Equity Research

SPROTT STUDENT INVESTMENT FUND

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MICRON Technology Inc. – Hold

Source: Bloomberg

NASDAQ: MU $61.40

Target Price: $77.13

Inside this Report	
☐☑ Initial Research	☐ Updated Research
☐ Price Target Change	☐ Rating Change

Research Highlights/Investment Thesis

- *Very Competitive Industry*
  The semiconductor industry is a very competitive one as the products are largely undifferentiated and there are a large number of players with small and roughly equal market share. This makes it difficult for Micron to stand out and the excess supply from so many other companies puts downward pressure on the price giving Micron little flexibility in setting favourable prices for their products

- *Trade Restrictions*
  The BIS has essentially barred Micron from doing business with Huawei; a customer that makes up roughly 10% of Micron's revenue. If trade tensions continue and lead to a permanent loss of this customer account, Micron's profitability could be seriously impacted. The impact could potentially even be worse if similar trade restrictions are enacted with regards to other important overseas customers.

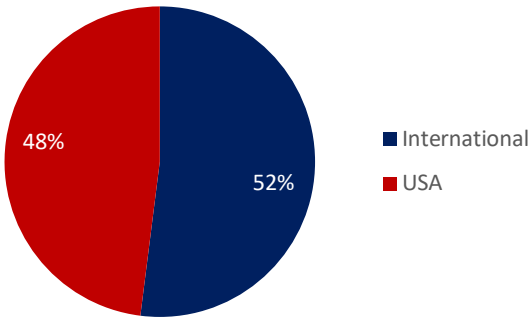
- *Subpar Activity Ratios*
  Micron's high cash conversion cycle, high days receivable outstanding, high days inventory outstanding and relatively low payable days outstanding show that the company has both a weak bargaining power and is inefficient in managing working capital which puts it in a precarious position especially in periods of low demand.

Key Financial Data	
Market Cap	$55.6 billion
S&P Credit Rating	BBB-
Debt to Equity Ratio	18.5%
Price to Earnings	19.2
EV/EBITDA	6.1
Dividend Yield	N.A.
Operating Margin	14.0%
Return on Assets	5.2%
Revenue Growth – 1yr	-8.4%

Company Outlook/Overview

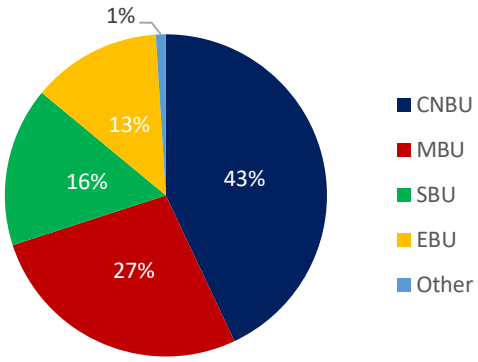
Micron Technology is one of the largest memory chip makers in the world and is an industry leader in innovative memory and storage solutions, with more than 40 years of technological leadership. The company's memory and storage solutions enable disruptive trends, including artificial intelligence, 5G, machine learning, and autonomous vehicles, in key market segments like mobile, data center, client, consumer, industrial, graphics, automotive, and networking. Micron makes DRAM (Dynamic Random-Access Memory), NAND Flash, NOR Flash memory and other memory technologies which are offered under the Micron, Crucial, and Ballistix brands, as well as private labels. Micron operates through four different segments, viz, Compute and Networking Business Unit (CNBU); Mobile Business Unit (MBU); Storage Business Unit (SBU) and Embedded Business Unit (EBU).

Figure 1: Revenue by Region



Source: Company's 2020 10-K Annual Report

Figure 2: Revenue by Business Unit



Source: Company's 2020 10-K Annual Report

Compute and Networking Business Unit

The CNBU unit includes memory products and technologies sold into client, cloud server, enterprise, graphics, and networking markets. CNBU reported revenue of $9.18 billion in 2020, $9.97 billion in 2019, and $15.25 billion in 2018. In late 2019, Micron was the first to introduce volume production of 1Znm DRAM which, at the time, was the industry's most advanced node. In 2020, they began ramping their 1Znm technology and achieved bit production crossover in the second half of 2020 with the aggregate of their 1Ynm and 1Znm nodes comprising more than 50% of their DRAM bit production. The company began sampling 1Znm DDR5 modules and are on track to introduce high bandwidth memory in calendar 2020. They also continue to make meaningful progress on their 1-alpha nm node, which is expected to be introduced in the 2021 fiscal year. During 2020, the company began sampling their first high-

bandwidth DRAM memory product, which is competitive with the industry's most advanced products, in order to enable expansion of their AI data center opportunities.

Mobile Business Unit ("MBU")

The MBU unit includes memory products sold into smartphone and other mobile-device markets and includes discrete NAND, DRAM, and managed NAND. MBU managed NAND includes embedded multi-media controller ("e.MMC") and universal flash storage ("UFS") solutions, each of which combine high-capacity NAND with a high-speed controller and firmware, and eMCP/uMCP products, which combine an e.MMC/UFS solution with LPDRAM. MBU reported revenue of $5.70 billion in 2020, $6.40 billion in 2019, and $6.58 billion in 2018. In 2020, Micron was the first company to deliver LPDDR5 mobile DRAM products to customers, including their LPDDR5 products in select 5G- capable smartphones, in capacities up to 12GB. They also began sampling the world's first LPDDR5 DRAM-based UFS MCPs, which enable longer smartphone battery life and high-performance image processing and utilize their advanced 1Ynm DRAM process technology and the world's smallest 512Gb 96-layer 3D NAND die.

Storage Business Unit ("SBU")

The SBU unit includes SSDs and component-level solutions sold into enterprise and cloud, client, and consumer storage markets and other discrete storage products sold in component and wafer forms to removable storage markets. SBU reported revenue of $3.77 billion in 2020, $3.83 billion in 2019, and $5.02 billion in 2018. In 2020, Micron continued their transition to NAND QLC technology, which represented nearly 20% of their overall NAND sales in the fourth quarter of 2020. The low cost per bit of their NAND QLC technology enables them to offer SSD products at a price point competitive with hard disk drives in a number of market segments. A meaningful portion of the consumer SSDs that were shipped in the second half of 2020 included the NAND QLC technology. In 2020, the company started volume production of their first-generation 128-layer 3D NAND using replacement gate technology and began shipping products to customers in the fourth quarter of 2020. Micron continues to make progress on their second-generation replacement gate node, which is expected to be broadly deployed across their product portfolio, and they anticipate that replacement gate production will comprise a meaningful portion of their NAND output by the end of the 2020 calendar year.

Embedded Business Unit ("EBU")

The EBU unit includes memory and storage products sold into industrial, automotive, and consumer markets and includes discrete and module DRAM, discrete NAND, managed NAND, SSDs, and NOR. EBU reported revenue of $2.76 billion in 2020, $3.14 billion in 2019, and $3.48 billion in 2018. The embedded market has traditionally been characterized by long life-cycle DRAM and non-volatile products manufactured on mature process technologies. With strong trends of digitization, connectivity, and

intelligence in every device, demand continues to grow for leading-edge products from newer process technologies emerging in the embedded market. Micron's embedded products enable edge devices to store, connect, and share information in the internet of things ("IoT") market and are utilized in a diverse set of applications in the automotive, industrial, and consumer markets.

Market Size & Structure

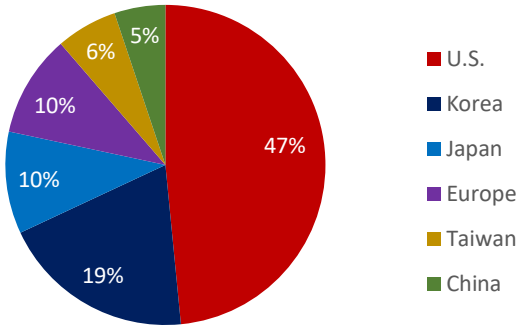
The Global Semiconductor Industry

The global semiconductor industry saw record sales of $468.8 billion in 2018, however, largely due to cyclicality in the memory market, revenue in 2019 decreased by 12% to $412.3 billion. To reflect the negative impact of the COVID-19 pandemic on the global economy and supply chains in the beginning of 2020, The World Semiconductor Trade Statistics (WSTS) released a forecast in June 2020 which projected that worldwide semiconductor industry sales will increase slightly to $426 billion in 2020, a downward revision from its Fall 2019 forecast for 2020. However, WSTS forecasts a recovery of up to $452 billion in global revenue for 2021.

The US Semiconductor Industry

Despite several challenges over the decades, the US has maintained its position as the leader in the semiconductor industry with almost 50% of the annual global share. Being the market leader brings a non-trivial advantage for the US semiconductor industry as sales leadership enables the U.S. industry to invest more into R&D which in turns helps ensure continued U.S. sales leadership. As long as the U.S. semiconductor industry maintains global market share leadership, it will continue to benefit from this virtuous cycle of innovation. However, the US leadership position is not uniform across all subproducts. U.S. has a substantial market share leadership in sales of logic and analog semiconductors, but other countries' industries lead in the market for memory and discrete semiconductors. This is especially noteworthy as Micron Technologies specializes in memory semiconductors.

Figure 3: 2019 Global Sales Market Share

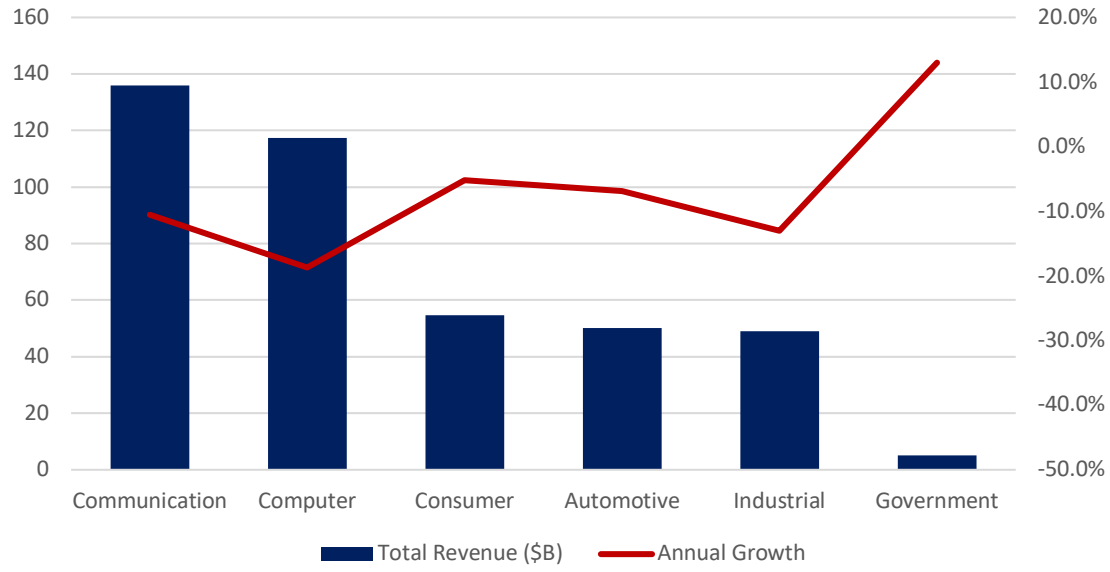


Source: Semiconductor Industry Association

Drivers of Demand

The use of semiconductors is pervasive in an economy that is marked by rapid technological innovation. Semiconductors enable a wide variety of products, from smartphones and computers to cars and industrial equipment, which will be referred to as "end-use categories" in this report. In 2019, end-use sales of semiconductors decreased across almost all categories, while end-use category shares remained stable from 2018. A major factor in the decrease in end-use sales was the decrease in memory product sales due to pricing. Semiconductors are also instrumental in fostering emerging markets based on disruptive technologies like AI, quantum computing, and advanced wireless networks, including 5G. AI is particularly promising and can be expected to be the major catalyst in driving a decade-long growth cycle in the semiconductor industry. The market for AI-related semiconductors is projected to grow from a current US$6bn in revenues to more than US$30bn by 2022. However, the implementation of 5G capabilities in new products like the iPhone 12 also portends growth from 5G-related semiconductors, especially if other smartphone competitors follow in Apple's footsteps, which has often been the case.

Figure 4: 2019 Demand by End-Use



Source: Semiconductor Industry Association

Value Chain

After obtaining materials from their suppliers, such as Applied Material and Tokyo Electron, Micron manufactures the semiconductor products for sale to customers. Most of the manufacturing is done in-house, however, the company also outsources assembly for certain products. In terms of selling to customers, Micron offers their memory and storage products under their Micron and Crucial brand names as well as through private labels. They also market their products primarily through their own direct sales force and, consequently, they maintain sales and/or representative offices in their primary markets around the world. The company sells Crucial-branded products through a web-based customer direct sales channel as well as through channel and distribution partners. However, their products are also offered through independent sales representatives, distributors, and retailers. The independent sales representatives obtain orders, subject to final acceptance by Micron, after which they make shipments against the orders directly to the customers or through Micron's distributors. Micron's distributors carry their products in inventory and typically sell a variety of other semiconductor products, including competitors' products. Micron maintains inventory at locations in close proximity to certain key customers to facilitate rapid delivery of products and reduce transportation costs.

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Industry Analysis

Competitive Rivalry - High

The semiconductor industry is a very competitive one and thus Micron faces fierce competition, especially from some of the big players like Intel, Kioxia Holdings, Samsung Electronics, SK Hynix Inc. and Western Digital. For one, the industry is a fragmented industry as there are no real industry leaders apart from Intel and Samsung Electronics which have market shares of 15.7% and 12.5% respectively as of 2019. The rest of the companies in the industry have relatively little market share: SK Hynix with 5.4% market share, Micron Technology with 4.8%, Broadcom with 3.7%, Qualcomm with 3.2%, Texas Instruments with 3.2%, STMicroelectronics with 2.2%, Kioxia with 2.1% and the others making up 45% of the market. In addition, the products themselves are not differentiated mostly because memory and storage products are manufactured to industry standard specifications and, as such, have similar performance characteristics. Hence, for these products, the principal competitive factors tend to be price and performance characteristics. All industry participants invest heavily in R&D and generally seek to increase wafer capacity, improve yields, and reduce die size in their product designs and thus there is limited opportunity to be competitive on a performance basis. The activity of so many competitors also increases worldwide supply of semiconductors which puts downward pressure on prices, again

making it difficult to be competitive on a price basis. With respect to its operations in China, Micron specifically faces the added threat of increasing competition as a result of significant investment in the semiconductor industry by the Chinese government and various state-owned or affiliated entities that are intended to advance China's stated national policy objectives. In addition, the Chinese government may restrict foreign companies from participating in the China market or may otherwise prevent them from competing effectively with Chinese companies.

Threat of New Entry - Low

One of the main features of the semiconductor industry is the significant degree of spending on R&D, as well as capital expenditures, which serves to limit the occurrence of new entrants into the industry. In the US alone, total R&D spending for semiconductor companies totaled $39.8 billion in 2019, representing a 6.6% compound annual growth from 1999. Given the importance of R&D in staying up to date with the pace of technological advancement, it is fair to assume that this trend will continue for decades. In terms of percentage of R&D to sales, the U.S. semiconductor industry was second only to the U.S. pharmaceuticals & biotechnology industry in terms of the rate of R&D spending with 16.4% as the percentage of R&D expenditures to sales. Micron for example spent $2.6 billion on R&D in the last year and this was 12.1% of revenue. Capital expenditure is also high in the industry and again, the semiconductor industry is second in this category, this time only behind alternative energy industry. The US semiconductor industry has capital expenditures that are 12.5% of sales as of 2019.

Threat of Substitution - Low

Given the importance of semiconductors in the production of a wide range of electrical devices, the threat of a substitute product is very low, especially considering the rate of technological advancement in the modern economy and the need for higher processing power provided by faster and more energy efficient chips. However, there are some technologies that have been suggested as possible alternatives to the normal silicon semiconductors. Quantum computing, graphene nanotubes and nanomagnetic logic are promising developments but they are all still in the infancy stages. Although the latter is the most promising, with quantum computing still just a theory and graphene having a number of practical problems, we are still a long way from having any replacement for semiconductors.

Buyer Bargaining Power - High

As noted previously, the products in this industry are largely undifferentiated and for the most part, with the possible exception of Intel and Samsung, brand loyalty is quite insignificant in the industry. The great supply of products also tends to put downward pressure on prices. There are also low, if any, switching costs for the products as semiconductors specified to industry standards have cross-compatibility. The

customers of this industry are also technology companies and, as can be seen with Samsung, can backward integrate if necessary. These factors together signify a high degree of buyer bargaining power. It is also relevant to note here that Micron in particularly gets about 50% of its revenue from its top 10 customers which greatly increases their bargaining power as the company will be wary of losing an important revenue stream. This high bargaining power is evident in the fact that the customers rarely enter long-term fixed contracts with the company. This is obviously not a good position to be in as Micron itself incurs significant fixed costs that could prove to be debilitating during weak demand cycles.

Supplier Bargaining Power - Moderate

The supplier industry is fairly concentrated with the 4-firm and 8-firm concentration ratios being 31.4% and 45% respectively. This effectively mean that there a couple of big players in the industry which makes it harder for companies in the semiconductor industry to drive hard bargains in effort to reduce their costs. Additionally, the quality of materials is very important in the semiconductor industry and as such there is some switching costs as semiconductor companies might find it difficult to find the same quality of material if they were to switch from one supplier to the other. Generally, semiconductor companies source a significant amount of their materials from a limited number of suppliers that have proven to meet their quality requirements. Not surprisingly, these suppliers are the top companies in the supplier industry, viz, Applied Material, TSMC, ASE Technologies, Tokyo Electron and LAM Research.

Industry Dynamics

Exponential Increase in Data

The amount of data used in the economy keeps on growing exponentially, a trend that will be accelerated by the rollout of 5G networks. There is a need for more and more servers; where these data are processed and stored. Following a 2020 Yole report, a compound annual growth rate of 29% is expected for the high-end central processing units (CPUs) and graphical processing units (GPUs) that are at the heart of these servers. They will support a host of datacenter applications, such as supercomputing and high-performance-computing as a service. Faster growth rate is expected for GPUs, triggered by emerging applications such as cloud gaming and artificial intelligence. Recent corona-related remote work and education will also leave their mark on the internet traffic. In March 2020, for example, internet traffic increased by nearly 50% and commercial internet data exchange in Frankfurt set a new world record for data throughput at more than 9.1 Terabits per second.

Artificial Intelligence

The global artificial intelligence market size was valued at $39.9 billion in 2019 and is expected to grow at a compound annual growth rate of 42.2% from 2020 to 2027. The continuous research and innovation directed by the tech giants are driving the adoption of advanced technologies in industries such as automotive, healthcare, retail, finance, and manufacturing. Although technology has always been an essential element for these industries, the usefulness of AI has begun to change that landscape even more in recent years. For instance, from self-driving vehicles to crucial life-saving medical gear, AI is being infused virtually into every apparatus and program. AI has proven to be the significant revolutionary element of the upcoming digital era. Tech giants like Amazon.com, Inc.; Google LLC; Apple Inc.; Facebook; International Business Machines Corporation; and Microsoft are investing significantly in the research and development of AI. These companies are working for making AI more accessible for enterprise use-cases.

Growth and Risk Analysis

Growth Outlook

Increasing Demand from Automotive Sector

Automotive electronics and industrial electronics are expected to be the fastest growing markets in the semiconductor industry, with revenue from consumer electronics, data processing and communication electronics set to grow steadily. In the automotive sector, the adoption of safety-related electronics systems has grown explosively. It is estimated that semiconductor components that make up these electronic systems will cost $600 per car by 2022. Automotive semiconductor vendors will benefit from a surge in demand for various semiconductor devices in cars, including microcontrollers (MCUs), sensors and memory. The integration of semiconductors is being viewed as a key component in technological advancements by automotive manufacturers. In addition, several other developments in the automotive sector including autonomous vehicles, wireless charging, EVs, and computer-based testing will drive the need for semiconductor components. Thus, the increasing integration of advanced automotive systems such as collision warning systems, smart cameras, and autonomous braking systems, will boost the demand for semiconductor ICs in the coming years.

Major Risks

Selling Price Volatility

As a result of the highly competitive nature of the semiconductor industry and the undifferentiated nature of the products, Micron has been subject to significant volatility in average selling prices, including dramatic declines such as demonstrated in the table below. This price volatility can be expected to continue into the future and can be especially damaging when the selling prices are below manufacturing costs, which has been the case in some prior periods. Average selling prices for Micron's products that decline faster than their costs could have a material adverse effect on their business, results of operations, or financial condition.

Table 1: Percentage Change in Average Selling Price

	DRAM	NAND
2020 from 2019	-34%	-9%
2019 from 2018	-30%	-47%
2018 from 2017	36%	-13%
2017 from 2016	18%	-10%
2016 from 2015	-34%	-16%

Source: Company's 2020 10-K Annual Report

Geopolitical Tensions

Given that in 2020, 88% of Micron's revenue came from products that were shipped to customer locations outside the United States, the company's prospects are very reliant on smooth international relations. Additionally, a significant number of the company's facilities are located outside the United States, including in Taiwan, Singapore, Japan, and China which makes the political environment of these countries particularly more salient. However, general trade tensions between the United States and China have been escalating since 2018, with U.S. tariffs on Chinese goods and retaliatory Chinese tariffs on U.S. goods. Some of Micron's products are included in these tariffs which can inhibit sales especially if the threatened higher tariffs materialize. Escalating trade tensions between the United States and China have also led to increased trade restrictions. For example, over the last 18 months the BIS has enacted increasingly broad trade restrictions with respect to Huawei (which represented approximately 10% of Micron's revenue in Q4 of 2020 and 12% in 2019), culminating with restrictions that took effect on September 15, 2020 and that currently prevent Micron and many other companies from shipping products to Huawei. This of course jeopardizes an important revenue source and the company could permanently lose 10% of its revenue if these restrictions remain, and potentially more if the restrictions are broadened to include other important customers.

Concentrated Customer Structure

In each of the last three years, about 50% of Micron's total revenue was from their top ten customers which is a rather precarious position to be in as any disruption in the company's relationship with any of these customers could potentially have a material adverse effect on their business. In addition, any consolidation of the company's customers could reduce the number of customers to whom their products may be sold, and this would be especially problematic if the top ten customers merge with each other. Also, material changes in the inventory strategy of Micron's customers, particularly those in China, could impact their industry bit demand growth outlook. The loss of, or restrictions on Micron's ability to sell to, one or more of their major customers, such as those relating to Huawei described above, or any significant reduction in orders from, or a shift in product mix by, customers could have a material adverse effect on their business, results of operations, or financial condition.

Management

Insider Ownership

Insiders own very little of Micron's outstanding shares. In total insiders own just 0.23% of the company's shares and the largest shareholder, Sanjay Mehrotra (President and CEO) owns only 0.06% of the company's stock. It should be noted however that this level of ownership is not unusual for tech companies in America. In fact, one of Micron's closest competitors, Intel, only has 0.04% of its shares held by insiders so it is hard to draw concrete conclusions on Micron's leadership based on insider ownership. However, the top 5 insider holders have been selling shares in the last 6 months, albeit relatively small chunks ranging from 2% to 3%, and over the last year there has been a lot more insider selling than buying. The frequency of selling and the rarity of buying does pose credible questions about insiders' beliefs on valuation.

Track Record

Micron had been quite engaged in the M&A market between 2002 and 2016, especially in 2015 when it acquired three companies, viz, Tidal Systems, Convey Computing and Pico Computing. The following year they acquired Inotera Memories after buying the remaining 67% of the business for $4.1 billion with the full value of the company being $5.2 billion, $1.1 billion of which was attributable to goodwill. However, the current CEO has only overseen one acquisition which happened in Q1 of 2020 when the company acquired Intel's ownership interest in IM Flash Technologies. The two companies had jointly owned and operated IMFT since 2006. Micron's acquisition strategy is quite clear and consistent as all the companies that have been acquired by Micron all specialize in making semiconductors, specifically DRAM, NAND, 3D XPoint and NOR products which are the products that Micron focuses on. There have

also not been any goodwill impairments with regards to the company's acquisitions. The focused nature of management's acquisitions and the lack of impairment suggest that management has had a good record of capital allocation thus far. To accentuate this point, Bloomberg provides data that shows that in his 3.5 years at the helm, Sanjay Mehrotra has led the company to achieve a total annualized return of 18.24%, significantly higher than the peer TRA of 7.33%.

Executive Compensation

A substantial portion of Micron's compensation available for executives is performance-based and delivered in the form of equity to more closely align management and shareholder interests. Specifically, the CEO's compensation is made up of 8% base salary with the remaining 92% variable based on performance. Of the 92%, 16% is for short-term incentive awards and 76% is for long-term incentive awards. Other executives have similar pay structures with 72% of their income being based on long-term incentive awards and the remaining 28% evenly split between base pay and short-term incentive awards. In addition, the long-term incentive pay for all executive is equally split between performance restricted stock units and time-based restricted stock units. The goal of the former is to create direct, specific alignment with shareholders' interests by focusing executives on long-term value creation through the achievement of key operational milestones and stock price performance while the goal of the latter is also to focus executives' interests on long-term value creation as well as to provide retention value. The metrics for performance-based restricted stock units include percentage of sales as high value solutions, free cash flow and company valuation. The free cash flow and high-value solutions goals have a three-year measurement period. The company valuation goal has a two-year measurement period plus an additional year of time-based vesting. The short-term incentive pay is based on annual net income targets as well as the achievement of certain technology, product, cost and customer milestones. Generally, the conclusion that the compensation structure is well designed to properly align management's interest with shareholders to ensure maximization of shareholder wealth.

Financial Statement Analysis

Figure 5: Financial Condition Ratios

Financial Condition Ratios					
	2016A	2017A	2018A	2019A	2020A
Profitability					
Gross Margin	20.20	41.51	58.87	45.72	30.57
Operating Margin	1.35	28.88	49.34	31.51	14.01
Profit Margin	(2.23)	25.04	46.51	26.97	12.54
Return on Assets	(1.07)	16.19	35.92	13.68	5.24
Return on Equity	(2.26)	33.13	55.50	18.52	7.18
Return on Invested Capital	0.08	21.06	42.41	16.70	6.20
Liquidity					
Current Ratio	1.96X	2.34X	2.79X	2.58X	2.71X
Cash Ratio	0.91X	1.02X	1.18X	1.24X	1.23X
Activity					
Accounts Receivable Turnover	6.27X	7.73X	7.11X	5.98X	6.84X
Inventory Turnover	3.78X	3.95X	3.72X	2.92X	2.78X
Accounts Payable Turnover	9.47X	9.62X	8.58X	8.45X	7.95X
Days Receivable Outstanding	58.02	47.06	51.18	60.92	54.28
Days Inventory Outstanding	96.19	92.06	97.81	124.82	133.68
Days Payable Outstanding	38.45	37.83	42.44	43.10	46.68
Cash Conversion Cycle	115.77	101.29	106.55	142.64	141.28
Total Asset Turnover	47.98	64.64	77.22	50.74	41.80
Fixed Asset Turnover	98.25	119.13	141.02	90.18	71.62
Financial Leverage					
Long Term Debt to Assets	33.24	27.94	8.71	9.29	12.87
Long Term Debt to Equity	70.81	50.65	11.35	12.32	17.71
Total Debt to Equity	76.66	57.12	13.94	15.87	18.54
Degree of Financial Leverage	(62.45)	114.12	103.04	102.46	107.91
Interest Coverage Ratio	0.38X	8.08X	33.85X	41.67X	13.65X
Capital Expenditure Ratio	0.50X	1.03X	2.30X	1.51X	1.03X
Shareholder Ratios					
Earnings per Share	$ (0.22)	$ 4.67	$ 11.56	$ 5.88	$ 2.59
Diluted Weighted Average Shares	1,036	1,154	1,229	1,143	1,131
Dividend Payout Ratio	0.00	0.00	0.00	0.00	0.00

Source: Bloomberg, Student Estimates

Profitability

The profitability ratios accentuate the cyclicality in Micron's business. Margins increased up until their peaks in 2018 and then declining thereafter. Although the 2020 margins reflect the effects of the COVID pandemic, the year was already forecast to have weak demand. The main reason for the poor margins in 2020 was the combination of a decline in revenue and a significant increase in cost of revenue.

Solvency

In terms of Micron's capital structure, the company has been consistently paying off its debt to reduce its leverage. Notably, in 2018 the company took advantage of the phenomenal year it had to pay down more than $10 billion of debt which significantly reduced its leverage. Given its lower debt levels and double-digit interest coverage ratio, the company is not in any serious danger of insolvency. However, it should be noted that Micron's debt level is not significantly lower than its competitors' and in fact some competitors like Nanya Tech and Samsung Corp. have essentially no debt.

Liquidity

Micron has a considerable amount of cash on its balance sheet and the cash balance has increased steadily over the years. With a cash ratio of 1.23X and a current ratio of 2.71X, Micron is well positioned to meet its short-term obligations.

Activity

The company's high cash conversion cycle is quite concerning as it shows that their working capital is held up for over a third of the year on average. This high cash conversion cycle is as a result of Micron's high days receivable outstanding, high days inventory outstanding and relatively low payable days outstanding. This underlines Micron's weak bargaining position with respect to both suppliers and customers as well as their inefficiency in handing inventory. Although this can be expected in this industry as buyer and supplier power is high, Intel does a lot better on this front as their cash conversion cycle is approximately half of Micron's

Shareholder Ratios

Micron notably does not pay any dividends, choosing instead to increase its cash balance steadily over the years. However, many of its competitors like Intel, Samsung and Nanya Tech pay dividends with average payout ratios ranging from 25% to over 50%. Interestingly, despite not paying dividends, Micron has less cash on its balance sheet than these competitors that do pay dividends, which may suggest that despite its size, Micron does not have a strong competitive position as it struggles to increase its cash flows. The company might be having to invest heavily in R&D and Capex just to stay competitive and not get swept away by other players in the industry.

Valuation

In valuing Micron, two valuation models were used, viz, the discounted cash flow model (DCF) and relative valuation. For the DCF model, a discount rate of 8% was used to discount the cash flows and an EV/EBITDA multiple of 6.0X was used to arrive at the terminal value. The 8% discount rate used was 140bps higher than that estimated from the WACC analysis which used a bottom-up beta of 1.109. The reason for using a slightly higher discount rate was to make the valuation more conservative, especially given the historical volatility in earnings. The EV/EBITDA multiple of 6.0X was right in line with analysts' estimates of the multiple as well as the average among comparable companies. In terms of the forecasted inputs that went into the model, reasonable estimates were made based on analysts' expectations and historical trends. Of great consequence, the revenue growth assumption was also based on an attempt to roughly mirror the historical cyclicality of the industry. The base case scenario estimates the intrinsic value of the company to be $77.13 which has a 25% margin of safety over the share price of $61.40 as at the time of valuation. The projected IRR from holding the stock through the forecast period is 11.2%. The relative valuation compares valuation multiples among comparable companies and estimates the share to be $119.30. This figure was based on using the mean 2022 EV/Revenue multiple of the comparable companies which was 5.7X. This valuation implies an upside of $57.90 if the stock is bought at $61.40.

DCF Valuation

WACC

Market Risk Premium (Rm - Rf)	5.6%
Multiplied by: Nasdaq: MU Bottom-Up Beta	1.109
Adjusted Market Risk Premium	6.2%
Add: Risk-Free Rate of Return (Rf)(1)	0.8%
Add: Size Premium	0.0%
Cost of Equity	**7.0%**
Multiplied by: Nasdaq: MU E/(D+P+E)	86.0%
Cost of Equity Portion	6.0%
	4.4%
Tax Rate (6 Year Average)	4.8%
After-Tax Cost of Debt	**4.2%**
Multiplied by: Nasdaq: MU D/(D+P+E)	14.0%
Cost of Debt Portion	0.6%
Nasdaq: MU Cost of Preferred (Rp)	**0.0%**
Multiplied by: Nasdaq: MU P/(D+P+E)	0.0%
Cost of Preferred Portion	0.0%
WACC	**6.6%**

Model Assumptions

	Model Exit Multiple	Growth Rate	
Terminal Value (Choose Option -->)	Exit Multiple	6.0x	3.0%
Terminal Value in Model	130,812	130,812	112,340
Discount Rate	8.0%		
Valuation Date	2020-11-24		
# Shares Outstanding as of Valuation Date (millions)	1,113.2		
Market Price as of Valuation Date	$61.40		

	Valuation Date								Terminal Value
Valuation Timeline	11-24-20	12-31-21	12-31-22	12-31-23	12-31-24	12-31-25	12-31-26	12-31-27	12-31-27
	Year Frac	1.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Free Cash Flow to Firm (FCFF)	**0**	**(1,432)**	**556**	**3,823**	**880**	**821**	**2,525**	**5,453**	**130,812**
Rolling Enterprise Value (NPV)	**83,819**	**91,233**	**100,078**	**107,484**	**111,977**	**119,985**	**128,697**	**136,266**	
Plus: Cash + Marketable Securities	8,142	9,487	13,818	18,546	19,606	21,769	25,896	35,180	
Less: Debt + Capital & Finance Leases	(6,103)	(8,469)	(11,095)	(12,248)	(13,170)	(14,422)	(15,716)	(19,915)	
Equity Value	**85,858**	**92,251**	**102,801**	**113,781**	**118,413**	**127,332**	**138,877**	**151,530**	
Fully Diluted Shares Outstanding	1,113	1,175	1,184	1,175	1,165	1,165	1,169	1,164	
Rolling MU Value per Share	**$77.13**	**$78.53**	**$86.82**	**$96.82**	**$101.61**	**$109.28**	**$118.81**	**$130.16**	
Investor IRR									
Equity Investor Return (After SBC dilution)	**($61.40)**							**$130.16**	
Equity Investor IRR (After SBC dilution)	**11.2%**								

Sensitivity Analysis

Instrinsic Value ($/share)

		Discount Rate				
		10.0%	9.0%	8.0%	7.0%	6.0%
Multiple	2.0x	$28	$30	$32	$34	$36
	4.0x	$48	$51	$54	$58	$62
	6.0x	$68	$72	$77	$82	$88
	8.0x	$88	$94	$100	$106	$114
	10.0x	$108	$115	$122	$131	$139

Internal Rate of Return (IRR)

		Purchase Price (per share)				
		$70	$65	$60	$55	$50
Multiple	2.0x	-3.3%	-2.3%	-1.2%	0.1%	1.4%
	4.0x	4.0%	5.1%	6.3%	7.6%	9.1%
	6.0x	9.1%	10.3%	11.5%	12.9%	14.4%
	8.0x	13.1%	14.3%	15.6%	17.0%	18.6%
	10.0x	16.3%	17.6%	18.9%	20.4%	22.0%

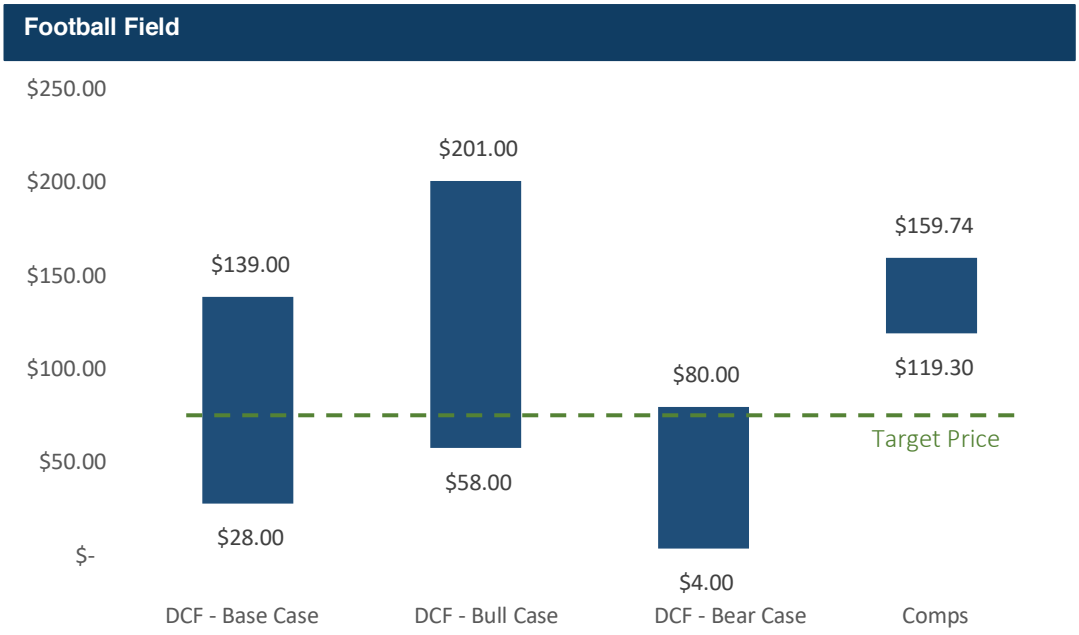
Relative Valuation

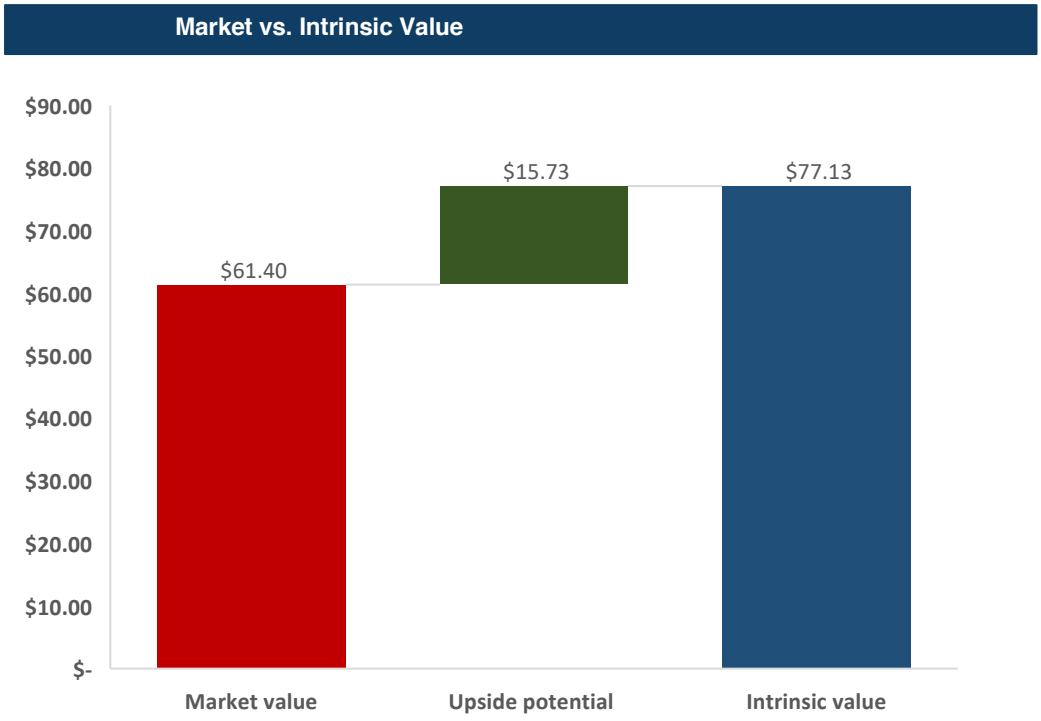
		Market Data				Financial Data					EV/Revenue		EV/EBITDA	
Company Name	Symbol	Market Capitalization	Net Debt	Minority Interest	Enterprise Value	LTM Total Revenue	2022E Total Revenue	LTM EBITDA	2022E EBITDA	2021E EBITDA Margin	LTM	2022E	LTM	2022E
Texas Instruments Inc	TXN	145,576.4	6,797.0	0.0	146,837.1	13,735.0	16,300.9	6,567.0	8,123.3	49.8%	10.7X	9.0X	22.4X	18.1X
Intel Corp	INTC	187,011.0	36,563.0	0.0	201,642.0	78,098.0	71,797.8	36,839.0	35,303.3	49.2%	2.6X	2.8X	5.5X	5.7X
Silicon Laboratories Inc	SLAB	4,923.6	561.7	0.0	4,763.5	863.2	1,025.0	94.9	234.0	22.8%	5.5X	4.6X	50.2X	20.4X
Marvell Technology Group Ltd	MRVL	29,790.0	1,144.7	0.0	30,103.5	2,801.1	3,456.6	220.5	1,196.5	34.6%	10.7X	8.7X	136.5X	25.2X
Microchip Technology	MCHP	34,104.1	9,217.7	0.0	42,951.5	5,233.0	5,902.5	1,952.2	2,517.0	42.6%	8.2X	7.3X	22.0X	17.1X
SK Hynix Inc	000660	70,470.6	12,944.7	20.0	78,679.4	30,861.3	42,946.3	13,707.9	23,380.1	54.4%	2.5X	1.8X	5.7X	3.4X
Mean		78,646.0	11,204.8	3.3	84,162.8	21,931.9	23,571.5	9,896.9	11,792.4	42.3%	6.7X	5.7X	40.4X	15.0X
Median		52,287.4	8,007.4	0.0	60,815.5	9,484.0	11,101.7	4,259.6	5,320.2	45.9%	6.9X	6.0X	22.2X	17.6X
Micron						**21,435.0**	**22,886.2**	**8,755.0**	**10,004.6**					

Enterprise Value	
Based on Revenue	
Mean multiple	**130,762.5**
Median multiple	**136,449.2**
Based on EBITDA	
Mean multiple	**149,625.5**
Median multple	**175,783.8**

Target Price (Based on Revenue Multiple)	**$119.30**

Valuation Summary





Investment Recommendation

Hold, Intrinsic Value: $77.13

Based on the valuation models used to ascertain the intrinsic value of Micron, the stock is attractively priced right now with a 25% margin of safety. Given the importance of semiconductor microchips in driving technological innovation, the industry is quite attractive as there is little concern of substitution or obsolescence, at least in the next decade. However, the company has no sustainable competitive advantage, and the industry is very competitive, thus, there is no guarantee that the company will maintain its current market position going forward. The cyclicality of the industry and the company's earnings also introduces risks as future earnings may be extremely poor especially during periods of low demand and/or lower prices. On the balance, the favourable current price and the less favourable fundamentals lead to a hold recommendation.

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