NeedhamFunds

The Growth Factor - Commentary by John Barr, jbarr@needhamco.com

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The Opportunity We See in Semiconductor Manufacturing

(6 minute read)

2020 brought an unprecedented economic shutdown. The pandemic accelerated trends that we have been focused on for a long time; we call this the Great Digital and Life Sciences Acceleration. I would like to zero in on the opportunities in semiconductor manufacturing.

I've long felt the semiconductor industry has moved beyond a cyclical, PC-driven industry to one of strategic importance. The confluence of manufacturing semiconductors for automotive, data center, machine learning, and remote work electronic systems; remaking the supply chain, and securing supplies for geopolitical needs have created a positive scenario for semiconductor manufacturing technology companies.

Needham's Semiconductor Expertise

Needham Funds have been owners of semiconductor manufacturing companies since our start in 1996. Needham Funds are an affiliate of Needham & Company, which has completed over 580 underwritings and M&A transactions for semiconductor companies since 1985.

Additionally, prior to my Wall Street career, I spent 12 years in sales and marketing for Electronic Design Automation companies, selling to semiconductor and electronic systems companies. I also spent 8 years as a sell-side senior research analyst following semiconductor design and technical software companies. I served on the board of directors of venture capital-backed Coventor, Inc., which provided simulation and modeling solutions for semiconductor process technology and was sold to Lam Research, Inc. in 2017.

What Does the Opportunity in Semiconductor Manufacturing Mean for Needham Funds?

Growth in advanced semiconductor manufacturing has been a dominant investment theme for Needham Funds for over 10 years. **We have more dollars invested in Semiconductor and Semiconductor Capital Equipment companies than any other theme in our portfolios. We believe that our deep sector expertise, long-term positioning and patience will result in wealth creation for our long-term investors, and we are excited about the future.**

NEEDHAM FUNDS SEMICONDUCTOR & SEMICONDUCTOR EQUIPMENT PORTFOLIO HOLDINGS AT MARCH 31, 2021	% OF NET ASSETS
NEEDHAM AGGRESSIVE GROWTH FUND	35.4%
NEEDHAM GROWTH FUND	31.7%
NEEDHAM SMALL CAP GROWTH FUND	17.8%

The Current Semiconductor Shortage

In March 2021, CNBC reported, "Ford is significantly cutting production at six plants in North America due to an ongoing global shortage of semiconductor chips. The actions vary by plant but range from overtime shift cancellations to facilities being closed for up to three weeks from April through June. The same is true at automakers around the world."

What types of semiconductors are in short supply?

Many types of semiconductors are experiencing a shortage, including microcontrollers, power chips and even capacitors. Parts that are in short supply are manufactured on both advanced and older semiconductor manufacturing processes. Automotive and artificial intelligence/machine learning (AI/ML) are two areas that are short of supply. NVIDIA Corporation (NVDA) and Advanced Micro Devices, Inc. (AMD) are two of the leading suppliers of these parts and they manufacture at Taiwan Semiconductor Manufacturing Co., Ltd. (TSM).

Adding capacity requires adding equipment and some of our equipment companies are sold out for quarters. Some say it's still getting worse.

Why did it happen?

The auto industry has run on just-in-time manufacturing for decades. In February 2020, automakers started to cut back their semiconductor orders as the pandemic spread. When automakers cut back orders, that capacity was absorbed by remote work demand, which has not abated.

It was not until January 2021 that Ford (F) made its first disclosure of semiconductor shortages and talked of losing 10-20% of production. By then it was too late. Ford has recently said full recovery may extend into 2022.

Then came famine, pestilence and fire. There was the general supply chain disruption from the COVID-19 pandemic**,** the February freeze in Texas that shut down manufacturing plants, a March fire at Renasas Electronics, a large Japanese chipmaker, and the Suez Canal shut down. All of these events disrupted semiconductor production.

The end of Just-In-Time Inventory

In April, Taiwan Semiconductor Manufacturing (NYSE: TSM; the company name is abbreviated as TSMC) said it sees a "different approach to inventory management." "We don't think it's going to revert back." Ford said, "this will not happen again." The CEO of On Semiconductor (ON) said, "the JIT era is not sustainable."

The end of JIT means more semiconductor inventory and better terms for semiconductor makers.

It means there's a need for better analytics to understand the supply chain.

Long-Term Growth Drivers in Semiconductor Manufacturing

Today, automotive semiconductors are used for advanced driver assistance systems (ADAS) applications, including blind-spot detection, automatic braking, 360-degree radar, and front and rear cameras. Future applications include infotainment (i.e. a Tesla dashboard display), electrical/hybrid powertrains, and battery management.

Safety is paramount in the auto industry. Semiconductors going into cars cannot fail. Mobile phones are more tolerant of semiconductor failures as they are not putting users into life or death situations. Higher reliability requires advanced manufacturing process control, test, and inspection, which requires more spending on equipment.

Electric vehicles (EVs) are coming fast and bring a step-change in semiconductor content. General Motors (GM) expects to have 35 new EV models by 2025. Ford recently announced the exciting F150 Lightning EV. EVs use over $1,200 of semiconductors per car, compared to $300 today. Level 3 autonomous cars will use over $2,000 and fully self-driving cars will use even more.

Industry Investment in Manufacturing Capacity

How is the semiconductor manufacturing industry responding to the shortages and increased demand? TSMC has a near-monopoly on leading-edge manufacturing for fabless chip companies like Apple, Inc. (AAPL), NVIDIA, Broadcom, Inc. (AVGO) and Advanced Micro Devices, Inc. (AMD). Leading-edge technology is important because it allows semiconductors to do more and use less power. TSMC recently announced a $100 billion, 3-year capital expenditure plan. This is an unprecedented length and amount of spending. The company expects 10-15% annual revenue growth. I believe this spending level may lead to over 20% annual growth. TSMC is a holding of the Needham Aggressive Growth Fund and the Needham Growth Fund.

Samsung Electronic Co., Ltd. (005930-KR) is TSMC's only close competitor in technology, but they are geared to manufacture for internal customers. There is talk of a new $10 billion Samsung plant in Texas.

Over the last 3-4 years, Intel Corporation (INTC) has fallen well behind TSMC, which means the U.S. lacks leading-edge semiconductor manufacturing. At the beginning of 2021, industry observers wondered whether Intel should give up on advanced manufacturing. In February 2021, Intel announced the return of Pat Gelsinger as CEO. In March, Gelsinger announced an aggressive plan committing Intel to manufacturing. It includes $20 billion of capital expenditures in 2021 versus just $14 billion 2 years ago, and a $20 billion plan to build two new semiconductor fabrication plants in Arizona to serve fabless customers. However, TSMC is not just ahead on the technology, but also knows how to develop the software and systems to support external customers.

Geopolitics of Semiconductor Manufacturing

What do you think about almost all of the world's leading-edge semiconductors being manufactured on an island 100 miles off the shore of China? And that island is claimed by China; recently China has sent military aircraft over Taiwan and it has rattled the markets. I'm optimistic that the status quo in Taiwan will last for a long time, while Taiwan gradually moves into China's orbit.

With the pandemic, U.S. businesses recognize that they need more resilient and closer supply chains. Politicians recognize that the United States should not be dependent on Taiwan. There is bipartisan support for a proposed $50 billion bill for U.S. semiconductor manufacturing.

In the fall of 2020, TSMC announced a 20,000 wafers per month facility in Arizona and bought 1,100 acres. Newly public SkyWater Technology, Inc. (SKYT) recently opened the first new semiconductor fab on U.S. soil in 20 years. They have a special radiation-hardened process required for the aerospace industry.

Sovereign Buyers

While those industry investments are important, governments are recognizing the importance of having domestic manufacturing. There is bipartisan support in the U.S. for the $50 billion CHIPS Act to invest in semiconductor manufacturing and research. China is way behind in semiconductor manufacturing and with the U.S. banning sales to Huawei and other Chinese companies, they had a wake-up call. China has an ambitious plan to become self-sufficient in semiconductors by 2030.

Then there's Europe, which 30 years ago, produced 44% of the world's semiconductors. It is down to 10% and The European Commission wants to double that.

There's also India, which completely lacks semiconductor manufacturing. As an emerging economic power it needs domestic manufacturing to go along with its nascent design companies.

Conclusion

Growth in advanced semiconductor manufacturing has been a dominant investment theme for Needham Funds for over 10 years. **We have more dollars invested in Semiconductor and Semiconductor Capital Equipment companies than any other theme in our portfolios. We believe that our deep sector expertise, long-term positioning and patience will result in wealth creation for our long-term investors, and we are excited about the future.**

About Needham

The Needham Group is an independent, employee-owned firm with consistent leadership for 36 years. Needham has two subsidiaries, Needham & Company and Needham Asset Management. Needham & Company was co-founded by George Needham in 1985 as an investment bank focused on small and midcap companies, with deep sector expertise in technology - namely semiconductors, software and life sciences. Needham & Co offers investment banking, sales, trading and publishes equity research on over 350 public companies in 20 sectors.

Needham Asset Management was founded in 1992 to invest long-term in small and mid-cap companies. Today, Needham manages over $600 million across three 1940 Act mutual funds and 2 hedge fund limited partnerships.

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Total return figures include reinvestment of all dividends and capital gains. Needham & Company, LLC, member FINRA/SIPC, is the distributor of The Needham Funds, Inc.

For details regarding the Needham Funds, please contact the Fund's Transfer Agent at 1-800-625-7071.

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