



Taiwan Semiconductor Manufacturing Co Ltd.

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Valuation Date: May 4, 2021

Recommendation: BUY

Stock Exchange: NYSE

Current Price: \$115.36

Target Price: \$120.93

Upside: 4.82% **Ticker:** TSM

Industry: Semiconductors & Semiconductor Equipment **Sector:** Information Technology

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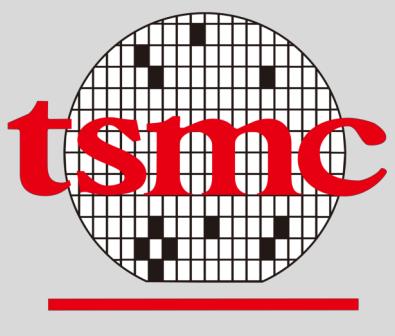
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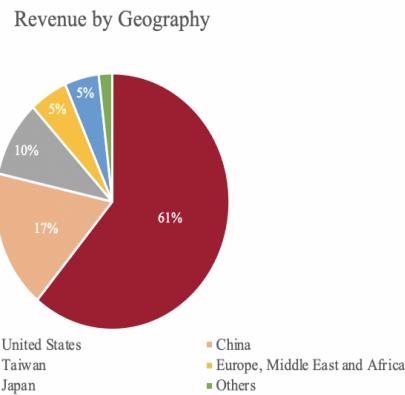
BUSINESS DESCRIPTION

Taiwan Semiconductor Manufacturing Co. is the world's largest dedicated semiconductor foundry and is mainly engaged in the manufacturing, sale, packaging, and test of integrated-circuit and other semiconductor products. TSM is headquartered in Hsinchu Science Park, Taiwan which is dubbed the "Silicon Valley" of Taiwan for its concentration of science and technological advancements.

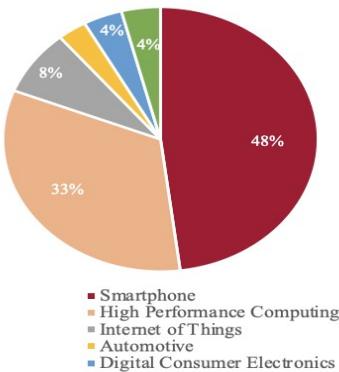
As a foundry, TSM manufactures semiconductors on silicon wafers using a specific manufacturing process based on either their own design or third-party's' proprietary integrated-circuit designs. In general, a wafer fabrication is a collection of individual microchips made of transistors that needs to be further cut and can be processed with a variety of technologies. The company offers an extensive variety of wafer fabrication processes, including complementary metal oxide silicon (CMOS) logic, mixed-signal, radio frequency, embedded memory, or bipolar complementary metal oxide silicon (BiCMOS). TSM also offers design, mask making, TSMC 3DFabric™ advanced 3D chip stacking and packaging, and testing services.

To derive its revenue, the company primarily takes order from fabless companies and then manufactures wafer fabrications. In terms of customers, about 83% of revenue comes from fabless semiconductor and system companies and while 17% comes from integrated device manufacturers. TSM does not sell direct-to-consumer product offerings but its products and technologies are applied to end goods such as PC's, data centers, industrial equipment, information applications, wireless communication services and consumer electronics, such as TV's or digital cameras. Consequently, in 2020, TSM's customers include many of the world's top semiconductor companies such as, but not limited to: Advanced Micro Devices (AMD), Broadcom Limited, Huawei Technologies, Intel Corporation, Marvell Technology Group, NVIDIA Corporation, Qualcomm Inc., Sony Corporation, and Texas Instruments Inc. Moreover, TSM's customers include the world's largest fabless companies who prefer to only develop designs and own intellectual property as opposed to manufacturing microchips. For instance, ranked by revenue, Qualcomm, Broadcom, Nvidia, MediaTek and AMD are the five largest fabless companies and are all significant customers of TSM. This is significant for TSM, because the fabless companies rely on their contracts with TSM for the development of their products and stimulate an increase in silicon wafer demand as their own product lines grow. (1)

In terms of geography, TSM derives most of its revenues from the United States and China. In 2020, 61% of TSM's revenue came from the United States, 17.5% came from China, 9.6% came from Taiwan, 5.2% came from EMEA (which consists of Europe, Middle East and Africa), and 4.7% came from Japan. However, recently, with the United States' strong push to disentangle supply chains with China, TSM may see even more of its revenue coming from the United States and away from China. Most



Revenue by Platform



notably, in 2020, TSM announced it would cease producing chips for Huawei and instead filled their capacity with a contract from Apple as Apple announced it would stop relying on Intel-designed chips and instead design its own chipset to be manufactured by TSM. (2)

TSM also distinguishes its revenue by platforms as different types of semiconfintel desiductors with distinct specific functions are used in different products. Moreover, the growth patterns arising from the individual platforms affect the overall demand for semiconductors. In 2020, TSM derived most of its revenues from Smartphones, High Performance computing and Internet of Things (IOT) applications at 48%, 33%, and 8% of revenue, respectively. Additionally, in the face of a global semiconductor shortage in the automotive industry, there are growing demands of semiconductors for automotives as cars will require more computation and the global market for automotive semiconductors is forecasted to grow annually at a 17.94% CAGR from 2021 to 2026. (3)

In terms of wafer resolution, TSM newest technological processes must be adopted in commercial production before it starts generating the most profit. For instance, although TSM unveiled their 7 nanometer (nm) technology in 2017, it is still rapidly growing in revenue as more companies switch to this technology despite the newer 5 nm technology unveiled in 2019. In the future, older wafer resolutions will contribute less to revenue however certain wafer resolutions are more popular than other and may still have prominence such as TSM's 16 nm and 28 nm processes.

IDMs

- Integrated device manufacturers design, manufacture, and sell integrated circuit (IC) products
- Ex) Samsung, Intel, Toshiba

Fabless Companies

- Designs and sells the hardware and semiconductor chips but does not manufacture the wafers, or chips, it uses in its products
- Outsource fabrication to a manufacturing plant or foundry.
- Ex) Qualcomm, Nvidia, and AMD

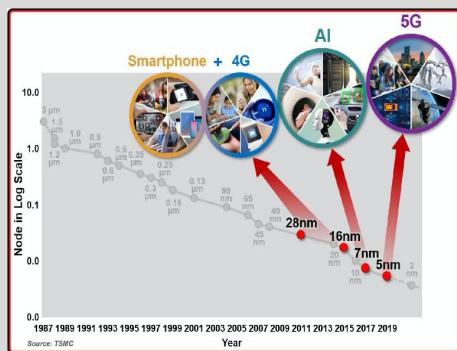
Pure-Play Foundries

- Foundries only manufacture devices under contract for other companies, without designing them.
- Ex) TSMC, Globalfoundries, and UMC

INDUSTRY OVERVIEW & COMPETETIVE POSITIONING

In the semiconductor industry there are three main businesses: Integrated-Device Manufacturers (IDMs), Fabless companies, and Pure-Play foundries. IDMs design, manufacture and sell integrated circuit (IC) products which generally have the greatest profit margin in the value-added chain. On the other hand, fabless companies design and sell hardware and semiconductor chips but do not manufacture the silicon wafers used in its products and instead outsource the fabrication to a manufacturing plant or foundry. Lastly, pureplay foundries are only involved in manufacturing wafers and are under contract for other companies. Taiwan Semiconductor, GlobalFoundries, and UMC are considered pureplay foundries whereas Samsung, Intel, and Toshiba are considered IDM's and Qualcomm, Nvidia, and AMD are considered fabless companies.

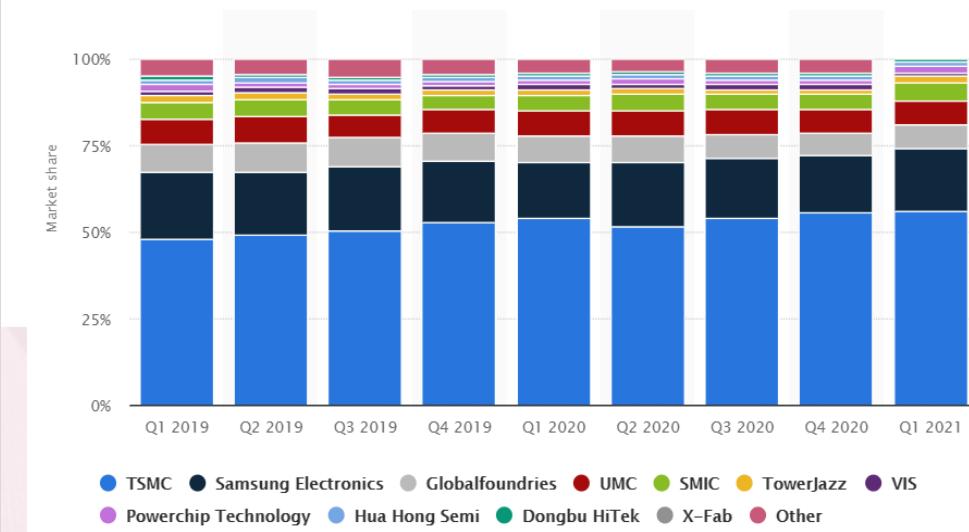
Additionally, the semiconductor industry is capital intensive and requires more investment in assets between each generation of process technologies. Consequently, the industry follows Moore's Law in which the number of transistors per microchip doubles every two years, while the cost of computers for consumers is halved. As we approach the physical limitations on silicon computing, the industry would see record spending on



research and development of new technologies and facilities as newer wafer resolutions are increasingly asset intensive. As such, the fabless business model has become much more popular in the semiconductor industry because it allows manufacturers to invest in the development of new device technologies and maintain high production volumes without the increasing capital costs associated with manufacturing silicon wafers. (4)

Furthermore, rapidly increasing development, equipment and facility costs has also led to a long-term trend of consolidation within the semiconductor industry and this trend shows no sign of halting.

Among semiconductor foundries, TSM holds 56% revenue market share which illustrates its dominance among the leading semiconductor makers. Following TSM, the next largest semiconductors foundries are Samsung Electronics, GlobalFoundries, UMC, and SMIC, holding 18%, 7%, 7% and 5% of revenue market share. (5)



Lastly, there are two salient components that determine a foundry's manufacturing capabilities: output capacity and fabrication process technologies. Since establishment, TSM has possessed the largest capacity among the world's dedicated foundries and has consistently been a technology leader as it constantly develops more powerful process technologies and beats the time to market of its competitors. To maintain its advantage in capacity and edge in technological processes, the company heavily invests in expanding manufacturing capacity and upgrading manufacturing technologies with recent years seeing large increases in capital expenditures from \$10.2 billion in 2018 to \$15.7 billion in 2019 to \$18.4 billion as it prepares for the new generation of 3 nanometer technology. Overall, TSM's large capacity, specifically for advanced technology is a major competitive advantage and allows the company to fulfill extensive orders which are required by customers who rely on mass manufacturing to distribute their innovative products.

INVESTMENT SUMMARY

With the trend of consolidation in the semiconductor industry, TSM sticks out as a winner due to its market dominance which it can capitalize on for inevitable M&A deals. TSM will also continue to gain market share from fabless companies as IDMs continue to gradually increase outsourcing. Given its position in the industry, the global reliance on semiconductors, and the trend towards consolidation, TSM could form a degree of monopoly in the market. Moreover, because the chip designers don't have production abilities, they are heavily reliant on foundries to manufacture their chips. There are no limits on how many chips a fabless company can design, but there are stark limits on how many chips a foundry can produce, ultimately creating a scenario where demand massively overwhelms the supply in the microchip market. This scenario actually manifested in 2020 and we are currently still undergoing a semiconductor shortage that is estimated to last until 2022 at the least and provide TSM with a significant tailwind. TSM's new 5 nm chips, now commercially available in Apple's A14 Bionic and M1 chips, have just started to give the world a sample of the amazing capabilities of TSM's 5 nm process and Apple is already working with TSM on the design of a 3 nm chip which would provide unmatched performance and significantly drive revenue growth for the next few years. TSM is also planning on building a \$12 billion mega-facility in Arizona by 2024 which will be capable of building 5 nm chips and will be able to domestically supply customers in the United States, such as Apple, while building closer manufacturing relationships. TSM guided that it would spend \$100 billion over the next 3 years in expanding its capacity and advancing its technology as it is planning to build five additional fabs in Arizona. The Biden administration is also reportedly supporting domestic chip manufacturing with tens of billions of dollars in incentives. (6)

I also believe TSM will continue to be a technologic leader for the foreseeable future. Samsung claimed they would start mass production of 5 nm chips in mid-2020 but ended up with very low yields and lower density logic process which significantly underperforms TSM's 5 nm chip. Meanwhile, Intel is still struggling with its 7 nm chip development, allowing TSM to gain market share and additional revenues that Apple would have paid Intel for its chips. market share and additional revenues that Apple would have paid Intel for its chips.

Regarding external growth factors, I believe the advancement in device connectivity brought by 5G networks will drive exponential growth of data. I expect the development of 5G-related and HPC applications will drive strong demands for TSM's semi-conductor chips in the next several years. TSM will also benefit from the ongoing automotive semiconductor

Appendix E:

shortage in the short run and will see long term growth from the rapidly growing market of electric vehicles fueling the demand for processors, sensors, and power management integrated circuits.

Referring to Appendix E, TSM has outperformed both the SNP500 and the PHLX semiconductor industry over the past two years is well positioned to continue doing so. Although past performance does not signify strength in itself, the world's reliance on TSM's semiconductors, paired with the attractive growth trends of semiconductors in connected devices will reflect in TSM's strong performance in the future.

FINANCIAL ANALYSIS

Compared to other pure play foundries in the industry, TSM has the strongest margins, capturing 38.9% of revenue as net income.

	TSM	UMC	SMIC	TSEM
Gross Profit Margin	53.2%	22.1%	23.6%	18.4%
EBITDA Margin	68.4%	39.7%	54%	25.6%
Net Income Margin	38.9%	15.4%	18.3%	6.6%
PE Ratio	31.190	23.28	29.34	37.33
ROE	29.9%	13.2%	4.2%	5.9%

In addition, TSM's margin supports a strong cash flow and the bottom line has grown faster in the past 2 years due to the improving margin profile, as illustrated in Appendix A. However, TSM also is very asset heavy and carries considerable amounts of long term debt obligations. TSM's debt profile is illustrated by its long term debt to equity of 14.3 with a total debt to equity of 21.3.

TSM has increased its revenue each year for the past decade and has also consistently raised their dividends since 2014 excluding the drop in dividend payout in 2020 from Covid19 slowdowns. The company currently offers a dividend yield of 1.8%. However, historically, TSM has had an average dividend yield closer to 3%. The significant run up in TSM's stock price over the past year caused its dividend yield to fall, despite the company increasing their dividend payout.

TSM also has strong profitability, returning 27% on invested capital, 20.6% on assets and 29% on equity compared to a weighted-average cost of capital (WACC) of 5.83% and a cost of equity of 6.9%. The company is able to generate significant value on its equity and invested capital which contributes to its solid cash flows.

Appendix F:

WACC	
Beta	0.90
R _m	7.50%
R _f	1.50%
Tax Rate	11.39%
CoE	6.90%
CoD	0.56%
E Amt	65,848.0
D Amt	13,158.0
%E	83.35%
%D	16.65%
Equity	5.75%
Debt	0.08%
WACC =	5.83%

VALUATION

A BUY recommendation is being initiated with a target price of \$120.93 which was derived by weighing five valuation models: DCF, DDM, Peer Multiples, RIM and MVA. The target price yields a 4.82% upside over the current price of \$115.36, reflecting bullish estimates of double-digit revenue growth arising from the commercial production of TSM's 5nm and 3nm processes in the upcoming years.

It is important to note that TSM has an ADR ratio of 1:5, meaning an issued ADR represents 5 shares of TSM. The public float of TSM stock is 25.93 billion, however the float in ADR is 5.19 billion. I used the ADR float to represent the number of shares in the company when determining the equity value per share. The risk-free rate of 1.5% is based on the 10 year US Government Treasury yield and the market returns of 7.5% is based on the historical returns of the US markets.

An intrinsic value of \$134.36 was derived using the DCF model, reflecting the strong estimated growth in its cash flow which is benefitted by the company's improving margin profile. On the lower end of the valuations, the DDM returned an intrinsic value of \$69.29 and the RIM returned an intrinsic value of \$74.03. While the company has historically raised dividends, it's more focused on maintaining its market position to invest heavily in innovation and capacity to generate more cash flow. As such, I weighted these models slightly lower at 10% each and weighed the DCF and MVA models slightly higher at 30% and 25% respectively as they better reflected TSM's focus on growing its cash flows and capital. For the peers multiple models, the intrinsic value derived was \$81.03. TSM is, by far, the leading pure foundry so I chose a peer group that consists of companies from each part of the semiconductor industry instead. My peer group was a mixture of IDM, fabless companies, and pure play foundries and included: Intel, United Micro Electronics, Texas Instruments, Broadcom and Qualcomm. Out of the peer multiples, TSM is given the most intrinsic value by the Price to Book and Price to Earnings ratios at \$112.52 and \$112.58, respectively. Lastly, the MVA model derives the highest intrinsic value at \$170.37. TSM is estimated to significantly add market value over the next few years supported by its high profitability including its high return on capital compared to its weighted cost of capital.

All in all, my weighted valuation arrived at an intrinsic value of \$120.93 as seen in the football analysis of target price in Appendix F, alongside the weighting of each valuation model.

INVESTMENT RISKS

The most pressing risk I see for TSM is if they are unable to continue developing leading-edge technologies at a pace consistent with the Moore's Law or if its technologies are delayed and other foundries take market share in its absence. Such was the case with Intel, as their 7nm technology was delayed significantly.

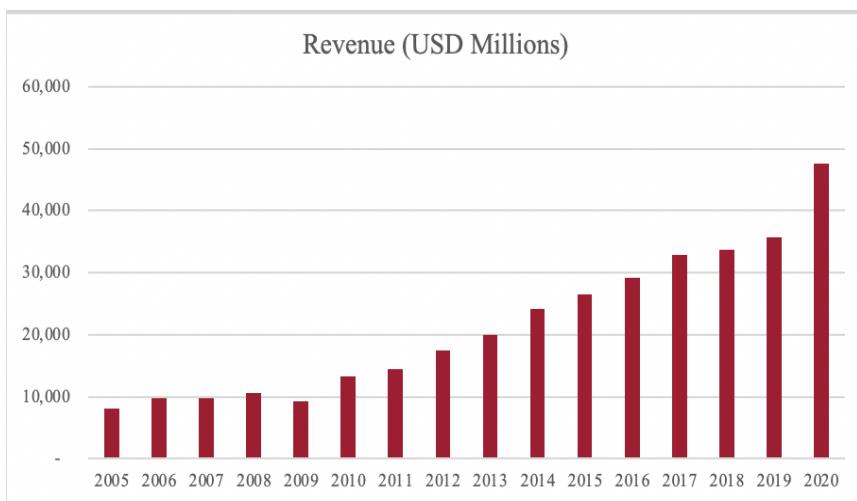
Based in Taiwan which uses a floating currency called the New Taiwan (NT) dollar, TSM also faces foreign currency risks. Effectively all of TSM's revenue is denominated in U.S. dollars and over half of all capital expenditures are denominated in currencies other than the NT dollar. As a result, disadvantageous fluctuations in the exchange rate, such as a weakening of the U.S. dollar compared to the NT dollar would have an adverse impact on operating profits. (7)

TSM is also dependent on the highly cyclical semiconductor and electronics markets which could experience rapid downturns or even sudden overcapacity which may result in volatility in earnings. TSM is heavily reliant on its fixed assets for manufacturing, and so if the company cannot effectively reduce costs to offset potential declines in demand, the fluctuations in order levels would prove to be adverse. (7) TSM's plant utilization rate should remain high from the backlog of semiconductor orders for at least the next year, but delays in innovation of process technologies or problems with commercial production could lead to unexpected underutilization which would erode TSM's revenue.

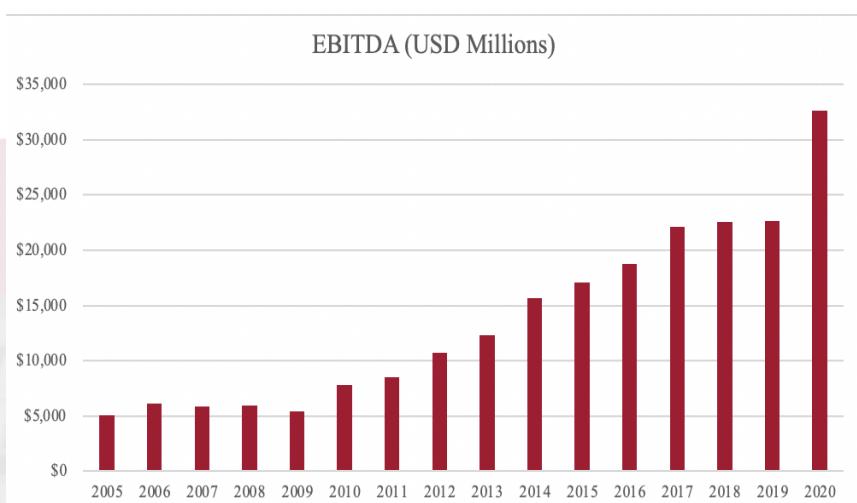
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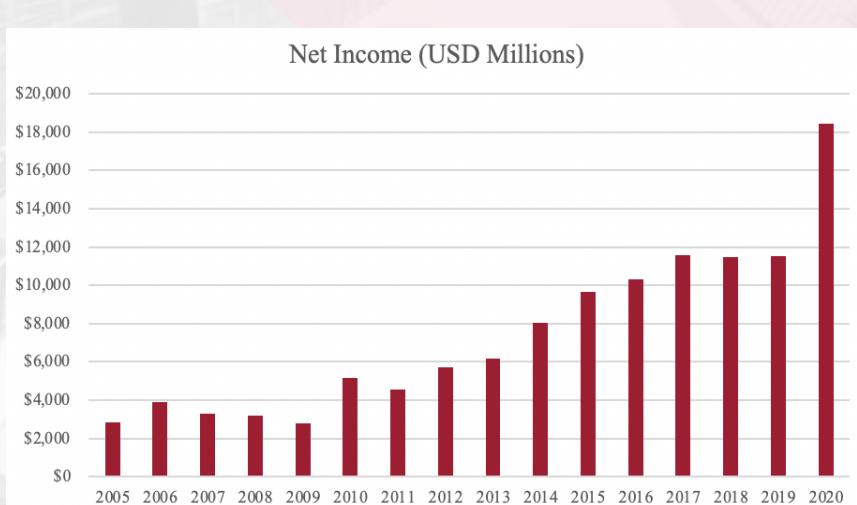
Appendix A: Top Line & Bottom Line Growth



Year	Revenue (Millions)	YoY Growth
2020	47,677	33.29%
2019	35,770	6.05%
2018	33,729	2.46%
2017	32,920	12.72%
2016	29,206	9.92%
2015	26,571	10.07%
2014	24,140	20.62%
2013	20,014	14.85%
2012	17,426	19.82%
2011	14,543	9.17%
2010	13,322	43.93%
2009	9,256	-12.75%
2008	10,608	8.02%
2007	9,820	0.83%
2006	9,739	19.84%
2005	8,127	



Year	EBITDA Margin
2020	68.4%
2019	63.2%
2018	67.0%
2017	67.0%
2016	64.2%
2015	64.3%
2014	65.0%
2013	61.3%
2012	61.7%
2011	58.4%
2010	58.9%
2009	58.4%
2008	55.8%
2007	59.4%
2006	63.3%
2005	62.6%



Year	NI Margin
2020	38.7%
2019	32.3%
2018	34.0%
2017	35.1%
2016	35.3%
2015	36.3%
2014	33.3%
2013	30.8%
2012	32.8%
2011	31.4%
2010	38.7%
2009	30.3%
2008	30.0%
2007	33.8%
2006	40.1%
2005	35.1%

Appendix B: Historical Financial Statements

	Historical				
	2016 FY	2017 FY	2018 FY	2019 FY	2020 FY
<i>Income Statement</i>					
Revenue & Gross Profit:					
Total Revenue	29,206	32,920	33,729	35,770	47,677
<i>YoY Revenue Growth %</i>		12.72%	2.46%	6.05%	33.29%
Operating Expenses:					
Cost of Revenue, Total	14,576	16,255	17,445	19,299	22,361
Sell/Gen/Admin Expenses, Total	792	915	858	939	1,266
Other, Net	2,198	2,765	2,882	3,072	3,873
Total Operating Expense	17,566	19,935	21,185	23,310	27,500
Total Operating Income	11,640	12,985	12,545	12,459	20,177
<i>Gross Margin</i>		50.09%	50.62%	48.28%	46.05%
Non-Operating Income & Expenses:					
Other Non-Operation Income (Expense)	4	13	(4)	22	39
Other, Net	1	9	25	(6)	(26)
Income Before Tax	11,891	13,342	12,999	13,033	20,818
Provision for Income Taxes	1,590	1,785	1,515	1,488	2,372
Net Income After Taxes	10,301	11,557	11,484	11,545	18,446
<i>Net Income Margin</i>		35.27%	35.11%	34.05%	32.28%
<i>Tax Rate %</i>		13.37%	13.38%	11.65%	11.42%
EBITDA	18,787	22,103	22,566	22,624	32,628
<i>EBITDA Margin</i>		64.33%	67.14%	66.90%	63.25%
Total Extraordinary Items	-				
Income Available to Common Excl. Extra. Items	10,298	11,556	11,482	11,542	18,437
Income Available to Common Incl. Extra. Items	10,298	11,556	11,482	11,542	18,437

	Historical				
	2016 FY	2017 FY	2018 FY	2019 FY	2020 FY
<i>Cash Flow Statement</i>					
<u>Cash From Operating Activities:</u>					
Net Income	11,891	13,342	12,999	13,033	20,818
Depreciation/Depletion	6,781	8,615	9,422	9,408	11,554
Amortization	115	146	145	183	256
Deferred Taxes	-	-	-	-	-
Discontinued Operations	-	-	-	-	-
Unusual Items	10	36	91	36	(58)
Other Non-Cash Items	(178)	(518)	(287)	(621)	(318)
Non-Cash Items	(276)	(583)	(296)	(681)	(503)
Cash Taxes Paid, Supplemental	1,416	2,143	1,484	1,740	1,829
Cash Interest Paid, Supplemental	102	117	106	120	63
Accounts Receivable	(1,535)	28	(411)	(615)	(277)
Inventories	566	(850)	(960)	677	(1,936)
Other Assets	(204)	131	(147)	139	(104)
Accounts Payable	229	100	139	198	38
Changes in Working Capital	(1,880)	(1,807)	(3,500)	(1,378)	(2,837)
Total Cash from Operations	16,632	19,714	18,768	20,564	29,287
<u>Cash From Investing Activities:</u>					
Capital Expenditures	(10,238)	(11,285)	(10,552)	(15,704)	(18,397)
Acquisition of Business	-	-	-	-	-
Sale of Business	-	-	-	-	-
Sale/Maturity of Investment	1,253	2,948	2,915	8,264	9,514
Purchase of Investments	(3,618)	(3,497)	(3,238)	(8,625)	(9,503)
Intangible, Net	-	-	-	-	-
Other Investing Cash Flow	416	500	583	732	370
Other Investment Cash Flow Items, Total	(1,946)	(37)	275	366	392
Total Cash from Investing	(12,183)	(11,322)	(10,277)	(15,338)	(18,006)
<u>Cash From Financing Activities:</u>					
Financing Cash Flow Items	71	(217)	(117)	(144)	(59)
Repurchase/Retirement Common	-	-	-	-	-
Common Stock, Net	-	-	-	-	-
Issuance (Retirement) of Stock, Net	-	-	-	-	-
Long Term Debt Issued	-	-	-	-	8,485
Long Term Debt Reduction	(723)	(1,284)	(1,897)	(1,265)	(1,225)
Long Term Debt, Net	(723)	(1,284)	(1,897)	(1,265)	7,260
Issue (Retirement) of Debt, Net	(139)	(934)	(1,115)	(201)	6,135
Total Cash from Financing	(4,862)	(7,265)	(8,016)	(9,014)	(3,155)
<u>Increase / (Decrease) in Cash:</u>					
Net Change in Cash	(660)	409	799	(4,092)	7,290
Net Cash - Begin Balance/Reserved for Future Use	17,336	18,229	18,096	19,316	16,212
Net Cash - End Balance/Reserved for Future Use	16,676	18,638	18,895	15,224	23,502
Depreciation, Supplemental	6,781	8,615	9,422	9,408	11,554
Cash Interest Paid, Supplemental	102	117	106	120	63
Cash Taxes Paid, Supplemental	1,416	2,143	1,484	1,740	1,829

Balance Sheet	Historical				
	2016 FY	2017 FY	2018 FY	2019 FY	2020 FY
Assets:					
Cash & Equivalents	134	50	65	89	235
Cash and Short Term Investments	19,597	22,094	23,337	19,863	28,476
Total Receivables, Net	3,988	4,125	4,227	4,674	5,201
Total Inventory	1,500	2,488	3,376	2,774	4,890
Prepaid Expenses	-	-	-	-	-
Discontinued Operations	-	-	-	-	-
Other Current Assets	109	164	180	189	315
Total Current Assets	25,194	28,871	31,120	27,500	38,882
Accumulated Depreciation	(54,702)	(67,969)	(75,234)	(85,573)	(102,245)
Property/Plant/Equipment - Net	30,742	35,786	35,056	45,786	56,366
Goodwill, Net	185	190	190	190	194
Intangibles, Gross	1,145	1,393	1,577	1,912	2,481
Accumulated Intangible Amortization	(880)	(1,105)	(1,211)	(1,411)	(1,757)
Note Receivables - Long Term	-	-	-	-	-
Deferred Income Tax - Long Term Asset	255	408	550	599	924
Other Long Term Assets	81,377	98,383	107,419	114,209	142,318
Total Assets	58,122	67,086	68,347	75,712	98,281
Liabilities:					
Accounts Payable	842	1,013	1,123	1,344	1,463
Accrued Expenses	1,884	3,192	2,900	2,864	4,548
Notes Payable/Short Term Debt	1,786	2,148	2,902	3,962	3,153
Current Portion of Long-Term Debt/Capital Liabilities	1,174	1,967	1,141	1,139	158
Other Current Liabilities, Total	4,119	3,761	3,070	10,439	12,649
Total Current Liabilities	9,805	12,081	11,136	19,748	21,971
Total Long Term Debt	4,717	3,092	1,861	1,342	9,848
Total Debt	7,677	7,206	5,904	6,443	13,158
Other Long Term Liabilities	504	318	173	77	95
Minority Interest	25	24	22	23	34
Other Liabilities, Total	767	616	489	384	519
Total Liabilities	15,319	15,823	13,515	21,509	32,434
Shareholder Equity:					
Preferred Stock - Non Redeemable, Net	-	-	-	-	-
Common Stock	7,989	8,733	8,479	8,669	9,231
Retained Earnings (Accumulated Deficit)	33,029	41,540	45,016	44,573	56,557
Treasury Stock - Common	-	-	-	-	-
Other Equity	-	-	-	-	-
Min. Pension Liability Adjustment	-	-	-	-	-
Other Equity, Total	51	(899)	(393)	(898)	(2,029)
Total Equity	42,803	51,263	54,832	54,204	65,848
Total Liabilities & Shareholders' Equity	58,122	67,086	68,347	75,712	98,281
Shares Outstanding-Common Primary Issue	-	-	-	-	-
Total Common Shares Outstanding	5,186	5,186	5,186	5,186	5,186

Appendix C: Historical & Forecasted Data

Actual Data					
Year	1	2	3	4	5
Sales	29,206	32,920	33,729	35,770	47,677
NOPAT	10,050	11,200	11,030	10,971	17,805
Capital	50,480	58,469	60,736	60,647	79,006
FCF	6,394.00	8,429.00	8,216.00	4,860.00	10,890.00
EPS	\$ 2.24	\$ 2.50	\$ 2.42	\$ 2.40	\$ 3.89
DVD	\$ 1.08	\$ 1.35	\$ 1.31	\$ 1.59	\$ 1.78
BVPS	\$ 8.25	\$ 9.88	\$ 10.57	\$ 10.45	\$ 12.70

Forecast Data					
Year	1	2	3	4	5
Sales	56,501	64,839	71,974	77,194	79,895
NOPAT	19,209	22,044	24,470	26,244	27,163
Capital	96,994	111,307	123,556	132,516	137,154
FCF	11,855	13,605	15,102	16,197	16,764
EPS	\$ 4.22	\$ 4.84	\$ 5.38	\$ 5.77	\$ 5.97
DVD	\$ 9.66	\$ 11.08	\$ 12.30	\$ 13.19	\$ 13.66

Forecast Data					
Year	1	2	3	4	5
g	18.51%	14.76%	11.00%	7.25%	3.50%

Appendix D: Historical Price Data

Historical Year					
Date	12/31/17	12/31/18	12/31/19	12/31/20	5/4/21
Closing Price	\$ 39.65	\$ 36.91	\$ 58.10	\$ 109.04	\$ 115.36

Appendix E: TSM Price Performance

TSM vs. PHLX Semiconductor ETF

1-YR Return Against Benchmarks



TSM vs. PHLX Semiconductor ETF

2-YR Return Against Benchmarks



Appendix F: Valuation Models

FCF	0	1	2	3	4	5
Year	0	1	2	3	4	5
g		18.51%	14.76%	11.00%	7.25%	3.50%
FCF	\$ 10,890.00	\$ 11,855.16	\$ 13,604.56	\$ 15,101.64	\$ 16,196.83	\$ 16,763.72
WACC		5.83%				
Horizon Value (Vop 4)						\$ 718,290.42
PV		\$11,201.68	\$12,146.06	\$12,739.44	\$585,445.01	
			\$12,854.64	\$13,482.64	\$619,598.91	
Vop			\$ 621,532.19	\$ 645,936.20		
+ Short-Term Investments			\$ 28,476.00	\$ 28,476.00		
+ Non-Operating Assets			\$ 35,519.00	\$ 35,519.00		
Value of Firm			\$ 685,527.19	\$ 709,931.20		
- Total debt			\$ 13,158.00	\$ 13,158.00		
- Preferred Equity and Minority Interest			\$ 34.00	\$ 34.00		
- Value of Equity			\$ 672,403.19	\$ 696,807.20		
Current Shares Outstanding			5,186.00	5,186.00		
FCF Price			\$ 129.66			
12-month Target				\$ 134.36		



DDM	0	1	2	3	4	5
Year	0	1	2	3	4	5
g		18.51%	14.76%	11.00%	7.25%	3.50%
DVD	\$ 1.78	\$ 1.93	\$ 2.22	\$ 2.46	\$ 2.64	\$ 2.73
Rs		6.90%				
Terminal Value				\$ 80.33	3.50%	
PV		\$1.81	\$1.94	\$2.01	\$63.53	
			\$2.07	\$2.15	\$67.92	
DDM Price		\$69.29				
12-month Target		\$72.14				

WACC	
Beta	0.90
Rm	7.50%
Rf	1.50%
Tax Rate	11.39%
CoE	6.90%
CoD	0.56%
E Amt	65,848.0
D Amt	13,158.0
%E	83.35%
%D	16.65%
Equity	5.75%
Debt	0.08%
WACC =	5.83%

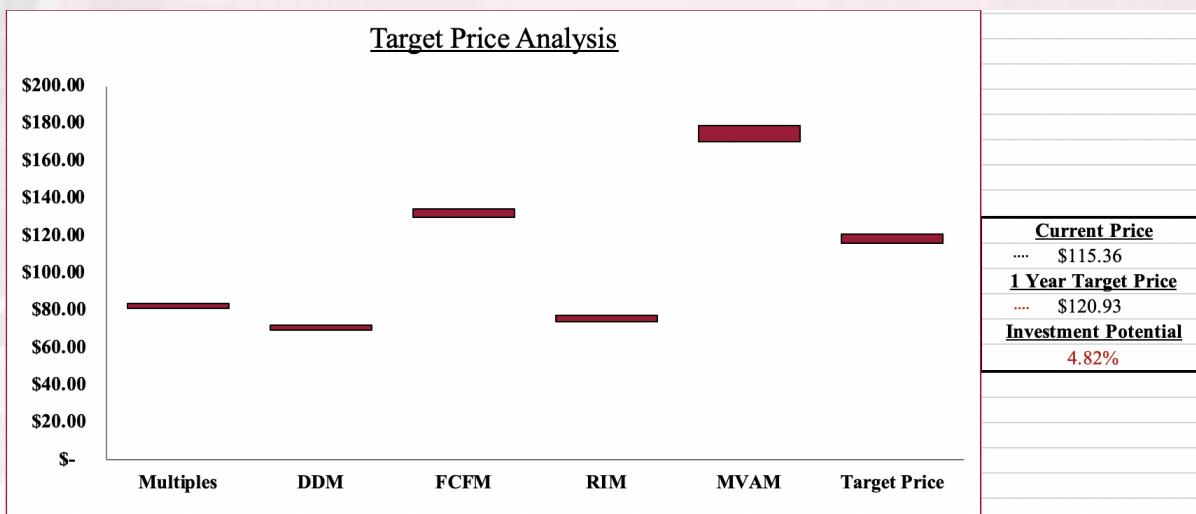
RIM	0	1	2	3	4	5
Year	0	1	2	3	4	5
g		18.51%	14.76%	11.00%	7.25%	3.50%
EPS	3.89	\$ 4.22	\$ 4.84	\$ 5.38	\$ 5.77	\$ 5.97
BVPS	12.70	\$ 14.99	\$ 17.62	\$ 20.53	\$ 23.66	\$ 26.90
Rs		6.90%				
RI	\$ 3.35	\$ 3.81	\$ 4.16	\$ 4.35	\$ 4.34	
Horizon Value RI				\$ 62.86		
PV	\$3.13	\$3.33	\$3.41	\$51.46		
		\$3.56	\$3.64	\$55.02		
RI 0	\$61.34					
RI Price = BVPS + RI	\$74.03					
12-month Target	\$ 77.21					

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Market Multipliers

	Competitors' Average Multipliers	TSM's Price
Price to Book Ratio	8.86	112.52
Price to Sales Ratio	5.51	69.12
Price to EPS Before Abnormal Items	28.94	112.58
Price to FCF	14.00	29.39
Price to EBITDA	12.96	81.55
Average		81.03

MVA Model						
Year	0	1	2	3	4	5
g		18.51%	14.76%	11.00%	7.25%	3.50%
NOPAT	\$ 17,805	\$ 19,209	\$ 22,044	\$ 24,470	\$ 26,244	\$ 27,163
Capital	\$ 79,006	\$ 96,994	\$ 111,307	\$ 123,556	\$ 132,516	\$ 137,154
WACC		5.83%				
EROIC_t = NOPAT_{t+1} / Capital_t		24.31%	22.73%	21.98%	21.24%	20.50%
MVA		\$ 17,924.44	\$ 18,803.27	\$ 19,954.30	\$ 20,416.69	\$ 20,112.09
Horizon Value MVA						\$ 861,761.23
PV		\$16,936.40	\$16,787.43	\$16,833.05	\$703,166.28	
MVA0		\$753,723.16				
MVA1		\$779,769.69	\$17,766.78	\$17,815.06	\$744,187.84	
		P0	P1			
Vop = MVA + Capital =		\$ 832,729	\$ 876,764			
Short-Term Investments		\$ 28,476	\$ 28,476			
Non-Operating Assets		\$ 35,519.00	\$ 35,519.00			
Value of Firm		\$ 896,724	\$ 940,759			
Total debt		\$ 13,158	\$ 13,158			
Preferred Equity and Minority Interest		\$ 34	\$ 34			
Value of Equity		\$ 883,532	\$ 927,567			
Current Shares Outstanding		5,186.00	5,186.00			
MVA Price		\$ 170.37				
12-month Target			\$ 178.86			



	Multiples	DDM	FCFM	RIM	MVAM	Target Price
Today's Price	\$ 81.03	\$ 69.29	\$ 129.66	\$ 74.03	\$ 170.37	\$ 116.08
Difference	\$ 2.84	\$ 2.85	\$ 4.71	\$ 3.18	\$ 8.49	\$ 4.85
1 Year Price	\$ 83.87	\$ 72.14	\$ 134.36	\$ 77.21	\$ 178.86	\$ 120.93
Weights	25.00%	10.00%	30.00%	10.00%	25.00%	100%