

October 21, 2020

Dear investor,

For the three months ended September 30<sup>th</sup>, 2020, the Bonsai Partners portfolio appreciated 70.6% gross, and 63.3% net of fees and expenses. The S&P 500 total return index returned 8.9% over this same period.

Year-to-date, the portfolio appreciated 179.3% gross, and 167.0% net of fees and expenses, compared to 5.6% for the S&P 500 total return index, as presented below.

At the end of the quarter, our gross exposure was 94.9%, with 5.1% held in cash.

**Bonsai Partners Historical Returns Summary**

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	<b>YTD 2020</b>	<b>2019</b>	<b>2018*</b>	<b>Since Inception*</b>	<b>Annualized Since Inception</b>
<b>Bonsai Gross Return</b>	<b>179.3%</b>	<b>60.6%</b>	<b>-17.9%</b>	<b>269.1%</b>	<b>95.9%</b>
<b>Bonsai Net Return**</b>	<b>167.0%</b>	<b>56.4%</b>	<b>-18.1%</b>	<b>242.0%</b>	<b>88.3%</b>
S&P 500 Return	5.6%	31.5%	-8.6%	26.8%	13.0%

*The performance data shown above represents past performance. Past performance does not guarantee future results. The investment return and principal value of an investment with Bonsai Partners will fluctuate so that an investment, when redeemed, may be worth more or less than its original cost. Performance may be lower or higher than the performance data quoted due to different fee structures, beginning periods, capital additions, or individual mandates.*

*\*Inception Date: 10/22/2018*

*\*\*Net Returns apply a 1.0% management fee and 10.0% incentive fee above a 6.0% compounding hurdle*

Well, it's been nearly two years since I started Bonsai. Has it really been that long?

While I expected my first few years to show gradual and steady progress, in reality, it's been anything but linear. On one hand I've raised less capital than I hoped, and on the other performance has been ahead of my high expectations. I'll gladly accept that trade-off any day of the week.

I'm happy to manage even a meager amount of capital if it means I'm generating returns I can be proud of. We are off to a reasonable start, but it's only the bottom of the first inning and I have a lot left to prove.

I started Bonsai as a way for me to express myself as an investor, and in turn, optimize my chance of generating the highest returns I can over my career. IRR has always been the variable I'm optimizing for, and I believe the asset side will take care of itself if I continue to focus on performance.

I'm pleased with our start, but the past is irrelevant if I'm unable to do it again.

To borrow David Sokol's words once more: **I'm pleased, but not satisfied.**

## Additional Thoughts On Holding A Large Position

As discussed in our last letter, my largest position: Redbubble, has so far experienced tailwinds from the pandemic. This turned what was once a large position into an enormous one.

It's easy to view an investment as a single decision, but I'd argue it's a series of many independent ones. Two managers can buy the same stock, in the same size, at the same time, and end up with remarkably different outcomes at the end. It's not only about the purchase decision or position sizing, but whether to add or reduce, and most importantly: **deciding when to sell.**

I cannot adequately describe how hard it was to not sell Redbubble when it doubled. And then doubled again. And then doubled again. It's easy to sell early, far harder to do nothing.

Our performance would be entirely different today if we sold most of the position based on a gut feeling, or if we adhered to an arbitrary portfolio management rule that forced me to sell at a certain size.

Fortunately, in the past, I've observed others make the painful mistake of **selling a good company too early.** I've been preparing for this moment for a long time, and such preparation allowed me to stay rational and only make a sell decision for what I consider the right reasons.

Ironically, I think it's riskier for me to arbitrarily sell down this large position than to continue holding it in size. When I sell a position, I introduce a new failure point into the investment cycle – reinvestment risk. Either I need to replace the sold shares with something new, or I need to buy it back at a lower price reasonably soon thereafter.

**The great opportunities in life are few and infrequent, and therefore my reinvestment risk is high.** Unless I've minimized this risk by finding something new that meets my purchase criteria, I don't intend on taking that gamble often. Similarly, as I've stated before, I don't want to go back to cash because it acts as a market timing call.

Finally, regarding buying back the shares at a lower price, most great businesses don't experience frequently slumping stock prices, and so this is usually a poor choice as well. I'd rather ride out the tough times than attempt to predict when they are going to occur. I believe I stand to lose more from reinvestment risk than share price volatility. I think it was Peter Lynch that said the right time to sell a great business is usually never.

Investors with concentrated portfolios and long time-horizons will earn 90% of their returns from just 10% of their ideas. Great returns aren't the result of broad diversity, but rather the deep concentration that results from compounding capital at high rates.

Why should I cut short the runway of one of our outlier ideas just for the sake of 'diversification' or the belief that I can predict near-term stock price movements? This is the exact opposite of what I'm trying to do: find and hold onto those 10% ideas for as long as I can. This is already extremely hard, so why make that job even harder? The concentration we're experiencing today isn't a bug; it's a feature of the strategy playing out as it should. By arbitrarily selling, I'd be throwing a wrench into the gears of a well running machine.

That said, as your portfolio manager, I have to adapt to the portfolio and adjust as conditions dictate. The truth is the change in Redbubble's valuation has happened so quickly that I haven't been able to keep up with new ideas. It will take me some time to redeploy some capital into attractive new ideas as I find them.

I can assure you that when I find new ideas that meet our threshold of attractive returns, it's likely that Redbubble will be a source of capital. While concentration isn't itself a problem that needs to be corrected immediately, running a position this large exposes us to unnecessary company-specific risks that I prefer to avoid if we have a diversity of good ideas. I anticipate that as we find new high-quality investments our exposure to Redbubble will decline, but I will continue to own it in size until that time comes. Even afterward, I expect the investment will be a large and important position for Bonsai.

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## PORTFOLIO REVIEW

### Portfolio Exposure (As of 9/30/2020)

Company:	Position Size (%):
Redbubble	60.6%
Pushpay	10.8%
Micron Technology	10.1%
Travelsky Technology	4.7%
LKQ	3.6%
Taiwan Semiconductor	2.2%
Genasys	2.0%
Illumina	0.9%
<b>Total Gross Exposure</b>	<b>94.9%</b>
Cash	5.1%
<b>Total Exposure</b>	<b>100.0%</b>

## Portfolio Update

This quarter, I made one new investment: Micron Technology, and sold our smallest position in MiX Telematics. **I outline the investment case for Micron at the end of this letter.** Our portfolio remains at eight positions total, and during the quarter I also added to Pushpay and LKQ.

As previously discussed, Redbubble continues to represent a significant part of our portfolio, and it will act as a potential source of capital for new ideas. During the quarter we executed on this strategy by selling a 10% position size worth of Redbubble and shifting those dollars into our new position in Micron.

Despite this, Redbubble continued to grow like a weed, and even after cutting it down, the position grew right back to where it was at the beginning of the quarter. In other words, our exposure roughly stayed the same despite selling part of the position.

MiX Telematics was a small position that did not pan out for several reasons outside our control. First, the precipitous decline in oil prices rendered their fleet management solution less appealing to customers (fuel savings are a key part of the purchase decision), and second, their venture-backed private competitors have been flooded with low-cost capital, making growth prospects far less appealing in the industry.

## Position Update

### Redbubble (ASX: RBL)

Redbubble is a three-sided marketplace that connects independent artists to consumers looking for designs that express who they are. These designs are printed and sold on nearly 100 different product types from t-shirts to jigsaw puzzles to shower curtains.

Similar to last quarter, Redbubble was the largest contributor to our performance, appreciating 101%.

During the quarter, management signaled that growth had further accelerated in July, reaching +130% for the month due to success in facemasks and overall increased momentum since lockdown began.

Redbubble continues to be well-positioned, and at the time of writing the company announced its third-quarter financial results. During the third quarter, the company generated \$25m of EBITDA; a significant accomplishment considering the business was only on the cusp of profitability when we first invested.

It's lazy math, but if we annualize this quarterly result, the company is on track to generate ~\$100m of EBITDA for a full year. Further, if we compare this to our average purchase price (an enterprise value of ~\$200mm) it represents a **50% EBITDA yield on our average cost basis**.

Considering Redbubble continues to grow and scale its profitability, our investment sits in a strong position.

Finally, I continue to be encouraged by management's focus on what I believe are the right strategic initiatives – understanding their customer, increasing customer retention, and building their brand leadership in this emerging category. I expect Redbubble's moat to continue to widen.

### Pushpay (ASX: PPH)

Pushpay is a leading provider of software and generosity solutions for the faith sector.

Pushpay shares were roughly flat in the quarter, depreciating -0.5%. The company will share its half-year results ending September 30<sup>th</sup> in the coming weeks.

Although not much occurred operationally this quarter, there were a few disappointing administrative moments. First, the quarter was punctuated by large share sales by management, and second, there were two executive turnover announcements.

One of Pushpay's credible board members resigned, and the current CEO: Bruce Gordon, indicated his intention to resign as well and search for a permanent replacement. The former is more concerning than the latter.

Bruce advised the company as the chairman for many years and stepped in after the prior CEO resigned last year. The fact that Bruce didn't assume an interim title suggests he wasn't expecting to resign and perhaps there are other issues at play. My biggest concern with Pushpay isn't product-related but managerial & cultural.

That said, I believe these managerial issues can resolve themselves with the leadership changes currently underway. A replacement board member was appointed during the quarter, and I'm closely watching for the appointment of the new CEO. This is a critical hire that has the potential to reset the culture of the company for the better (or do the opposite). I used points of weakness during the quarter to add to our position, but I'm closely monitoring these growing pains to ensure the thesis remains intact.

### **Micron Technologies (Nasdaq: MU)**

Micron is a manufacturer of memory semiconductor chips.

Micron's shares appreciated modestly from our cost basis this quarter: around 3%.

**I provide a detailed overview of the Micron investment thesis in the pages below.**

### **Travelsky Technologies (HKEX: 0696)**

Travelsky is the leading provider of software and systems for airlines and airports in China.

Travelsky shares appreciated 21% during the quarter.

Domestic air travel in China continues to improve at a faster rate than in the United States, leading to some optimism by investors. Presently, air traffic in the United States is down over -60%, while the most recent Chinese data suggests volumes are down around -40% and improving.

We are currently above our cost basis in Travelsky, which is remarkable considering the circumstance.

### **LKQ (Nasdaq: LKQ)**

LKQ is the largest provider of alternative collision and mechanical automotive parts in the United States. In Europe, they are the leading distributor of general automotive maintenance parts and supplies.

LKQ shares appreciated approximately 6% during the quarter.

During the quarter, LKQ hosted a virtual analyst day where they laid out their current set of initiatives and goals. I believe the company is focused on the right set of activities to improve its efficiency and reach its operational targets in the medium term.

### **Genasys (Nasdaq: GNSS)**

Genasys is a provider of critical communications solutions for both civilian and government personnel.

Genasys shares appreciated approximately 27% during the quarter.

In September, the company announced contract wins with two of Australia's three telecom companies to deploy its country-wide next-generation public warning system. This is a great contract for Genasys and serves as another example of the management team doing what they said they would. I continue to be impressed by Richard Danforth's consistent track record of execution since he took over as CEO.

Genasys also acquired Amika Mobile during the quarter, a Canadian provider of adjacent software solutions in the field of critical event communication and control products. I look forward to learning more about this asset and its strategic fit.

### **Taiwan Semiconductor (NYSE: TSM)**

Taiwan Semiconductor is the world's largest outsourced foundry of logic semiconductor chips.

Taiwan Semiconductor's shares appreciated approximately 43% during the quarter.

Last we discussed the Taiwan Semiconductor saga, the company was caught in the crossfire of the U.S.-China geopolitical firefight.

If that wasn't enough to consider, this quarter presented another important development for the business. Today, there are three large manufacturers of cutting-edge logic semiconductor chips: TSMC, Samsung, and Intel. Four if you include SMIC.

Depending on who you asked, it was either Intel or TSMC who had an advantage due to its business model. Some believed Intel's vertical integration provided an advantage, while others suggested TSMC's singular focus offered an edge.

This debate finally came to a head this quarter as Intel indicated they again stumbled while transitioning to the next process node. This signaled to the market that TSMC has unquestioned process leadership and a multi-year lead. If that wasn't enough, Intel announced that they too will outsource part of their manufacturing to TSMC.

TSMC has been enjoying a year of strong growth and this development made the narrative even more compelling to investors. I wish I owned more.

## Illumina (NASDAQ: ILMN)

Illumina is the leading provider of genomic sequencing instruments and reagents.

Illumina shares declined -17% during the quarter. Shares traded lower based on analyst downgrades following cautious guidance from management on their most recent earnings call. The investment thesis remains in-tact and I'm not concerned by the short-term sales difficulties caused by closed labs and constrained research budgets. Eventually, these issues should correct themselves.

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## New Investment: Micron Technology (Nasdaq: MU)

### Situation Overview

If there's one investment mistake I've made multiple times in my career it's accepting lower quality businesses available at attractive prices. I hope I'm not repeating this mistake again with Micron.

Acquiring a low-quality business at a great price usually does not lead to great investment returns, but neither does a great business at a low-quality price. You have to have both to earn superior returns.

I view Micron's share price is quite attractive, but I also believe the business is transitioning from being mediocre to rather good. If that happens, attractive returns should follow.

Historically, Micron has not been kind to shareholders, and its shares are currently priced to reflect this. However, I believe that the nature of the DRAM industry has structurally changed for the better.

From a high-level, what makes Micron attractive is how essential it is to human progress. Without getting too professorial, humanity has had multiple waves of productivity gains over the past 12,000 years.

The first big improvement in productivity came from the agricultural revolution, which allowed humans to shift from hunting and gathering into high productivity farming and the division of labor.

The second wave of human productivity came from the industrial revolution, which harnessed machines to perform repetitive tasks on our behalf.

We are now in the third wave of human productivity: the information age. Like the machines of the industrial revolution, silicon chips are now automating and simplifying information-driven tasks.

Each of these waves relied on certain enabling resources; those that had them thrived, and those that did not fell behind. In the agricultural revolution, the enabling resources were arable land and nutrient-rich grains. In the industrial revolution, it was fossil fuels. And in the information revolution, **it is silicon chips**.

If you're wondering why the United States government recently imposed restrictions on Chinese use of U.S. semiconductor technology (such as in the case of Huawei) – this action is like taking control of the world's oil fields during the industrial revolution. It's a way to keep China in check and maintain dominance of the global economy.

Micron makes memory; the chips that allow a computing system to store information (either temporarily or on a longer-term basis). Memory chips are quite different from the most commonly thought of

semiconductors: logic chips, which have the job of processing data. Memory chips don't process data, instead, their job is to feed data into processing chips, similar to a hopper in a factory, or a storage unit. Without memory, computers can't function, and human productivity stalls.

Similar to our investment in Taiwan Semiconductor, the key to Micron is that they are part of a small cadre that controls the means of chip production. For logic chips, most companies create their own designs but outsource their production to Taiwan Semiconductor. In memory chips, production is vertically integrated; the same companies that design the chips also make the chips.

The DRAM industry has significantly consolidated over the past 10 years, and today there are only three players of consequence remaining - Micron, SK Hynix, and Samsung. SK Hynix and Samsung are both Korean, while Micron is American (underscoring Micron's strategic value to the west).

Each of these memory makers has invested a tremendous amount of capital and expertise into their manufacturing footprint, and without many billions in investment and unincumbered intellectual property, it's very difficult for a new competitor to emerge. Even though Micron is the third-largest player in DRAM, its capital expenditure budget for the upcoming year is expected to be \$9 billion.

Even if you have the money and the intellectual property to reach a cutting edge node, there is tremendous execution required to keep up with market leaders who have decades of experience and know-how. Without that ability, a new player will likely be left behind, chronically unprofitable, and with little to show for its massive investment.

The advantages a Chinese company can bring to the memory business (low cost of labor and lower internal margin requirements) are not meaningful if the unit economics themselves aren't competitive. In a scale chipmaking operation, the majority of the cost base isn't due to labor but rather the remaining production costs in each chip (determined by manufacturing yield, technology process, and scale). There is a 20-30% cost difference per chip if you aren't on-par with your competitors, and this is a 20-40% gross margin industry!

So, from a high level, I was attracted to Micron because it's an essential business with very high barriers that keep out competitors, but it was also available at a great price.

### **The Investment Case For Micron**

Unfortunately, the investment case for Micron is pretty complicated. Not only does Micron have a complicated business, but its cyclical nature also makes it difficult for an investor to ascribe a valuation based on its earnings power. Micron is a large-cap stock, but these barriers to investment keep out most investors and allowed us to acquire the position at an attractive price.

I much prefer a simple thesis to a complicated one. However, when I mention Micron's complexity, it's not that 50 things need to happen for the investment to work, instead, the complexity lies in understanding how Micron operates, what the technology is, and how the industry has changed. These are knowledge based barriers that can be broken down through research and understanding.

Of course, there's a real chance I will be wrong about Micron, but I believe that its share price compensates us well compared to its risks. Further, my research suggests the business is improving for multiple reasons, which I outline here.

But, before I do, I won't dance around the biggest flaw in Micron's business that you have to understand. Despite operating in a DRAM oligopoly, Micron's key products are commodity. That is, any of the three major players' products are interchangeable.

Also, of Micron's two business lines, only one is attractive in my opinion today: DRAM is attractive, NAND is not.

Micron's business is 75% DRAM and 25% NAND, with the vast majority of their profits coming from the DRAM business. Think of DRAM as the short-term memory of your computer, and NAND as long-term data storage.

Getting back to the investment thesis, the performance of any commodity-driven company is ultimately determined by the conditions of supply and demand. If demand sustainably outstrips supply, you have a favorable operating environment, and if supply sustainably outstrips demand you have an unfavorable one.

Unlike Taiwan Semiconductor, memory companies have far less visibility into their end-customer demand (shorter order cycles), meanwhile, suppliers historically tried to steal share from one another by increasing their scale and thereby lowering prices. This led to multiple historical supply/demand imbalances and large gyrations in product prices, margins, and earnings.

I believe the supply/demand imbalance in DRAM has structurally changed and is now in a much-improved position. NAND will take a longer time to reach such an equilibrium, but, since DRAM is virtually the entire profit pool for Micron, I believe the business has shifted from being a mediocre one to a pretty good one with high returns on invested capital.

There are two key points to understand:

1. **DRAM supply is now constrained by the limitations of physics** - The physical limitations of chip design now make it difficult for DRAM makers to rapidly increase their supply without incurring inordinate costs. *Counter-intuitively, this is a significant positive for the industry.*
2. **Demand has increasingly strong secular growth trends** - Demand for Micron's products are in a fundamentally improved position due to the increasing value of data. This drives memory and storage bit demand.

## Supply-Side Improvements in DRAM

If you consider a logic chip, the underlying functional unit of that semiconductor is called a transistor. There are many transistors within a processor, and each transistor is a circuit that either allows current to pass or blocks it. This action of blocking/unblocking electricity allows a transistor to transmit data in the form of 1's and 0's (on and off states).

Memory chips are a bit different in that they have slightly more complexity in their underlying functional unit. Unlike a logic chip that is largely a series of transistors, memory chips are made of 'memory cells.' Memory cells typically have a '1T1C' structure: meaning one transistor and one capacitor per cell. Think of a capacitor as a temporary storage location that maintains the charge a transistor might pass through. The capacitor is what provides 'memory' of 1's and 0's.

A capacitor has a larger volume requirement than a transistor, and if you shrink it too much it won't be able to hold a charge, rendering it useless. Since each memory cell has both a capacitor and a transistor, the amount that you can shrink it down is less than you can for just a transistor alone. In other words, for two identical silicon wafers, you can theoretically make more logic chips than memory chips.

Today, logic chips are continuing to scale down at a rapid pace (Taiwan Semiconductor is already rolling out their 5-nanometer process with plans to roll out their 4-nanometer and 3-nanometer processes in the coming years), meanwhile, memory chip makers are theoretically capped at around 10 to 15-nanometer processes. Today, memory makers are largely already at these mature nodes with little runway remaining.

So, what does this all mean? It means that the cost to fit an incremental memory chip onto each of your wafer capacity has gone up exponentially. We've seen this play out over the past few years. For example, the cost to add 1% more memory chips to a wafer has increased 7x over the past 7 years! We are now at the point of significantly diminishing marginal returns.

Memory chip manufacturers only have two ways to make more chips, either by 1) improving the process technology (fitting more chips into each wafer of your existing manufacturing footprint) or 2) by adding new manufacturing lines at the current process technology.

Improving process technology is usually the far superior option of the two because by fitting more chips on every wafer you not only increase capacity, but you also lower the cost of each chip you make. This ensures an increased level of cost competitiveness in addition to expanding your supply. On the other hand, when you add additional manufacturing lines to a factory, your underlying cost structure per chip does not change, historically making it the inferior choice.

In the past, Samsung, which has the largest share in the DRAM market (around 50%), had been very aggressive in its investments in process technology. Samsung invested especially heavily at times when the memory market was weak to further drive down prices, steal share, and shake out weak competition from the market. It worked, and now only three players remain.

Samsung was able to enjoy these investments because 1) it allowed them to maintain their cost leadership in DRAM, and 2) they were cross-subsidized by other divisions within their conglomerate during periods of DRAM weakness.

Now that we've mostly reached process maturity (for the reasons mentioned above), incremental investment in Samsung's process technology will no longer provide a significant cost advantage. To increase supply Samsung therefore has to employ a mix of new production lines and update remaining lines that aren't yet on the latest nodes.

Similarly, due to the state of process maturity, any earlier cost advantage Samsung enjoyed over Micron and SK Hynix is now quite limited. The cost curve is now flat, and an incremental investment in process improvement will yield limited advantage despite the high cost of executing such a change. Process improvements now offer a much lower return on investment.

**Going forward, much more supply growth will come from adding new manufacturing lines rather than trying to shrink down the manufacturing process, and this I believe is the key insight of the investment.** With less rampant supply expansion in boom and bust times, this will lead to far better-matched supply and demand as well as improved profitability for all three players. Intuitively, you'd think

a higher cost of capital expenditures would be a bad thing, but in an industry where oversupply is catastrophic and players have historically been quite aggressive, it's exactly the opposite.

I believe the prisoner's dilemma is an economic theory that is applicable in this situation. Over the past decades, each of the memory players has been 'cheating' behind the other's back to get ahead. When all players cheat, everyone loses the game, (except for customers who enjoy the low prices). What's different now is that the laws of physics have eliminated the incentive for cheating, and this breaks the prisoner's dilemma.

I believe we've achieved a new equilibrium where the players in this industry are finally incentivized to behave rationally.

This thesis has been in play for a couple of years and we've already seen it bearing fruit. However, any improvements so far enjoyed have been masked by the cyclical memory correction that began in early 2019. Over this period each of the three memory players described their approach to expanding their supply as an effort to 'match demand,' and in 2020, capital spending declined significantly across the industry to match this reality.

This is a critical change for the industry because the DRAM makers have shifted their production decisions from "beating the competition" into forecasting what actual demand levels are likely to be at their given market share. This creates a much more rational supply/demand balance and superior profitability for all firms. In fact, we've seen improved profitability across the most recent market cycle in DRAM: all players earned reasonably good profits even at the bottom of the cycle (vs losses in prior cycles).

In short, historically the DRAM market was a painful boom/bust industry with several players overproducing to lower their cost structure and gain share from the other. These overproduction periods caused massive price and profitability swings.

Today, the industry has evolved into an oligopoly of just three players where it's no longer in the best interest of any one player to undercut the other in a parasitic game-theory dystopia.

Going forward, I expect DRAM to be a good margin and return industry with few players and more rational behavior. Both the peak and trough earnings should improve and offer attractive returns on invested capital.

### **Demand Side Has Increasing Secular Growth Trends**

Earlier I described memory chips as the hopper that feeds data into a computer's processor. That context is important to understand how software changes will increase the amount of memory required by the computing industry at large.

Artificial intelligence and machine learning offer a paradigm shift for software and semiconductors. What AI allows software to do is write its own code rather than rely on a software engineer to do it. The way AI does this is by gathering massive amounts of data from users, sensors, and other sources, and then trains itself off that data to make inferences around how it should behave.

For software companies to have market supremacy in an AI world, they will need to have the most and best data to fuel their growth loop. Having the best data allows machines to improve their software and

offer the best service to customers. Whoever has the best service will have the most customers, and in turn, the best dataset to further train the algorithm. This is a reinforcing cycle that repeats itself.

It's been said before that data is the new gold, and I think memory and storage act as picks and shovels. There are dramatically increasing demands placed on the chips that process these data, and without massive investments in the datacenters that process, store, and transfer this information, a technology company will fall behind. This benefits memory and storage bit demand.

Further, it's important to understand that machine learning algorithms are incredibly data-hungry, and they suffer diminishing marginal returns on additional data. This means that a company needs even more data every time it wants to achieve an algorithmic lead. As a rough rule, to double the efficiency of the leading deep learning algorithm, the machine requires 10x more new data. To double its performance again, the machine requires yet another 10x increase (a 100x amplification from the start), and so on.

Not only are these massive quantities of data, but the way data is parameterized and analyzed by these algorithms is also very data-intensive. Machine learning algorithms often overparameterize input data by design because it can't function like a human brain. This means that every piece of data inputted may have hundreds or even millions of categorization variables attached to each data point, and as more data is inputted, additional variable types are identified and added. We have a true data explosion problem, and the semiconductor companies that analyze and process these data stand to benefit since they are the ultimate bottlenecks.

Historically, the bottleneck of processing data had been the processor itself, but going forward, the demands of computing are shifting the bottlenecks from just the processor to networking, memory, and storage. Micron addresses two of these.

While I've focused on the center of the computing world today: the powerful datacenters where many of these computations happen, the edge computing nodes that generate most of these data – PCs, laptops, smartphones, the internet of things (IoT), etc. are all creating, consuming and sharing more data than ever as well. With advances such as 5G, each of these end nodes can transmit and store more data, and this requires higher amounts of memory and storage on the edges too.

While the demand side is much harder to forecast, I believe these factors all bolster structural bit growth demand in DRAM and NAND. Higher demand in addition to tighter supply should lead to an improved supply/demand dynamic over the medium to long term.

## What Could Go Wrong?

Every investment has multiple ways that a thesis might not play out, and in Micron's case, there are several ways I can be wrong. Compared to some of our other investments, Micron is less durable given its capital intensity, cyclical underpinnings, and lower gross margins.

The three largest areas of concern for me with Micron are: 1) new entrants into the DRAM and NAND markets (likely fueled by Chinese sovereign capital) 2) new technologies emerge that break the détente in DRAM and 3) the NAND business serves as a drag on overall company performance.

I'm monitoring each of these risks and believe that we are well compensated for them by the low stock price.

## Putting Numbers to the Investment Case

I won't share what I think the company is ultimately worth, but I believe there are two sides to this thesis – the first is that the earnings power of the business will continue to improve through the cycle, and the second is that with reduced cyclical and increased understanding by investors, its valuation multiple should expand.

If Micron continues to improve its through cycle margins while revenues grow at mid-to-high single-digits on average, I believe we will see even higher earnings growth. Compounding this intrinsic growth with reasonable multiple expansion (Micron trades today at ~6x trailing EBITDA) this will result in a healthy IRR, all while we own a well-positioned strategic business, with limited downside if the thesis doesn't play out as expected.

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## CONCLUDING THOUGHTS

I look forward to updating you again in our end of year letter in a few months.

As always, if you have questions or comments don't hesitate to reach out to me directly.

Sincerely,



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