

Mu Capital Group



[28/10/2021]

TSM

Taiwan Semiconductor Manufacturing Company

We believe we should invest in TSMC because of its growing global presence, the high demand in chips, its place in the supply chain and its financial success over the past year. In a high revenue growth and dramatic earnings per share

COMPANY OVERVIEW

Taiwan Semiconductor Manufacturing Company (TSMC) is the most valuable semiconductor company in the world. It was founded in 1987 by Morris Chang in Taiwan and, since then, has grown to be the greatest provider of semi-conductor related goods to many leading fabless semiconductor companies. TSMC's established business model surrounds the idea of pure-play foundry, which means instead of providing integrated chip (IC) products of its own design, it operates semiconductor fabrication plants focused on producing ICs for other companies. Essentially, TSMC provides the crucial IC components for a variety of different companies, which include Apple, AMD, Nvidia and many other large technology companies (Intel joining this in 2022). Resultantly TSMC constructed components are in a great variety of manufactured goods, from mobile phones to military related products. In 2020 alone TSMC was responsible for 24% of the world's semiconductor output. Although TSMC has fabrication facilities across Southern and Central Taiwan, its base of operations is in Hsinchu in Northern Taiwan. Alongside its base of Taiwan, TSMC also operates in the US and China, and in total has 12 fabrication sites. As of 2020, TSMC has planned and started production of a large fabrication facility in Arizona, which importantly will bring TSMC's newest 5 nm process to the US.

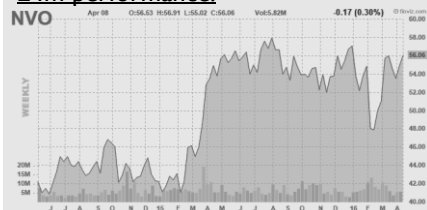
This graph gives a geographical representation of revenue (2019).

Price ([28/10])	[\$115.29]
Market Cap (bn)	[\$598.049]
EV (bn)	[\$546,267]
Beta (5Y monthly)	[1.01]

Semiconductor Manufacturing

Mean Price Target	[\$142.5]
% Upside	[2.63%]

24m performance:



Market Data:

52- Week Range	[83.16-142.2]
Shares Out. (bn)	[0.0]
P/E (ttm)	[29.06]x
PEG (5-yr expected)	[1.7]
EPS (ttm)	[4.16]
EPS growth	[2.97]%
Div./Yield	[\$0.00]/[0.0]%
Payout ratio	[48.5]%

Profitability:

Profit margin	[37.68]%
Op margin	[39.15]%
ROA (ttm)	[18.42]%
ROE (ttm)	[29.71]%

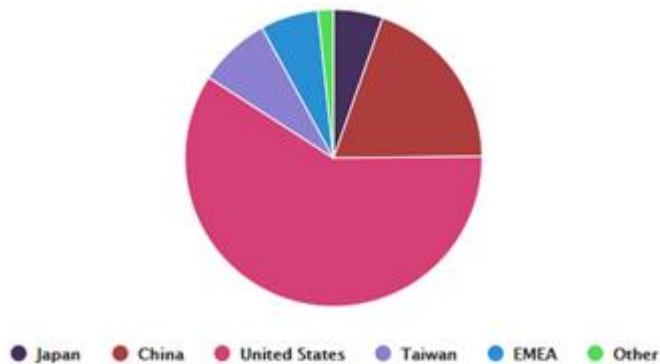
Financial Data:

Revenue (bn)	[414.67]
Revenue growth	[33.32]%
EBITDA (bn)	[31.998]
EBITDA growth	[45.1]%
EBITDA margin	[61.54]%

Leverage:

Net debt (bn)	[39.8]
Total debt/equity	[19.98]x
Current ratio	[1.882]
Cash ratio	[1.92]

Geographic Segment



The US (59.3%) is clearly the greatest consumer of TSMC's products, followed by China (19.4%) and Japan (7.9%).

INVESTMENT RATIONALE

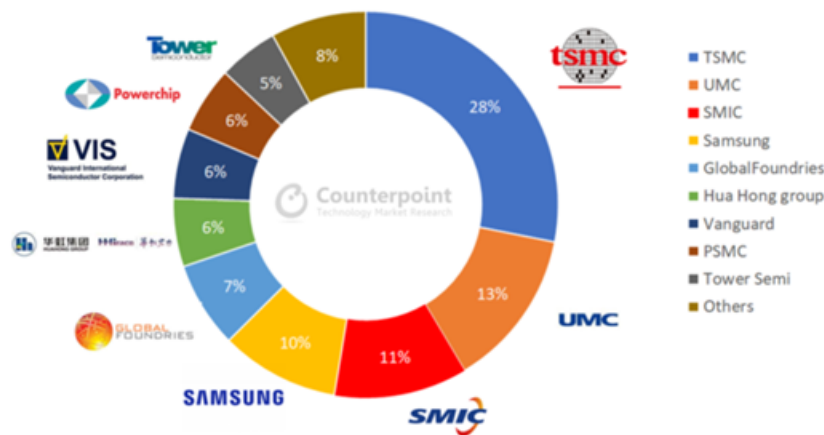
[This section should be 2-3 paragraphs in length and should cover the key facts needed to convince the other analysts and management why this stock should be added to the Mu Capital Group portfolio.]

Firstly, compared to the competitors in the semiconductor manufacturing market which share TSM's business model, TSM has a far greater global outreach. Crucially, it has established operations in the US with its creation of a facility in Arizona. This is of significance, since not only does the US account for the majority of TSM's revenue, but as the geopolitical situation between China and Taiwan escalates, TSM can rely more greatly on the US.

Alongside this, TSMC holds an integral position in the global supply of all electronic goods. As global demand increases for technology, especially as developing economies expand their own economic footprint, the requirement for ICs will skyrocket. TSM's position as market leader in the semiconductor manufacturing market puts it in good stead to capitalise of a rise in global demand.

Based on the financials TSM should be invested in. It has had an extremely high return of equity of 28% and continues to grow. It has stable financial reports and has the ability to cover its debt and remain high liquidity. There are little risks to it financially making it finally be a worthwhile investment.

MARKET POSITION



TSMC's holds a dominant position in the semiconductor manufacturing market, and this is hardly surprising considering that its customers are for industry bigwigs such as Apple, Nvidia, and AMD. Intel is expected to join that party in 2022, once TSMC's 3nm process is fully functional. (Notably, TSMC is unable to keep up with additional demand from the likes of AMD, however, its current plans for expansion of around 28\$ Bn should allow it to supply for greater levels of demand). A good chunk of that amount will go towards furthering its EUV (extreme-ultraviolet lithography) processes. The rest will likely be used to set up additional manufacturing plants to ramp up production.

A method of examining the Semiconductor manufacturing market is to investigate the fabless companies that rely on the assembly of ICs, such as Intel or Apple, who have direct interaction with consumers. This market has witnessed unprecedented demand during the Covid-19 pandemic, and this is because of increasing consumption of consumer electronic devices across the globe. It is predicted that strong levels of growth will remain, with the market being projected to grow from USD 452.25 billion in 2021 to USD 803.15 billion in 2028 at a CAGR of 8.6% during this period (*Fortune Business Insights*). Alongside rising demand for consumer electronics due to growing populations and increasing urbanization, another important driving factor for growth is the increasing demand for ICs in developing economies. Social and economic policy, such as Chinas Belt and Road Initiative, will see developing economies play an increasing role in the Global economy, and ultimately prompt a rise in demand for consumer electronics amongst other goods, which will prompt exponential growth in the semiconductor market. Taiwan has been outlined as an area for particularly high growth due to it being renowned for advanced technology within ICs, and TSMC, therefore, holds a lucrative position in terms of growth prospects.

A restraining factor to consider, however, is the potential of disruption from tariffs established by the US and China. Increasing tension between the US and China, which would likely result in the imposition of trade restrictions, stands as a threat to growth.

MANAGEMENT STRUCTURE

Dr. C.C. Wei – Chief Executive Officer

Prior to his appointment in as CEO in June 2018, Dr Wei fulfilled several other jobs in the company including Co-CEO and Co-Chief Operating Officer. Dr Wei joined the company in 1998, and before that worked as Senior Vice President of Chartered Semiconductor Manufacturing. Chartered Semiconductor is, likewise to TSMC, a large semiconductor foundry which operates Singapore and was acquired by GlobalFoundries in 2009. Dr Wei has a B.S. degree in electrical engineering from National Chiao Tung University and was later awarded a PhD from Yale University. Recently at the TSMC 2021 Online technology Symposium, Dr Wei, discussed the

increased digitization of the global economy, and the role TSMC will play, which will involve their innovative 3DFabric technology that will have five dedicated Fabrication sites by the end of 2022.

Dr. Mark Lui – Chairman

Dr. Mark Lui has been chairman of TSMC since 2018 and before that served as President and Co-CEO from 2013. Dr. Mark Lui has served in several executive positions at TSMC and is responsible for establishing TSMC's first fabrication site producing 12-inch wafers, and later TSMC's GIGAFAB operations. Alongside his work at TSMC, Dr. Liu is also Chairman of the Taiwan Semiconductor Industry Association (TSIA) and, in addition, serves on the Presidential CEO Advisory Board of the Massachusetts Institute of Technology, and on the Engineering Advisory Board of the UC Berkeley College of Engineering. Dr. Mark Lui received a B.S. degree in electrical engineering from National Taiwan University and a PhD in electrical engineering and computer science from University of California, Berkeley.

Rick Cassidy – Senior Vice President, Corporate Strategy Office / CEO and President of TSMC Arizona

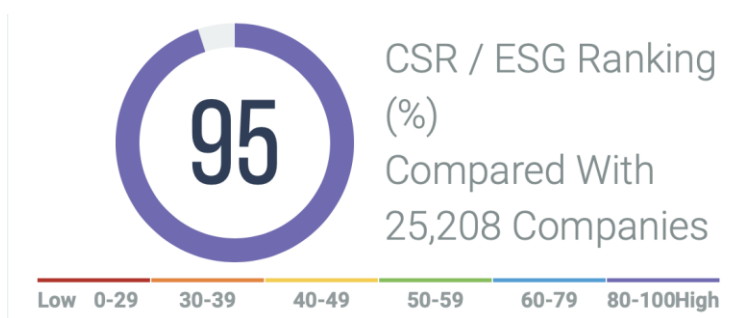
Rick Cassidy joined TSMC in 1997 as Vice President of Account management and since then has been promoted to Senior Vice President for the North America region and is responsible for the Corporate Strategy Office. Before joining TSMC, Cassidy served in the U.S. Army which culminated with his appointment as General Manager of the National's Military and Aerospace Division. Cassidy has greatly contributed to the success of the fables semiconductor business model with his dedication to consumer trust and has since brought record levels of growth to the company. Cassidy has a Bachelor of Science degree in Engineering from the United States Military Academy at West Point. Cassidy also serves on the Global Semiconductor Alliance Board of Directors. Integrity and esg analysis

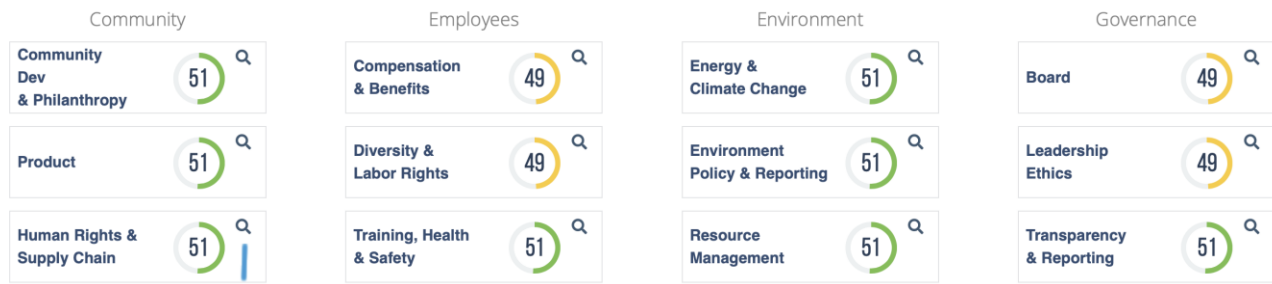
TSMC's core values:

- Integrity – Tell the truth, accomplishments proof of merit. Most important value
- Commitment – welfare of customers
- Innovation – all aspects of business

Social responsibility report 2020. They have a long-term strategic direction for ESG linking with UN SDG. Green manufacturing, Responsible supply chain, Diverse and inclusive supply chain, Caring for disadvantage. Want to his Net Zero by 2050.

ESG model:





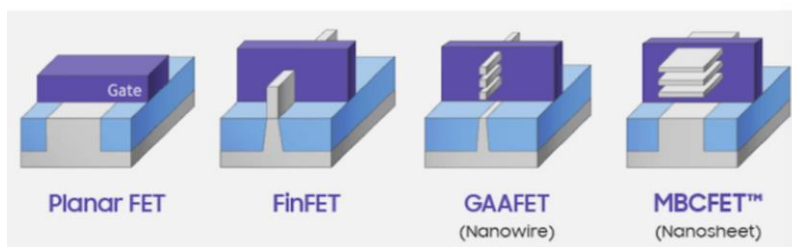
Middle risk in all but the environment means that it is not too dramatic as the overall comparison. It's obviously a manufacturer which makes it more environmental hazards, but in their statements TSMC is dedicated to a diverse and fair employment and is trying to combat its environmental issues. Key risks

China as a geopolitical conflict

Only 12% of chips made in the United States. The rest are all in Taiwan. While there are good relations with the country, the threat of the geographical position of Taiwan is concerning. China politically is in long-term growing economics and the conditions for a peaceful unification. Chinese industry likes the Taiwanese labour, and its military capacity can overwhelm Taiwan's. Seizing TSMC would therefore be a benefit. And if TSMC was captured it would be difficult to stay afloat. However, China is working towards their own technology independence, and it is unlikely for long that they will want to rely on TSMC. Additionally, the US is investing in the Chips Act to make the firms operate in the United States. \$50 B investment doubles domestic chip investments.

Samsung 3 nm chips

Samsung is TSMC's biggest rival when it comes to the chip making industry. Samsung is an industry that is of wider focus. It produces not only chips but computers and phones that use such chips. One important plan by Samsung is their increase in production of 3nm chips to match TSMC in the second half of 2022. It is also planning to create a more advanced Gate-All-Around technique. Which makes is more effective and uses lower power consumptions.



Additionally, the gap of the total capacity between the two nodes is reducing from 3.3%

to 2.3% since 2016. Finally, Samsung is closing the technology gap with its transition to advances logic architectures. However, TSMC is spending a record \$25 billion in 2021 to remain at the top. It continues to dominate in customer share revenues, ins 7mn node capacity and its overall advantage in revenue.

Natural Hazards

TSMC is very variable based on the effects of natural incidents. The power outage in May caused a stopping of semiconductor production that could cause a risk to the stock. The extra natural risk is that the company is on an island. It has its fair share of natural disasters. Droughts are an often occurrence as well as typhons because of its location on the Pacific Ring of Fire. Because the market is so dependent on TSMC's chips, 54% of the world's production, disasters like this could have major economic issues. It would impact productions of any basic electronic, cell phones, electric vehicles, or coffee machines. Therefore, by having a stock in the hands of weather could be a potential risk. Yet, once again, it is important to consider the change to Arizona production. Covering two geographic areas will be of more benefit if a natural disaster were to happen to one of the bases.

OPPORTUNITIES FOR GROWTH

There are many opportunities for growth for TSMC, its demand is forever expanding and will not shorten for some time.

Bringing new factory in Arizona 2024 – US customer base

One of the key risks just mentioned was the variability of a base in Taiwan. However, construction of a US base are underway. This would include their 5-nanometer technology in place, 1600 high-tech professional jobs and indirect jobs in semiconductor ecosystem. The positive implications for such are massive. It first widens the production. Because of Covid there was a supply shortage of chips. Having the main supply chain be overseas meant a huge issue for the US supply chain. By having a US base, this issue would be less common to occur, and it would really benefit TSMC as a stock. It also benefits the New York stocks by making the US a more competitive US semiconductor trader. This transition is extremely beneficial in the long time. It would increase the supply chain and allow the stock to flourish even more.

More automation of cars and Space Missions

TSMC has grown in its impact on both the automation of cars and space missions. In the automated car industry. Since December 2020, Apple had just collaborated once again in a plan to develop a self-driving car. TSMC would provide the development of the self-driving chips, especially within its new US headquarters. Additionally, Tesla is working with TSMC on its HW4.0 self-driving chip.

Additionally, space travel is vital for TSMC. They had a vital impact the mars space trip. They have joined to be a part of Ark Invest's Space Exploration Fund which is an asset-management firm looking to get involved in the exchange traded fund. It is a fund playing a crucial role in space exploration.

FINANCIAL EVALUATION

Market Performance



The market performance of TSM has been on a steady increase throughout the past year. Its peak was in February this year which could be attributed to the Biden administration releasing a chip shortage appeal. The fact that there was such a demand for chips would thus benefit the stock. It is coming in as a stock of \$113.64.

Present and past performance

Financial Summary						
	2016	2017	2018	2019	2020	Sum of Previous 4 Quarters
Revenue	947,909	977,443	1,031,362	1,069,989	1,339,238	0
growth		3.12%	5.52%	3.75%	25.16%	-100.00%
EBITDA	601,731	647,003	678,271	660,057	897,763	0
growth		7.52%	4.83%	-2.69%	36.01%	-100.00%
margin	63.48%	66.19%	65.76%	61.69%	67.04%	#DIV/0!
EBIT	(223,828)	(260,143)	(292,546)	(286,884)	(331,725)	(397,000)
growth		16.22%	12.46%	-1.94%	15.63%	19.68%
margin	-23.61%	-26.61%	-28.37%	-26.81%	-24.77%	#DIV/0!
FCF	220,456	265,165	273,221	173,450	327,978	0
growth		20.28%	3.04%	-36.52%	89.09%	-100.00%
margin	40.19%	44.51%	46.40%	27.51%	39.32%	#DIV/0!
Net Income	334,247	343,111	351,131	345,264	517,885	0
growth		2.65%	2.34%	-1.67%	50.00%	-100.00%
margin	35.26%	35.10%	34.05%	32.27%	38.67%	#DIV/0!
EPS	12.89	13.23	13.54	13.32	19.97	#FIELD!
growth		2.65%	2.34%	-1.67%	50.00%	#FIELD!
IRR	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

CAGR Table			
	1 Year	2 Year	4 Year
Revenue	25%	14%	9%
EBITDA	36%	15%	11%
EBIT	16%	6%	10%
FCF	89%	10%	10%
Net Income	50%	21%	12%
EPS	50%	21%	12%

Fiscal Year	2016	2017	2018	2019	2020	Qs	Current (Ex-Qs)
Profitability Ratios							
Return on Equity	24%	23%	21%	21%	28%	#DIV/0!	
Profit Margin	35%	35%	34%	32%	39%	#DIV/0!	
Internal Rate of Return	#VALUE!	#VALUE!	#VALUE!	#N/A	#VALUE!	#VALUE!	
Asset Turnover	50%	49%	49%	47%	49%	0%	
Profitability	35%	35%	34%	32%	39%	#DIV/0!	
Leverage	136%	131%	125%	140%	149%	155%	
Liquidity Ratios							
Current Ratio	2.57	2.39	2.79	1.39	1.77	1.92	
Cash Ratio	1.99	1.81	2.04	0.99	1.28	1.34	
Debt Ratios							
Debt to Equity	36%	31%	25%	40%	49%	55%	
Interest Coverage Ratio	165.91	178.90	192.99	#N/A	400.84	0.00	
Interest Coverage Ratio Applicable?	YES	YES	YES	#N/A	YES	YES	
Valuation Ratios							
Earnings Per Share	12.89	13.23	13.54	13.32	19.97	#FIELD!	#FIELD!
Price to Earnings	-	-	-	-	-	-	#FIELD!
PEG	-	-	-	-	-	-	#FIELD!
PEG Including Dividends	-	-	-	-	-	-	#FIELD!
FCF Per Share	8.50	10.23	10.54	6.69	12.65	#FIELD!	-
Price to Free Cash Flow	-	-	-	-	8.98	#FIELD!	8.98
Dividend Per Share	6.00	7.00	8.00	#N/A	10.00	#FIELD!	-
Dividend Yield	-	-	-	-	-	-	8.80%

From comparing to 2016, TSM has seen a stable and vastly growing increase especially leading into 2020 with a grow of 25%. Its return on equity is very promising in 2020 of 28%. Over the past 4 years the stock's profit has skyrocketed especially since COVID. Additional growth can be seen in the EBITDA and net income. The overall net income growth in the past years shows a positive sign that the goods sold, and other expenses are becoming less expensive and therefore generating more growth. Its Earnings per share have also dramatically increased in 2020.

When analysing profit, while there were some dips in 2018 and 2019, it is on the surge again, primarily because of shortage and high demand due to Covid. As of 2020 the margin is now at 39% the highest it has been over the four years. The debt-to-equity ratio is reasonable. It can pay off its debts with the US market, in jun 2021 it was .29%,

The company has been around for a while and generated successful income to cover the debts. By having a high interest coverage ratio, TSM will continue to be okay with debt issues.

In terms of liquidity the ratio remains above 1.00, thus demonstrating the ability to cover short-term obligations. Additionally, the cash ratio typically stays high enough, which means it will remain liquidity once again. So it has good short-term financial strength.

Comparable analysis

Although TSMC has a hegemonic position in the Semiconductor manufacturing market, there are still three major competitors. United Microelectronics Corporations (UMC), which is likewise a Taiwanese company, is the next biggest company in the market, with a 13% market share. UMC has 12 manufacturing facilities worldwide and is a significant supplier to the global automotive industry. Following UMC, is Semiconductor Manufacturing International Corporation (SMIC), with a market share of 11%. SMIC is a state-owned, publicly listed Chinese company based in Shanghai. In 2005, TSMC brought a lawsuit against SMIC citing misappropriation of intellectual property, and this ended with settlement in 2009, with TSMC receiving a 10% share of SMIC. (US sanctions were placed on SMIC in 2020 during the US-China trade war). The fourth major company in the market, Samsung, will not be included in this comparison since, unlike its market counterparts, it is not solely a semiconductor foundry, and operates far more widely in the global electronics industry.

SHAREHOLDER STRUCTURE

The Shareholder structure is quite surprising there is a lot of shares open still to the public. It could grow in shareholders once it launches to the US. Therefore, it has little share holder influence and can act how it wants. It means the stock is a little more volatile but there is reason to believe it will continue to be a good investment.

Stockholder	Stake	Shares owned	Total value (\$)	Shares bought / sold	Total change
Sanders Capital LLC	0.78%	40,434,002	4,514,456,323	+1,391,488	+3.56%
Capital Research & Management Co....	0.69%	35,567,322	3,971,091,501	-708,068	-1.95%
Capital Research & Management Co....	0.67%	34,607,357	3,863,911,409	+1,421,474	+4.28%
Massachusetts Financial Services ...	0.64%	33,364,658	3,725,164,066	-218,353	-0.65%
Walter Scott & Partners Ltd.	0.51%	26,540,996	2,963,302,203	-747,835	-2.74%
Fisher Asset Management LLC	0.50%	25,981,273	2,900,809,130	-658,898	-2.47%

0.01% % of Shares Held by All Insider

17.18% % of Shares Held by Institutions

17.18% % of Float Held by Institutions

1,893 Number of Institutions Holding Shares

