Mom, Baseball, Apple Pie and Semiconductors
Recapturing Value in the Data Driven Economy

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Our Analytical Framework

Secular
Cyclical
Seasonal
Product Cycle
Valuation

Source: Credit Suisse Research
Key Message

**Secular**
After ~20 years of losing value to the Global Economy, Semiconductors are poised to recapture value. Rev CAGR is accelerating from 3-5% to AT LEAST 6-8% with potential upside to 9-12%.

**Cyclical**
After ~10 years of low volatility, cyclicality is likely to INCREASE over time. The Industry is currently no worse than MID-Cycle with a strong potential for “Stronger for Longer.”

**Seasonal**
“Sell in May and Go Away” is a hallmark of C2Q Tech/Semi, exacerbated by Lockdown vrs Re-opening, Inflationary Concerns and the impact of Government Policy.

**Product Cycle**
Data in all of its forms (Creation/Capture, Storage, Transmission, Analytics) is the ultimate product cycle and Semiconductors are one of the most levered sectors in the Economy to the Data Driven Economy.

**Valuation**
Semiconductors have been one of the best performing sectors in the market on a 3, 5, 10 year basis and public assets are trading well above trend line valuation albeit still below top-down intrinsic value.
Our Analytical Framework

Secular

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Source: Credit Suisse Research
Semiconductors Not Capturing Value

Our View:

- While Semiconductors have continued to outgrow Real GDP, Semis have undergrown Nominal GDP since 2000.
- Semiconductors as a percent of Nominal Global GDP in 2015 was the same as 1993.
- While many view Semis as inherently deflationary, for 30+ years the value of silicon in the economy consistently increased.

Source: SIA, Thomson Reuters Datastream, Factset Company data, Credit Suisse Estimates
What Went Wrong, How Does it Get Fixed?

**Then: 1998-2007**

- **SUPPLY GROWTH**
  - Moore’s Accelerates
  - 300 mm

- **BARRIERS TO ENTRY**
  - Foundry
  - IPOs

- **END DEMAND**
  - Consumerization
  - “Good-Enough”

**Now: 2008-2021**

- **SUPPLY GROWTH**
  - Moore’s Decelerates
  - No 450 mm

- **BARRIERS TO ENTRY**
  - R&D/Design
  - M&A

- **END DEMAND**
  - Few to Many
  - Consumer to Cloud

Source: Credit Suisse Research
Barriers to Entry

Then: Declining

- From the mid-90s through the mid-00s, Foundries went from supporting ~3% of Semi Rev to ~20%.
- The foundry model lowered Semi Entry Costs by an order of magnitude – from ~$200m to ~$10m.
- From ‘95-05 ~120 Semi Companies IPO’d. From ‘05-20 only ~45 Semi Companies IPO’d.

Now: Rising

- Sub-wavelength processing, multi-core, SoCs and Ecosystem Development greatly increased the R&D burden.
- While foundries mitigated the capital cost for new entrants, R&D became the new driver for scale.
- Over the last 12 years there have been >250 M&A transactions valued in aggregate >$500bn in M&A transactions, >3x more than in the prior 15 years.

Source: IDC, FactSet, Thomson Reuters Datastream, Company data, Credit Suisse Estimates
Supply Growth

Then: Accelerating

- Exiting the 1990s, supply growth accelerated along at least two vectors – a shortening of Moore’s Law and the move to 300 mm.

- As 300 mm moved from pilot to volume, supply growth accelerated by 50% from what had been 7-8% to 12% per year.

- 300 mm would mark a ~15 year period when Semi Rev increased ~75% from $190bn to $335bn and WFE remained flat at ~$32bn.

Now: Decelerating

- Beginning in 2008, Moore’s Law started to become more difficult – elongating node transitions from ~2 years to ~3 years.

- Wafer size transitions occur ~10 years – implying 450 mm R&D in 2008. Litho throughput has made 450 mm "uneconomical."

- Along with the above, DRAM and Fabless consolidation caused supply growth to decelerate to just 2% from 2010-2017.
End Demand

Then: Consumerization

- From 1995 to the mid 2000s, Consumer as a % of Semi Rev increased from <40 to ~55%.
- This was largely driven by PCs and Handsets. Over 10 years PC penetration increased ~5x.
- Moore’s Law accelerated when software innovation slowed – causing a “good enough” phenomenon.

Now: Cloudification

- As Semi Mix moved higher, ASP declines have slowed from a -4% CAGR to flat.
- We see application driven growth as providing the foundation for stable to rising ASPs longer term.

Source: IDC, Gartner, Company data, Credit Suisse Estimates
Our Data Paradigm
Bridge to $1 tn in Semiconductor Revenue

$1 tn in Semi Rev (CY30) BEFORE Data Economy Upside

- CY15 Semi Rev ($335 bn)
- CY18 Semi Rev ($470 bn)
- CY21E Semi Rev ($540 bn)
- CY30E Semi Rev ($1 tn)
- +AI TAM (+$110 bn)
- +AI TAM (+$450 bn)

Source: IDC, FactSet, Thomson Reuters Datastream, Company data, Credit Suisse Estimates
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