

Micron Technology, Inc. (NASDAQ: MU) Technology – Semiconductors

November 15th, 2019

Stock Rating: **HOLD**

Analysts

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Target Price: \$51-\$54

Investment Thesis

Drivers of Thesis:

- **Micron trades at a discount to our target price range.** Micron's stock price as of November 15, 2019, is \$47.71 while our target price range based upon our DCF Model and Relative P/E model is higher at \$51-\$54. Additionally, throughout a difficult 2019 fiscal year for the industry and Micron, the stock price ended higher than at beginning of the year.
- **The semiconductor industry is bottoming and bound to recover.** Since the end of Micron's Q1 of 2019, demand levels have been low. Historically, down cycles do not last longer than a year, so we expect demand to recover.
- **U.S. and China trade war will see progress over the next year.** Given that a phase one trade deal will be official in the near future, the semiconductor industry will face less uncertainty.

Risks of Thesis:

- **Micron could improve their inventory levels sooner than we believe.** Supply has shown both DRAM and NAND memory chips to be at high inventory levels. Micron has been working to reduce their inventories with positive results occurring for the NAND market. The DRAM market could recover sooner than we expect if demand increases.

DCF Model	\$54
DDM Model	\$43
Relative P/E	\$51

Price Data

Current Price	\$47.71
52 Week High	\$51.39
52 Week Low	\$28.39

Key Statistics

Market Cap (Millions)	\$52,662
Shares Outstanding (Millions)	1,114
Beta	1.71
Dividend Yield	0%
P/E Ratio (TTM)	8.50

Profitability Ratios

Return on Assets	5.88%
Return on Equity	7.88%
Profit Margin	13.50%

Earnings Estimates

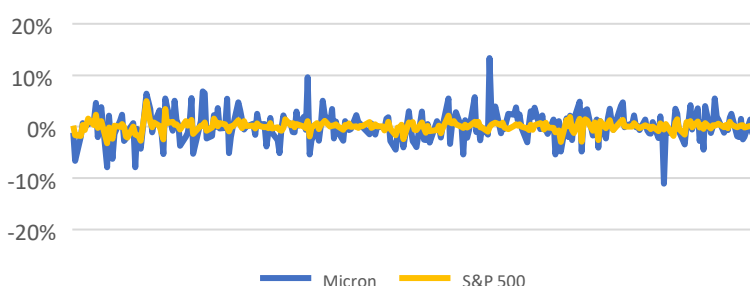
Year	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
EPS	\$4.67	\$12.27	\$5.67	\$2.68	\$4.71	\$5.88	\$6.69	\$7.20

Company Description

Micron Technology, Inc. (MU) manufactures and distributes data memory and storage solutions. It sells Dynamic Random Access Memory (DRAM) and NAND semiconductor chips. These chips are silicon wafers that partially conduct electricity and are integrated into electronic devices. Micron's four main business segments are Compute and Networking Business Unit (CNBU), Mobile Business Unit (MBU), Storage Business Unit (SBU), and Embedded Business Unit (EBU). Micron was founded in 1978 in Boise, Idaho, and has grown due to acquisitions and research and development.

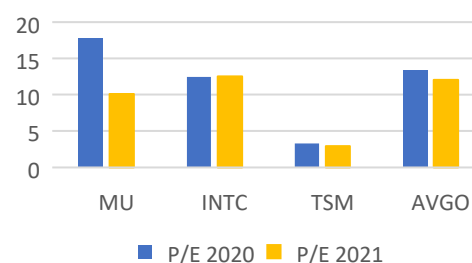
Stock Performance (Last 12 Months)

12 Month Performance



Relative Financial Performance

Relative P/E



Executive Summary

As of November 15th, 2019, we recommend a HOLD rating for Micron Technology, Inc. (NASDAQ: MU) for the University of Iowa Krause Fund Portfolio. Micron has experienced rapid growth in recent years and gained market share in the DRAM and NAND memory chip markets. We believe their strong position and ability to navigate this cyclical market makes them a sound competitor. However, the recent macroeconomic outlook presents challenges for the company going forward. With slowing GDP and on-going U.S. China trade war tension, the industry has experienced volatility and uncertainty. The company has also experienced supply issues and faces the challenge of selling off inventory. Our forecasts included in the report along with the provided model support our HOLD rating. We believe this rating is appropriate given their potential to perform better given better economic circumstances. Our current price target is \$51-\$54.

Economic Outlook

U.S. Real Gross Domestic Product (GDP)

Real GDP is a key indicator of the overall health of the U.S. economy. It measures the value of all goods and services produced in a given year. The four components of GDP are personal consumption, business investment, government spending, and net exports. Historically, personal consumption roughly accounts for 70% of real GDP¹. Beginning in 2001, approximately 70% of semiconductor industry revenue has come from consumer markets.¹ With personal consumption as the largest contributor to real GDP and industry revenue, a correlation between real GDP and the semiconductor industry cycle exists¹. As a result, growth in real GDP signals increased industrial output and related demand for semiconductors. Meanwhile, stagnating or declining GDP growth signals less industrial output and demand for consumer products. Real GDP as an indicator of economic health and consumer spending activity makes it an important indicator for Micron.

As seen in the graph above, in 2019, Q1 GDP growth was 3.1%.² In Q2, GDP growth was much lower at 2.0% and slightly lower at 1.9% in Q3.² The decline in growth from Q1 to Q3 signals a slowdown in the U.S. economy. In alignment with the forecast of the St. Louis Federal Reserve, we predict real GDP growth will be 1.95% in 2020.² We expect to see this decline in real GDP continue and reach 1.7% in 2023.



Retrieved From: FRED

We reached an estimate of 1.7% by analyzing historical data from a similar capital markets context. Recently, the U.S. entered its longest bull market in history. The second longest bull market was from October 1990 to March 2000.³ Historical data shows a trend of declining real GDP growth beginning at the end of the bull market in March 2000 until March 2003 when it bottomed at 1.7%.⁴ Since we are in the longest bull market and anticipate it will end before 2021, we believe 1.7% is an appropriate prediction when forecasting approximately three years into the future.

U.S. and China Relations

The U.S. and China have been in a trade war since 2017 which has resulted in billions of dollars of tariffs imposed by both countries. Since the most recent trade talks on October 11, 2019, both countries have been working on a phase one trade deal that would enforce intellectual property rights, increase U.S. access to Chinese markets, and limit subsidies on China's state-owned businesses.⁵ The phase one deal could be official as soon as December 2019.

Amid trade tensions, in May 2019 the U.S. placed Huawei Technologies Co., Ltd., a Chinese smartphone and network supplier, on the Department of Commerce's Entity List after identifying it as a national security risk. This prevented U.S. companies from supplying the company with technology from the U.S.. The technology supplied to Huawei is primarily in the form of semiconductor chips which are then used in their smartphones and network equipment. As a result of the ban, U.S. companies like Micron could not sell their products to Huawei.

After receiving pushback from U.S. companies, the U.S. offered a temporary reprieve to allow them to work with Huawei until August 2019.⁶ That reprieve was extended to November and is currently expected to receive a two-week extension. According to the Trump administration,

issues related to Huawei will face a separate negotiation process from the phase one deal and most likely be discussed in the phase two deal.⁵

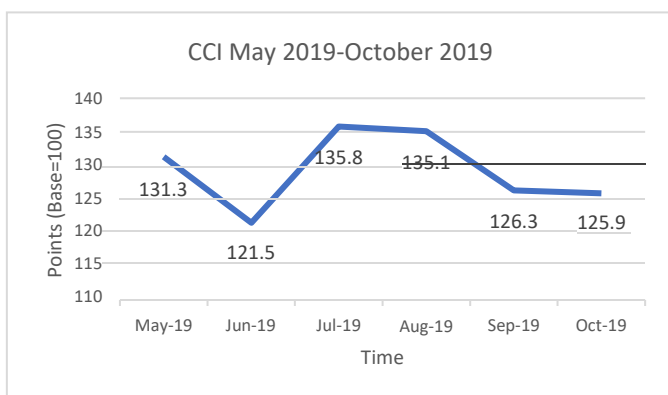
U.S. and China trade relations are critical to the semiconductor industry. Tariffs can result in more expensive goods due to artificially increased costs which may decrease consumer and business demand for electronic devices that utilize semiconductors like computers, smartphones, and servers. Despite the reprieves and ongoing negotiations, the trade war has negatively affected companies in the industry by creating uncertainty.

If the trade war is not resolved, we predict these nations will impose additional tariffs and trade bans on companies. It is possible that all Chinese imports into the U.S. could eventually have tariffs and China would respond similarly. Trade bans on companies vital to each country, such as Huawei in China, would most likely resume in order to put pressure on each country to make a deal.

However, if the U.S. and China reach an agreement, which we predict to occur by the end of 2020 due to a close resolution on the phase one deal, the escalating tariffs and trade bans would be removed. As a result, free trade will resume, confidence in the economy will be restored, and U.S. companies like Micron will be more competitive in the global market.

Consumer Confidence Index (CCI)

The CCI is a measurement of how optimistic or pessimistic Americans are about current and future economic conditions.⁷ This statistic is a leading indicator of consumer spending. Because this indicator can predict consumer spending, it is important in the semiconductor industry and for companies like Micron. With a base of 100 points, the CCI has fallen from July’s high level of 135.8 to 125.9 in October.⁷ We believe this decline is due to consumer uncertainty regarding the slowdown in GDP growth and unresolved trade war.



Data Retrieved From: The Confidence Board

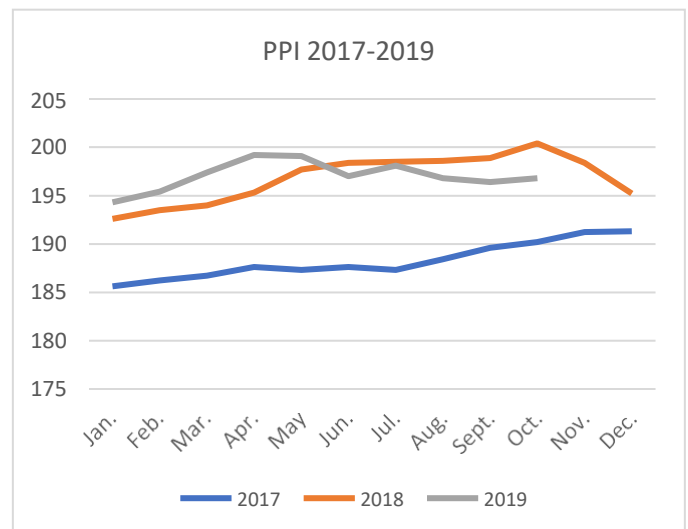
While the CCI has declined, quarterly consumer spending growth has decreased by 3% from Q2 2019 to Q3 2019.⁷ We believe that the decrease in consumer confidence has materialized through less consumer spending. We anticipate the decline in real GDP growth and unresolved trade tensions to continue over the next year. With these issues driving the decrease consumer confidence, we expect consumer confidence to continue to decline and result in less consumer spending. This will result in decreased demand for the industry’s end markets and hurt its profitability.

Inflation

Producer Price Index (PPI)

The PPI measures the average change over time in the selling prices received by domestic producers for their output.⁷ The U.S. and China have placed retaliatory tariffs on each nation’s goods. It is important to note if the tariffs have increased the price of goods because this may have an adverse effect on consumer spending that makes up most of the semiconductor industry’s revenue.

The graph below illustrates the monthly PPI levels for 2017 to 2019.⁸ The blue line representing 2017 was entirely lower than both 2018 and 2019 lines. This means that there was less change over time in the selling prices received by producers. However, both 2018 and 2019 lines are higher signaling higher selling prices received by producers than in 2017. Since May 2019, the PPI has been lower than 2018 levels which indicates a decrease in the average selling price to levels below this time in 2018.



Data Retrieved From: Bureau of Labor Statistics

The recent downward trend in the PPI as of May 2019 indicates that retaliatory tariffs are not materializing as increases in the selling price received by producers. If the tariffs were creating artificially higher prices it would reflect in the PPI data. For the semiconductor industry,

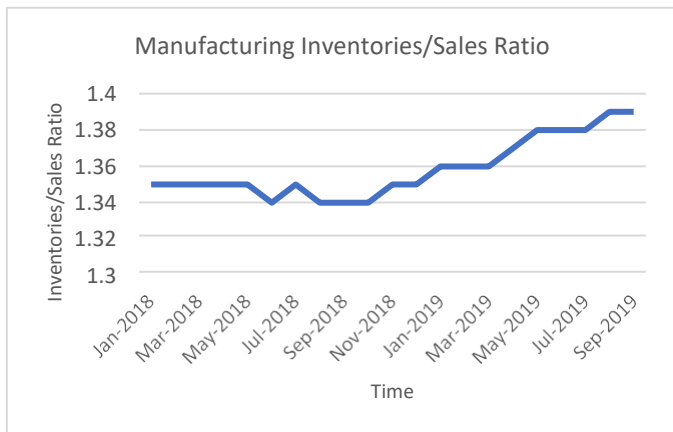
U.S. based manufacturers like Micron would find the recent PPI data important because it indicates tariffs have not increased their selling prices to manufacturers of electronic devices which would then be passed along to consumers.

As a result, we believe the cost of tariffs have not been passed along to consumers because consumer spending has not fallen. It has remained around 3% growth levels over the last three quarters.⁷ However, we believe that the tariffs can create uncertainty that may cause people to lose confidence in the U.S. economy. This specific impact has materialized in the CCI.

Manufacturing & Trade Inventories & Sales (MTIS)

The Manufacturing & Trade Inventories & Sales (MTIS) report measures product inventory values for manufacturers, retailers, and wholesalers as well as the inventories to sales ratio.⁹ This indicator is useful for manufacturers in the semiconductor industry because inventory and sales are critical to their ability to generate profits.

The graph below shows the inventories to sales ratio for U.S. manufacturers from 2018 to 2019. This ratio shows the relationship of the end-of-month values of inventory to the monthly sales level. A high ratio means manufacturers have enough inventory to cover monthly sales. This indicator is important for semiconductor companies to look at because it signals demand for manufactured goods, most of which are electronics requiring semiconductor components. The ratio was 1.39 for September and August 2019.⁹ However, in September 2018 the ratio was 1.34.⁹ Over the past year, the ratio has increased which means manufacturers are increasing inventory or decreasing sales. A decrease in sales corresponds to the slowing GDP growth rate. We believe that the U.S. economy is showing signs of slowing down which a rising manufacturing inventories/sales ratio supports.



Data Retrieved From: U.S. Census Bureau

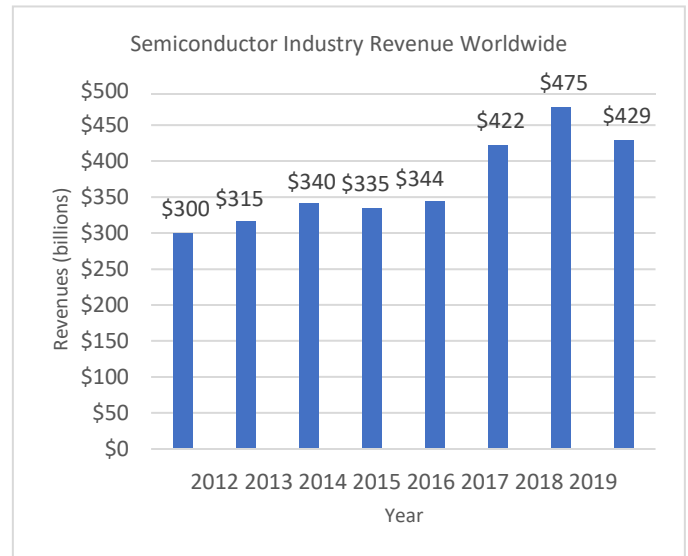
Capital Markets Outlook

The U.S. economy recently experienced its longest bull market in history. However, indicators are signaling a slowdown in economic growth. The technology sector and S&P 500 have a correlation of 0.94.¹⁰ A slowing economy would slow growth in the technology sector as well as semiconductor industry Micron operates under. We do not anticipate positive market conditions for the technology sector and semiconductor industry based upon slowing real GDP growth, on-going trade war uncertainty, and declining consumer confidence.

Industry Analysis

Industry Description

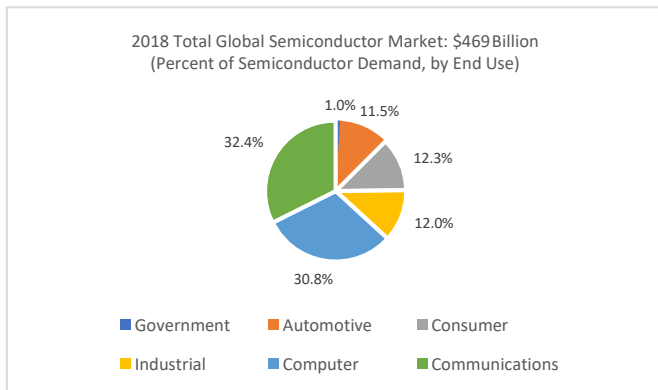
The semiconductor industry contains companies that manufacture semiconductor chips or semiconductor equipment. As shown in the graph below, global industry revenues were relatively constant from 2012 to 2016. However, there was an approximately \$78 billion increase from 2016 to 2017 and \$52 billion increase from 2017 to 2018.¹² Revenue for 2019 is projected at \$429.¹² We believe this decline reflects the relationship between slowing real GDP growth and decreased demand for semiconductors. For the first half of 2019, the semiconductors sub-industry, in which Micron operates, represented more than 80% of industry revenues while semiconductor equipment companies contributed to 20% of revenues.¹³ Going forward, we anticipate the semiconductor sub-industry to continue to dominate the industry.



Data Retrieved From: Statista

The four main categories of semiconductor chips based on functionality are memory chips, microprocessors, standard chips, and complex systems-on-a-chip (SoC).¹⁵ The two popular memory chips are Dynamic Random Access Memory (DRAM) and NAND Flash. DRAM saves data when it has power, meanwhile NAND saves data without power. Micron focuses on manufacturing both chips.

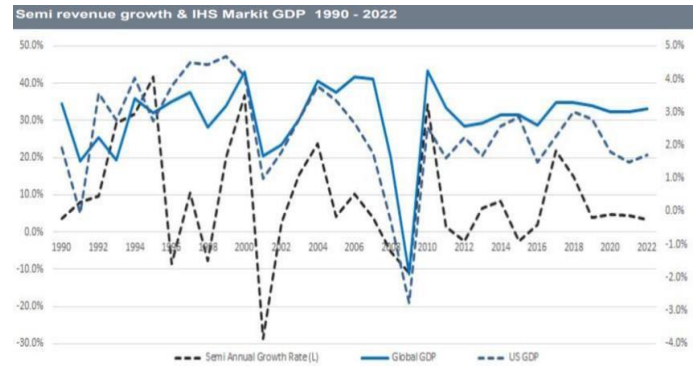
Manufacturers of semiconductor chips sell them to manufacturers of electronic devices that eventually reach business and consumer markets. The chart below breaks down demand for semiconductors by end use. The majority of demand comes from products ultimately purchased by consumers. As a result, the industry focuses on consumer driven economic indicators and revolves the industry around consumer innovations. Micron focuses on consumer driven end markets by operating in these four business segments: compute and networking, mobile, storage, and embedded.



Data Retrieved From: Semiconductor Industry Association

Business Cycle

Since 2001, approximately 70% of semiconductor industry revenue has come from consumer markets.¹ Given personal consumption is the largest component of real GDP, there has been a historical relationship between the industry and economic performance. The graph above shows the industry's annual growth rate compared to the global GDP and U.S. GDP. This relationship was especially apparent during the economic downturn following the tech bubble in 2000 and housing bubble in 2007. As a result, the demand for semiconductors is cyclical. During periods of economic expansion, the industry experiences high demand due to manufacturers producing more electronic devices and consumers wanting to purchase them. To meet this demand, the industry ramps up production and increases the supply. However, once the economy starts to slow down, the semiconductor manufacturers race to sell off excess inventory so prices are not lowered due to market oversaturation. In order for the industry to perform well, economic growth is essential.

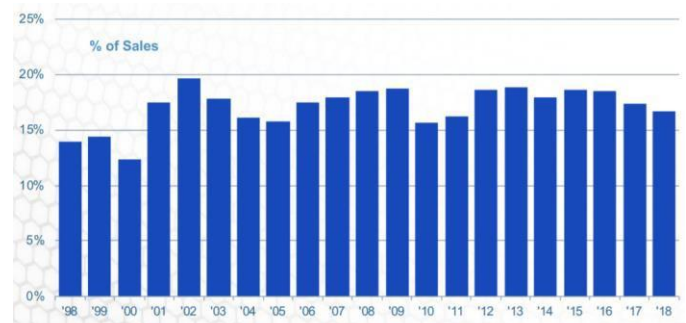


Data Retrieved From: St. Louis Federal Reserve

R&D Expenditures

The idea of constant improvement in the industry is expressed through Moore's Law, the idea that the number of transistors on a chip will double every year.¹⁵ This law is the foundation of the industry's competitive environment and emphasis on research and development (R&D) to develop a competitive advantage.

Out of all the U.S. industries, the semiconductor industry devotes the second highest average percentage of sales to R&D.¹⁶ As seen below, over the past 20 years R&D as a percentage of sales has exceeded 10%. In 2018 alone, the industry spent 17.4% of sales on R&D.¹⁶ R&D enables companies to innovate their products and expand into new markets by producing intellectual property. As a result, R&D leads to intellectual property that can serve as a company's competitive advantage.



Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the USSEC and SIA Estimates.

Data Retrieved From: Semiconductor Industry Association

Capital Expenditures

The semiconductor industry relies on capital expenditures to invest in property, plants, and equipment to manufacture semiconductor chips. Since 2000, the industry has made significant increases in capital expenditures as more goods contain chips and demand increases. The past three years have seen the highest levels of capital expenditures at \$95.6 billion in 2017, \$105.9 billion in 2018, and \$97.8 billion in 2019.¹⁷

Companies must build their own fabrication facilities or rely on outsourcing to save money. According to Intel, building one modern fabrication facility can cost between \$3 billion and \$8 billion and this will only increase as chips continue to evolve.¹⁸ Consequently, a limited number of companies can afford to build and maintain their own facilities. This has led companies to outsource their manufacturing to save money in an attempt to remain competitive in the industry.

Recent Developments and Industry Trends

Growth in M&A

Companies in the semiconductor industry operate in an extremely competitive environment. Semiconductor companies are turning to M&A to sustain profitability, seek new sources of revenue, and reduce revenue volatility by diversifying their product portfolios.¹⁹ The M&A value for the industry in 2014 was just \$16.9 billion but increased to \$107.3 billion in 2015.²⁰ It has since leveled off around \$23 billion.²⁰ Some companies that have engaged in M&A deals include: Intel, Broadcom, and Micron.

According to McKinsey, the most important contributor to growth for the semiconductor industry has been venturing into the right new market.²¹ From 2005 to 2008, the new market a company chose to enter contributed to growth, on average, 70% of the time.²¹ The second most successful growth method was M&A which contributed to growth, on average, 19% of the time.²¹ The increase in M&A value for the industry from 2014 to 2018 reflects the trend to rely on inorganic growth to spark the industry even if it has not been the most successful method.

Micron is positioning themselves to compete in new markets. In 2015, the company created a joint venture with Intel called IM Flash to develop and manufacture new 3D XPoint technology. This technology provides a solution to the gap in the memory market between DRAM and NAND. On October 31, 2019, Micron closed its acquisition of Intel's equity interest in the joint venture for approximately \$1.4 billion.²²

Also, on October 24, 2019, Micron announced it acquired FWDNXT, a start-up affiliated with the University of Purdue and developer of AI hardware and software.²³ By engaging in M&A activity, Micron is attempting to strengthen its position in new 3D XPoint and artificial intelligence markets.

Markets and Competition

Porter's Five Forces

Threat of New Entrants: Low

For the semiconductor industry, high start-up costs and capital investments needed to create and develop the technology creates a major barrier to entry. The industry is also global and already dominated by established brands like Intel, Samsung, and Taiwan Semiconductors. Many of the established companies already have efficient and cost-effective manufacturing processes that allow them to sell chips at lower and more attractive price. Based on the high costs and intense competition, it would be difficult for a company to enter the industry.

Power of Suppliers: Moderate

Major players in the semiconductor industry rely upon raw materials as inputs to produce semiconductors. Raw materials needed include silicon and germanium. These raw materials can be sourced from around the world, but the largest production comes from China. There are many suppliers relative to the number of players in the industry, but each company sets its own standards to its raw material inputs. There are various factors that control the availability of materials like silicone, chemicals, gases, photoresist, and printed circuit boards. Supply and demand along with international disputes such as the trade war pose risks to semiconductor companies that rely on a few suppliers.

Power of Consumers: High

Consumers of semiconductors are original equipment manufacturers (OEMs) that manufacture goods that integrate semiconductor chips. These manufacturers produce products for different segments of the market. As a result, segment challenges can follow. Micron operates under four main business segments in order to diversify its end markets.

Competitive Rivalry: Moderate to High

The industry as a whole is competitive. However, categorizing companies in the industry by the type of chip manufactured makes the industry less competitive. The memory chip sub-industry has grown the most from 2017 to 2018 at 27.4%.¹⁶ Micron is in this sub-industry and its main competitors are Samsung and SK Hynix. All three companies operate globally and rely on brand recognition, pricing, and R&D to remain competitive. One competitive advantage for Micron is its emphasis on finding manufacturing process and supply chain efficiencies to reduce the average selling price per chip.

Threat of Substitutes: Low

Micron manufactures a product that is an input in electronics. Although technology is rapidly changing and innovating around the world, these changes are due to advancements in semiconductor chips and rely on this input to exist. Micron focuses on memory chips which are the highest growth sub-industry in recent years. As technology continues to evolve, more memory semiconductors will be needed to support complex functions. Micron does not face the threat of substitution.

Peer Comparisons

Micron operates solely in semiconductor manufacturing. Companies that compete in semiconductor manufacturing have varying operations as some companies have other technology business operations while others purely focus on semiconductor manufacturing. The industry is also geographically diverse with a presence in the U.S., Japan, Korea, Taiwan, and China.¹⁶ These differences make comparing Micron to perfect competitors rather difficult, so we chose to compare Micron to companies that focus on the production of DRAM and NAND chips. For DRAM, Micron competes against Samsung and SK Hynix. In 2013, Micron's market share of DRAM chips by manufacturer almost doubled and took away competition from Elpida.²⁴ In the NAND category Micron primarily competes against Samsung, Toshiba, and Western Digital Corporation.

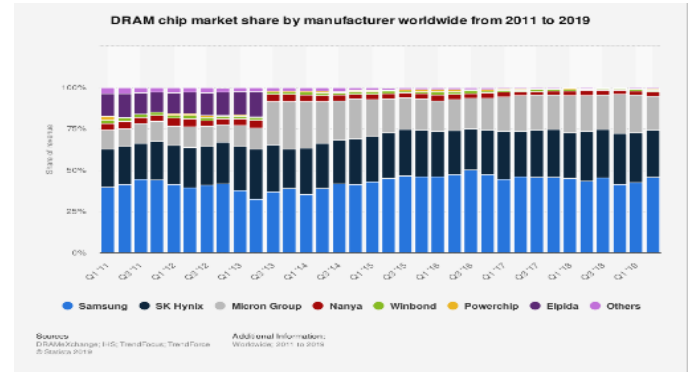
DRAM

Samsung

Samsung is multinational company from South Korea. It manufactures and sells electronic devices and computer components. It operated under various business segments including: Device Solutions-Semiconductors, Consumer Electronics, Information Technology & Mobile, and Device Solutions-Display. These consumer centric business segments are similar to Micron's. Samsung's market cap is near \$354,808 billion. The company has maintained steady market share in the DRAM chip market worldwide from 2011 to 2018.²⁴

SK Hynix

SK Hynix manufactures and sells semiconductor products. It operates under three business segments. These segments are DRAM, NAND Flash, and Other. In 2014, DRAM became its primary focus and is currently 80% of total revenue. These chips are used in consumer centric devices. SK Hynix's market cap is near \$58,345 billion. Like Micron, this company receives the majority of its revenue from DRAM chips followed by NAND.



Data Retrieved From: Statista

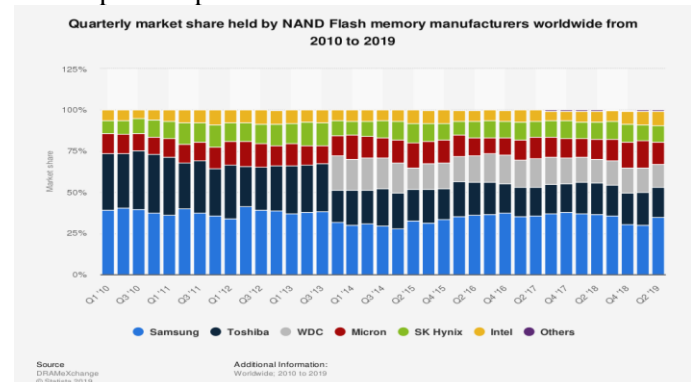
NAND

Toshiba

Toshiba is a manufacturer and seller of electronic devices and products. It operates through the following business segments: Energy Systems Solutions, Infrastructure Systems Solutions, Retail and Printing Solutions, Storage and Device Solutions, Industrial ICT Solutions, and Others. The Storage and Device Solutions segment manufactures NAND Flash along with other semiconductor components. Toshiba's market cap is \$1,656 billion and has lost market share in the NAND chip market due to the emergence of Western Digital Corporation in 2014.²⁴

Western Digital Corporation

Western Digital Corporation develops, manufactures, and sells data storage devices and solutions. There are several business segments like Micron's consumer-centric model. The three business segments are client devices, data center devices and solutions, and client solutions. The client solutions category focuses on NAND chips and solutions. The company was founded by Alvin B. Phillips in 1970 and is headquartered in San Jose, CA. It has a market cap of \$14,725 million. In 2014, Western Digital Corporation emerged in the NAND chip market and took away nearly half of Toshiba's NAND chip market share.²⁴ Since 2014, Western Digital Corporation has maintained its competitive position.

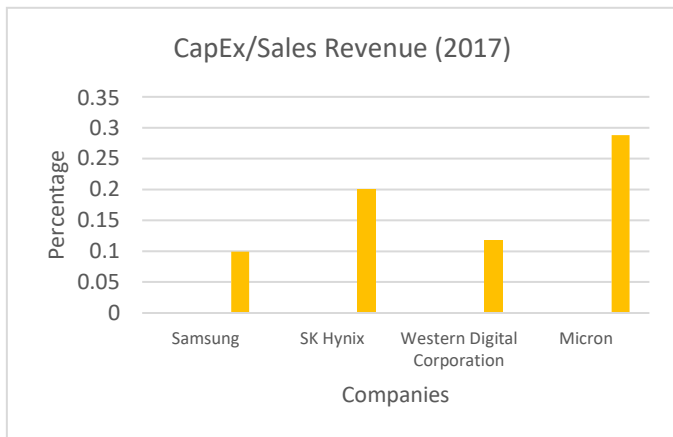


Data Retrieved From: Statista

Peer Financial Metric Comparisons

CapEx/Sales Revenue

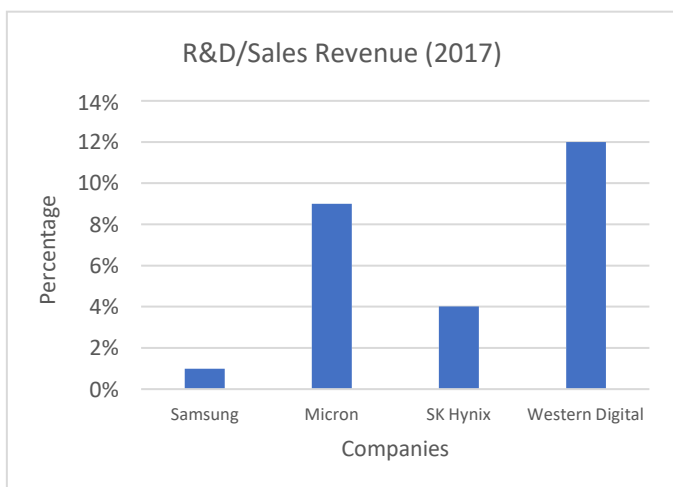
As a financial metric, CapEx as a percentage of sales measures the how much of revenue a company puts toward capital expenditures. This is a useful metric because the industry relies on capital expenditures to create fabrication facilities where chips are produced. These facilities also require heavy investment in equipment and machinery.



Data Retrieved From: HIS Market

R&D Expense

R&D as a percentage of sales measures the portion of sales a company dedicates toward their future product innovations and potential intellectual property. The semiconductor industry is reliant upon R&D for growth. As a result, companies invest heavily in R&D to remain innovative and competitive. Currently, companies are seeking to enter new markets like artificial intelligence, internet of things (IoT), and autonomous vehicles. This metric can indicate what players are taking financial steps to innovate for the future.



Data Retrieved From: Statista

Company Analysis

Business Overview

Founded in 1978, Micron has over 40 years of experience developing and manufacturing memory and storage solutions that serve as the essential heartbeat of technological innovation. Micron invests heavily in capital expenditures and research and development initiatives to further advance the capabilities of its semiconductor products and improve its manufacturing cost efficiency. The company's primary products are composed of Dynamic Random Access Memory (DRAM), NAND (Not And), NOR (Not Or), and 3D XPoint technology. Micron offers these devices to the market through its four business units: Compute and Networking Business Unit (CNBU), Mobile Business Unit (MBU), Storage Business Unit (SBU), and Embedded Business Unit (EBU).²²

Products Driving Revenue

DRAM & NAND

DRAM chips are high-speed data memory devices that historically account for approximately 60% of Micron's revenue.²² DRAM products are considered commodities in the semiconductor industry because they are the least expensive and most common semiconductors in the market. NAND products are data memory and storage devices that do not have the data access speed of DRAM technology, but instead have greater long-term storage capacity than the commodity chip. NAND historically accounts for approximately 30% of Micron's revenue.²²

Business Segments

CNBU

Micron's Compute and Networking Business Unit is the company's largest and most profitable business segment year after year. CNBU sells memory products and solutions into cloud server, enterprise, client, graphics, and networking markets. CNBU's most profitable market in 2019 came from the client segment, with memory content per unit driving sales growth. This business unit focuses on generating sales of the company's marketable DRAM technology products.

MBU

The Mobile Business Unit is intuitively responsible for sales of memory products into mobile-device markets. MBU sells both DRAM and NAND technology that are

necessary parts of the anatomy of smartphones and other mobile-devices like tablets.

SBU

The Storage Business Unit is responsible for transactions involving Solid State Drive (SSD) and other storage devices sold into data center, client, and consumer markets. Products sold through SBU primarily use NAND technology, but new 3D XPoint technology that has been developed through the IMFT joint venture with Intel accounts for an increasing portion of SBU sales.

EBU

Micron's Embedded Business Unit operates in a unique and developing marketplace, selling DRAM, NAND, and NOR technology to automotive, industrial, and consumer segments. Essentially, EBU offers products that contribute to the advancement of the Internet of Things (IoT), enabling heightened connectivity among technology devices. EBU provides the automotive market with technology vital to autonomous driving capabilities; provides the industrial market with devices that enable better machine-to-machine communication and coordination; and provides the consumer market with technology necessary for consumer products' access to and utilization of the IoT.

Production and Distribution

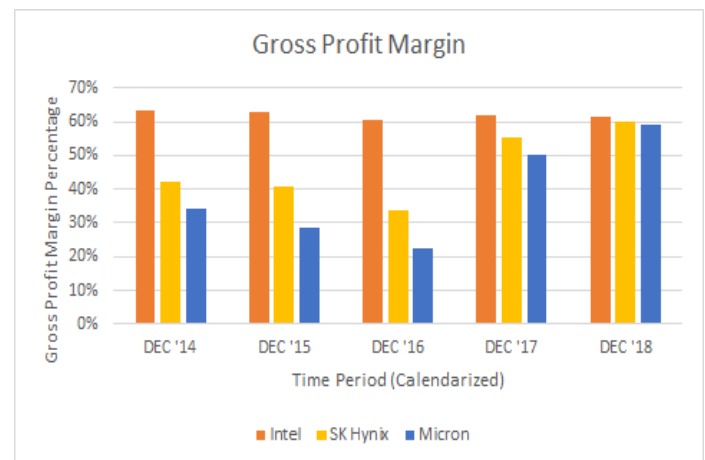
Manufacturing Process & Costs

Micron is an international semiconductor company with manufacturing plants across the world. Its primary facilities are located in the United States, Taiwan, Singapore, Japan, China, and Malaysia. While internationality is certainly a positive for any business, the trade war has had a noteworthy negative influence on Micron's operations due to its relationship and presence in Asia. Semiconductor manufacturing is extremely capital intensive, requiring significant investments in sophisticated fixed assets. Micron's CapEx levels have elevated in recent years as the company has enacted substantial growth initiatives with a long-term CapEx model of 30-35% of sales.²² Such expenditures have a versatile impact on production as DRAM, NAND, 3D XPoint memory, and NOR Flash products share several common manufacturing processes including wafer fabrication, assembly, and testing. Furthermore, a significant portion of semiconductor equipment must be replaced by newer and more advanced equipment every five to seven years to keep pace with the manufacturing process efficiency of competitors.

Competition

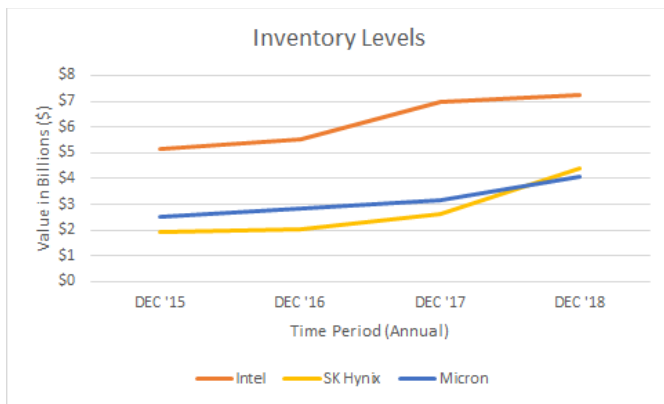
Companies' ability to manage the cyclical nature of the semiconductor industry is a major determinant of competitiveness. Micron has several large entity competitors with greater resources that enable flexible allocation strategies among their more diverse product portfolios, allowing them to effectively combat semiconductor cyclical. For instance, Samsung Electronics Co., Ltd. competes in the semiconductor realm of the technology sector but does not rely solely on sales of memory and storage solutions to generate revenue. This diversity of revenue sources helps guard against vulnerabilities to Samsung's bottom line when semiconductor profitability experiences periods of decline.

Three of the most important financial measures to consider when valuing semiconductor companies' operations are gross profit margin, inventory levels, and R&D as a percentage of sales. The following graph illustrates the gross profit margin for Micron, Intel, and SK Hynix, and offers a useful visualization of semiconductor cyclical. SK Hynix and Micron are more dependent on semiconductor sales than Intel, and therefore show more fluctuation in gross margin.



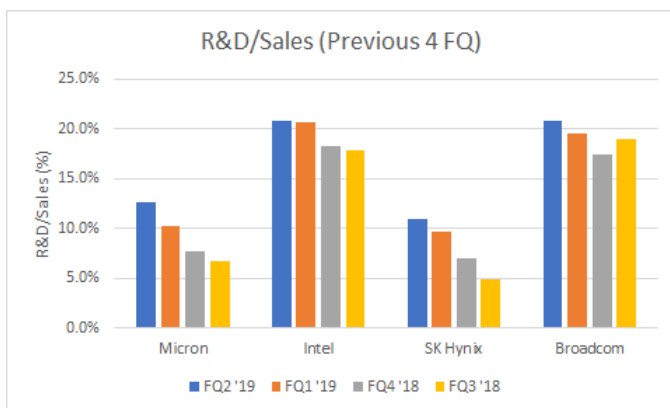
Data Retrieved From: FactSet

Inventory levels are important to consider because rising inventory figures for semiconductor companies are often a leading indicator of supply and demand imbalance. Supply and demand abnormalities have hurt 2019 profitability for the entire industry, and Micron cited it as one of the leading causes of its down year.



Data Retrieved From: FactSet

R&D as a percentage of sales is incredibly important for Micron and its competitors because semiconductors play such a vital role in enabling tech products to advance their AI and 5G capabilities. The diagram below shows a consistent upward trend in R&D expense for Micron and three of its competitors over the course of four recent fiscal quarters. Micron has made the most significant jump in R&D/Sales in recent periods, and we are confident the company will continue to exhibit a similar devotion to R&D moving forward.



Data Retrieved From: FactSet

Catalysts for Growth

Micron appears well positioned within the market to take advantage of technological advances in the Artificial Intelligence and 5G space. EBU can expect to recognize momentous revenue spikes as a result of AI growth and its potential impact on the automotive segment. Furthermore, management asserts that sales in the automotive section of EBU have offset some of the lower sales figures recently reported by the business unit's consumer market.

The desire for more automation and data processing and storage capacity will drive semiconductor R&D, which eventually results in positive returns for companies in the industry. Another encouraging point regarding R&D is

that the Semiconductor Industry Association, comprised of industry leading companies and their executives, recently called on the U.S. government to revamp its investment in R&D to supplement research initiatives that companies in the industry consistently allocate revenue towards.¹⁵ The entire I.T. sector needs both public and private commitment towards research and development in order to maximize and efficiently realize the potential benefits of technological advances. Although wide-spread R&D ramping will likely lead to even greater and more relentless competition, an established and fiscally capable company like Micron should be able to take total advantage of the movement and profit from the innovation it inspires.

Analysis of Recent Financials and Guidance

Micron's 2018 fiscal year set new records for the company in terms of sales and production, having benefited from a semiconductor market in peak condition and a stimulated macroeconomic environment. 2019's quarterly releases reported concerning year-over-year sales and earnings declines, however, and the trend had not ceased by the time the annual report was filed on October 17, 2019. Total revenue for 2019 was \$23B, reflecting a 23% decline from the 2018 mark.²² And, with a relatively consistent COGS expense despite the sales drop, Micron's gross margin reduced by over \$7B. Earnings per share for 2019 was \$5.67, down \$6.60 from 2018 and only \$1.00 greater than 2017's EPS.²

2019's semiconductor market was markedly inferior to that of 2018 and at the crux of the issue was a growing supply and demand imbalance. Selling prices slipped and Micron's inventories as a percentage of sales rose 10% which approximated the ratio reported in 2016, a year when Micron ended with a net loss.²² Management was confident that the downward cycle experienced during the first three fiscal quarters of 2019 would bottom by the end of the year, but after Micron released its fourth quarter earnings report it was evident that the semiconductor market had not yet bottomed, and demand was still a concern. To combat the supply and demand issue, the company stated its plan to reduce production volume and thereby reduce its high level of inventory. Micron is also depending on an easing of the trade war to aid its recovery, as China is one of the company's largest and most important markets.

SWOT Analysis

Strengths

Micron is one of the longest tenured semiconductor companies with over 40 years of experience. Throughout that time, Micron has established itself as an industry leader in semiconductor innovation and solidified its substantial market share. Operating in a rapidly evolving and cyclical industry, the company has proven its ability to navigate harsh and uncertain business climates time and again for nearly a half century. Micron's low debt levels also represent one of its stronger traits. Low debt levels allow for flexibility which proves extremely useful during the industry's frequent down cycles.

Weaknesses

Despite Micron's strong ability to work through inevitable market fluctuations, the company operates in a particularly cyclical industry with downturns that harm the profitability of even the most established chip producers. Micron's sales and earnings figures fall victim to semiconductor down cycles approximately every three years, and the company has historically relied on inorganic growth to catalyze recoveries from such cycles.

Micron generates the majority of its revenue through sales of DRAM products, which are considered a commodity within the semiconductor market. Micron is forced to accept the prices offered within the market as a result of its dependence on commodity chip sales. The market for semiconductor technology has been significantly oversupplied for much of the last year. This supply and demand imbalance resulted in meaningful price declines and low margins, particularly for companies like Micron that rely heavily on sales of DRAM commodity chips. Further complications arise when Micron's other major revenue driving product, NAND technology, also struggles to garner healthy levels of demand.

Opportunities

The growing demand for AI and 5G products that rely on semiconductor technology presents a profitable opportunity. Micron has shown a desire to capitalize on this opportunity through its willingness to increase its research and development expense and employ a robust capital expenditure model.

Industry demand during Micron's 2019 fiscal year reached levels low enough to expect a strong recovery in the near-term. From our perspective, Micron is not the problem. The company has a proven business model and offers products that are only increasing in importance for

the modern world. The issue in 2019 has been cyclicity and external hinderances discussed in the following section. Although the impact and duration of some external forces are difficult to predict, industry and company specific indicators reflect a bottoming of demand and an inevitable recovery soon to come.

Threats

Several financial measures such as profitability, inventory, pricing, and supply and demand almost exclusively describe a bottoming semiconductor market poised for a recovery in the near-term. However, the trade war is an unpredictable variable with an undeniable influence on semiconductor business. One of the most harmful trade war developments for Micron has been the situation pertaining to Huawei Technologies's trade ban. Huawei accounted for over ten percent of Micron's sales in 2019, making it the most valuable customer Micron had for the year. However, Micron is only allowed to sell specific products to the China-based company due to the trade ban restrictions. So, with heightened tariffs and a limit on sellable products, business dealings with Micron's largest customer have become strenuous for both sides. As a result, Huawei has made efforts to become increasingly self-reliant. More troubling from Micron's perspective is the potential for Huawei to begin dealing with some of Micron's foreign competitors that offer suitable substitute products and are not restrained by trade war restrictions.

Another threat to Micron is growing recessionary concerns that will lead to decreased consumer spending. While the argument can be made that certain consumer tech products are trending in the direction of necessity good status and away from discretionary, this does not imply that the market will be immediately responsive to rollouts of new tech products. Instead, consumers are likely to wait for price declines during times of economic distress.

Valuation Analysis

Revenue Decomposition

Total year end revenue forecasts are calculated as the sum of the sales projections we predict Micron's four business units will report individually during each of the next five years.

CNBU primarily sells DRAM products and its most profitable market is the client segment. Therefore, our analysis of DRAM demand, particularly pertaining to the client market, is the driving force behind the revenue

projections we predict for CNBU during the forecast horizon. DRAM demand has suffered significantly over the course of the last year and is taking longer to recover than management originally estimated. With Micron approaching the end of its first fiscal quarter of 2020 and DRAM demand still lagging, we forecast another year of negative revenue growth for the business unit before positive returns are again realized in 2021.

MBU generates revenue through sales of both DRAM and NAND technology to mobile-device markets. Mobile phones are an intriguing product because of their increasing necessity. Their capabilities have become so versatile and important for consumers' daily life that they seem to be less of a discretionary item than they were in years past. Considering this shift in perception, we anticipate MBU's revenue to remain stable. However, we are expecting a slight decline in sales during the current fiscal year due to the business segment's partial reliance on DRAM performance in the market.

NAND and new advanced storage technologies like 3D XPoint account for the revenue generated by SBU. Once the second generation of 3D XPoint had been developed and Micron acquired Intel's remaining interest in their IMFT joint venture on October 31st, Micron announced its intention to ramp the new technology in the coming year. Demand for 3D XPoint is driven by big data analytics, machine learning, and AI technology, all of which are extremely relevant in today's market. Pairing this with improved NAND supply and demand balance, we anticipate revenue growth for SBU throughout the entire forecast horizon.

EBU offers DRAM, NAND, and NOR products to markets engaged with the growing IoT. Semiconductor technology is vitally important for IoT advancement, which we are confident is going to continue to grow in relevancy and profitability. However, much like other business units offering products with demand issues, we forecast a slight decline in revenue generation in 2020. Following 2020 we expect EBU to experience relatively stable growth, reaching as high as 8% in 2022 before leveling at 4% during the CV year of 2024.

Cost of Goods Sold (COGS)

COGS less depreciation and amortization is forecasted as a percentage of sales based on the average ratio of the most recent three years. 2017 was the first year that Micron generated revenue above \$20 billion, and the company stayed north of that mark in the following two fiscal years.²¹ Because the revenue spike was so significant in 2017 and the company has been able to

generate similar levels of revenue in the two years since, a three-year moving average is ideal for projecting COGS as a percentage of sales. This approach allows the forecast ratio to maintain consistency with recent trends and not become skewed by outdated figures.

Operating Expenses

Selling, General, and Administrative (SG&A) expense is forecasted in the same manner as COGS. SG&A has been stable at approximately 3% of sales since revenue cracked \$20 billion for the first time in 2017.²¹ So, SG&A is calculated as a percentage of sales based on a three-year moving average over the course of the forecast horizon.

Research and Development (R&D) expense is one of the most important costs semiconductor companies must incur because the industry requires constant innovation in order for product lines to remain competitive. As a result, R&D moves uniformly among industry leaders who compete against each other to supply the market with the most advanced and marketable products. Micron and its competitors have increased their R&D expense in each of the last two years. We anticipate another increase in R&D as a percentage of sales during Micron's 2020 fiscal year. However, Micron has incurred R&D expense above 12% of sales only once in the last five years.²¹ Consequently, R&D is held constant at 10% of sales for the remainder of the forecast horizon beyond 2020.

Cost of Equity

Micron's cost of equity is calculated using the Capital Asset Pricing Model (CAPM). The risk-free rate used in the calculation is the yield on the 30-year treasury bond as of November 15, 2019 (2.31%). A beta of 1.71 is plugged into the formula and represents the average of the 1 year, 2 year, and 5 year weekly raw betas pulled from Bloomberg. By calculating the beta in this manner, we arrive at a figure that most appropriately reflects Micron's systemic risk given its cyclical nature. The risk premium we factor into the CAPM equation is Damodaran's value of 5.44%. Using these inputs, our CAPM equation calculates an 11.59% cost of equity.

Cost of Debt

To arrive at Micron's cost of debt, we used the yield on Micron's 12 year bond as the pre-tax cost of debt (4.24%). Multiplying the pre-tax cost by the marginal tax rate of 14% results in an after-tax cost of debt equal to 3.65%.

WACC

Micron's market value of equity and debt are \$53,149 million and \$6,417 million respectively. This equates to an equity market weight of 89.23% and a debt market weight of 10.77%. Multiplying the cost of equity and cost of debt by these weights and summing the products results in a WACC of 10.74%.

Valuation Models

Discounted Cash Flow (DCF) & Economic Profit (EP)

We believe Micron's most significant periods of growth have passed, and since the semiconductor industry is so volatile and cyclical, we decided a five year forecast horizon would be most appropriate. The value of operating assets provided in the DCF model calculates to \$62 billion, and the value of equity calculates to \$57 billion following the necessary adjustments. With 1,081 shares outstanding, the intrinsic value of Micron's stock as of November 15, 2019 equals \$54.43.

The value of economic profit calculated in the EP model equals approximately \$30 billion. After adding beginning invested capital of \$32 billion dollars to the value of economic profit and making subsequent adjustments necessary to arrive at the value of equity, we eventually calculate an intrinsic value equal to that of the DCF model.

Dividend Discount Model (DDM)

Using the dividend discount model, we calculate an intrinsic value of Micron stock significantly lower than the result we arrived at through the DCF and EP models. The DDM approach produces an intrinsic value of \$43.84. One major factor contributing to the lower price is the fact that Micron does not issue dividends to shareholders. In the end, the DCF and EP models provide more realistic figures because they use cash flows that are more representative of Micron's entire operation rather than focusing on EPS and dividends.

Relative Valuation

Our relative valuation model calculates Micron's 2020 implied relative value to be \$51.28. We included 8 of Micron's top competitors in the calculation: Intel, Taiwan Semiconductor Manufacturing, Qualcomm, NVIDIA, Broadcom, Western Digital, Analog Devices, and Texas Instruments. The average P/E for 2020 and 2021 came to be 19.12 and 14.76, respectively. Both figures are above Micron's expected P/E multiples. This relative valuation model resulted in a value close to what we calculated using the DCF and EP models.

Sensitivity Analysis

Beta vs. Risk-free Rate

The sensitivity table illustrating the impact of movements in beta and the risk-free rate shows that movements in the beta have a much larger impact on the stock price than movements in the risk-free rate. This makes sense considering how high Micron's beta is at 1.71. Any movement in either direction will have a very noticeable affect on stock price.

WACC vs. CV Growth

This sensitivity table shows how important the growth rate at the continuing value period is to stock price. The WACC appears to have much less influence on stock price. The forecasted CV growth is undoubtedly one of the most important assumptions factored into any valuation model because it dictates perceived future value that investors look to.

Equity Risk Premium vs. Marginal Tax Rate

As one would expect, both assumptions have a substantial influence on stock price considering their role in determining profitability and expected returns. Micron enjoys tax breaks from government incentives, which makes looking at the price sensitivity as a result of lower marginal tax rates interesting to examine. An increase in equity risk premium results in a higher cost of equity and expected return threshold, thereby lowering the stock price.

Pre-Tax Cost of Debt vs. CV R&D

The pre-tax cost of debt and continuing value R&D percentage of sales sensitivity table most notably demonstrates the consequence Micron could potentially face if it were to over-invest in R&D programs. While this expense is important for companies in the semiconductor industry, overspending on R&D typically indicates an unrealistic growth strategy which can stretch a company's discretionary funds too thin, thereby scaring off investors and hurting stock price.

CV COGS/Sales vs. CapEx

This sensitivity table illustrates a stronger stock price reaction to changes in continuing value COGS as opposed to CapEx movements. Both cash outflows have a significant impact on operating margins and stock price fluctuations, but because COGS is directly related to profits generated while CapEx can be manipulated depending on corporate strategy, it has a more profound impact on stock price.

References

¹Jelinek, Len. "Global Semiconductor Market Trends." IHS Markit, July 2018.

²"Real Gross Domestic Product." FRED, October 30, 2019. <https://fred.stlouisfed.org/series/A191RL1Q225SBEA>.

³Ken. "The Second Longest Bull Market Since WWII...How Does It End?" Melotte Financial Advisors, February 2, 2017. <https://melottefa.com/second-longest-bull-market/>.

⁴"United States Real GDP Growth [1948 - 2019] [Data & Charts]." CEIC, September 1, 2019. <https://www.ceicdata.com/en/indicator/united-states/real-gdp-growth>.

⁵"Here's What's in the First Stage of the Partial US-China Trade Agreement | Markets Insider." Business Insider. Accessed November 15, 2019. <https://markets.businessinsider.com/news/stocks/us-china-trade-deal-phase-one-what-agreement-should-include-2019-10-1028641083>.

⁶Reuters. "U.S. to Extend License for Its Companies to Continue Business with Huawei: Sources." Fox Business. Fox Business, November 16, 2019. <https://www.foxbusiness.com/markets/u-s-to-extend-license-for-its-companies-to-continue-business-with-huawei-sources>.

⁷"Consumer Confidence Index®." The Conference Board. Accessed November 14, 2019. <https://conference-board.org/data/consumerconfidence.cfm>.

⁸"Producer Price Index." U.S. Bureau of Labor Statistics. Accessed November 11, 2019. <https://data.bls.gov/cgi-bin/surveymost>.

⁹"Manufacturing Trade Inventories Sales Report." U.S. Census Bureau, n.d.

¹⁰Bausys, Marius. "U.S. Stock Market Sectors: Correlations." Seeking Alpha, January 12, 2016. <https://seekingalpha.com/article/3805416-u-s-stock-market-sectors-correlations>.

¹¹"Global Semiconductor Industry Sales Revenue 2009-2019." Statista. Accessed November 19, 2019. <https://www.statista.com/statistics/1008019/global-semiconductor-revenue-forecast/>.

¹²"Global Semiconductor Industry Sales Revenue 2009-2019." Statista. Accessed November 9, 2019. <https://www.statista.com/statistics/1008019/global-semiconductor-revenue-forecast/>.

¹³"Semiconductor Industry Sub-Industries." Capital IQ. Accessed November 10, 2019. <https://www-capitaliq-com>.

¹⁴Investopedia. "The Main Types of Chips Produced by Semiconductor Companies." Investopedia, November 18, 2019. <https://www.investopedia.com/ask/answers/042115/what-are-main-types-chips-produced-semiconductor-companies.asp>.

¹⁵Dcadmin. "What Is Moore's Law and Why Is It So Great?" Semiconductor Industry Association, February 26, 2019. <https://www.semiconductors.org/what-is-moores-law-and-why-is-it-so-great/>.

¹⁶"Semiconductor Industry Association Report 2019." Semiconductor Industry Association, n.d. Accessed November 10, 2019.

¹⁷"Capital Expenditure in the Global Semiconductor Industry from 2000 to 2019." Statista. Accessed November 11, 2019. <https://www-statista-com.proxy.lib.uiowa.edu/statistics/864897/worldwide-capital-spending-in-the-semiconductor-industry/>.

¹⁸"Intel Supports American Innovation with \$7 Billion Investment in Next-Generation Semiconductor Factory in Arizona." Intel Newsroom, February 8, 2017. <https://newsroom.intel.com/news-releases/intel-supports-american-innovation-7-billion-investment-next-generation-semiconductor-factory-arizona/#gs.hq3noi>.

¹⁹"Semiconductor Industry Trends and Consulting Services." Deloitte United States. Accessed November 20, 2019. <https://www2.deloitte.com/us/en/pages/technology-media-and-telecommunications/solutions/semiconductor-industry-services.html>.

²⁰"Semiconductor Industry Merger and Acquisition (M&A) Agreements Value Worldwide." Statista. Accessed November 10, 2019. <https://www-statista-com.proxy.lib.uiowa.edu/statistics/757321/worldwide-semiconductor-manda-value/>.

²¹"McKinsey on Semiconductors." McKinsey & Company, n.d.

²²Micron Technology, Inc. "SEC Filing: Micron Technology." SEC Filing | Micron Technology, October 2019. <http://investors.micron.com/node/39931/html>.

²³Takahashi, Dean. “Micron Technology Acquires Fwdnxt to Move into AI Hardware and Software.” VentureBeat, October 24, 2019.
<https://venturebeat.com/2019/10/24/micron-technology-acquires-fwdnxt-to-move-into-ai-hardware-and-software/>.

²⁴“DRAM Manufacturers Market Share Worldwide 2011-2019.” Statista. Accessed November 10, 2019.
<https://www.statista.com/statistics/271726/global-market-share-held-by-dram-chip-vendors-since-2010/>.

²⁵Broadcom, Inc. Income Statement. (OAD). Retrieved from <https://my.apps.factset.com/navigator/company-security/income-statement/AVGO-US>

²⁶Intel Corporation Income Statement. (n.d.). Retrieved From <https://my.apps.factset.com/navigator/company-security/income-statement/INTC-US>

²⁷Micron Technology, Inc. (2019, June 26). SEC Filing Form 10-Q: Micron Technology. Retrieved from <http://investors.micron.com/node/39566/html>

²⁸Micron Technology, Inc. (2019, June). Fiscal Q3 2019 Earnings Call Prepared Remarks. Retrieved from <http://investors.micron.com/static-files/8b6253d7-194b-4ebe-9101-85bff4711c0c>

²⁹Semiconductor Industry Association (SIA). (2019, September). Semiconductors.org. Retrieved from <https://www.semiconductors.org/wp-content/uploads/2019/09/Semiconductor-Industry-Association-Response-to-DOE-RFI-Basic-Research-Microelectronics.pdf>

³⁰SK Hynix, Inc. Income Statement. (n.d.). Retrieved from <https://my.apps.factset.com/navigator/company-security/income-statement/000660-KR>

Micron Technology, Inc.
Revenue Decomposition

Fiscal Years Ending Aug. 31	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
Revenue by Business Segment								
Compute and Networking Business Unit (CNBU)	8,624	15,252	9,968	8,473	9,151	10,523	11,576	12,154
YoY Growth	90.4%	76.9%	-34.6%	-15.0%	8.0%	15.0%	10.0%	5.0%
Mobile Business Unit (MBU)	4,424	6,579	6,403	5,891	6,067	6,280	6,374	6,438
YoY Growth	72.2%	48.7%	-2.7%	-8.0%	3.0%	3.5%	1.5%	1.0%
Storage Business Unit (SBU)	4,514	5,022	3,826	3,979	4,496	5,171	5,584	5,808
YoY Growth	38.4%	11.3%	-23.8%	4.0%	13.0%	15.0%	8.0%	4.0%
Embedded Business Unit (EBU)	2,695	3,479	3,137	3,043	3,195	3,451	3,658	3,804
YoY Growth	39.0%	29.1%	-9.8%	-3.0%	5.0%	8.0%	6.0%	4.0%
Other	65	59	72	86	105	129	148	166
YoY Growth	-35.0%	-9.2%	22.0%	20.0%	22.0%	22.0%	15.0%	12.0%
Total Revenue	20,322	30,391	23,406	21,472	23,015	25,553	27,340	28,370
YoY Growth	63.9%	49.5%	-23.0%	-8.3%	7.2%	11.0%	7.0%	3.8%
% Revenue (Business Segment)								
CNBU	42.4%	50.2%	42.6%	39.5%	39.8%	41.2%	42.3%	42.8%
MBU	21.8%	21.6%	27.4%	27.4%	26.4%	24.6%	23.3%	22.7%
SBU	22.2%	16.5%	16.3%	18.5%	19.5%	20.2%	20.4%	20.5%
EBU	13.3%	11.4%	13.4%	14.2%	13.9%	13.5%	13.4%	13.4%
Other	0.3%	0.2%	0.3%	0.4%	0.5%	0.5%	0.5%	0.6%

Micron Technology, Inc.
Income Statement

Fiscal Years Ending Aug. 31	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
Net sales	20,322	30,391	23,406	21,472	23,015	25,553	27,340	28,370
Cost of goods sold	7,900	7,640	7,231	6,793	6,726	7,815	8,333	8,538
Depreciation	3,861	4,759	5,424	7,196	7,333	7,283	7,629	8,003
Amortization	125	101	49	72	62	50	44	40
Gross margin	8,436	17,891	10,702	7,411	8,894	10,405	11,333	11,788
Selling, general, and administrative	743	813	836	709	732	856	896	928
Research and development	1,824	2,141	2,441	2,577	2,301	2,555	2,734	2,837
Operating income	5,869	14,937	7,425	4,125	5,860	6,993	7,702	8,023
Interest income	41	120	205	(593)	90	100	107	111
Interest expense	(601)	(342)	(128)	(162)	(180)	(150)	(153)	(165)
Other operating income (expense), net	(1)	57	(49)	-	-	-	-	-
Other non-operating income (expense), net	(112)	(465)	(405)	-	-	-	-	-
Total Income	5,196	14,307	7,048	3,371	5,770	6,943	7,656	7,969
Income tax provision	114	168	693	472	808	972	1,072	1,116
Equity in net (income) loss of equity method investees	8	(1)	3	-	-	-	-	-
Net income (loss)	5,090	14,138	6,358	2,899	4,962	5,971	6,584	6,853
Net income attributable to noncontrolling interests	(1)	(3)	(45)	-	-	-	-	-
Net income (loss) attributable to Micron	5,089	14,135	6,313	2,899	4,962	5,971	6,584	6,853
Earnings (loss) per share								
Basic	4.67	12.27	5.67	2.68	4.71	5.88	6.69	7.20
Number of shares used in per share calculations								
Basic	1,089	1,152	1,114	1081	1054	1015	984	952

All figures in millions of USD except per share data

Micron Technology, Inc.
Balance Sheet

Fiscal Years Ending Aug. 31	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
Assets								
Cash and equivalents	5,109	6,506	7,152	8,373	10,637	12,644	15,661	19,170
Short-term investments	319	296	803	831	859	889	919	951
Receivables	3,759	5,478	3,195	3,591	3,713	3,961	4,407	4,516
Inventories	3,123	3,595	5,118	3,618	3,130	3,475	3,718	3,858
Other current assets	147	164	235	216	231	257	274	285
Total current assets	12,457	16,039	16,503	16,627	18,569	21,225	24,979	28,779
Long-term marketable investments	617	473	1,164	1,222	1,283	1,346	1,413	1,484
Property, plant, and equipment, net	19,431	23,672	28,240	28,544	28,919	30,564	31,941	33,740
Intangible assets, net	387	331	340	268	206	156	112	72
Deferred tax assets	766	1,022	837	925	1,022	1,129	1,247	1,378
Goodwill	1,228	1,228	1,228	1,228	1,228	1,228	1,228	1,228
Other noncurrent assets, excluding goodwill	450	611	575	478	514	589	616	642
Equity method investments	-	-	-	-	-	-	-	-
Total assets	35,336	43,376	48,887	49,292	51,741	56,238	61,537	67,323
Liabilities and equity								
Accounts payable and accrued expenses	3,664	4,611	4,626	4,223	4,181	4,858	5,180	5,308
Current debt	1,262	859	1,310	1,343	241	73	48	637
Other current liabilities	-	521	454	416	446	496	530	550
Total current liabilities	5,334	5,754	6,390	5,982	4,868	5,427	5,759	6,495
Long-term debt	9,872	3,777	4,541	5,164	5,206	5,465	5,940	6,500
Other noncurrent liabilities	639	581	1,088	998	1,070	1,188	1,271	1,319
Total liabilities	15,845	10,112	12,019	12,144	11,144	12,080	12,969	14,313
Common stock/additional capital	8,399	8,318	8,332	8,404	8,477	8,549	8,622	8,643
Retained earnings/accumulated deficit	10,260	24,395	30,761	33,660	38,622	44,593	51,177	58,030
Treasury stock	(67)	(429)	(3,221)	(4,926)	(6,512)	(8,993)	(11,240)	(13,673)
Accumulated other comprehensive income/loss	29	10	9	9	9	9	9	9
Total Micron shareholders' equity	18,621	32,294	35,881	37,148	40,596	44,158	48,568	53,010
Noncontrolling interests in subsidiaries	870	970	987	-	-	-	-	-
Total equity	19,470	33,164	36,770	37,148	40,596	44,158	48,568	53,010
Total liabilities and equity	35,336	43,376	48,887	49,292	51,741	56,238	61,537	67,323

All figures in millions of USD

Micron Technology, Inc.
Cash Flow Statement

Fiscal Years Ending Aug. 31	2015	2016	2017	2018	2019
Cash flows from operating activities					
Net income (loss)	2,899	(275)	5,090	14,138	6,358
Adjustments to reconcile net income / loss to net cash provided by operating activities					
Depreciation expense and amortization of intangible assets	2,667	2,980	3,861	4,759	5,424
Amortization of debt discount and other costs	138	126	125	101	49
Loss on debt repayments, repurchases, and conversions	49	4	99	385	396
Stock-based compensation	168	191	215	198	243
Gain on remeasurement of previously-held equity interest in Inotera	-	-	(71)	-	-
Equity in net income / loss of equity method investees	(447)	(25)	(8)	-	-
Change in operating assets and liabilities					
Receivables	393	465	(1,651)	(1,734)	2,431
Inventories	116	(549)	50	(472)	(1,528)
Payments attributed to intercompany balances with Inotera	-	-	(361)	-	-
Accounts payable and accrued expenses	(691)	272	564	668	(174)
Other	21	(15)	22	(378)	(160)
Net cash provided by operating activities	5,208	3,168	8,153	17,400	13,189
Cash flows from investing activities					
Expenditures for property, plant, and equipment	(4,021)	(5,817)	(4,734)	(8,879)	(9,780)
Purchases of available-for-sale securities	(4,392)	(1,026)	(1,239)	(760)	(4,218)
Acquisition of Inotera	-	-	(2,634)	-	-
Proceeds from sales and maturities of available-for-sale securities	2,248	3,690	970	924	3,045
Proceeds from government incentives	-	16	21	355	748
Other	(51)	93	79	144	120
Net cash provided by / used for investing activities	(6,216)	(3,044)	(7,537)	(8,216)	(10,085)
Cash flows from financing activities					
Repayment of debt	(2,329)	(870)	(2,558)	(10,194)	(3,340)
Payments to acquire treasury stock	(884)	-	(36)	(71)	(2,729)
Payments on equipment purchase contracts	(95)	(46)	(519)	(206)	(75)
Proceeds from equipment sale-leaseback transactions	291	765	-	-	-
Proceeds from issuance of debt	2,212	2,199	3,311	1,009	3,550
Proceeds from issuance of stock	74	48	142	1,655	179
Other	13	(351)	9	31	(23)
Net cash provided by financing activities	(718)	1,745	349	(7,776)	(2,438)
Effect of changes in currency exchange rates on cash, cash equivalents, and restricted cash	(133)	19	(12)	(37)	26
Net increase (decrease) in cash, cash equivalents, and restricted cash	(1,859)	1,888	953	1,371	692
Cash, cash equivalents, and restricted cash at beginning of period	4,234	2,375	4,263	5,216	6,587
Cash, cash equivalents, and restricted cash at end of period	2,375	4,263	5,216	6,587	7,279

All figures in millions of USD

Micron Technology, Inc.
Forecasted Cash Flow Statement

Fiscal Years Ending Aug. 31	2020E	2021E	2022E	2023E	2024E
Cash flows from operating activities					
Net income (loss)	2,899	4,962	5,971	6,584	6,853
Adjustments to reconcile net income to cash from operating activities:					
Add: Depreciation expense	7,196	7,333	7,283	7,629	8,003
Add: Amortization of intangible assets	72	62	50	44	40
Change in deferred taxes, net	(88)	(97)	(107)	(118)	(131)
Changes in working capital accounts:					
Change in receivables	(396)	(122)	(248)	(446)	(109)
Change in inventories	1,500	488	(345)	(243)	(140)
Change in other current assets	19	(15)	(25)	(18)	(10)
Change in accounts payable and accrued expenses	(403)	(42)	677	322	127
Change in other noncurrent liabilities	(90)	72	118	83	48
Change in other liabilities	(38)	30	49	35	20
Net cash provided by operating activities	10,673	12,671	13,422	13,873	14,701
Cash flows from investing activities					
(Increase) decrease in short-term investments	(28)	(28)	(29)	(30)	(32)
(Increase) decrease in long-term marketable investments	(58)	(61)	(64)	(67)	(70)
Expenditures for property, plant, and equipment	(7,500)	(7,709)	(8,928)	(9,007)	(9,802)
Capitalization of intangible assets	-	-	-	-	-
Equity method investment	-	-	-	-	-
Business acquisitions	-	-	-	-	-
(Increase) decrease in other non-current assets	97	(35)	(75)	(27)	(26)
Net cash provided by / used for investing activities	(7,489)	(7,834)	(9,097)	(9,131)	(9,930)
Cash flows from financing activities					
Current debt	33	(1,102)	(168)	(25)	589
Long-term debt	623	43	259	475	560
Proceeds from issuance of common stock	72	72	72	72	22
Repurchases of common stock	(1,705)	(1,586)	(2,481)	(2,247)	(2,433)
Proceeds from issuance of notes payable & long-term debt	-	-	-	-	-
Non-controlling interest	(987)	-	-	-	-
Changes in accumulated other comprehensive income	-	-	-	-	-
Net cash provided by / used for financing activities	(1,964)	(2,573)	(2,318)	(1,724)	(1,263)
Change in Cash	1,221	2,264	2,007	3,017	3,509
Add: cash at beginning of year	7,152	8,373	10,637	12,644	15,661
Cash at End of the Year	8,373	10,637	12,644	15,661	19,170

All figures in millions of USD

Micron Technology, Inc.
Common Size Income Statement

Fiscal Years Ending Aug. 31	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
Net sales	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Cost of goods sold	38.87%	25.14%	30.89%	31.64%	29.22%	30.58%	30.48%	30.10%
Depreciation	19.00%	15.66%	23.17%	33.52%	31.86%	28.50%	27.91%	28.21%
Amortization	0.62%	0.33%	0.21%	0.34%	0.27%	0.20%	0.16%	0.14%
Gross margin	41.51%	58.87%	45.72%	34.51%	38.64%	40.72%	41.45%	41.55%
Selling, general, and administrative	3.66%	2.68%	3.57%	3.30%	3.18%	3.35%	3.28%	3.27%
Research and development	8.98%	7.04%	10.43%	12.00%	10.00%	10.00%	10.00%	10.00%
Operating income	28.88%	49.15%	31.72%	19.21%	25.46%	27.37%	28.17%	28.28%
Interest income	0.20%	0.39%	0.88%	-2.76%	0.39%	0.39%	0.39%	0.39%
Interest expense	-2.96%	-1.13%	-0.55%	-0.75%	-0.78%	-0.59%	-0.56%	-0.58%
Other operating (income) expense, net	0.00%	0.19%	-0.21%	0.00%	0.00%	0.00%	0.00%	0.00%
Other non-operating income (expense), net	-0.55%	-1.53%	-1.73%	0.00%	0.00%	0.00%	0.00%	0.00%
Total Income	25.57%	47.08%	30.11%	15.70%	25.07%	27.17%	28.00%	28.09%
Income tax provision	0.56%	0.55%	2.96%	2.20%	3.51%	3.80%	3.92%	3.93%
Equity in net income (loss) of equity method investees	0.04%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Net income (loss)	25.05%	46.52%	27.16%	13.50%	21.56%	23.37%	24.08%	24.16%
Net income attributable to noncontrolling interests	0.00%	-0.01%	-0.19%	0.00%	0.00%	0.00%	0.00%	0.00%
Net income (loss) attributable to Micron	25.04%	46.51%	26.97%	13.50%	21.56%	23.37%	24.08%	24.16%

Figures as a percentage of sales

Micron Technology, Inc.
Common Size Balance Sheet

Fiscal Years Ending Aug. 31	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
Assets								
Cash and equivalents	25.14%	21.41%	30.56%	38.99%	46.22%	49.48%	57.28%	67.57%
Short-term investments	1.57%	0.97%	3.43%	3.87%	3.73%	3.48%	3.36%	3.35%
Receivables	18.50%	18.03%	13.65%	16.72%	16.13%	15.50%	16.12%	15.92%
Inventories	15.37%	11.83%	21.87%	16.85%	13.60%	13.60%	13.60%	13.60%
Other current assets	0.72%	0.54%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
Total current assets	61.30%	52.78%	70.51%	77.44%	80.68%	83.06%	91.37%	101.44%
Long-term marketable investments	3.04%	1.56%	4.97%	5.69%	5.57%	5.27%	5.17%	5.23%
Property, plant, and equipment, net	95.62%	77.89%	120.65%	132.94%	125.65%	119.61%	116.83%	118.93%
Intangible assets, net	1.90%	1.09%	1.45%	1.25%	0.90%	0.61%	0.41%	0.25%
Deferred tax assets	3.77%	3.36%	3.58%	4.31%	4.44%	4.42%	4.56%	4.86%
Goodwill	6.04%	4.04%	5.25%	5.72%	5.34%	4.81%	4.49%	4.33%
Other noncurrent assets, net	2.21%	2.01%	2.46%	2.23%	2.23%	2.31%	2.25%	2.26%
Equity method investments	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total assets	173.88%	142.73%	208.87%	229.56%	224.81%	220.08%	225.09%	237.31%
Liabilities and equity								
Accounts payable and accrued expenses	18.03%	15.17%	19.76%	19.67%	18.17%	19.01%	18.95%	18.71%
Current debt	6.21%	2.83%	5.60%	6.25%	1.05%	0.29%	0.18%	2.25%
Other current liabilities	0.00%	1.71%	1.94%	1.94%	1.94%	1.94%	1.94%	1.94%
Total current liabilities	26.25%	18.93%	27.30%	27.86%	21.15%	21.24%	21.06%	22.89%
Long-term debt	48.58%	12.43%	19.40%	24.05%	22.62%	21.39%	21.73%	22.91%
Other noncurrent liabilities	3.14%	1.91%	4.65%	4.65%	4.65%	4.65%	4.65%	4.65%
Total liabilities	77.97%	33.27%	51.35%	56.56%	48.42%	47.27%	47.44%	50.45%
Additional capital	41.33%	27.37%	35.60%	39.14%	36.83%	33.46%	31.54%	30.47%
Retained earnings/accumulated deficit	50.49%	80.27%	131.42%	156.76%	167.81%	174.51%	187.19%	204.55%
Treasury stock	-0.33%	-1.41%	-13.76%	-22.94%	-28.29%	-35.19%	-41.11%	-48.20%
Accumulated other comprehensive income/loss	0.14%	0.03%	0.04%	0.04%	0.04%	0.04%	0.03%	0.03%
Total Micron shareholders' equity	91.63%	106.26%	153.30%	173.01%	176.39%	172.81%	177.65%	186.85%
Noncontrolling interests in subsidiaries	4.28%	3.19%	4.22%	0.00%	0.00%	0.00%	0.00%	0.00%
Total equity	95.81%	109.12%	157.10%	173.01%	176.39%	172.81%	177.65%	186.85%
Total liabilities and equity	173.88%	142.73%	208.87%	229.56%	224.81%	220.08%	225.09%	237.31%

Figures as a percentage of sales

Micron Technology, Inc.
Common Size Balance Sheet

Fiscal Years Ending Aug. 31	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
Assets								
Cash and equivalents	14.46%	15.00%	14.63%	16.99%	20.56%	22.48%	25.45%	28.47%
Short-term investments	0.90%	0.68%	1.64%	1.68%	1.66%	1.58%	1.49%	1.41%
Receivables	10.64%	12.63%	6.54%	7.29%	7.18%	7.04%	7.16%	6.71%
Inventories	8.84%	8.29%	10.47%	7.34%	6.05%	6.18%	6.04%	5.73%
Other current assets	0.42%	0.38%	0.48%	0.44%	0.45%	0.46%	0.45%	0.42%
Total Current Assets	35.25%	36.98%	33.76%	33.73%	35.89%	37.74%	40.59%	42.75%
Long-term marketable investments	1.75%	1.09%	2.38%	2.48%	2.48%	2.39%	2.30%	2.20%
Property, plant, and equipment, net	54.99%	54.57%	57.77%	57.91%	55.89%	54.35%	51.91%	50.12%
Intangible assets, net	1.10%	0.76%	0.70%	0.54%	0.40%	0.28%	0.18%	0.11%
Deferred tax assets	2.17%	2.36%	1.71%	1.88%	1.97%	2.01%	2.03%	2.05%
Goodwill	3.48%	2.83%	2.51%	2.49%	2.37%	2.18%	2.00%	1.82%
Other noncurrent assets, net	1.27%	1.41%	1.18%	0.97%	0.99%	1.05%	1.00%	0.95%
Equity method investments	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total Assets	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Liabilities and Equity								
Accounts payable and accrued expenses	10.37%	10.63%	9.46%	8.57%	8.08%	8.64%	8.42%	7.88%
Current debt	3.57%	1.98%	2.68%	2.72%	0.47%	0.13%	0.08%	0.95%
Other current liabilities	0.00%	1.20%	0.93%	0.84%	0.86%	0.88%	0.86%	0.82%
Total current liabilities	15.10%	13.27%	13.07%	12.14%	9.41%	9.65%	9.36%	9.65%
Long-term debt	27.94%	8.71%	9.29%	10.48%	10.06%	9.72%	9.65%	9.65%
Other noncurrent liabilities	1.81%	1.34%	2.23%	2.02%	2.07%	2.11%	2.07%	1.96%
Total liabilities	44.84%	23.31%	24.59%	24.64%	21.54%	21.48%	21.08%	21.26%
Additional capital	23.77%	19.18%	17.04%	17.05%	16.38%	15.20%	14.01%	12.84%
Retained earnings/accumulated deficit	29.04%	56.24%	62.92%	68.29%	74.65%	79.29%	83.16%	86.20%
Treasury stock	-0.19%	-0.99%	-6.59%	-9.99%	-12.59%	-15.99%	-18.26%	-20.31%
Accumulated other comprehensive income/loss	0.08%	0.02%	0.02%	0.02%	0.02%	0.02%	0.01%	0.01%
Total Micron shareholders' equity	52.70%	74.45%	73.40%	75.36%	78.46%	78.52%	78.92%	78.74%
Noncontrolling interests in subsidiaries	2.46%	2.24%	2.02%	0.00%	0.00%	0.00%	0.00%	0.00%
Total equity	55.10%	76.46%	75.21%	75.36%	78.46%	78.52%	78.92%	78.74%
Total liabilities and equity	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Figures as a percentage of assets

Micron Technology, Inc.
Value Driver Estimation

Fiscal Years Ending Aug. 31	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
NOPLAT								
Sales	20,322	30,391	23,406	21,472	23,015	25,553	27,340	28,370
Less: Cost of Good Sold	-7,900	-7,640	-7,231	-6,793	-6,726	-7,815	-8,333	-8,538
Less: Depreciation	-3,861	-4,759	-5,424	-7,196	-7,333	-7,283	-7,629	-8,003
Less: SG&A Expense	-743	-813	-836	-709	-732	-856	-896	-928
Less: Research and Development	-1,824	-2,141	-2,441	-2,577	-2,301	-2,555	-2,734	-2,837
Add: Interest on PV of Operating Leases	39	6	19	24	24	25	26	27
EBITA	6,033	15,044	7,493	4,221	5,946	7,068	7,772	8,090
Income Tax Provision	114	168	693	472	808	972	1,072	1,116
Add: Tax Shield on Interest Expense	28	10	18	23	25	21	21	23
Less: Tax on Interest or Investment Income	2	4	29	-83	13	14	15	15
Less: Tax on Non-Operating Income (Expense)	-5	-14	-57	0	0	0	0	0
Add: Tax Shield on Gains and Acquisitions	0	2	-7	0	0	0	0	0
Add: Tax Shield on Operating Lease Interest	2	0	3	3	3	3	4	4
Less: Adjusted Taxes	147	190	735	581	824	982	1,082	1,127
Add: Changes in Deferred Taxes	218	-265	150	-88	-97	-107	-118	-131
NOPLAT	6,104	14,588	6,759	3,640	5,122	6,085	6,690	6,963
Invested Capital								
Normal Cash	305	456	351	322	345	383	410	426
Add: Accounts Receivable	3,759	5,478	3,195	3,591	3,713	3,961	4,407	4,516
Less: Accounts Payable	3,664	4,611	4,626	4,223	4,181	4,858	5,180	5,308
Add: Inventory	3,123	3,595	5,118	3,618	3,130	3,475	3,718	3,858
Net Working Capital	3,523	4,918	4,038	3,308	3,007	2,961	3,355	3,492
Add: Net PPE	19,431	23,672	28,240	28,544	28,919	30,564	31,941	33,740
Add: Other Operating Current Assets	147	164	235	216	231	257	274	285
Add: Intangible Assets	387	331	340	268	206	156	112	72
Add: Capitalized PV of Operating Leases	133	459	566	572	580	613	640	676
Less: Other Non-Current Liabilities	639	581	1,088	998	1,070	1,188	1,271	1,319
Invested Capital	22,982	28,963	32,331	31,909	31,873	33,363	35,052	36,946
ROIC (NOPLAT/Beg. Invested Capital)	36.21%	63.48%	23.34%	11.26%	16.05%	19.09%	20.05%	19.87%
FCF (NOPLAT - Change in Invested Capital)	-21	8,606	3,391	4,062	5,158	4,595	5,002	5,069
EP (NOPLAT - (Beg. Invested Capital*WACC))	4,294	12,121	3,649	169	1,696	2,663	3,108	3,200

Micron Technology, Inc.
Weighted Average Cost of Capital (WACC) Estimation

Cost of Equity

Beta	1.71
Risk Free	2.31%
Market Risk Premium	5.44%
Cost of Equity	11.59%

Cost of Debt

Pre-tax	4.24%
Tax Rate	14.00%
After-tax Cost of Debt	3.65%

Market Value of Equity

Share Price	\$47.71
Shares Outstanding	1,114
Market Value of Equity	<u>\$ 53,149</u>

Market Value of Debt

STD & Current Portion of LTD	1,310
LTD	4,541
PV of Operating Leases	566
Market Value of Debt	<u>\$ 6,417</u>

Market Weights

Weight of Equity	89.23%
Weight of Debt	10.77%
Total Weight	100.00%

WACC 10.74%

Micron Technology, Inc.
Discounted Cash Flow (DCF) and Economic Profit (EP) Valuation Models

Key Inputs:

CV Growth	2.00%
CV ROIC	19.87%
WACC	10.74%
Cost of Equity	11.59%

Fiscal Years Ending Aug. 31	2020E	2021E	2022E	2023E	CV 2024E
DCF Model					
NOPLAT	3,640	5,122	6,085	6,690	6,963
Beginning Invested Capital	32,331	31,909	31,873	33,363	35,052
ROIC	11.26%	16.05%	19.09%	20.05%	19.87%
NOPLAT	3,640	5,122	6,085	6,690	6,963
Less: Change in Invested Capital	-422	-36	1,490	1,689	1,894
FCF	4,062	5,158	4,595	5,002	5,069
CV (T=4)					71,681
Cash Flows to Discount					
Periods to Discount	1	2	3	4	4
Discount Factor	1.11	1.23	1.36	1.50	1.50
PV of Cash Flows	3,669	4,207	3,384	3,326	47,670
Value of Operating Assets	62,256				
Less: PV of Operating Leases	566				
Less: ESOP	316				
Add: Long Term Marketable Securities	1,164				
Less: Current Debt	1,310				
Less: Long Term Debt	4,541				
Add: Short-term Investments	803				
Value of Equity	\$ 57,489				
Shares Outstanding	1,081				
Intrinsic Value	\$ 53.18				
Intrinsic Value as of 11/15/19	\$ 54.43				

EP Model

NOPLAT	3,640	5,122	6,085	6,690	6,963
Invested capital	32,331	31,909	31,873	33,363	35,052
ROIC	11.26%	16.05%	19.09%	20.05%	19.87%
WACC	10.74%	10.74%	10.74%	10.74%	10.74%
EP	169.28	1,696.41	2,663.34	3,108.49	3,200.07
CV (T=4)					36,629.46
Cash Flows to Discount					
Periods to Discount	1	2	3	4	4
Discount Factor	1.11	1.23	1.36	1.50	1.50
PV of Cash Flows	153	1,383	1,961	2,067	24,360
Value of Economic Profit	29,924				
Add: Beginning Invested Capital	32,331				
Value of Operating Assets	62,256				
Less: PV of Operating Leases	566				
Less: ESOP	316				
Add: Long Term Marketable Securities	1,164				
Less: Current Debt	1,310				
Less: Long Term Debt	4,541				
Add: Short-term Investments	803				
Value of Equity	\$ 57,489				
Shares Outstanding	1,081				
Intrinsic Value	\$ 53.18				
Intrinsic Value as of 11/15/19	\$ 54.43				

Micron Technology, Inc.

Dividend Discount Model (DDM) or Fundamental P/E Valuation Model

<u>Fiscal Years Ending</u>	<u>2020E</u>	<u>2021E</u>	<u>2022E</u>	<u>2023E</u>	<u>CV 2024E</u>
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EPS	\$ 2.68	\$ 4.71	\$ 5.88	\$ 6.69	\$ 7.20
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Key Assumptions

CV growth	2.00%
CV ROE	14.11%
Cost of Equity	11.59%

Future Cash Flows

P/E Multiple (CV Year)					8.95
EPS (CV Year)				\$	7.20
Future Stock Price				\$	64.41
Dividends Per Share	-	-	-	-	-
Future Cash Flows				\$	64.41
Discount Periods	1	2	3	4	4
Discounted Cash Flows				\$	42.83

<u>Intrinsic Value</u>	<u>\$ 42.83</u>
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<u>Intrinsic value as of 11/15/19</u>	<u>\$ 43.84</u>
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Micron Technology, Inc.
Relative Valuation Models

Ticker	Company	Price	EPS 2020E	EPS 2021E	P/E 20	P/E 21
INTC	Intel	\$57.96	\$4.66	\$4.63	12.44	12.52
TSM	Taiwan Semiconductor Manufacturing	\$53.29	\$16.27	\$18.26	3.28	2.92
QCOM	Qualcomm	\$90.81	\$4.17	\$6.15	21.78	14.77
NVDA	NVIDIA	\$204.19	\$5.53	\$7.28	36.92	28.05
AVGO	Broadcomm	\$312.91	\$23.34	\$26.02	13.41	12.03
WDC	Western Digital	\$50.34	\$2.51	\$6.26	20.06	8.04
ADI	Analog Devices	\$113.40	\$5.29	\$5.95	21.44	19.06
TXN	Texas Instruments	\$118.00	\$4.99	\$5.69	23.65	20.74
Average					19.12	14.76

MU	Micron Technology, Inc.	\$47.71	\$2.68	\$4.71	17.8	10.1
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Implied Relative Value:

P/E(EPS20)	\$	51.28
P/E(EPS21)	\$	69.51

Micron Technology, Inc.
Key Management Ratios

Fiscal Years Ending		2017	2018	2019	2020E	2021E	2022E	2023E	2024E
Liquidity Ratios									
Quick Ratio	(Cash Equivalents + Accounts Receivable) / (Current Liabilities)	1.72	2.13	1.74	2.14	3.12	3.22	3.64	3.79
Current Ratio	(Current Assets) / (Current Liabilities)	2.34	2.79	2.58	2.78	3.81	3.91	4.34	4.43
Operating Cash Flow Ratio	(Operating Cash Flow) / (Current Liabilities)	1.53	3.02	2.06	1.78	2.60	2.47	2.41	2.26
Activity or Asset-Management Ratios									
Total Asset Turnover	(Sales) / (Total Assets)	0.58	0.70	0.48	0.44	0.44	0.45	0.44	0.42
Inventory Turnover	(Cost of Goods Sold) / (Average Inventory)	2.53	2.13	1.41	1.88	2.15	2.25	2.24	2.21
Receivables Turnover	(Sales) / (Average Accounts Receivable)	5.41	5.55	7.33	5.98	6.20	6.45	6.20	6.28
Financial Leverage Ratios									
Debt to Equity	(Total Liabilities) / (Shareholders' Equity)	0.85	0.31	0.33	0.33	0.27	0.27	0.27	0.27
Equity Multiplier	(Total Assets) / (Total Liabilities)	2.23	4.29	4.07	4.06	4.64	4.66	4.74	4.70
Interest Coverage	(EBIT) / (Interest Expense)	8.65	41.83	55.06	20.87	32.12	46.16	50.07	48.20
Profitability Ratios									
Profit Margin	(Net Income) / (Sales)	25.05%	46.52%	27.16%	13.50%	21.56%	23.37%	24.08%	24.16%
Return on Equity	(Net Income) / (Shareholders' Equity)	39.37%	72.61%	19.17%	7.88%	13.36%	14.71%	14.91%	14.11%
Return on Assets	(Net Income) / (Total Assets)	14.40%	32.59%	13.01%	5.88%	9.59%	10.62%	10.70%	10.18%
Payout Policy Ratios									
Total Payout Ratio	(Dividends + Repurchases)/Net Income	0.01	0.01	0.43	0.59	0.32	0.42	0.34	0.36

		Beta							
	\$ 54.43	1.41	1.51	1.61	1.71	1.81	1.91	2.01	
Risk-free rate	2.16%	67.84	63.11	58.95	55.38	51.96	49.00	46.33	
	2.21%	67.38	62.71	58.59	55.06	51.67	48.74	46.09	
	2.26%	66.92	62.31	58.23	54.75	51.39	48.49	45.86	
	2.31%	66.47	61.91	57.88	54.43	51.11	48.23	45.63	
	2.36%	66.03	61.52	57.54	54.12	50.83	47.98	45.41	
	2.41%	65.59	61.13	57.19	53.81	50.56	47.74	45.18	
	2.46%	65.15	60.75	56.86	53.51	50.29	47.49	44.96	

		WACC							
	\$ 54.43	7.74%	8.74%	9.74%	10.74%	11.74%	12.74%	13.74%	
CV Growth	0.50%	52.01	51.68	51.36	51.05	50.75	50.46	50.19	
	1.00%	53.02	52.69	52.37	52.06	51.76	51.48	51.20	
	1.50%	54.15	53.81	53.49	53.18	52.88	52.60	52.32	
	2.00%	55.39	55.06	54.74	54.43	54.13	53.84	53.57	
	2.50%	56.79	56.46	56.14	55.83	55.53	55.24	54.97	
	3.00%	58.38	58.04	57.72	57.41	57.11	56.83	56.55	
	3.50%	60.17	59.84	59.52	59.21	58.91	58.63	58.35	

		Equity Risk Premium							
	\$ 54.43	4.84%	5.04%	5.24%	5.44%	5.64%	5.84%	6.04%	
Marginal T.R.	5.00%	68.81	65.99	63.37	60.94	58.67	56.54	54.55	
	8.00%	66.41	63.67	61.14	58.78	56.58	54.52	52.59	
	11.00%	63.99	61.34	58.89	56.61	54.48	52.49	50.63	
	14.00%	61.56	59.01	56.64	54.43	52.38	50.46	48.66	
	17.00%	59.13	56.66	54.38	52.25	50.27	48.42	46.68	
	20.00%	56.68	54.31	52.11	50.06	48.15	46.37	44.70	
	23.00%	54.23	51.95	49.83	47.86	46.03	44.32	42.71	

		CV R&D							
	\$ 54.43	4.00%	6.00%	8.00%	10.00%	12.00%	14.00%	16.00%	
Pre-Tax Cost of Debt	3.34%	65.67	62.11	58.55	54.98	51.42	47.85	44.29	
	3.64%	65.44	61.89	58.35	54.80	51.25	47.70	44.15	
	3.94%	65.21	61.68	58.15	54.61	51.08	47.55	44.02	
	4.24%	64.98	61.47	57.95	54.43	50.92	47.40	43.88	
	4.54%	64.76	61.25	57.75	54.25	50.75	47.25	43.75	
	4.84%	64.53	61.04	57.56	54.07	50.58	47.10	43.61	
	5.14%	64.31	60.84	57.36	53.89	50.42	46.95	43.48	

		CapEx							
	\$ 54.43	6,750	7,000	7,250	7,500	7,750	8,000	8,250	
CV COGS/Sales	24.10%	67.18	66.45	65.71	64.98	64.24	63.51	62.77	
	26.10%	63.67	62.93	62.19	61.46	60.72	59.99	59.25	
	28.10%	60.15	59.41	58.68	57.94	57.21	56.47	55.74	
	30.10%	56.63	55.90	55.16	54.43	53.69	52.95	52.22	
	32.10%	53.11	52.38	51.64	50.91	50.17	49.44	48.70	
	34.10%	49.60	48.86	48.13	47.39	46.66	45.92	45.19	
	36.10%	46.08	45.35	44.61	43.87	43.14	42.40	41.67	

Present Value of Operating Lease Obligations (2019)

Fiscal Years Ending Aug. 31	Operating Leases
2020	54
2021	64
2022	63
2023	59
2024	53
Thereafter	459
Total Minimum Payments	752
Less: Interest	186
PV of Minimum Payments	566

Capitalization of Operating Leases

Pre-Tax Cost of Debt	4.24%
Number Years Implied by Year 6 Payment	8.7

Year	Lease Commitment	PV Lease Payment
1	54	51.8
2	64	58.9
3	63	55.6
4	59	50.0
5	53	43.1
6 & beyond	53	306.8
PV of Minimum Payments		566.2

Present Value of Operating Lease Obligations (2018)

Fiscal Years Ending Aug. 31	Operating Leases
2019	37
2020	43
2021	50
2022	50
2023	45
Thereafter	391
Total Minimum Payments	616
Less: Interest	157
PV of Minimum Payments	459

Capitalization of Operating Leases

Pre-Tax Cost of Debt	4.24%
Number Years Implied by Year 6 Payment	8.7

Year	Lease Commitment	PV Lease Payment
1	37	35.5
2	43	39.6
3	50	44.1
4	50	42.3
5	45	36.6
6 & beyond	45	261.2
PV of Minimum Payments		459.3

Present Value of Operating Lease Obligations (2017)

Fiscal Years Ending Aug. 31	Operating Leases
2018	29
2019	28
2020	23
2021	19
2022	17
Thereafter	38
Total Minimum Payments	154
Less: Interest	21
PV of Minimum Payments	133

Capitalization of Operating Leases

Pre-Tax Cost of Debt	4.24%
Number Years Implied by Year 6 Payment	2.2

Year	Lease Commitment	PV Lease Payment
1	29	27.8
2	28	25.8
3	23	20.3
4	19	16.1
5	17	13.8
6 & beyond	17	28.9
PV of Minimum Payments		132.7

VALUATION OF OPTIONS GRANTED IN ESOP

Ticker Symbol	MU
Current Stock Price	\$47.71
Risk Free Rate	2.31%
Current Dividend Yield	0.00%
Annualized St. Dev. of Stock Returns	35.58%

Range of Outstanding Options	Number of Shares	Average Exercise Price	Average Remaining Life (yrs)	B-S Option Price	Value of Options Granted
Range 1	12,000,000	25.94	4.30	\$ 26.35	\$ 316,171,320
Total	12,000,000	\$ 25.94	4.30	\$ 26.35	\$ 316,171,320

Effects of ESOP Exercise and Share Repurchases on Common Stock Balance Sheet Account and Number of Shares Outstanding

Number of Options Outstanding (shares):	12,000,000					
Average Time to Maturity (years):	4.30					
Expected Annual Number of Options Exercised:	2,790,698					
Current Average Strike Price:	\$ 25.94					
Cost of Equity:	11.59%					
Current Stock Price:	\$47.71					
		2020E	2021E	2022E	2023E	2024E
Increase in Shares Outstanding:		2.79	2.79	2.79	2.79	0.84
Average Strike Price:	\$ 25.94	\$ 25.94	\$ 25.94	\$ 25.94	\$ 25.94	\$ 25.94
Increase in Common Stock Account:	72	72	72	72	72	22
Change in Treasury Stock	-1,705	-1,586	-2,481	-2,247	-2,433	
Expected Price of Repurchased Shares:	\$ 47.71	\$ 53.24	\$ 59.41	\$ 66.30	\$ 73.99	
Number of Shares Repurchased:	(36)	(30)	(42)	(34)	(33)	
Shares Outstanding (beginning of the year)	1,114	1,081	1,054	1,015	984	
Plus: Shares Issued Through ESOP	3	3	3	3	1	
Less: Shares Repurchased in Treasury	(36)	(30)	(42)	(34)	(33)	
Shares Outstanding (end of the year)	1,081	1,054	1,015	984	952	