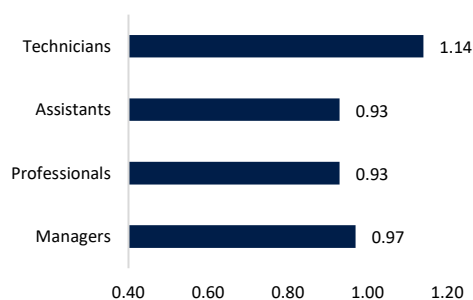
Source: Company Filings

**Fig 7.4: TSMC Renewable Energy Capacity (kWp) and Generated (GWh)**

Source: Company Filings

**Fig 7.5: TSMC's 15 Year Energy-Savings Target (GWh)**

Source: Company Filings

**Fig 7.6: Compensation Ratio of Female Employees by Profession**

Source: Statista

they can hedge against aggressive policies affecting trade. TSMC also continues to monitor the recent shifts in trade policies and will take corresponding responsive actions in accordance with subsequent developments.

### Operational Risk

#### R1 | Expansion Risk

*Probability: High | Impact: Low*

Expansion plans will increase TSMC's costs substantially as they would need to build new facilities and purchase additional equipment. Capex will increase due to new hires and trainings that are required to ensure new global plants and offices work efficiently. Global expansion also exposes TSMC to economic and foreign exchange volatilities. This is primarily due to their short-term loans for expansions and exposure to different currencies. Fluctuating interest rates on loans will impact their cashflow, while multi-currency fluctuations against NTD to their disadvantage will add on to their costs.

**R1 | Mitigation:** To ensure minimal risk exposure, TSMC must purchase a foreign exchange outright with banks to hedge against currency fluctuation and reevaluate all long-term debts before proceeding with the expansion to prevent any additional costs due to sudden increases in interest rates. TSMC uses foreign currency derivative contracts, such as currency forwards or currency swaps, to protect against currency exchange rate risks. Furthermore, TSMC's big expansion to set up a plant in Arizona is further backed by its suppliers as they follow TSMC into setting up their plants in U.S to facilitate smoother supplier chain integration.

### Cyclical Risk

#### C1 | Vulnerable Cyclical Nature

*Probability: High | Impact: Low*

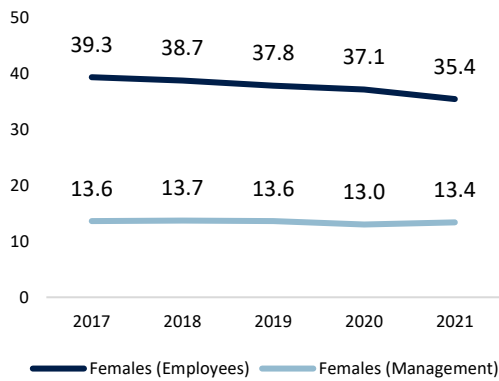
The Semiconductor Industry has always reflected its high risk due to its cyclical nature. Which means that it will experience a fluctuation in demand and supply, and this will result in constant expansion and contraction. As the industry leverages immensely on consumer spending, the demand of customers will greatly affect the top-line growth of companies.

As 2023 starts to unfold, consensus is that the economy will begin to contract, thus, demand for semiconductors will start to decrease as companies will begin to cut back on spendings and consumers become more cautious with their money. Although there is a forecasted short-term cyclical downturn, the long-term growth of the semiconductor industry is still looking strong as the industry will be carried by tailwinds from the IoT, autonomous vehicle and 5G industry.

**C1 | Mitigation:** TSMC has a strong diversified customer base which allows them to serve customers internationally. The customers include companies that offer a wide range of applications in communications, high performance computers, smartphones, digital consumer electronics, Internet of Things and autonomous vehicles. Although the smartphone industry has entered its mature phase, other growing industries will be the new driving forces that will enable growth for the company. Additionally, the release of the 3nm chip will likely boost top line growth furthermore and help pick up the company from its cyclical downturn in the first half of this year.

## Environmental, Social, and Governance

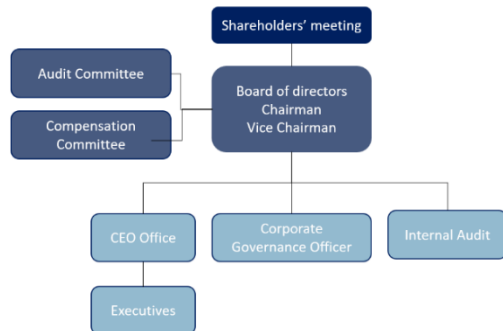
TSMC's past efforts and current achievements in FY21 has earned them an ESG rating of 14.3 (low risk) from Sustainalytics. They are ranked 8<sup>th</sup> in ESG in the semiconductor industry, highest in comparison to its competitors like Qualcomm, Intel, and Broadcom, with rankings of 11<sup>th</sup>, 37<sup>th</sup>, and 86<sup>th</sup> respectively. Its ratings are lower than the same competitors mentioned, with an ESG rating of 14.5, 18.5, and 22.4 respectively. A report by McKinsey outlined how ESG efforts raises a company's top line and reduces default risk significantly. This can be substantiated by TSMC's vast amount of sustainability-linked loans and green bonds worth more than \$4bn collectively, with interest rates not exceeding 2%.

**Fig 7.7: Percentage of Female Employees**

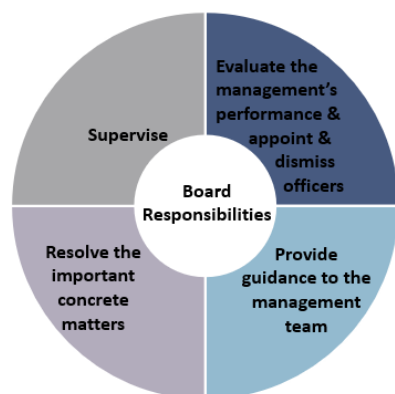
Source: Company Filings

**Fig 7.8: Impacts on Student's Education**

Source: Company Filings

**Fig 7.9: Governance Structure**

Source: Company Filings

**Fig 7.10: Board's Responsibility**

Source: Company Filings

**Environmental**

TSMC has set out to achieve net-zero greenhouse gas (GHG) emissions by 2050 by reducing Scope 1 and 2 GHG emissions by 25% by 2030. TSMC has also targeted to achieve zero water discharge in its fabs, reduce waste generation, increase recycling rates and renewable energy usage by 2030. Furthermore, TSMC has started 44 ESG programs to achieve 23 long-term sustainability goals by 2030.

TSMC joined the Taiwan Climate Partnership and the Association of Taiwan Net Zero Emissions in 2021, aiming to integrate green technologies into its operations and supply chain. As such, TSMC places requirements on all suppliers to ensure they uphold sustainability standards. TSMC has tremendously increased sustainability efforts on all fronts through in-house water recycling and waste management systems. Greater collaboration with renewable energy companies and signing of multiple renewable energy purchase agreements has also helped TSMC achieve 100% renewable energy use in all global offices. Resultantly, they are currently ahead of their 2030 target and are set to achieve 40% renewable energy for all TSMC fab operation sites instead of the previous goal of 25%.

**Social**

TSMC is enhancing long-term shareholder return by its commitment to social responsibility through investing in their employees, contractors, and the local communities. They have spent NTD 572mn annually to impact the next generation and cultivating talents by dedicating educational resources for students in all education stages. During the recent COVID-19 pandemic, TSMC have allocated NTD 4bn to support global efforts through medical, remote learning equipment, and food packages.

TSMC has established an open-style management systems to fulfil core values and business philosophy to continually inculcate an inclusive workplace environment. The TSMC Childcare Benefit program provides free advanced health check-ups and diverse learning resources to strengthen professional skills. They have created over 8,000 new high quality job opportunity. To promote a safety culture, TSMC has made 100% of employees and contractors pass safety and health training programs.

In 2021, TSMC has 36% female employees with 14% in management. In their efforts to create a more diverse workforce, they have organised inclusive leadership workshops and a series of courses on diversity and inclusion to offer female employees a platform of support and self-growth. They will be extending it to the TSMC STEM for High School Girls Program to cultivate future semiconductor professionals.

**Governance**

TSMC has an exemplary governance structure to facilitates future growth. The TSMC Board delegates various responsibility and authority to their two board committees consisting of the Audit Committee and the Compensation Committee. The respective committee's chairperson is required to regularly report to the Board on activities and actions of the relevant committees. The ESG Steering Committee is led by the TSMC Chairman and the Chairperson serves as its Executive Secretary and reports quarterly to the Board on the implementation of results and future.

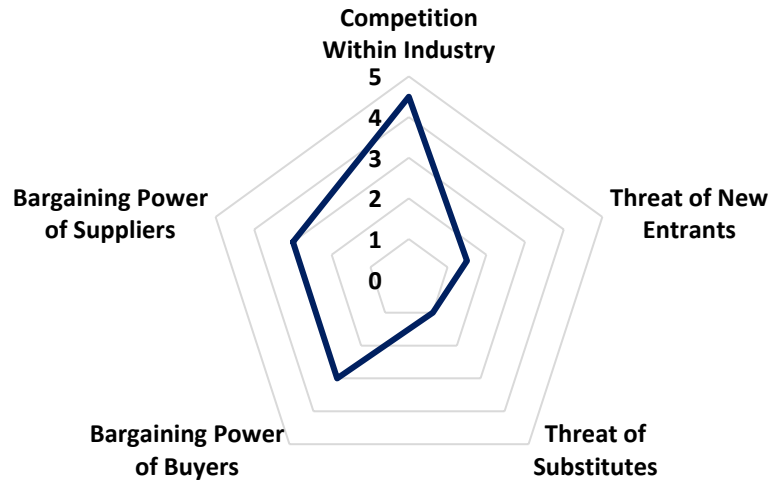
TSMC takes their ethics policies seriously by implementing an Ethics and Business Conduct Policy, TSMC Anti- Corruption Commitment and Complaint Policy and Procedure for Certain Accounting & Legal Matters. This ensures that TSMC operates with integrity and create multiple reporting channels available for both internal and external voices through anonymous reporting.

TSMC has a risk management organization that includes the RM Steering Committee, Executive Council, and RM Task Force. Through cross-function collaboration, TSMC has developed a comprehensive enterprise risk management (ERM) program that applies an ERM framework and risk map to identify and manage potential sustainability risks. The organization assesses the level of risk by determining the likelihood and severity of the impact of events on TSMC operations.

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## Appendix A – Porter's 5 Forces



**Competition Within Industry – High (4.5):** TSMC faces tough competition from both national and international players. Since TSMC competes in selected geographic regions or application end markets, it faces competition with big players based on process technologies, manufacturing excellence and customer trust.

**Threat of New Entrants – Low (1.5):** There are high barriers of entry for the semiconductor industry. Hence, high CAPEX and R&D commitment is needed to obtain the right technology and chip production to compete with the large existing companies.

**Threat of Substitutes – Low (1):** There are many substitutes available in the market especially with the rapid change in technological advancement. Therefore, TSMC is heavily investing in R&D so that they would always be ahead of technological advancement.

**Customer's Bargaining Power – Moderate (3):** Buyer power is low as not all substitutes are compatible with certain models of laptops or phones therefore making switching cost high. Therefore, allowing TSMC to build a strong, loyal customer base.

**Supplier's Bargaining Power – Moderate (3):** TSMC have diversified their materials such as raw wafers, chemicals, photoresist, and gases by ordering from a few suppliers. Therefore, since they do not rely solely on one supplier, their suppliers will have less control of the prices, hence TSMC will have a higher bargaining power.



## Appendix B - SWOT Analysis

### Strength:

The company's semiconductors are trusted by a diverse and expansive global customer base, ranging from major players in communications, computer, consumer, and industrial/standard sectors. These cutting-edge products are utilized in a wide variety of end markets, including high-performance computing, smartphones, digital consumer electronics, the Internet of Things (IoT), and automotive electronics. Thanks to its strong diversification strategy, TSMC can navigate fluctuations in demand with ease, maintaining consistently high levels of profitability and capacity utilization. This allows the company to generate robust returns on its future investments.

### Weakness:

Apple is TSMC's largest customer, accounting for more than 20% of its revenue. This makes TSMC heavily dependent on Apple's orders and vulnerable to any changes in their relationship. TSMC has been working to diversify its customer base to reduce this risk, but it can be difficult to replace such a large and important customer. Despite these challenges, TSMC has a strong track record of managing its customer relationships and investing in new technologies to stay competitive.

### Opportunity:

The IoT market is set to grow rapidly, reaching an estimated \$318 billion by 2023, with software and services accounting for many expenditures. TSMC offers a comprehensive ultra-low power technology platform, as well as cutting-edge technologies in RF, memory, sensors, and packaging to meet the demands of IoT edge computing and wireless connectivity. These products position TSMC to tap into growing markets and generate revenue in the future.

### Threats:

Apple is TSMC's largest customer, accounting for more than 20% of its revenue. This makes TSMC heavily dependent on Apple's orders and vulnerable to any changes in their relationship. TSMC has been working to diversify its customer base to reduce this risk, but it can be difficult to replace such a large and important customer. Despite these challenges, TSMC has a strong track record of managing its customer relationships and investing in new technologies to stay competitive.

## Appendix C - Financial Analysis

For Year Ended 31 December <i>All figures expressed in (USDm) unless stated otherwise</i>	Historical					Forecasted				
	2017A	2018A	2019A	2020A	2021A	2022E	2023E	2024E	2025E	2026E
<b>YoY Revenue Growth by Segments</b>										
Wafer	-	4.2%	1.8%	27.1%	19.2%	14.1%	35.0%	12.0%	12.1%	12.2%
Other	-	16.8%	18.7%	12.7%	13.3%	18.7%	18.7%	18.7%	18.7%	18.7%
<b>Total Revenue</b>	-	<b>5.5%</b>	<b>3.7%</b>	<b>25.2%</b>	<b>18.5%</b>	<b>14.6%</b>	<b>33.0%</b>	<b>12.7%</b>	<b>12.8%</b>	<b>12.9%</b>
<b>Profitability</b>										
Gross Margin %	50.6%	48.3%	46.0%	53.1%	51.6%	56.5%	58.6%	60.7%	60.7%	60.7%
EBITDA Margin %	39.6%	37.4%	34.9%	42.3%	41.0%	46.2%	48.0%	49.7%	49.2%	48.8%
EBIT Margin %	39.6%	37.4%	34.9%	42.3%	41.0%	36.6%	38.4%	39.0%	37.9%	37.0%
Net Income Margin %	35.3%	35.2%	33.1%	38.2%	37.3%	33.4%	35.1%	35.6%	34.6%	33.8%
Return on Assets	17.3%	17.4%	15.6%	18.5%	15.9%	14.1%	15.8%	15.1%	14.0%	13.2%
Return on Equity	23.1%	21.9%	21.9%	27.6%	27.3%	21.9%	23.4%	21.1%	18.8%	17.2%
Return on Invested Capital	20.2%	19.7%	19.8%	23.3%	20.4%	17.3%	19.4%	18.1%	16.6%	15.5%
<b>Liquidity</b>										
Current Ratio	2.22	2.67	1.37	1.77	2.17	2.34	2.15	2.35	2.57	2.84
Quick Ratio	2.02	2.38	1.24	1.55	1.91	2.12	1.93	2.14	2.36	2.63
Cash Ratio	1.43	1.62	0.76	1.07	1.44	1.49	1.29	1.49	1.70	1.96
<b>Leverage</b>										
Debt to Equity Ratio	0.25	0.21	0.29	0.33	0.42	0.35	0.32	0.29	0.25	0.23
Debt to EBITDA Ratio	1.29	1.11	1.74	1.61	2.39	1.81	1.49	1.36	1.28	1.20
<b>Efficiency</b>										
Asset Turnover Ratio	0.49	0.49	0.47	0.49	0.43	0.42	0.45	0.42	0.41	0.39
Receivables Turnover Ratio	8.07	8.02	7.70	9.21	8.03	8.03	8.03	8.06	8.03	8.03
Payables Turnover Ratio	16.99	16.18	14.89	16.11	16.24	16.18	16.18	16.22	16.18	16.18
<b>DuPont Analysis</b>										
<b>ROE</b>										
Net Income Margin %	35.3%	35.2%	33.1%	38.2%	37.3%	33.4%	35.1%	35.6%	34.6%	33.8%
Asset Turnover Ratio	0.49	0.49	0.47	0.49	0.43	0.42	0.45	0.42	0.41	0.39
Equity Multiplier	1.33	1.26	1.40	1.49	1.72	1.55	1.48	1.40	1.34	1.30
Earnings per Share (NT)	\$66.53	\$70.02	\$68.27	\$98.54	\$114.32	\$117.19	\$163.59	\$187.26	\$205.19	\$226.39

# Appendix D - Revenue Build & Income Statement Forecast

For Year Ended 31 December All Figure Expressed in Millions of New Taiwan Dollars	Historical					Forecasted				
	2017A	2018A	2019A	2020A	2021A	2022E	2023E	2024E	2025E	2026E
BOP	1/1/2017	1/1/2018	1/1/2019	1/1/2020	1/1/2021	1/1/2022	1/1/2023	1/1/2024	1/1/2025	1/1/2026
EOP	12/31/201	12/31/201	12/31/201	12/31/2020	12/31/2021	12/31/2022	12/31/2023	12/31/2024	12/31/2025	12/31/2026
Days	7	8	9							
	365	365	365	366	365	365	365	366	365	365

Scenario Toggle:	
Base	1
Bull	2
Bear	3
Case >>>	1

Revenue Forecast										
Revenue	\$977,447	\$1,031,474	\$1,069,985	\$1,339,255	\$1,587,415	\$1,818,965	\$2,419,610	\$2,728,088	\$3,077,504	\$3,475,036
Wafer	\$874,573	\$911,296	\$927,317	\$1,178,456	\$1,405,300	\$1,602,886	\$2,163,232	\$2,423,896	\$2,716,579	\$3,046,799
Others	\$102,875	\$120,177	\$142,668	\$160,799	\$182,115	\$216,079	\$256,378	\$304,192	\$360,924	\$428,237
						14.59%	33.02%	12.75%	12.81%	12.92%
Others	\$102,875	\$120,177	\$142,668	\$160,799	\$182,115	\$216,079	\$256,378	\$304,192	\$360,924	\$428,237
Growth Rate		16.82%	18.71%	12.71%	13.26%					
Live Case						18.65%	18.65%	18.65%	18.65%	18.65%
Base Case						18.65%	18.65%	18.65%	18.65%	18.65%
Bull Case						19.96%	19.96%	19.96%	19.96%	19.96%
Bear Case						17.72%	17.72%	17.72%	17.72%	17.72%
Revenue from 3 nanometer Wafers							\$364,847	\$406,697	\$453,120	\$504,588
Price per Chip (NT)				\$5,180	\$5,180	\$5,180	\$5,149	\$5,116	\$5,080	\$5,042
Live Case							0.60%	0.65%	0.70%	0.75%
Base Case							0.60%	0.65%	0.70%	0.75%
Bull Case							0.58%	0.62%	0.67%	0.72%
Bear Case							0.62%	0.67%	0.72%	0.77%
No. of Chips Sold				68	68.00	70.86	79.50	89.20	100.08	
Live Case						4.20%	12.20%	12.20%	12.20%	12.20%
Base Case						4.20%	12.20%	12.20%	12.20%	12.20%
Bull Case						4.49%	13.05%	13.05%	13.05%	13.05%
Bear Case						4.03%	11.71%	11.71%	11.71%	11.71%
Revenue from 5 nanometer Wafers			\$90,934.5	\$262,327.4		\$331,494	\$396,343	\$473,878	\$566,580	\$677,417
Price per Wafer (USD)			\$0.016	\$0.014						
Price per Wafer (NT)			\$0.491	\$0.432		\$0.429	\$0.425	\$0.422	\$0.418	\$0.414
Live Case						0.85%	0.85%	0.85%	0.85%	0.85%
Base Case						0.85%	0.85%	0.85%	0.85%	0.85%
Bull Case						0.81%	0.81%	0.81%	0.81%	0.81%
Bear Case						0.88%	0.88%	0.88%	0.88%	0.88%
No. of 5 nanometer Wafers			185,369	606,594		773,104.59	932,267.50	1,124,198.07	1,355,642.35	1,634,735.22
Live Case						27.45%	20.59%	20.59%	20.59%	20.59%
Base Case					227%	27.45%	20.59%	20.59%	20.59%	20.59%

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Bull Case						28.82%	21.62%	21.62%	21.62%	21.62%
Bear Case						24.71%	24.71%	24.71%	24.71%	24.71%
Revenue from 7 nanometer Wafers	\$81,680.7	\$249,548.1	\$394,837.0	\$440,383.1		\$509,699.07	\$581,418.48	\$663,229.48	\$756,552.06	\$863,005.99
Price per Wafer (USD)			\$0.011	\$0.011						
Price per Wafer (NT)			\$0.330	\$0.330		\$0.327	\$0.324	\$0.321	\$0.318	\$0.315
Live Case						0.95%	0.95%	0.95%	0.95%	0.95%
Base Case						0.95%	0.95%	0.95%	0.95%	0.95%
Bull Case						0.90%	0.90%	0.90%	0.90%	0.90%
Bear Case						1.06%	1.06%	1.06%	1.06%	1.06%
No. of 7 nanometer Wafers			1,195,167	1,333,034		1,557,650.19	1,793,867.84	2,065,907.90	2,379,202.83	2,740,008.94
Live Case						16.85%	15.17%	15.17%	15.17%	15.17%
Base Case				12%		16.85%	15.17%	15.17%	15.17%	15.17%
Bull Case						18.35%	18.35%	18.35%	18.35%	18.35%
Bear Case						15.17%	15.17%	15.17%	15.17%	15.17%
Revenue from 16 nanometer Wafers	\$187,371	\$186,701	\$197,959.0	\$191,058.9		\$214,589	\$236,522	\$256,485	\$274,251	\$289,719
Price per Wafer (USD)			\$0.045	\$0.045						
Price per Wafer (NT)			\$1.380	\$1.380		\$1.357	\$1.335	\$1.313	\$1.291	\$1270
Live Case						1.7%	1.7%	1.7%	1.7%	1.7%
Base Case						1.65%	1.65%	1.65%	1.65%	1.65%
Bull Case						1.57%	1.57%	1.57%	1.57%	1.57%
Bear Case						1.72%	1.72%	1.72%	1.72%	1.72%
No. of 16 nanometer Wafers			143,479.74	138,478.58		158,142.54	177,230.35	195,413.29	212,454.46	228,202.62
Live Case						14.2%	12.1%	10.3%	8.7%	7.4%
Base Case						14.20%	12.07%	10.26%	8.72%	7.41%
Bull Case						15.30%	13.01%	11.05%	9.40%	7.99%
Bear Case						12.50%	10.63%	9.03%	7.68%	6.53%
Revenue from 28 nanometer Wafers	\$178,440.4	\$149,578.7	\$149,367.0	\$153,066.0		\$166,754	\$180,578	\$195,549	\$211,760	\$229,316
Price per Wafer (USD)			\$0.003	\$0.003						
Price per Wafer (NT)			\$0.092	\$0.092		\$0.088	\$0.085	\$0.081	\$0.078	\$0.075
Live Case						4.1%	4.1%	4.1%	4.1%	4.1%
Base Case						4.1%	4.1%	4.1%	4.1%	4.1%
Bull Case						2.3%	2.3%	2.3%	2.3%	2.3%
Bear Case						3.9%	3.9%	3.9%	3.9%	3.9%
No. of 28 nanometer Wafers			1,623,907.37	1,664,122.64		1,890,443.31	2,134,688.59	2,410,490.36	2,721,925.71	3,073,598.51
Live Case						13.6%	12.9%	12.9%	12.9%	12.9%
Base Case						13.60%	12.92%	12.92%	12.92%	12.92%
Bull Case						14.01%	13.31%	13.31%	13.31%	13.31%
Bear Case						13.20%	13.20%	13.20%	13.20%	13.20%
Revenue from 40/45 nanometer Wafers	\$101,801	\$93,366.3	\$103,176.5	\$103,413.6		\$111,270	\$118,300	\$124,295	\$129,290	\$133,350
Price per Wafer (USD)			\$0.003	\$0.003						
Price per Wafer (NT)			\$0.080	\$0.080		\$0.077	\$0.075	\$0.072	\$0.070	\$0.068
Live Case						3.50%	3.15%	2.99%	2.84%	2.70%
Base Case						3.50%	3.15%	2.99%	2.84%	2.70%
Bull Case						3.75%	3.37%	3.20%	3.04%	2.89%



Bear Case						3.05%	2.74%	2.60%	2.47%	2.35%					
No. of 40/45 nanometer Wafers						1,294,301.55	1,297,275.82	1,446,462.54	1,587,854.25	1,719,785.09	1,841,243.84	1,951,775.03			
Live Case								11.50%	9.78%	8.31%	7.06%	6.00%			
Base Case								11.50%	9.78%	8.31%	7.06%	6.00%			
Bull Case								13.80%	11.73%	9.97%	8.47%	7.20%			
Bear Case								8.05%	6.84%	5.82%	4.94%	4.20%			
Revenue from other Wafers as a						\$242,182.258	\$255,051.261	\$269,079	\$285,224	\$303,763	\$325,027	\$349,404			
Live Case							5.31%	5.50%	6.00%	6.50%	7.00%	7.50%			
Base Case								5.50%	6.00%	6.50%	7.00%	7.50%			
Bull Case								6.00%	6.75%	7.50%	8.25%	9.00%			
Bear Case								5.00%	5.25%	5.50%	5.75%	6.00%			
Expenses Forecast															
Cost of Sales						(\$482,621)	(\$533,600)	(\$577,284)	(\$628,125)	(\$767,878)	\$791,896.53	\$1,000,720.91	\$1,071,888.65	\$1,209,176.98	\$1,365,370.60
% of Total Revenue											43.5%	41.4%	39.3%	39.3%	39.3%
Live Case											43.5%	41.4%	39.3%	39.3%	39.3%
Base Case						49.4%	51.7%	54.0%	46.9%	48.4%	43.5%	41.4%	39.3%	39.3%	39.3%
Bull Case											43.0%	40.9%	38.8%	38.8%	38.8%
Bear Case											44.0%	41.9%	39.8%	39.8%	39.8%
Research and Development						(\$80,733)	(\$85,896)	(\$91,419)	(\$109,486)	(\$124,735)	(\$142,929)	(\$199,633)	(\$236,338)	(\$279,939)	(\$331,905)
% of Total Revenue											7.9%	8.3%	8.7%	9.1%	9.6%
Live Case											7.9%	8.3%	8.7%	9.1%	9.6%
Base Case						8.3%	8.3%	8.5%	8.2%	7.9%	7.86%	8.25%	8.66%	9.10%	9.55%
Bull Case											7.36%	7.75%	8.16%	8.60%	9.05%
Bear Case											8.36%	8.75%	9.16%	9.60%	10.05%
General & Administrative						(\$21,197)	(\$20,266)	(\$21,737)	(\$28,458)	(\$36,930)	(\$34,786)	(\$46,272)	(\$52,172)	(\$58,854)	(\$66,456)
% of Revenue											1.91%	1.91%	1.91%	1.91%	1.91%
Live Case											1.91%	1.91%	1.91%	1.91%	1.91%
Base Case						2.17%	1.96%	2.03%	2.12%	2.33%	1.91%	1.91%	1.91%	1.91%	1.91%
Bull Case											1.76%	1.76%	1.76%	1.76%	1.76%
Bear Case											1.96%	1.96%	1.96%	1.96%	1.96%
Marketing						(\$5,973)	(\$5,988)	(\$6,349)	(\$7,113)	(\$7,559)	(\$8,740)	(\$11,626)	(\$13,109)	(\$14,788)	(\$16,698)
% of Revenue											0.48%	0.48%	0.48%	0.48%	0.48%
Live Case											0.48%	0.48%	0.48%	0.48%	0.48%
Base Case						0.61%	0.58%	0.59%	0.53%	0.48%	0.48%	0.48%	0.48%	0.48%	0.48%
Bull Case											0.46%	0.46%	0.46%	0.46%	0.46%
Bear Case											0.53%	0.53%	0.53%	0.53%	0.53%
Interest Income						\$9,465	\$14,694	\$16,189	\$9,018	\$5,709	\$11,024	\$14,664	\$16,534	\$18,651	\$21,060
% of Total Revenue											0.61%	0.61%	0.61%	0.61%	0.61%
Live Case											0.61%	0.61%	0.61%	0.61%	0.61%
Base Case						0.97%	1.42%	1.51%	0.67%	0.36%	0.61%	0.61%	0.61%	0.61%	0.61%
Bull Case											0.67%	0.67%	0.67%	0.67%	0.67%
Bear Case											0.55%	0.55%	0.55%	0.55%	0.55%
Finance Cost						(\$3,330)	(\$3,051)	(\$3,251)	(\$2,082)	(\$5,414)	(\$6,204)	(\$8,253)	(\$9,305)	(\$10,496)	(\$11,852)
% of Total Revenue											-0.34%	-0.34%	-0.34%	-0.34%	-0.34%
Live Case											-0.34%	-0.34%	-0.34%	-0.34%	-0.34%
Base Case						-0.34%	-0.30%	-0.30%	-0.16%	-0.34%	-0.34%	-0.34%	-0.34%	-0.34%	-0.34%

Bull Case						-0.38%	-0.38%	-0.38%	-0.38%	-0.38%
Bear Case						-0.31%	-0.31%	-0.31%	-0.31%	-0.31%
Foreign exchange gain (loss), net % of Total Revenue	(\$1,510)	\$2,438	\$2,095	(\$3,303)	\$13,663	\$4,910	\$6,532	\$7,364	\$8,308	\$9,381
Live Case						0.27%	0.27%	0.27%	0.27%	0.27%
Base Case	-0.15%	0.24%	0.20%	-0.25%	0.86%	0.27%	0.27%	0.27%	0.27%	0.27%
Bull Case						0.30%	0.30%	0.30%	0.30%	0.30%
Bear Case						0.24%	0.24%	0.24%	0.24%	0.24%
Other Income % of Total Revenue	\$146	\$158	\$417	\$661	\$973	\$709	\$944	\$1,064	\$1,200	\$1,355
Live Case						0.04%	0.04%	0.04%	0.04%	0.04%
Base Case	0.01%	0.02%	0.04%	0.05%	0.06%	0.04%	0.04%	0.04%	0.04%	0.04%
Bull Case						0.02%	0.02%	0.02%	0.02%	0.02%
Bear Case						0.06%	0.06%	0.06%	0.06%	0.06%
Other Gains and Losses, net % of Total Revenue	\$5,832	(\$320)	\$1,710	\$13,668	(\$1,875)	\$5,922	\$7,878	\$8,882	\$10,020	\$11,314
Live Case						0.3%	0.3%	0.3%	0.3%	0.3%
Base Case	0.60%	-0.03%	0.16%	1.02%	-0.12%	0.3%	0.3%	0.3%	0.3%	0.3%
Bull Case						0.2%	0.2%	0.2%	0.2%	0.2%
Bear Case						0.5%	0.5%	0.5%	0.5%	0.5%

## Appendix E - Supporting Schedules

For Year Ended 31 December <i>All figures expressed in (TW\$m) unless stated otherwise</i>	Historical					Forecasted				
	2017A	2018A	2019A	2020A	2021A	2022E	2023E	2024E	2025E	2026E
BOP	1/1/2017	1/1/2018	1/1/2019	1/1/2020	1/1/2021	1/1/2022	1/1/2023	1/1/2024	1/1/2025	1/1/2026
EOP	12/31/2017	12/31/2018	12/31/2019	12/31/2020	12/31/2021	12/31/2022	12/31/2023	12/31/2024	12/31/2025	12/31/2026
Days	365	365	365	366	365	365	365	366	365	365
Revenue	\$977,447	\$1,031,474	\$1,069,985	\$1,339,255	\$1,587,415	\$1,818,965	\$2,419,610	\$2,728,088	\$3,077,504	\$3,475,036
COGS	\$482,621	\$533,600	\$577,284	\$628,125	\$767,878	\$791,897	\$1,000,721	\$1,071,889	\$1,209,177	\$1,365,371
General and Administrative	\$21,197	\$20,266	\$21,737	\$28,458	\$36,930	\$34,786	\$46,272	\$52,172	\$58,854	\$66,456
Total OPEX	\$107,902	\$112,149	\$119,505	\$145,056	\$169,223	\$361,855	\$489,335	\$591,796	\$702,878	\$824,538
Net Income	\$345,039	\$363,106	\$354,027	\$511,008	\$592,881	\$607,736	\$848,373	\$971,148	\$1,064,095	\$1,174,050
Intangible Asset	\$14,175	\$17,002	\$20,653	\$25,768	\$26,822					
Total non-current liabilities	\$110,395	\$72,089	\$51,974	\$292,938	\$815,267	\$835,056	\$833,718	\$846,665	\$829,269	\$801,635
				\$27,728	\$32,735	\$1,818,965	\$2,419,610	\$2,728,088	\$3,077,504	\$3,475,036
Working Capital Schedule										
Short-term Investments	\$121,133	\$128,613	\$138,909	\$145,480	\$197,586	\$226,407	\$301,170	\$339,566	\$383,058	\$432,539
% of Revenue	12.4%	12.5%	13.0%	10.9%	12.4%	12.4%	12.4%	12.4%	12.4%	12.4%
Assets										
Notes and accounts receivable, net	\$121,133	\$128,613	\$138,909	\$145,480	\$197,586	\$226,407	\$301,170	\$338,638	\$383,058	\$432,539
Account receivable days	45	46	47	40	45	45	45	45	45	45
Receivables from related parties	\$1,184	\$584	\$862	\$558	\$715	\$1,031	\$1,371	\$1,546	\$1,744	\$1,969
% of Revenue	0.12%	0.06%	0.08%	0.04%	0.05%	0.1%	0.1%	0.1%	0.1%	0.1%
Other current assets	\$4,222	\$5,406	\$5,321	\$6,590	\$10,521	\$12,056	\$16,037	\$18,082	\$20,398	\$23,033
% of Revenue	0.43%	0.52%	0.50%	0.49%	0.66%	0.66%	0.66%	0.66%	0.66%	0.66%
Inventories	\$73,881	\$103,231	\$82,981	\$137,353	\$193,102	\$153,201	\$193,601	\$206,803	\$233,929	\$264,147
Inventory Days	55.9	70.6	52.5	80.0	91.8	70.6	70.6	70.6	70.6	70.6
Short-Term Financial Assets	\$103,220	\$135,965	\$139,090	\$141,982	\$140,096	\$192,839	\$256,517	\$289,220	\$326,264	\$368,408
% of Revenue	10.6%	13.2%	13.0%	10.6%	8.8%	10.6%	10.6%	10.6%	10.6%	10.6%
Right of Use Asset	--	--	--	\$27,728	\$32,735	\$37,585	\$49,996	\$56,370	\$63,590	\$71,804
% of Revenue	0.00%	0.00%	0.00%	2.07%	2.06%	2.07%	2.07%	2.07%	2.07%	2.07%
Intangible assets	\$14,175	\$17,002	\$20,653	\$25,768	\$26,822	\$26,379	\$28,072	\$25,321	\$22,851	\$20,642
% of Revenue	1.5%	1.6%	1.9%	1.9%	1.7%	1.5%	1.2%	0.9%	0.7%	0.6%
Deferred income tax assets	\$12,106	\$16,806	\$17,928	\$25,958	\$49,154	\$45,790	\$60,910	\$68,676	\$77,472	\$87,479
% of Revenue	1.2%	1.6%	1.7%	1.9%	3.1%	2.5%	2.5%	2.5%	2.5%	2.5%
Refundable deposits	\$1,283	\$1,700	\$2,085	\$1,343	\$2,625	\$2,753	\$3,758	\$4,186	\$4,467	\$5,356
% of Revenue	0.13%	0.16%	0.19%	0.10%	0.17%	0.15%	0.16%	0.15%	0.15%	0.15%

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<b>Other Non-Current Assets</b>	<b>\$2,983</b>	<b>\$1,585</b>	<b>\$1,743</b>	<b>\$4,411</b>	<b>\$2,592</b>	<b>\$2,970</b>	<b>\$3,951</b>	<b>\$4,455</b>	<b>\$5,025</b>	<b>\$5,675</b>
	<i>% of Revenue</i>	0.31%	0.15%	0.16%	0.33%	0.16%	0.16%	0.16%	0.16%	0.16%
<b>Long-Term Financial Assets</b>	<b>\$23,708</b>	<b>\$11,439</b>	<b>\$28,706</b>	<b>\$8,887</b>	<b>\$7,421</b>	<b>\$20,172</b>	<b>\$26,833</b>	<b>\$30,254</b>	<b>\$34,129</b>	<b>\$38,538</b>
	<i>% of Revenue</i>	2.43%	1.11%	2.68%	0.66%	1.1%	1.1%	1.1%	1.1%	1.1%
<u>Liabilities</u>										
<b>Accounts Payable</b>	<b>\$28,413</b>	<b>\$32,981</b>	<b>\$38,771</b>	<b>\$38,987</b>	<b>\$47,286</b>	<b>\$48,946</b>	<b>\$61,853</b>	<b>\$66,071</b>	<b>\$74,737</b>	<b>\$84,391</b>
	<i>Account payable days</i>	21	23	25	23	22	23	23	23	23
<b>Short Term Loan</b>	<b>\$63,767</b>	<b>\$88,755</b>	<b>\$118,522</b>	<b>\$88,559</b>	<b>\$114,921</b>	<b>\$118,516</b>	<b>\$149,769</b>	<b>\$160,420</b>	<b>\$180,967</b>	<b>\$204,343</b>
	<i>% of COGS</i>	13.21%	16.63%	20.53%	14.10%	14.97%	15.0%	15.0%	15.0%	15.0%
<b>Short-term Financial liabilities</b>	<b>\$42</b>	<b>\$197</b>	<b>\$984</b>	<b>\$95</b>	<b>\$692</b>	<b>\$292</b>	<b>\$369</b>	<b>\$395</b>	<b>\$446</b>	<b>\$503</b>
	<i>% of COGS</i>	0.01%	0.04%	0.17%	0.02%	0.09%	0.04%	0.04%	0.04%	0.04%
<b>Payables to related parties, contractors and equipment suppliers</b>	<b>\$57,380</b>	<b>\$44,510</b>	<b>\$142,246</b>	<b>\$159,913</b>	<b>\$147,179</b>	<b>\$151,783</b>	<b>\$191,808</b>	<b>\$204,888</b>	<b>\$231,763</b>	<b>\$261,701</b>
	<i>Payable days</i>	43.40	30.45	89.94	93.18	69.96	69.96	69.96	69.96	69.96
<b>Income tax payable</b>	<b>\$61,663</b>	<b>\$55,282</b>	<b>\$40,094</b>	<b>\$53,909</b>	<b>\$59,647</b>	<b>\$68,827</b>	<b>\$96,080</b>	<b>\$109,985</b>	<b>\$120,511</b>	<b>\$132,964</b>
	<i>% of Net Income</i>	18%	15%	11%	11%	10%	11.33%	11.33%	11.33%	11.33%
<b>Salary and bonus payable</b>	<b>\$14,255</b>	<b>\$14,471</b>	<b>\$16,272</b>	<b>\$20,071</b>	<b>\$23,802</b>	<b>\$24,535</b>	<b>\$32,636</b>	<b>\$36,797</b>	<b>\$41,510</b>	<b>\$46,872</b>
	<i>% of General and administrative expense</i>	67.25%	71.41%	74.86%	70.53%	64.45%	70.53%	70.53%	70.53%	70.53%
<b>Accrued profit sharing bonus to employees and compensation to directors and supervisors</b>	<b>\$23,419</b>	<b>\$23,981</b>	<b>\$23,649</b>	<b>\$35,681</b>	<b>\$36,525</b>	<b>\$40,597</b>	<b>\$56,357</b>	<b>\$64,513</b>	<b>\$70,687</b>	<b>\$77,992</b>
	<i>% of Net Income</i>	6.79%	6.60%	6.68%	6.98%	6.16%	6.68%	6.64%	6.64%	6.64%
<b>Long-term liabilities - current portion</b>	<b>\$58,401</b>	<b>\$34,900</b>	<b>\$31,800</b>	<b>\$2,600</b>	<b>\$4,567</b>	<b>\$6,045</b>	<b>\$6,035</b>	<b>\$6,129</b>	<b>\$6,003</b>	<b>\$5,803</b>
	<i>% of Total long-term liabilities</i>	52.90%	48.41%	61.18%	0.89%	0.56%	0.72%	0.72%	0.72%	0.72%
<b>Accrued expenses and other current liabilities</b>	<b>\$65,588</b>	<b>\$61,761</b>	<b>\$56,373</b>	<b>\$87,683</b>	<b>\$162,268</b>	<b>\$72,269</b>	<b>\$91,326</b>	<b>\$97,554</b>	<b>\$110,350</b>	<b>\$124,604</b>
	<i>% of Total Opex</i>	60.79%	55.07%	47.17%	60.45%	95.89%	47.17%	47.17%	47.17%	47.17%
<b>Cash dividends payable</b>	<b>--</b>	<b>--</b>	<b>\$129,652</b>	<b>\$129,652</b>	<b>\$142,617</b>	<b>\$154,194</b>	<b>\$215,248</b>	<b>\$246,398</b>	<b>\$269,980</b>	<b>\$297,878</b>
	<i>% of Net Income</i>	0.00%	0.00%	36.62%	25.37%	24.05%	25.37%	25.37%	25.37%	25.37%
<b>Long-term bank loans</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>\$1,968</b>	<b>\$3,309</b>	<b>\$2,716</b>	<b>\$3,432</b>	<b>\$3,483</b>	<b>\$3,536</b>	<b>\$3,593</b>
	<i>% of Capex</i>	0.00%	0.00%	0.00%	0.38%	0.39%	0.38%	0.38%	0.38%	0.38%
<b>Lease liabilities</b>	<b>--</b>	<b>--</b>	<b>\$15,042</b>	<b>\$20,561</b>	<b>\$20,764</b>	<b>\$45,546</b>	<b>\$61,592</b>	<b>\$74,488</b>	<b>\$88,470</b>	<b>\$103,783</b>
	<i>% of Total Opex</i>	0.00%	0.00%	12.59%	14.17%	12.27%	12.59%	12.59%	12.59%	12.59%
<b>CAPEX</b>	<b>\$335,889</b>	<b>\$322,682</b>	<b>\$469,752</b>	<b>\$521,475</b>	<b>\$849,436</b>	<b>\$708,263</b>	<b>\$895,033</b>	<b>\$908,228</b>	<b>\$922,099</b>	<b>\$937,089</b>
	<i>% of Revenue</i>	34.36%	31.28%	43.90%	38.94%	53.51%	38.94%	36.99%	33.29%	29.96%

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						17 Apr 2022									
Addition of ROU						\$13,481	\$13,481	\$17,990	\$20,614	\$27,421	\$30,917	\$34,877	\$39,382		
% of revenue						1.26%	1.01%	1.13%	1.13%	1.13%	1.13%	1.13%	1.13%		
Depreciation of ROU						\$2,682	\$2,682	\$8,261.90	\$9,754	\$12,989	\$17,289	\$21,350	\$25,380		
% of Net ROU						43.75%	15.84%	29.80%	29.80%	29.80%	29.80%	29.80%	29.80%		
Addition of Intangible Asset						\$4,481	\$7,100	\$9,330	\$12,559	\$9,318	\$12,891	\$17,148	\$19,334	\$21,811	\$24,628
% Revenue						0.46%	0.69%	0.87%	0.94%	0.59%	0.71%	0.71%	0.71%	0.71%	
Amortization of Intangible Asset						\$4,347	\$4,421	\$5,472	\$7,186	\$8,207	\$11,251	\$12,922	\$14,738	\$16,742	\$18,976
% of Intangible Asset						30.66%	26.01%	26.50%	27.89%	30.60%	28.33%	28.33%	28.33%	28.33%	28.33%
Depreciation Schedule															
Property, Plant & Equipment															
PPE Opening Balance						Useful Lives									
CAPEX						17.38 Years									
Total PPE before Depreciation															
Depreciation of Existing PPE															
Depreciation of new CAPEX															
2022															
2023															
2024															
2025															
2026															
Total Depreciation of new CAPEX															
Total Depreciation for the Year															
PPE Closing Balance															
Rights of Use Assets															
ROU opening balance						\$6,129	\$16,929	\$27,728	\$32,735	\$43,595	\$58,026	\$71,654	\$85,181		
Additions						\$13,481	\$13,481	\$7,770	\$20,614	\$27,421	\$30,917	\$34,877	\$39,382		
Less: Amortization						\$2,682	\$2,682	\$2,556	\$9,754	\$12,989	\$17,289	\$21,350	\$25,380		
Total ROU						\$16,929	\$27,728	\$32,735	\$43,595	\$58,026	\$71,654	\$85,181	\$99,182		
Intangible Asset															
Intangible Asset Opening Balance															
Additions															
Total Intangible Asset before Amortization															
Less: Amortization						28%									
Intangible Asset Ending Balance						\$26,822									

Bonds expiring in 2022					
Opening Debt Balance	Coupon Rate	Principal Amount			
Mandatory debt repayment	0.78%	4,400			
Principle Repayment					
Closing Debt Balance					
Interest Expense					
Bonds expiring in 2023					
Opening Debt Balance	Coupon Rate	Principal Amount			
Mandatory debt repayment	0.76%	18,100			
Principle Repayment					
Closing Debt Balance					
Interest Expense					
Bonds expiring in 2025					
Opening Debt Balance	Coupon Rate	Principal Amount			
Mandatory debt repayment	0.69%	31,431			
Principle Repayment					
Closing Debt Balance					
Interest Expense					
Bonds expiring in 2026 and onwards					
Opening Debt Balance	Coupon Rate	Principal Amount	2022	2023	2024
Mandatory debt repayment	0.72%	556,140			
Principle Repayment					
Closing Debt Balance					
Interest Expense					
Total Interest Payment					

## Appendix F - Pro-Forma Income Statement

For Year Ended 31 December All Figure Expressed in Millions of New Taiwan Dollars unless stated otherwise Income Statement (TW\$m)	Historical					Forecasted				
	2017A	2018A	2019A	2020A	2021A	2022E	2023E	2024E	2025E	2026E
<b>Revenue:</b>										
Wafer	\$874,573	\$911,296	\$927,317	\$1,178,456	\$1,405,300	\$1,602,886	\$2,163,232	\$2,423,896	\$2,716,579	\$3,046,799
Other	\$102,875	\$120,177	\$142,668	\$160,799	\$182,115	\$216,079	\$256,378	\$304,192	\$360,924	\$428,237
<b>Total Revenue</b>	<b>\$977,447</b>	<b>\$1,031,474</b>	<b>\$1,069,985</b>	<b>\$1,339,255</b>	<b>\$1,587,415</b>	<b>\$1,818,965</b>	<b>\$2,419,610</b>	<b>\$2,728,088</b>	<b>\$3,077,504</b>	<b>\$3,475,036</b>
Cost of sales	(\$482,621)	(\$533,600)	(\$577,284)	(\$628,125)	(\$767,878)	(\$791,89)	(\$1,000,72)	(\$1,071,88)	(\$1,209,17)	(\$1,365,37)
<b>Gross Profit</b>	<b>\$494,826</b>	<b>\$497,874</b>	<b>\$492,702</b>	<b>\$711,130</b>	<b>\$819,537</b>	<b>\$1,027,069</b>	<b>\$1,418,889</b>	<b>\$1,656,199</b>	<b>\$1,868,327</b>	<b>\$2,109,665</b>
Research and Development	(\$80,733)	(\$85,896)	(\$91,419)	(\$109,486)	(\$124,735)	(\$142,929)	(\$199,633)	(\$236,338)	(\$279,939)	(\$331,905)
General & Administrative	(\$21,197)	(\$20,266)	(\$21,737)	(\$28,458)	(\$36,930)	(\$34,786)	(\$46,272)	(\$52,172)	(\$58,854)	(\$66,456)
Marketing	(\$5,973)	(\$5,988)	(\$6,349)	(\$7,113)	(\$7,559)	(\$8,740)	(\$11,626)	(\$13,109)	(\$14,788)	(\$16,698)
Depreciation						(\$154,395)	(\$205,893)	(\$258,150)	(\$311,205)	(\$365,123)
Amortization						(\$21,004)	(\$25,911)	(\$32,028)	(\$38,092)	(\$44,356)
Total Operating Expense	(\$107,902)	(\$112,149)	(\$119,505)	(\$145,056)	(\$169,223)	(\$361,855)	(\$489,335)	(\$591,796)	(\$702,878)	(\$824,538)
<b>Operating Income Before Other Operating Income and Expenses</b>	<b>\$386,925</b>	<b>\$385,725</b>	<b>\$373,197</b>	<b>\$566,074</b>	<b>\$650,314</b>	<b>\$665,214</b>	<b>\$929,553</b>	<b>\$1,064,403</b>	<b>\$1,165,449</b>	<b>\$1,285,127</b>
Other Operating Income and Expenses, net	(\$1,366)	(\$2,102)	(\$496)	\$710	(\$333)	(\$333)	(\$333)	(\$333)	(\$333)	(\$333)
<b>Operating Income</b>	<b>\$385,559</b>	<b>\$383,623</b>	<b>\$372,701</b>	<b>\$566,784</b>	<b>\$649,981</b>	<b>\$664,880</b>	<b>\$929,220</b>	<b>\$1,064,070</b>	<b>\$1,165,116</b>	<b>\$1,284,794</b>
Interest Expense						(\$4,393)	(\$4,359)	(\$4,221)	(\$4,221)	(\$4,004)
Interest Income	\$9,465	\$14,694	\$16,189	\$9,018	\$5,709	\$11,024	\$14,664	\$16,534	\$18,651	\$21,060
Finance Cost	(\$3,330)	(\$3,051)	(\$3,251)	(\$2,082)	(\$5,414)	(\$6,204)	(\$8,253)	(\$9,305)	(\$10,496)	(\$11,852)
Foreign exchange gain (loss), net	(\$1,510)	\$2,438	\$2,095	(\$3,303)	\$13,663	\$4,910	\$6,532	\$7,364	\$8,308	\$9,381
Other Income	\$146	\$158	\$417	\$661	\$973	\$709	\$944	\$1,064	\$1,200	\$1,355
Other Gains and losses, net	\$5,832	(\$320)	\$1,710	\$13,668	(\$1,875)	\$5,922	\$7,878	\$8,882	\$10,020	\$11,314
<b>Total non-operating income and expenses</b>	<b>\$10,603</b>	<b>\$13,920</b>	<b>\$17,161</b>	<b>\$17,963</b>	<b>\$13,055</b>	<b>\$16,362</b>	<b>\$21,765</b>	<b>\$24,540</b>	<b>\$27,683</b>	<b>\$31,258</b>
Income Before Tax	\$396,162	\$397,543	\$389,862	\$584,746	\$663,036	\$681,242	\$950,985	\$1,088,609	\$1,192,798	\$1,316,052
Income Tax Expense	(\$51,123)	(\$34,437)	(\$35,835)	(\$73,738)	(\$70,155)	(\$73,506)	(\$102,611)	(\$117,461)	(\$128,703)	(\$142,002)
<b>Net Income</b>	<b>\$345,039</b>	<b>\$363,106</b>	<b>\$354,027</b>	<b>\$511,008</b>	<b>\$592,881</b>	<b>\$607,736</b>	<b>\$848,373</b>	<b>\$971,148</b>	<b>\$1,064,095</b>	<b>\$1,174,050</b>
Exchange Rate	29.64	30.61	29.91	28.08	27.74	29.20	29.20	29.20	29.20	29.20
Net Income (USD)	\$11,641	\$11,862	\$11,836	\$18,198	\$21,373	\$20,816	\$29,058	\$33,263	\$36,447	\$40,213
Shares Outstanding:										
Basic	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186
Diluted	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186
Earnings (loss) per share:										
Basic (USD)	2.24	2.29	2.28	3.51	4.12	4.01	5.60	6.41	7.03	7.75
Diluted (USD)	2.24	2.29	2.28	3.51	4.12	4.01	5.60	6.41	7.03	7.75
Earnings (loss) per share:										
Basic (NT)	66.53	70.02	68.27	98.54	114.32	117.19	163.59	187.26	205.19	226.39
Diluted (NT)	66.53	70.02	68.27	98.54	114.32	117.19	163.59	187.26	205.19	226.39
Tax Rate	-12.90%	-8.66%	-9.19%	-12.61%	-10.58%	-10.79%	-10.79%	-10.79%	-10.79%	-10.79%

## Appendix G - Pro-Forma Balance Sheet

For Year Ended 31 December	Historical		
All Figure Expressed in Millions of New Taiwan Dollars unless stated otherwise	2017A	2018A	2019A
<b>Balance Sheet (TW\$m)</b>			
<b>Current Assets:</b>			
Cash and cash equivalents	\$553,392	\$577,815	\$455,399
Notes and accounts receivable, net	\$121,133	\$128,613	\$138,909
Receivables from related parties	\$1,184	\$584	\$862
Other receivables from related parties	\$171	\$65	\$52
Other Current Assets	\$4,222	\$5,406	\$5,321
Inventories	\$73,881	\$103,231	\$82,981
Short-Term Financial Assets	\$103,220	\$135,965	\$139,090
<b>Total current assets</b>	<b>\$857,203</b>	<b>\$951,680</b>	<b>\$822,614</b>
Property, plant & equipment, net	\$1,062,542	\$1,072,050	\$1,352,377
Investments accounted for using equity method	\$17,732	\$17,769	\$18,619
Right-of-use assets	--	--	--
Intangible assets	\$14,175	\$17,002	\$20,653
Deferred income tax assets	\$12,106	\$16,806	\$17,928
Refundable deposits	\$1,283	\$1,700	\$2,085
Other noncurrent assets	\$2,983	\$1,585	\$1,743
Long-Term Financial Assets	\$23,708	\$11,439	\$28,706
<b>Total non-current assets</b>	<b>\$1,134,529</b>	<b>\$1,138,352</b>	<b>\$1,442,111</b>
<b>Total Assets</b>	<b>\$1,991,732</b>	<b>\$2,090,031</b>	<b>\$2,264,725</b>
<b>Current Liabilities:</b>			
Accounts Payable	\$28,413	\$32,981	\$38,771
Short-term loans	\$63,767	\$88,755	\$118,522
Short-term Financial liabilities	\$42	\$197	\$984
Payables to related parties, contractors and equipment suppliers	\$57,380	\$44,510	\$142,246
Income tax payable	\$61,663	\$55,282	\$40,094
Provisions	\$13,962	--	--
Salary and bonus payable	\$14,255	\$14,471	\$16,272
Accrued profit sharing bonus to employees and compensation to directors and supervisors	\$23,419	\$23,981	\$23,649
Long-term liabilities - current portion	\$58,401	\$34,900	\$31,800
Accrued expenses and other current liabilities	\$65,588	\$61,761	\$56,373
Cash dividends payable	--	--	\$129,652
<b>Total current liabilities</b>	<b>\$386,890</b>	<b>\$356,837</b>	<b>\$598,364</b>
<b>Long-term Liabilities:</b>			
Long-term bank loans	--	--	--
Bonds payable	\$91,800	\$56,900	\$25,100
Net defined benefit liability	\$8,851	\$9,651	\$9,183
Guarantee deposits	\$7,587	\$3,353	\$177
Deferred Income Tax Liability, Non-Current	\$302	\$233	\$344
Lease liabilities	--	--	\$15,042
Other Non-Current Liabilities	\$1,856	\$1,951	\$2,128
<b>Total non-current liabilities</b>	<b>\$110,395</b>	<b>\$72,089</b>	<b>\$51,974</b>
<b>Shareholders' Equity:</b>			

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			14 April 2023
Capital Stock	\$259,304	\$259,304	\$259,304
Capital surplus	\$56,310	\$56,316	\$56,340
Retained Earnings	\$1,205,051	\$1,360,259	\$1,325,630
Comprehensive Inc. and Other	(\$26,918)	(\$15,450)	(\$27,568)
Non-controlling interest	\$700	\$676	\$682
<b>Total shareholders' equity</b>	<b>\$1,494,447</b>	<b>\$1,661,105</b>	<b>\$1,614,387</b>
<b>Total liabilities and shareholders' equity</b>	<b>\$1,991,732</b>	<b>\$2,090,031</b>	<b>\$2,264,725</b>

## Appendix H - Pro-Forma Cash Flow Statement

For Year Ended 31 December	Forecasted				
All Figure Expressed in Millions of New Taiwan Dollars unless stated otherwise	2022E	2023E	2024E	2025E	2026E
<b>Cash Flow Statement (TW\$m)</b>					
<b>Cash flows from operating activities:</b>					
Net Income	\$607,736	\$848,373	\$971,148	\$1,064,095	\$1,174,050
Depreciation Expense	\$154,395	\$205,893	\$258,150	\$311,205	\$365,123
Amortization of Intangible Assets	\$11,251	\$12,922	\$14,738	\$16,742	\$18,976
Amortization of ROU Assets	\$9,754	\$12,989	\$17,289	\$21,350	\$25,380
<b>Changes in Net Working Capital:</b>					
Account receivables	(\$28,821)	(\$74,762)	(\$37,469)	(\$44,420)	(\$49,481)
Receivables from related parties	(\$315)	(\$340)	(\$175)	(\$198)	(\$225)
Other Current Assets	(\$1,535)	(\$3,981)	(\$2,045)	(\$2,316)	(\$2,635)
Inventories	\$39,901	(\$40,399)	(\$13,202)	(\$27,127)	(\$30,217)
Short-Term Financial Assets	(\$52,743)	(\$63,678)	(\$32,704)	(\$37,044)	(\$42,145)
Accounts Payable	\$1,660	\$12,907	\$4,218	\$8,667	\$9,654
Short-term loans	\$3,595	\$31,253	\$10,651	\$20,547	\$23,376
Short-term Financial liabilities	(\$400)	\$77	\$26	\$51	\$58
Payables to related parties, contractors and equipment suppliers	\$4,604	\$40,025	\$13,079	\$26,875	\$29,938
Income tax payable	\$9,180	\$27,253	\$13,905	\$10,526	\$12,453
Salary and bonus payable	\$732	\$8,102	\$4,161	\$4,713	\$5,362
Accrued profit sharing bonus to employees and compensation to directors and supervisors	\$4,072	\$15,761	\$8,156	\$6,174	\$7,304
Long-term liabilities - current portion	\$1,478	(\$10)	\$94	(\$126)	(\$200)
Accrued expenses and other current liabilities	(\$89,999)	\$19,057	\$6,228	\$12,796	\$14,254
Cash dividends payable	\$11,577	\$61,054	\$31,150	\$23,582	\$27,897
<b>Net cash provided by operating activities</b>	<b>\$686,121</b>	<b>\$1,112,495</b>	<b>\$1,267,400</b>	<b>\$1,416,094</b>	<b>\$1,588,922</b>
<b>Cash flows from investing activities:</b>					
Capital Expenditure	(\$708,263)	(\$895,033)	(\$908,228)	(\$922,099)	(\$937,089)
Purchase of ROU Assets	(\$20,614)	(\$27,421)	(\$30,917)	(\$34,877)	(\$39,382)
Acquisition of Intangible Assets	(\$12,891)	(\$17,148)	(\$19,334)	(\$21,811)	(\$24,628)
(Purchase)/Sale of Deferred Income Tax Assets	\$3,364	(\$15,120)	(\$7,766)	(\$8,796)	(\$10,007)
(Purchase)/Sale of Refundable Deposit	(\$128)	(\$1,006)	(\$427)	(\$281)	(\$889)
(Purchase)/Sale of Non-Current Assets	(\$378)	(\$981)	(\$504)	(\$571)	(\$649)
(Purchase)/Sale of Financial Assets	(\$12,751)	(\$6,661)	(\$3,421)	(\$3,875)	(\$4,409)
Lease Agreements	\$24,782	\$16,046	\$12,897	\$13,982	\$15,313
<b>Net cash used in investing activities</b>	<b>(\$726,879)</b>	<b>(\$947,325)</b>	<b>(\$957,700)</b>	<b>(\$978,327)</b>	<b>(\$1,001,739)</b>
<b>Cash flows from financing activities:</b>					
Long-Term Bank Loans	(\$593)	\$716	\$51	\$53	\$57
Bond Repaid	(\$4,400)	(\$18,100)	--	(\$31,431)	(\$43,004)
<b>Net cash (used in) provided by financing activities</b>	<b>(\$4,993)</b>	<b>(\$17,384)</b>	<b>\$51</b>	<b>(\$31,377)</b>	<b>(\$42,947)</b>
Net increase in cash and cash equivalents, and restricted cash	(\$45,751)	\$147,786	\$309,750	\$406,390	\$544,236
Cash, cash equivalents and restricted cash at beginning of year	\$1,064,990	\$1,019,239	\$1,167,025	\$1,476,775	\$1,883,165
<b>Cash, cash equivalents and restricted cash at end of year</b>	<b>\$1,019,239</b>	<b>\$1,167,025</b>	<b>\$1,476,775</b>	<b>\$1,883,165</b>	<b>\$2,427,401</b>

## Appendix I - Weighted Average Cost of Capital (WACC) Computation

Capital Asset Pricing Model (CAPM)		
Risk-free Rate	3.38%	10-Year US Treasury Yield as at 24/03/2022
Equity Risk Premium	6.21%	Blended by Region (Damodaran)
Unlevered Beta	1.22	Hamada Equation
Re-levered Beta	1.27	Bottom-up Beta
<b>Cost of Equity</b>	<b>11.24%</b>	
Cost of Debt		
Pre-tax Cost of Debt	0.77%	Weighted Avg. Interest Rate of Existing Debt
Country Risk Premium	0.34%	Blended by Region (Damodaran)
Corporate Tax Rate	24.03%	Blended by Region (Damodaran)
<b>After-tax Cost of Debt</b>	<b>0.85%</b>	
Capital Structure		
Market D/E	0.054	Target Ratio
Proportion of Equity	94.90%	
Proportion of Debt	5.10%	
<b>WACC</b>	<b>10.71%</b>	

Blended				
Countries	Default Spread	Country Risk Premium	Equity Risk Premium	Corporate Tax Rate
Taiwan	0.09%	0.13%	0.90%	2.57%
United States	0.00%	0.00%	3.80%	16.00%
China	0.09%	0.13%	0.74%	2.59%
Europe, Middle East and Africa	0.00%	0.00%	0.27%	1.21%
Japan	0.04%	0.06%	0.32%	1.05%
Others	0.00%	0.03%	0.18%	0.61%
<b>Total</b>	<b>0.22%</b>	<b>0.34%</b>	<b>6.21%</b>	<b>24.03%</b>

Unblended				
Countries	Default Spread	Country Risk Premium	Equity Risk Premium	Corporate Tax Rate
Taiwan	0.73%	1.03%	6.97%	20.00%
United States	0.00%	0.00%	5.94%	25.00%
China	0.86%	1.22%	7.16%	25.00%
Europe, Middle East and Africa	0.00%	0.00%	4.73%	21.50%
Japan	0.86%	1.22%	7.16%	23.20%
Others	0.00%	1.03%	6.97%	23.20%

## Bottom Up Beta Computation

Company Name	Country	Debt/Equity	Tax Rate	Levered Beta 5 Year
Advanced Micro Devices, Inc.	United States	0.05%	27.00%	1.95
Analog Devices, Inc.	Japan	0.18%	23.20%	1.14
NVIDIA Corporation	Uruguay	0.54%	25.00%	1.76
Texas Instruments Incorporated	India	0.63%	25.00%	1.02
Broadcom Inc.	United Kingdom	1.69%	19.00%	1.12
Intel Corporation	United States	0.41%	27.00%	0.81
QUALCOMM Incorporated	United Kingdom	0.90%	19.00%	1.30
NXP Semiconductors N.V.	Germany	1.48%	15.83%	1.53
<b>Median</b>		<b>0.59%</b>	<b>24.10%</b>	<b>1.22</b>

## Appendix J - Cost of Debt (Synthetic Credit Rating)

Revenue Breakdown by Geography		
Countries	Revenue	% of Total Revenue
Taiwan	180,581.09	12.9%
United States	899,392.19	64.0%
China	145,729.64	10.4%
Europe, Middle East and Africa	78,837.35	5.6%
Japan	63,660.10	4.5%
Others	37,099.93	2.6%
<b>Total Revenue</b>	<b>1,405,300.30</b>	<b>100.0%</b>

Debt	Interest Rate	Value	% of Total Debt
Bonds expiring in 2022	0.78%	4,400.00	0.58%
Bonds expiring in 2023	0.76%	18,100.00	2.40%
Bonds expiring in 2025	0.69%	31,430.63	4.17%
Bonds expiring in 2026 and onwards	0.72%	556,140.02	73.79%
Bank Loans, Lease Liabilities	0.99%	143,561.35	19.05%
<b>Total</b>		<b>753,632.00</b>	<b>100.00%</b>
<b>Pre-tax Cost of Debt</b>	<b>0.77%</b>		

Debt	Credit Ratings	Corresponding Interest Rate
S&P Global	AA-	0.85%
Moody's	Aa3	0.85%
Fitch Ratings	A	1.42%
Taiwan Ratings	AA+	0.85%
<b>Average Interest Rate</b>		<b>0.99%</b>

## Appendix K - Discounted Cash Flow (DCF) Valuation

Unlevered Free Cash Flow										
Revenue	\$977,447	\$1,031,474	\$1,069,985	\$1,339,255	\$1,587,415	\$1,818,965	\$2,419,610	\$2,728,088	\$3,077,504	\$3,475,036
Operating Profit (EBIT)	\$385,559	\$383,623	\$372,701	\$566,784	\$649,981	\$664,880	\$929,220	\$1,064,070	\$1,165,116	\$1,284,794
Less: Unlevered Taxes	(\$51,123)	(\$34,437)	(\$35,835)	(\$73,738)	(\$70,155)	(\$73,506)	(\$102,611)	(\$117,461)	(\$128,703)	(\$142,002)
<b>Net Operating Profit After Tax (NOPAT)</b>	<b>\$334,436</b>	<b>\$349,186</b>	<b>\$336,866</b>	<b>\$493,045</b>	<b>\$579,826</b>	<b>\$591,374</b>	<b>\$826,609</b>	<b>\$946,609</b>	<b>\$1,036,413</b>	<b>\$1,142,792</b>
Add: Depreciation	--	--	--	--	--	\$154,395	\$205,893	\$258,150	\$311,205	\$365,123
Add: Amortization	--	--	--	--	--	\$21,004	\$25,911	\$32,028	\$38,092	\$44,356
Less: Capital Expenditure	--	--	--	--	--	(\$708,263)	(\$895,033)	(\$908,228)	(\$922,099)	(\$937,089)
Less: Dividends pay-out (10% from Net income)	--	--	--	--	--	(\$60,774)	(\$84,837)	(\$97,115)	(\$106,410)	(\$117,405)
Add/(Less): Changes in Net Working Capital	--	--	--	--	--	(\$97,014)	\$32,318	\$6,074	\$2,702	\$5,393
<b>Free Cash Flow to Firm</b>	<b>\$334,436</b>	<b>\$349,186</b>	<b>\$336,866</b>	<b>\$493,045</b>	<b>\$579,826</b>	<b>(\$99,277)</b>	<b>\$110,860</b>	<b>\$237,518</b>	<b>\$359,903</b>	<b>\$503,170</b>

	Model	Exit Multiple	Perp. Growth
Terminal Value Toggle	Exit Multiple	26.4x	3.10%
Terminal Value in Model	\$22,183,132	\$22,183,132	\$6,815,414
Discount Rate (WACC)	10.71%		
Valuation Date	4/1/2023		
No. of Shares Outstanding (millions)	4875.63		

DCF Valuation						Terminal Value
	12/31/2022	12/31/2023	12/31/2024	12/31/2025	12/31/2026	12/31/2026
Year	0.25	1.00	1.00	1.00	1.00	
Frac						
<b>Free Cash Flow to Firm</b>	<b>(\$25,095)</b>	<b>\$110,860</b>	<b>\$237,518</b>	<b>\$359,903</b>	<b>\$503,170</b>	<b>\$22,183,132</b>
<b>Rolling Enterprise Value</b>	<b>\$15,630,149</b>	<b>\$17,332,184</b>	<b>\$19,071,335</b>	<b>\$20,851,238</b>	<b>\$22,686,302</b>	<b>\$22,183,132</b>
Plus: Cash and Marketable Securities	\$1,212,078	\$1,423,542	\$1,765,996	\$2,209,429	\$2,795,810	
Less: Debt and Leases	(\$659,977)	(\$658,629)	(\$671,670)	(\$654,148)	(\$626,315)	
Less: Minority Interest	--	--	--	--	--	
<b>Equity Value</b>	<b>\$16,182,249</b>	<b>\$18,097,097</b>	<b>\$20,165,661</b>	<b>\$22,406,518</b>	<b>\$24,855,796</b>	
Number of Shares Outstanding (millions)	4,875.6	4,875.6	4,875.6	4,875.6	4,875.6	
<b>Rolling value per share</b>	<b>\$3,319.01</b>	<b>\$3,711.75</b>	<b>\$4,136.01</b>	<b>\$4,595.62</b>	<b>\$5,097.97</b>	



Appendix L - Relative Valuation

Ticker	Company Name	Share Price	Multiples											
			EV/Revenue			EV/EBITDA			EV/EBIT			P/E		
			LTM	FY+1	FY+2	LTM	FY+1	FY+2	LTM	FY+1	FY+2	LTM	FY+1	FY+2
Target Company														
NYSE: TSM	Taiwan Semiconductor Manufacturing Company Limited	\$94.59	6.0x	5.8x	4.8x	8.7x	8.5x	6.9x	12.0x	13.4x	11.1x	13.9x	16.1x	13.2x
Comparable Companies														
NASDAQGS: AMD	Advanced Micro Devices, Inc.	\$100.2	6.7x	6.7x	5.7x	33.8x	22.3x	17.7x	125.5x	28.0x	20.1x	122.4x	100.9x	47.0x
NASDAQGS: ADI	Analog Devices, Inc.	\$189.4	8.0x	7.9x	7.7x	15.3x	15.1x	15.4x	23.7x	15.8x	15.7x	27.9x	26.7x	25.7x
NASDAQGS: NVDA	NVIDIA Corporation	\$271.9	24.8x	22.4x	18.0x	94.0x	67.8x	51.7x	120.0x	52.9x	39.3x	153.5x	83.1x	58.6x
NASDAQGS: TXN	Texas Instruments Incorporated	\$180.2	8.2x	8.9x	8.3x	14.8x	17.2x	15.7x	16.2x	20.1x	18.3x	18.7x	23.5x	21.5x
NASDAQGS: AVGO	Broadcom Inc.	\$639.2	8.5x	8.3x	7.9x	14.7x	13.1x	12.5x	19.2x	13.5x	12.9x	20.8x	18.5x	17.5x
NASDAQGS: ITC	Intel Corporation	\$29.0	2.1x	2.7x	2.3x	8.8x	13.4x	7.7x	57.7x	60.8x	15.0x	15.0x	N.M.	26.8x
NASDAQGS: QCOM	QUALCOMM Incorporated	\$124.1	3.4x	3.9x	3.4x	9.0x	10.3x	8.7x	10.1x	11.4x	9.3x	11.8x	15.7x	12.4x
NASDAQGS: NXPI	NXP Semiconductors N.V.	\$182.0	4.2x	4.4x	4.1x	11.0x	11.4x	10.4x	14.6x	12.9x	11.7x	17.0x	19.1x	16.9x
Low			2.1x	2.7x	2.3x	8.8x	10.3x	7.7x	10.1x	11.4x	9.3x	11.8x	15.7x	12.4x
25th Percentile			4.0x	4.3x	3.9x	10.5x	12.7x	9.9x	15.8x	13.3x	12.6x	16.5x	18.8x	17.4x
Mean			8.2x	8.1x	7.2x	25.2x	21.3x	17.5x	48.4x	26.9x	17.8x	48.4x	41.1x	28.3x
Median			7.4x	7.3x	6.7x	14.7x	14.2x	14.0x	21.4x	18.0x	15.4x	19.7x	23.5x	23.6x
75th Percentile			8.3x	8.4x	8.0x	26.4x	18.5x	16.2x	73.3x	34.2x	18.8x	51.6x	54.9x	31.9x
90th Percentile			13.4x	6.2x	11.2x	51.8x	35.9x	27.9x	121.7x	55.3x	25.9x	131.7x	90.2x	50.5x
High			24.8x	22.4x	18.0x	94.0x	67.8x	51.7x	125.5x	60.8x	39.3x	153.5x	100.9x	58.6x

## Appendix M - Peer Comparison

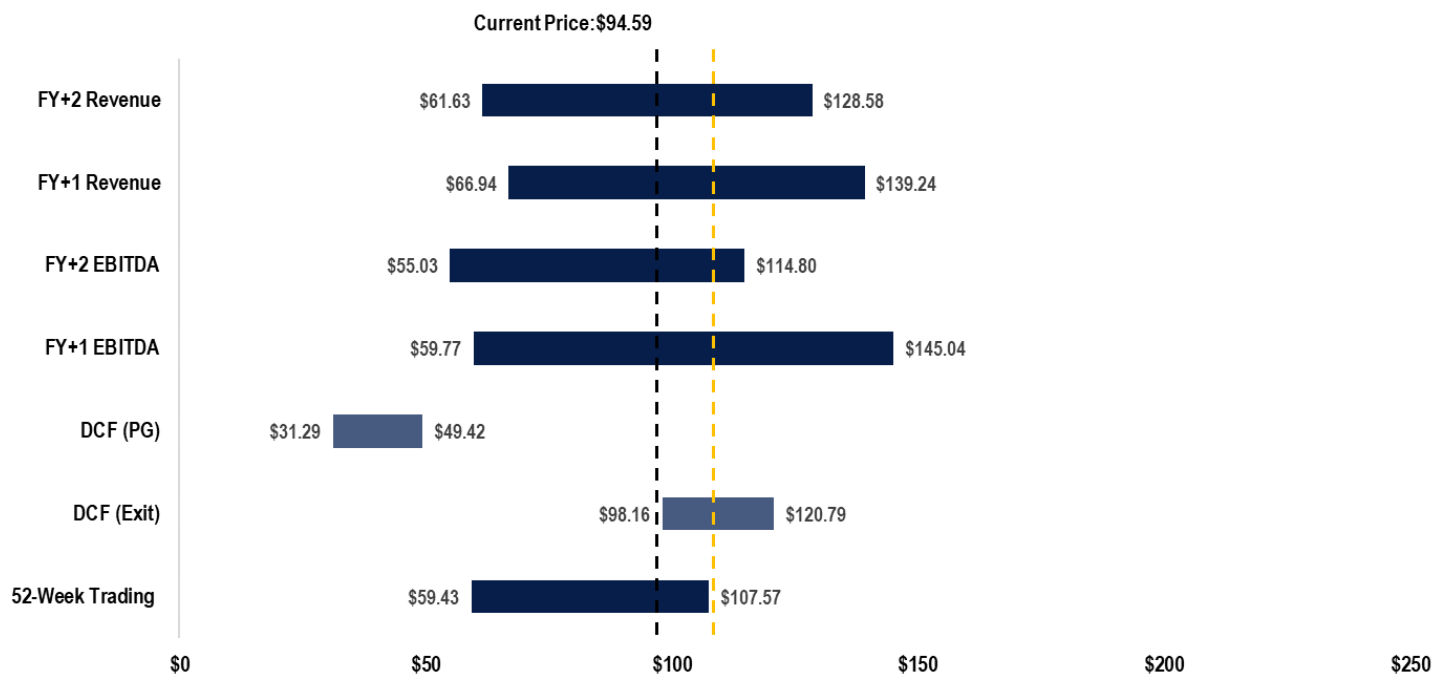
Peer Comparison					
Net Income Margin %	2017	2018	2019	2020	2021
<b>TSMC</b>	<b>35.3%</b>	<b>35.2%</b>	<b>33.1%</b>	<b>38.2%</b>	<b>37.3%</b>
Advanced Micro Devices, Inc.	-0.63%	5.20%	5.07%	25.5%	19.24%
Analog Devices, Inc.	15.35%	24.11%	22.70%	21.79%	18.99%
NVIDIA Corporation	24.11%	31.37%	35.34%	25.61%	25.98%
Texas Instruments Incorporated	24.38%	35.08%	34.66%	38.50%	42.17%
Broadcom Inc.	9.59%	58.89%	12.11%	12.40%	24.54%
Intel Corporation	15.30%	29.72%	29.25%	26.84%	25.14%
QUALCOMM Incorporated	10.98%	-21.95%	18.07%	22.09%	26.94%
NXP Semiconductors N.V.	23.93%	-52.77%	49.41%	60.36%	81.74%
<b>Mean</b>	<b>17.3%</b>	<b>20.2%</b>	<b>19.1%</b>	<b>31.8%</b>	<b>28.3%</b>
<b>Median</b>	<b>17.3%</b>	<b>20.2%</b>	<b>19.1%</b>	<b>31.8%</b>	<b>28.3%</b>
Return on Equity %	2017	2018	2019	2020	2021
<b>TSMC</b>	<b>23.1%</b>	<b>21.9%</b>	<b>21.9%</b>	<b>27.6%</b>	<b>27.3%</b>
Advanced Micro Devices, Inc.	-6.8%	36.2%	16.7%	57.5%	47.4%
Analog Devices, Inc.	7.9%	13.4%	11.6%	10.2%	3.7%
NVIDIA Corporation	28.9%	40.8%	44.3%	22.9%	25.5%
Texas Instruments Incorporated	35.6%	62.0%	56.3%	60.9%	58.3%
Broadcom Inc.	7.7%	47.4%	11.0%	12.4%	27.0%
Intel Corporation	13.9%	28.2%	27.2%	25.8%	20.8%
QUALCOMM Incorporated	7.9%	-615.1%	89.3%	85.5%	90.9%
NXP Semiconductors N.V.	16.8%	21.1%	2.8%	0.9%	28.2%
<b>Mean</b>	<b>15.0%</b>	<b>-38.2%</b>	<b>33.7%</b>	<b>33.7%</b>	<b>36.6%</b>
<b>Median</b>	<b>13.9%</b>	<b>28.2%</b>	<b>24.6%</b>	<b>25.8%</b>	<b>27.3%</b>
Quick Ratio	2017	2018	2019	2020	2021
<b>TSMC</b>	<b>2.0x</b>	<b>2.4x</b>	<b>1.2x</b>	<b>1.5x</b>	<b>1.9x</b>
Advanced Micro Devices, Inc.	1.2x	1.4x	1.5x	2.0x	1.6x
Analog Devices, Inc.	1.1x	1.5x	0.9x	1.4x	1.5x
NVIDIA Corporation	7.4x	6.2x	7.7x	3.5x	6.5x
Texas Instruments Incorporated	3.0x	2.4x	3.2x	3.5x	4.6x
Broadcom Inc.	5.7x	3.4x	1.3x	1.7x	2.4x
Intel Corporation	1.3x	1.3x	1.0x	1.6x	1.7x
QUALCOMM Incorporated	3.3x	1.4x	1.6x	1.9x	1.3x
NXP Semiconductors N.V.	1.8x	1.2x	1.2x	1.6x	1.7x
<b>Mean</b>	<b>3.0x</b>	<b>2.3x</b>	<b>2.2x</b>	<b>2.1x</b>	<b>2.6x</b>
<b>Median</b>	<b>1.2x</b>	<b>1.5x</b>	<b>1.2x</b>	<b>1.5x</b>	<b>1.6x</b>
Book Debt-to-Equity %	2017	2018	2019	2020	2021
<b>TSMC</b>	<b>25.0%</b>	<b>20.5%</b>	<b>28.7%</b>	<b>33.0%</b>	<b>41.7%</b>
Advanced Micro Devices, Inc.	5.0%	2.6%	1.1%	0.5%	0.7%
Analog Devices, Inc.	0.8%	0.6%	0.5%	0.4%	0.2%
NVIDIA Corporation	0.5%	0.3%	0.2%	0.2%	0.4%
Texas Instruments Incorporated	0.4%	0.6%	0.7%	0.7%	0.6%
Broadcom Inc.	0.8%	0.7%	1.3%	1.7%	1.6%
Intel Corporation	0.4%	0.4%	0.4%	0.5%	0.4%
QUALCOMM Incorporated	0.7%	20.3%	3.3%	2.6%	1.6%
NXP Semiconductors N.V.	0.5%	0.7%	0.8%	0.8%	1.6%
<b>Mean</b>	<b>3.8%</b>	<b>5.2%</b>	<b>4.1%</b>	<b>4.5%</b>	<b>5.4%</b>
<b>Median</b>	<b>0.7%</b>	<b>0.7%</b>	<b>0.8%</b>	<b>0.7%</b>	<b>0.7%</b>
Total Asset Turnover	2017	2018	2019	2020	2021

<b>TSMC</b>	<b>0.5x</b>	<b>0.5x</b>	<b>0.5x</b>	<b>0.5x</b>	<b>0.4x</b>
Advanced Micro Devices, Inc.	1.5x	1.4x	1.1x	1.1x	1.3x
Analog Devices, Inc.	0.3x	0.3x	0.3x	0.3x	0.1x
NVIDIA Corporation	0.7x	0.9x	0.9x	0.6x	0.6x
Texas Instruments Incorporated	0.9%	0.9%	0.8%	0.8x	0.7x
Broadcom Inc.	0.3x	0.4x	0.3x	0.3x	0.4x
Intel Corporation	0.5x	0.6x	0.5x	0.5x	0.5x
QUALCOMM Incorporated	0.3x	0.7x	0.7x	0.7x	0.8x
NXP Semiconductors N.V.	0.4x	0.4x	0.4x	0.4x	0.5x
<b>Mean</b>	<b>0.5x</b>	<b>0.6x</b>	<b>0.5x</b>	<b>0.6x</b>	<b>0.6x</b>
<b>Median</b>	<b>0.4x</b>	<b>0.5x</b>	<b>0.5x</b>	<b>0.5x</b>	<b>0.5x</b>

## Appendix N - Brokers Consensus

Broker Consensus		
Date	Brokerage	Price Target
3/10/2023	Needham & Company LLC	\$110
10/20/2022	Cowen	\$75
7/14/2022	Susquehanna Bancshares	\$88
1/13/2022	Atlantic Securities	\$170
1/12/2022	DZ Bank	\$145
6/22/2021	Argus	\$150
1/12/2021	Sanford C. Bernstein	\$149
2/1/2023	The Goldman Sachs Group	\$98
<b>Low</b>		<b>\$75</b>
<b>Median</b>		<b>\$128</b>
<b>High</b>		<b>\$170</b>

## Appendix O - Football Field Analysis



## Appendix P - ESG Comparison Against Peers and Rankings

Companies	Sustainalytics ESG Risk Rating
Advanced Micro Devices, Inc.	20.4
Analog Devices, Inc.	24.4
NVIDIA Corp.	13.6
Texas Instruments Incorporated	21.8
Broadcom, Inc.	22.2
Intel Corporation	18.5
QUALCOMM, Inc.	14.5
NXP Semiconductors N.V.	21.5
<b>Taiwan Semiconductor Manufacturing Co., Ltd.</b>	<b>14.3</b>
<b>Peer's Average</b>	<b>18.63</b>
<b>Peer's Median</b>	<b>20.40</b>



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