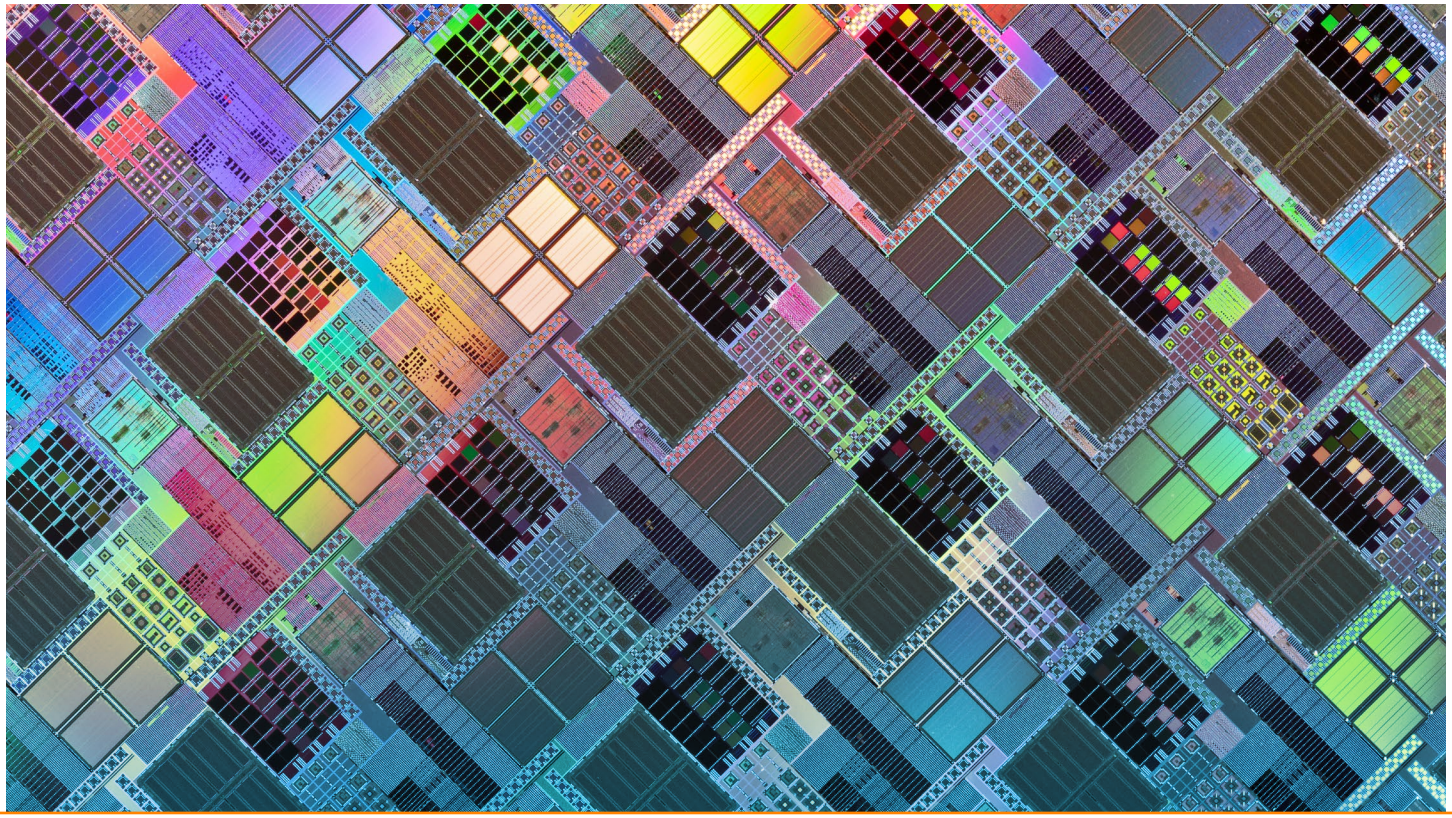

Semiconductor and Electronic Components Industry Report and Outlook for 2025

Maintain a competitive advantage despite market conditions

Produced in close collaboration between Model N and Future Horizons

Originally presented at Rainmaker24 in June 2024 as an outlook for revenue optimization and compliance professionals to forecast and strategically plan against.

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INDUSTRY REPORT

Introduction

The reliance on meaningful business data—particularly the ability to harness this data for deriving insights and making critical business decisions—is essential for driving growth and establishing a sustainable competitive advantage.

The Model N 2024 State of Revenue Report indicates that 96% of life sciences and high-tech companies utilize external data sources for revenue management decisions. Additionally, 94% of respondents expressed willingness to contribute to industry benchmarks to collectively enhance business outcomes. This collective effort is crucial as it benefits the entire ecosystem, facilitating improved decision-making that ultimately enables the delivery of transformative products, whether life-saving therapies or essential technologies.

This year's State of Revenue Report underscores the market's significant need for leveraging data and analytics for effective revenue optimization and compliance:

1. **Enhanced revenue operations:** 75% of executives believe they could enhance their revenue operations management. This sentiment is partly due to the vast quantities of data generated.
2. **Data overload:** The healthcare industry alone contributes to 30% of the 300 terabytes of data produced daily.
3. **Need for improved data utilization:** There is a pressing need for more effective methods to utilize data.

Indeed, more than 96% of pharmaceutical, medtech, and high-tech companies rely on external data sources. This demonstrates that the demand for intelligent and interconnected data is not diminishing but is, in fact, intensifying.

To address these needs and support companies making data-driven decisions, Model N sponsored Future Horizons to provide an updated analysis of the semiconductor and electronic component manufacturing industry.

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Preface

With 35 years in the semiconductor industry, Future Horizons has observed both enduring fundamentals and evolving nuances. This aligns with the adage: "The more things change, the more they stay the same."

In light of this, Future Horizons remains focused on the industry's enduring fundamentals. By consistently monitoring these fundamental elements—understanding the industry's operation and behavior—they have found that one can navigate industry developments effectively. It is essential to consider the nuances of each cycle, as every cycle presents unique characteristics.

Future Horizons recently celebrated their 35th anniversary in April. Their methodology emphasizes analytical rigor and historical context to provide actionable insights. Emphasis on analytics is important, as raw data alone has limited value. For instance, rising prices may be advantageous for sellers but detrimental to buyers. Thus, a single data point can have varying implications depending on one's perspective.

Their analytical approach involves comparing current data with historical trends, aiming to avoid repeating past mistakes. While the industry often reinvents historical concepts as new ideas, they strive to incorporate common sense and maintain accountability. They ensure transparency by articulating the rationale behind their conclusions, thus inviting scrutiny and constructive challenge.

In addressing prevalent inquiries, they noted the following key areas of interest:

- How sustainable is the current value-based rebound?
- When will semiconductor unit growth return?
- Can the U.S. and world economies continue to defy gravity indefinitely?
- Is the current surge in average selling prices a false dawn?
- Was 2023 the onset of the next semiconductor super cycle?
- Is artificial intelligence the next transformative industry product or merely hype?
- Will the CHIPS Act stimulate or overheat the industry?
- How will current U.S.-China policies impact the industry?
- Was the market collapse in Q1 2024 a significant setback or a minor issue?

Unparalleled data consistency and rigorous methodology

1. Track current status against underlying trends.
2. Learn from historical lessons.
3. Apply common sense and maintain accountability.

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Industry update

The growth momentum indicator is a metric that tracks quarterly growth against the annualized growth rate on a 12-month rolling basis. In positive developments, the downturn reached its nadir in Q1 2023, and subsequently transitioned into a golden cross by July. This pattern suggested the potential for two to three years of relatively stable growth.

Figure 1: SC growth momentum indicator

Source: Data from World Semiconductor Trade Statistics (WSTS), analysis by Future Horizons

Golden cross:
Occurs when the 3-month moving average rises above the 12-month moving average, typically signaling a period of relative stability and favorable conditions.

Death cross:
Occurs when the 3-month moving average falls below the 12-month moving average, generally indicating the onset of challenging conditions and potential turbulence.

However, by March 2024, the two curves appeared to converge, signaling a potential risk of a death cross in Q3 2024. Such a shift would shorten the anticipated stable growth period from one to two or three years to just one to two quarters. This development prompted concerns that the extrapolation of trends might lead to a more immediate downturn.

Fortunately, the data for April stabilized, delaying the onset of the death cross by an additional 12 months. This situation underscores the necessity of continuous monitoring and flexibility in strategy. It is crucial to rigorously analyze data, frequently cross-check and challenge assumptions, and remain adaptable to changes. Even a single month can significantly influence the overall trend.

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Analysis and implications of the 2023 market resurgence

Headlines

- **Downturn recovery ahead of schedule:** The market downturn reached its bottom one quarter earlier than the typical four-quarter recovery period.
- **Unexpected Q2 performance:** The second quarter exhibited exceptionally strong performance, exceeding expectations, including those of Taiwan Semiconductor Manufacturing Company (TSMC).
- **Strong Q3 and Q4 projections:** Q3 is anticipated to perform at a robust seasonal level, with Q4 expected to be even stronger. This represents an improvement from the initial forecast of a-20% decline to a revised estimate of-8%.
- **Elevated 2025 forecasts:** Enthusiasm surrounding a potential "super cycle" has elevated 2025 growth forecasts to the "high 20%" range.

Figure 2: 2023 market

Quarter	Market ($B)	Growth	Comment
Q1 2023	$119.511	-8.2%	Bottomed
Q2	$126.714	6.0%	Strong rebound
Q3	$134.674	6.3%	Solid growth
Q4	$145.986	8.4%	Above seasonal growth
2023	**$526.885**	**-8.1%**	

Source: Data from WSTS, analysis by Future Horizons

In 2023, the market experienced an unexpected resurgence, surpassing typical downturn recovery patterns. Quarterly growth rates showed unprecedented strength, with a notable 8% increase in Q4. This performance, however, may not indicate a sustained trend.

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Market decline in Q1 2024

Highlights

- **Sudden and unexpected market crash:** The market experienced a dramatic downturn beginning in January 2024.
- **Forecast versus actual performance:** A forecasted growth of 3.0% for Q1 2024 turned into an actual decline of 5.7%, a significant drop from Q4's growth of 8.4%.
- **Impact on integrated circuit (IC) market:** IC unit demand fell sharply, and IC average selling price (ASP) growth stalled. This combined effect reduced the Q1 forecast by $10 billion, and the 2024 forecast by $50 billion.
- **Unlikely Q3 and Q4 growth:** The negative performance in Q1 renders a 2.5% growth for the rest of the year highly improbable.

On January 1, 2024, the market abruptly entered a down cycle, with growth expectations of approximately 3% in Q1 2024 deteriorating into nearly a 6% decline. This sharp change was substantial and unforeseen.

Figure 3: 2024 market forecast

Quarter	Value ($B)	Growth
Q1 2024	$147.610	3.0%
Q2	$151.300	2.5%
Q3	$156.595	3.5%
Q4	$152.681	-2.5%
2024	**$608.186**	**16.0%**

Source: Data from WSTS, analysis by Future Horizons

Figure 4: Q1 2024 "lost" revenue

Quarter	Units	Growth
Q1 2024	$137.717	-5.7%
Q2	**$10B**	
Q3		
Q4		
2024		

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The downturn was not limited to a decline in ASPs; unit demand also experienced a significant drop. Although there were indications of underlying unit demand issues, they escalated into a severe problem. It remains unclear if this was due to quarter-end or year-end adjustments, but the impact was dramatic, removing approximately $10 billion from the Q1 forecast and $50 billion from the 2024 forecast.

This abrupt shift early in the year has a pronounced leverage effect, making it more impactful than similar changes occurring later in the year. It is crucial to analyze absolute numbers alongside growth rates, as they can be misleading.

Additionally, evaluating value growth alone can be deceptive; unit demand is a more accurate indicator of market conditions, given that production focuses on units rather than dollar value.

Month-on-month growth rates: Monitoring month-on-month growth rates, not just annualized figures, is essential. The need to closely monitor and analyze data has never been more critical.

Drivers of 2023's growth surge

A deeper analysis reveals the primary driver of semiconductor value growth in 2023 was the increase in ASPs. This reliance on ASP growth is concerning, as it may not accurately reflect underlying market health.

Sector performance

- **ICs** were a significant contributor to the overall growth.
- **Discrete** components experienced stagnation, with no growth observed. This raises questions about the strength of end-product demand if discrete components, which are crucial in many applications, are not growing.
- **Analog ICs** faced challenges. Although not considered high profile or particularly innovative, analog ICs are ubiquitous. They serve as a better indicator of overall industry health compared to niche products, such as GPUs from companies like NVIDIA, which have a limited application base predominantly in companies like Meta and Google.

This discrepancy suggests that while nominal growth appeared robust, underlying unit demand remained weak and prompts further inquiry into what factors within the IC market may have contributed to its apparent growth.

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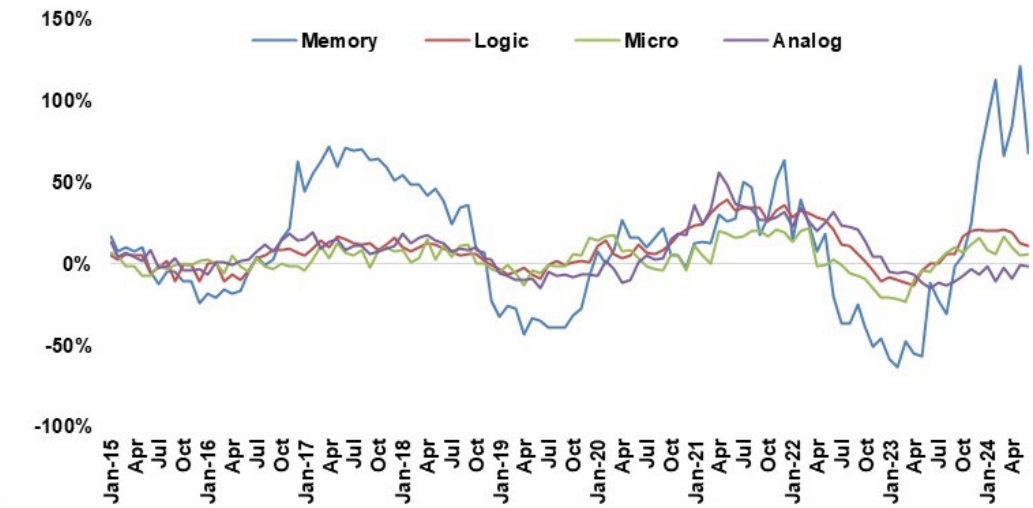
Figure 5: 12:12 IC growth rates



Source: Data from WSTS, analysis by Future Horizons

Average selling price (ASP): Represents the average price at which a product or service is sold across various markets and channels. It is calculated by dividing the total revenue earned from the product or service by the number of units sold.

Figure 6: Sector performance for components for ICs, optical, and discreet

Source: Data from WSTS, analysis by Future Horizons

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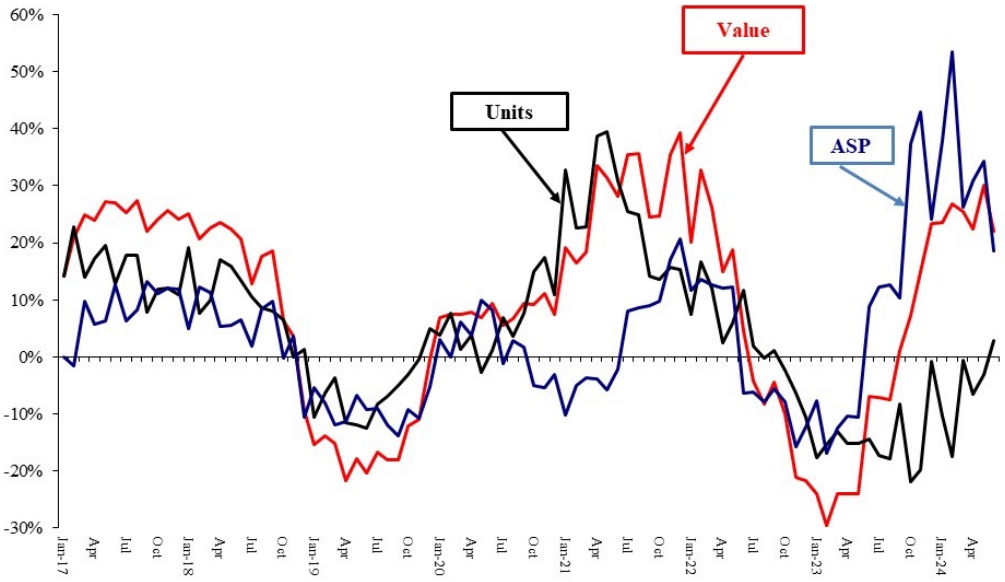
IC growth rate surge driven by ASPs, not units

The surge in IC growth rates observed in 2023 was primarily driven by increases in ASPs, as illustrated by the blue curve in Figure 7. Meanwhile, unit sales, represented by the black curve, continued to show negative trends. This divergence suggests that the market's apparent recovery, as indicated by overall value growth, does not reflect a true recovery in fundamental unit demand.

Figure 7: IC unit, value, and ASP growth rate



Source: Data from WSTS, analysis by Future Horizons. Growth adjusted for five-week months.

The reliance on ASP-driven growth contradicts basic principles of supply and demand economics. Despite an oversupply and low unit demand, prices have increased, which is contrary to typical economic behavior. Normally, an oversupply would lead to price reductions to balance supply and demand. The current situation, where prices rise amid oversupply, either indicates a cartel-like behavior or an unidentified factor disrupting traditional economic logic. This anomaly is inconsistent with historical patterns and lacks a clear explanation.

Key points to consider

- **Cyclical patterns:** All sectors follow cyclical patterns, though the timing of these cycles varies.
- **IC growth rates:** Monthly annualized growth rates for ICs stopped declining in Q1 2023 and plateaued in Q4.

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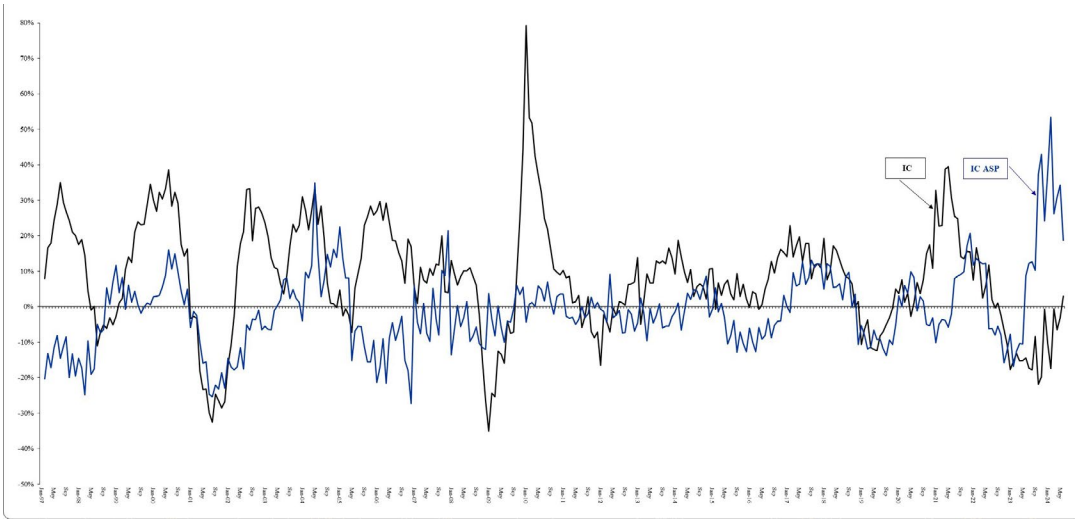
- **Sector recovery:** Recovery began with memory sectors in March 2023, followed by micro components in April 2023, and logic components in May 2023. However, analog ICs and discrete components have yet to show recovery, potentially more accurately indicating the real demand.
- **Value growth plateau:** Value growth has plateaued. Future directions remain uncertain.
- **ASP rebound:** The recovery observed since March 2023 can be attributed to the rebound in ASPs measured against the collapse in July 2022.
- **Future projections:** Monitor for potential declines in IC ASP growth rates starting in the second half of 2024.
- **Unit growth recovery:** The recovery of IC unit growth remains uncertain. It is unclear whether it will be sufficient to offset the anticipated decline in ASPs.

Units first, ASPs a year later

Figure 8: IC unit versus ASP growth



Source: Data from WSTS, analysis by Future Horizons. Growth adjusted for five-week months.

This chart, which extends as far back as WSTS data allows, illustrates a historical pattern where IC unit recoveries typically preceded increases in ASPs by approximately one year. This trend was a well-established rule of thumb. However, the recent data presents an anomaly where ASPs increased while unit growth lagged by a year. This deviation from the norm prompts questions about its underlying causes.

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Currently, sufficient data to fully understand this anomaly is lacking. Likely, this situation results from measuring ASPs against an unusually low base, given that ASPs plummeted by 85% in July 2023. Such a dramatic reset in the baseline makes any subsequent improvement appear more significant in comparison.

Bottomline

- **Unprecedented situation:** This time, ASPs increased before units, contradicting a 40-year historical pattern.
- **Economic fundamentals:** This development challenges traditional supply and demand economic principles.
- **Potential misleading indicators:** The observed increase in ASPs might be a statistical artifact due to percentage calculations, or there may be other unknown factors at play.

Caution against overinterpretation

At the beginning of the year, we cautioned against overreacting to headlines. While the surface data may appear promising, the underlying reality may not be as favorable.

- **ASP-driven growth:** The strong market value growth observed was driven by ASPs rather than unit growth. In the semiconductor industry, production and sales are primarily measured in units, not dollar values.
- **Persistent issues:** Ongoing excess inventory and slow end-market demand are fundamental issues contributing to lackluster unit demand.
- **Long-term agreements:** The lingering impact of "take-or-pay" long-term price agreements, prevalent during the post-COVID shortage boom, continues to affect the market.
- **Demand slowdown:** The overall slowdown in demand is influenced by inflation and rising interest rates, which affect consumer and business spending.
- **Capacity utilization:** Current capacity utilization rates are generally in the 70% to 75% range, with additional new capacity expected in the near future.

Key considerations

- **Market composition:** The majority of the chip market is not limited to NVIDIA GPUs and AI applications.
- **Recovery indicators:** Declaring a recovery is challenging when unit demand remains subdued.
- **Super cycle expectations:** The data from 2023 does not indicate the beginning of a semiconductor super cycle.

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Industry outlook

In the current climate, focusing on industry fundamental aspects is essential.

The lingering effects of long-term price agreements (LTAs) established during the COVID-19 shortages continue to impact the market. The "take-or-pay" contracts, which compel customers to accept parts they do not currently need, benefit suppliers' balance sheets but are detrimental to market dynamics. These agreements delay reorders, as customers remain burdened with excess inventory. This situation is not sustainable in the long term, as customers are constrained to take more parts than necessary, contributing to an ongoing inventory issue.

The COVID-era LTAs introduced a unique challenge. Historically, during shortages, LTAs have been adjusted or waived, but this time, customers are being required to adhere strictly to these agreements. This practice extends to wafer substrate manufacturers, who are compelling their customers to accept wafers they do not need to maintain their LTAs.

The result is a significant inventory surplus that will take considerable time to resolve. Additionally, it is crucial to recognize that the majority of the market extends beyond NVIDIA GPUs and AI applications, which represent only a small segment of the overall industry. Thus, the expectation of a new super cycle based on these high-profile segments was unfounded.

Long-term price agreements (LTAs): Contracts that formalize business relationships over a specified period are common in many industries, including high-tech manufacturing.

The impact and role of key market influencers

The semiconductor market is influenced by four primary factors that play a critical role in shaping market dynamics: the economy, unit demand, capacity, and ASPs. Understanding these drivers and their interactions is crucial for accurate market forecasting.

1. **Economy:** The overall economic environment dictates consumer and business spending power, affecting how much can be afforded and consequently, how much semiconductor technology is purchased. A buoyant economy typically drives stronger demand.
2. **Unit demand:** This metric provides insight into real consumption patterns and demand as it reflects the actual quantity of ICs purchased, adjusted for existing inventory levels.

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3. **Capacity:** The ability to meet demand influences whether there is an oversupply or undersupply in the market. Adequate capacity is crucial for aligning production with demand.
4. **ASPs:** Typically, ASPs are determined on a cost-plus basis rather than a value proposition. While selling on a value basis is occasionally successful, most ICs are priced based on cost-plus models.

Key considerations

- **Current status versus trends:** Monitoring the current status of these factors relative to underlying trends is essential. Deviations from the trend line often signal the need for market corrections.
- **Reinforcing or offsetting influences:** The impacts of these factors can either reinforce or offset each other, affecting overall market conditions.

1. Economy – persistent confusion and uncertainty

- **Divergent economic reports:** The current economic environment presents a perplexing array of conflicting reports.
- **Labor costs and treasury yields:** A recent rise in U.S. labor costs led to a surge in two-year Treasury yields, which was subsequently moderated by a report indicating the smallest wage increase since 2021.
- **Retail sales versus GDP growth:** Despite apparent surges in U.S. retail sales, GDP growth appears to be slowing.
- **Industrial production and manufacturing:** While industrial production has been on the rise, manufacturing activities are showing signs of easing.
- **Job market trends:** Jobless claims remain steady, yet hiring rates have slightly declined.
- **Interest rates and inflation:** Ongoing debates surround the future of high interest rates and inflation.
- **International trends:** Canada and Europe have recently begun easing interest rates.

The global economic landscape remains highly unpredictable, with conflicting signals and uncertainty. Economic indicators present a mixed picture, with divergent reports on labor costs, retail sales, and industrial production. Economists and market participants alike are grappling with these challenges, and adapting to the evolving situation is essential. The International Monetary Fund (IMF) forecasts modest GDP growth, with little expectation for dramatic economic shifts in 2025.

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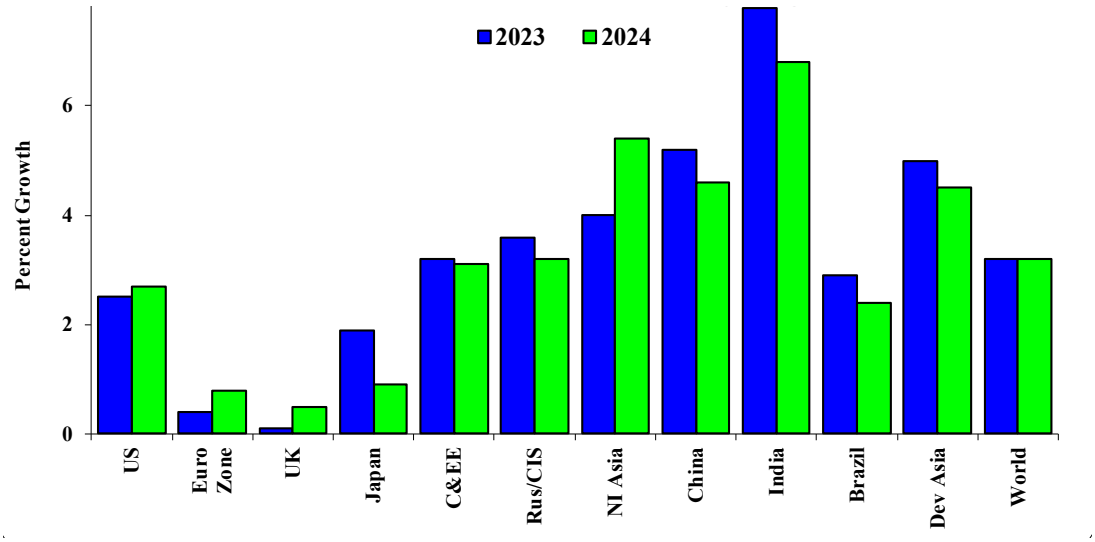
IMF forecast: limited growth prospects

- **2024 outlook:** The IMF has slightly revised the 2024 global growth forecast to 3.2%, up from 3.1% in January. The 2025 forecast remains unchanged at 3.2%.
- **Regional adjustments:**
  - U.S.: Forecasted GDP growth increased from 2.1% to 2.7%
  - Eurozone: Revised down from 0.9% to 0.8%
  - China: *No change*
  - Japan: *No change*
  - India: Revised up from 6.5% to 6.8%

The latest IMF forecast indicates modest global GDP growth at approximately 3.2%. The most notable adjustment was an increase in the U.S. growth forecast to 2.7% from 2.1%. Conversely, the Eurozone's growth forecast was slightly reduced, while forecasts for China and Japan remained stable. India experienced a positive revision. Overall, the IMF does not anticipate significant economic changes that would markedly impact industry growth in the near term.

Figure 9: World GDP growth rate by region



Source: IMF

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Figure 10: Regional market forecasts

Region	2022	2023	2024	2025
India	7.2	7.8	6.8	6.5
Asia	5.5	4.0	5.4	5.7
China	3.0	5.2	4.6	4.9
Developing Asia	4.5	5.0	4.5	4.3
Russia/CIS	-2.1	3.6	3.2	1.8
Central and Eastern Europe	0.8	3.2	3.1	2.8
U.S.	2.1	2.5	2.7	1.9
Brazil	2.9	2.9	2.4	2.1
Japan	1.0	1.9	0.9	1.0
Eurozone	3.5	0.4	0.8	1.5
UK	4.1	0.1	0.5	1.5
World	**3.5**	**3.2**	**3.2**	**3.2**

Source: IMF

2. Unit shipments – still significantly below long-term averages

- **Current shipment levels:** In June, unit shipments were 22.3% below the peak of 8.2 billion units per week and 11.9% below the long-term trend line.
- **Forecast uncertainty:** The anticipated unit balance is unlikely to materialize this year.
- **Conclusion:** A true recovery cannot be claimed until IC unit growth resumes.

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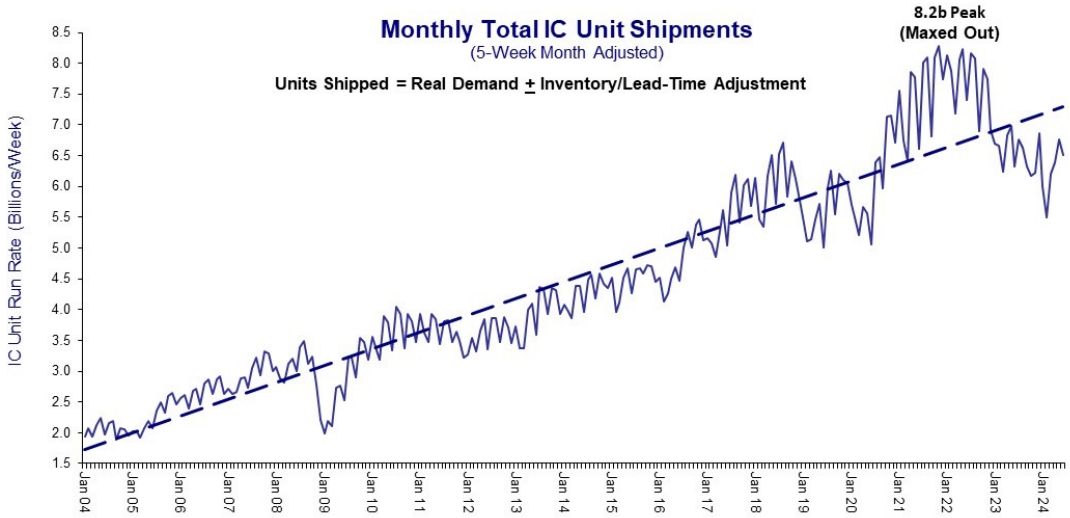
Figure 11: Monthly IC unit shipments

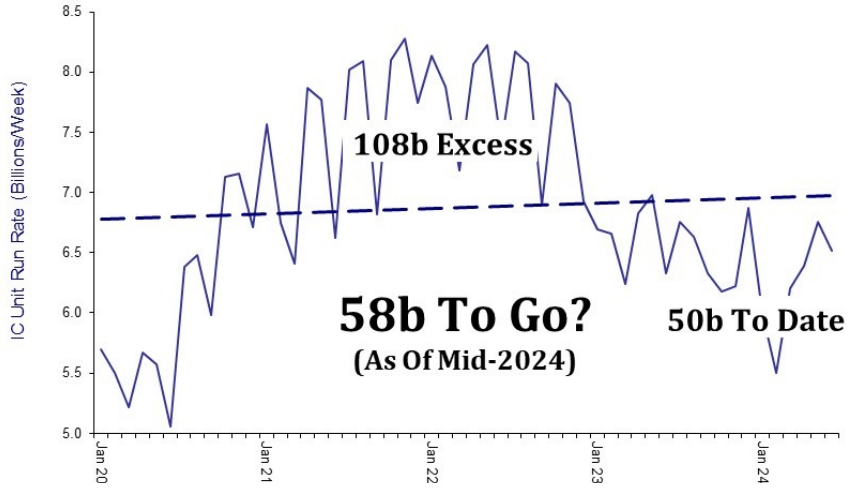


Source: Data from WSTS, analysis by Future Horizons. Growth adjusted for five-week months.

Current unit shipments are significantly below historical averages, reflecting ongoing inventory adjustments and a slower-than-expected recovery. The long-term trend indicates a substantial overcapacity that will take time to address.

Unit shipments, assessed on a weekly run rate basis, reveal that during the COVID-induced boom, shipments reached a peak of 8.2 billion units per week—an upper limit constrained by existing capacity. Subsequent capacity expansions, which began to impact in mid-2023, coincided with a sharp decline in unit demand as the market adjusted to previously accumulated inventory.

Figure 12: Excess inventory that must be absorbed



Source: Data from WSTS, analysis by Future Horizons.

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Historically, the trend line for unit growth has been reliable, reflecting an average annual growth rate of 8% over the past 35 years. Although the units being shipped today differ from those in 1970, the long-term growth rate remains consistent. As of mid-2024, there is a significant excess of 108 billion units shipped above the trend line, with only 50 billion units accounted for in inventory adjustments. This implies a remaining excess of 58 billion units must be absorbed before equilibrium returns. While this estimate is provisional, it underscores the substantial overshipment and the potential extent of the correction required.

Additionally, capacity has increased substantially since the peak of 8.2 billion units per week, likely approaching 10 billion units as new fabs come online. Although exact figures are uncertain due to the discontinuation of industry capacity reports by SICAS, the expansion indicates a substantial increase in production capabilities.

3. Capacity – capital expenditure and its implications

- **Capital expenditure trends:** CapEx as a percentage of IC sales peaked in Q1 2023, reaching historically high levels exceeding the dot-com bubble era.
- **Recent adjustments:** By February 2024, CapEx spending had returned to a more stable level of 14%, which is considered a safe threshold.
- **Future outlook:** Given the soft unit demand, a continued reduction in CapEx is expected for the remainder of 2024. This reflects a shift from aggressive capacity expansion to more cautious spending.
- **New fab capacity:** Global new fab capacity starting production in 2024 has increased by 6.4% (42 new fabs) compared to 11 fabs in 2023.

CapEx spending serves as a strong indicator of new capacity; investments typically translate into new capacity three quarters later. Historically, CapEx has maintained around 14% of semiconductor sales, but recent spending surged to more than 20%, the highest level recorded, surpassing even the dot-com bubble peak. While CapEx is now decreasing, it remains significantly above the long-term trend, suggesting that the industry is still adjusting from the over-expansion period.

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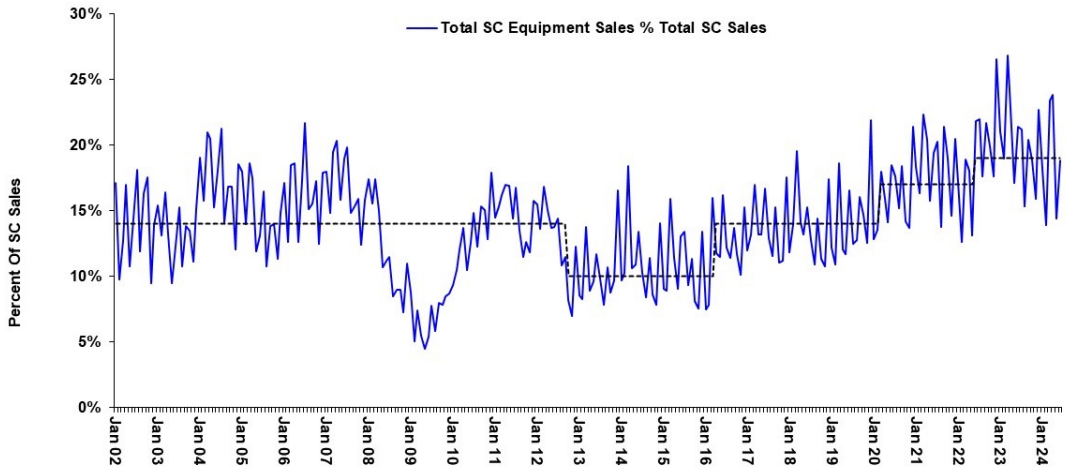
Figure 13: CapEx spending as a percent of semiconductor sales



Source: Data from SEMI, analysis by Future Horizons.

Capital expenditure on semiconductor manufacturing peaked in early 2023 and has since normalized. The significant investment by China in capacity expansion poses a potential risk, particularly in non-advanced technologies.

Impact of China on CapEx

- **Non-China CapEx trends:** Non-China CapEx reductions began in Q2 2023, following the market collapse.
- **China's CapEx surge:** China's CapEx has reached unprecedented levels, constituting 47.2% of total global CapEx – a 34% increase from 2023 and an 80% increase from 2022.
- **Market implications:** China's aggressive CapEx is a critical concern. While Western firms have reduced spending and are managing their capacity more responsibly, China's continued investment in semiconductor manufacturing, including in sectors like solar panels, EV batteries, and automotive semiconductors, poses a significant challenge. China's expanding capabilities and potential for market entry into automotive semiconductors could lead to increased competition and tariffs, potentially impacting global pricing and trade dynamics.

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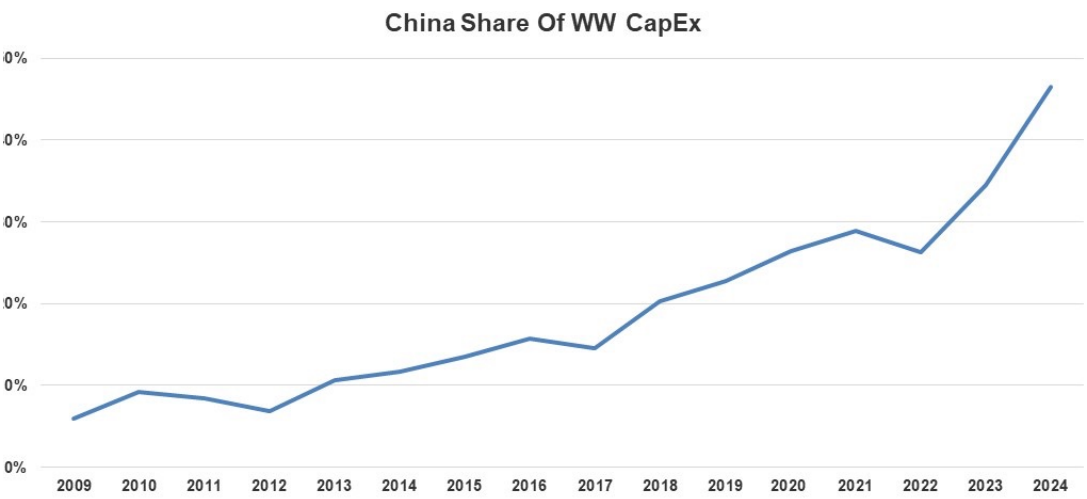
Figure 14: China's share of worldwide CapEx



Source: Data from SEMI and TrendForce, analysis by Future Horizons.

4. ASPs – from peak to correction

- **Current trends:** IC ASPs peaked in February 2024, reaching a level 52% higher than the downturn low of $1.10 observed in July 2022.
- **Future outlook:** A correction in ASPs is anticipated for the second half of 2024, primarily due to industry overcapacity.
- **Long-term perspective:** Historical data indicates that ASPs exhibit significant cyclical fluctuations, with long-term average growth trending toward zero.

IC ASPs experienced a peak in February 2024, followed by a correction as expected due to overcapacity. Historical data suggests that ASPs will likely revert to long-term averages in the coming months.

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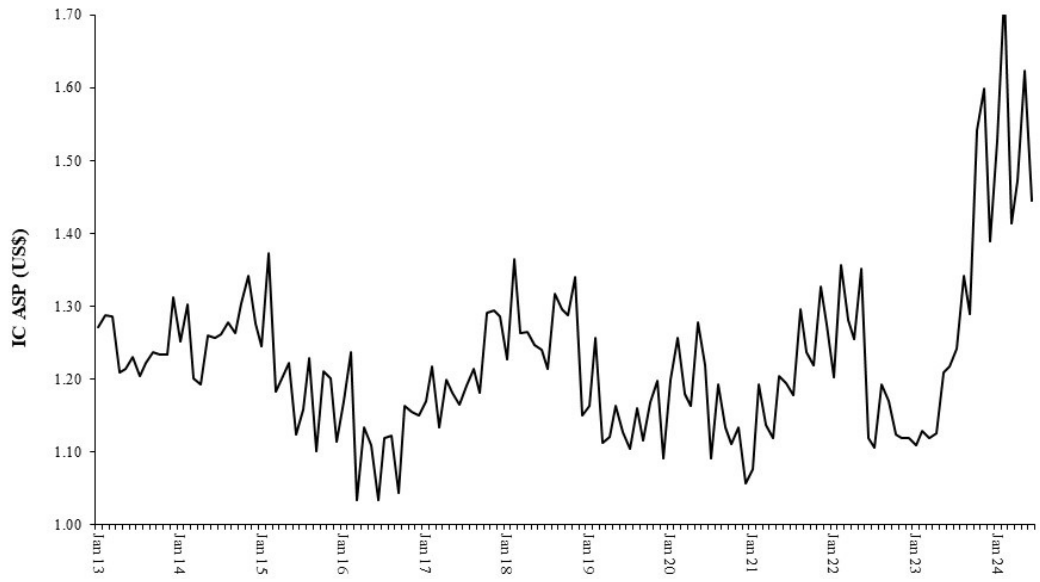
Figure 15: IC ASPs year over year



Source: Data from WSTS, analysis by Future Horizons

Following a dramatic decline of 85% in ASPs within a single month, the market has experienced a notable rebound. This rebound, however, is largely attributed to the low base from which the recovery is measured. Historically, ASPs have shown robust cyclical patterns, with significant upswings followed by downturns.

Given the current overcapacity and high base values, a strong ASP correction is expected in the latter half of the year. Long-term trends suggest that ASP growth is inherently cyclical, with average growth rates approaching zero over extended periods. Thus, a notable increase in ASPs, such as a 20% rise, is likely to be followed by an equivalent decline.

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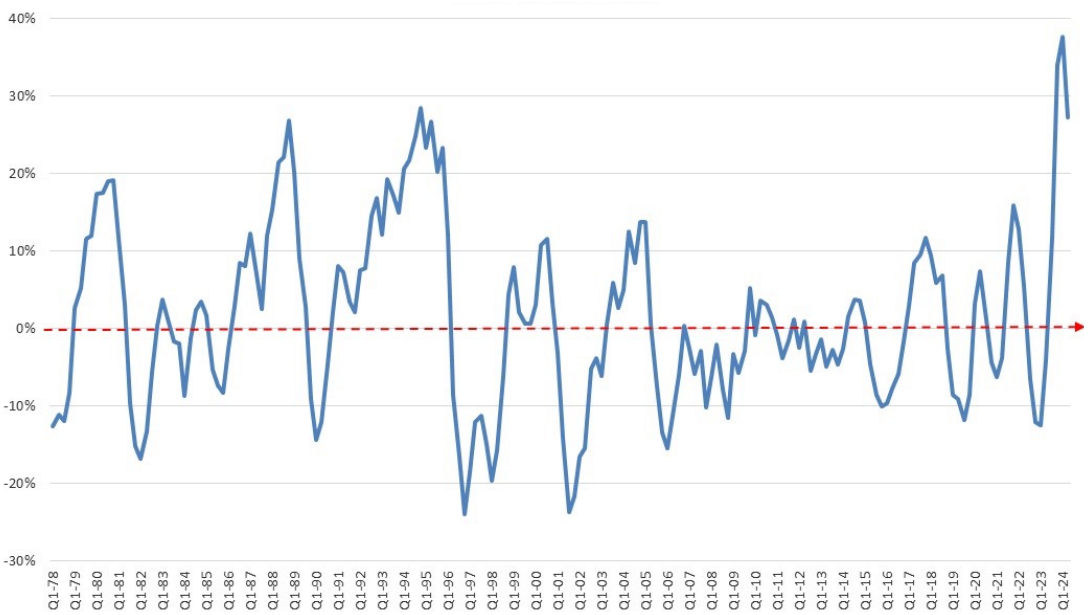
Figure 16: IC ASP growth trend



Source: Data from WSTS, analysis by Future Horizons

The key focus for the semiconductor industry remains on unit growth, as the long-term growth rate for units is approximately 8%, translating to a 6% growth in value.

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Industry forecast

Key driving influences

The current industry outlook is shaped by four primary factors: the economy, unit demand, capacity, and ASPs. The prevailing conditions present a challenging environment with limited immediate prospects for improvement.

1. **Economic contradictory factors:** The economic landscape is marked by high interest rates and persistent inflation. Additionally, heightened geopolitical tensions and uncertainties surrounding the U.S. Presidential election in November contribute to an enigmatic and unstable economic environment.
2. **Below long-term average unit demand:** Unit demand remains significantly below the long-term average, hindered by stubbornly high excess inventory levels and weak end-market demand. A recovery in unit demand is now unlikely before 2025.
3. **Divergent CapEx trends impacting capacity:** A stark contrast exists between China and non-China CapEx. Non-China CapEx has been prudently scaled back, while China continues to exhibit substantial overspending, well beyond current needs.
4. **The volatile trajectory of ASPs:** Since May 2023, ASPs have experienced a steep upward trajectory. However, this growth is based on a low reference base and characterized by significant volatility. The current trend is unsustainable and poised for a correction.

Summary: red flag alert

- **Systemic weaknesses:** The chip market fundamentals continue to show systemic weaknesses. Warning indicators across all key factors remain at amber or red.
- **Economic and geopolitical instability:** The unsettled economic and geopolitical outlook poses ongoing challenges.
- **Pressure on non-bleeding edge nodes:** Longer-term pressure is anticipated on non-bleeding edge technologies, influenced by factors such as China's policies and chip acts.
- **Growth constraints:** Double-digit growth in 2024 is highly unlikely given the current conditions.

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Updated forecast for 2024

In light of the current challenging environment, Future Horizons revised their 2024 forecast to 4.6%, with potential upside at 8% and downside risks slightly less. This adjustment represents a substantial downward revision from their January 2024 projection, primarily due to the unexpected downturn in the first quarter, which countered the previously anticipated momentum from the second half of 2023.

- **Revised forecast:** Down to 4.6% growth, with a range from +3.5% to +8%.
- **Limited upside potential:** The forecast indicates minimal potential for significant growth, with downside risks being more pronounced.
- **Potential for negative growth:** Should Q2 performance prove weak, the 2024 outlook could turn negative.

Figure 17: Future Horizons' 2024 market forecast

Quarter	Value ($B)	Growth
Q1 2024	$137.717	-5.7%
Q2	$135.651	-1.5%
Q3	$140.399	3.5%
Q4	$138.995	-1.0%
2024	**$552.762**	**4.9%**

Figure 18: Future Horizons' 2024 bear market forecast

Quarter	Value ($B)	Growth
Q1 2024	$137.717	-5.7%
Q2	$134.274	-2.5%
Q3	$137.631	2.5%
Q4	$135.566	-1.5%
2024	**$545.188**	**3.5%**

Figure 19: Future Horizons' 2024 bull market forecast

Quarter	Value ($B)	Growth
Q1 2024	$137.717	-5.7%
Q2	$139.783	1.5%
Q3	$145.793	4.3%
Q4	$145.793	0.0%
2024	**$569.086**	**8.5%**

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2025 forecast summary – proceed with extreme caution

- **2024 forecast revision:** Adjusted to 4.9% growth, with a range of +3.5% (bear case) to +8% (bull case).
- **Focus on IC units:** The true market dynamics are driven by IC unit growth, capital expenditures, and material costs.
- **Brace for economic impact:** A deteriorating economic environment will likely delay the recovery further.
- **Monitor industry fundamentals:** Historical patterns suggest that deviations from the norm are rare.
- **Avoid overcomplication:** Simple, straightforward analyses often provide the most accurate insights.
- **Anticipate value growth slowdown:** Plan for a potential uptick in unit demand despite a slowdown in value growth.
- **Stay vigilant for indicators:** Continuously monitor market signals and be prepared to act based on emerging data.
- **Trust in fundamentals:** Focus on fundamental data rather than short-term noise.
- **Prioritize long-term trends over short-term fluctuations:** Minor fluctuations are less significant compared to overarching long-term trends.

While there are complexities to consider, it is essential not to overcomplicate or overhype the situation. Annualized monthly value growth rates are expected to decline, reflecting a return to normal market conditions. This adjustment is not indicative of a market failure but rather a realignment with cyclical patterns.

Remain attentive to new information and avoid relying solely on preferred data points. Balance all available data to make informed decisions. Trust in the fundamentals, which remain strong despite short-term variations. The industry's long-term prospects are promising, reaffirming its position as a leading sector.

2024 forecast: Revised to 4.9% with variability.

Focus areas: Monitor IC units, CapEx, and industry fundamentals.

Advice: Avoid overthinking and focus on long-term trends.

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Industry Issues

The hype surrounding generative AI

Generative AI is poised to become one of the most overhyped trends in the semiconductor industry, reminiscent of the fervor surrounding the launch of the first transistor radio in 1954. Developed by Texas Instruments and marketed by Regency, the term "transistorized" quickly became a buzzword, with manufacturers exaggerating the number of transistors in their radios to enhance their appeal—even if it meant including unnecessary components.

AI will create super cool, intelligent, smug, superior beings that will take over the world... Not really, they just do more complex grunt work.

Similarly, the current enthusiasm for AI is marked by widespread claims that products are "AI-enabled," despite a lack of clear understanding about what AI truly entails. The term "AI" is often misused or misunderstood, with some companies and products promoting AI capabilities without providing substantive explanations. It is important to recognize that AI is not science fiction robots or humanoids, and it cannot perform subjective tasks or make nuanced judgments.

- **Current perception:** AI is heavily hyped, but its practical applications and limitations are not fully understood.
- **Reality check:** AI is more of an enabler for existing products rather than a standalone high-value generator.

AI excels at processing large volumes of hard data and can significantly aid in data analysis tasks, where human cognition may fall short. However, AI struggles with interpreting data beyond its surface level, particularly in areas requiring intuition, creativity, and emotional understanding. As a tool, AI enhances existing products but is not yet a standalone solution.

Limitations of AI compared to human capabilities[1]:

- Imagination
- Originality
- Kindness
- Gut feeling
- Surprise
- Sense of failure
- Emotional experiences (joy, sadness, pride, etc.)
- Physical sensations (pleasure, pain)
- Appreciation
- of natural beauty
- Mental states (turmoil, self-doubt)
- Ambition

While AI is a powerful tool for data analysis and automation, its current capabilities are limited to what can be derived from structured information, and it cannot replicate the full spectrum of human experience and creativity.

[1] Source: David Manners and Future Horizons.

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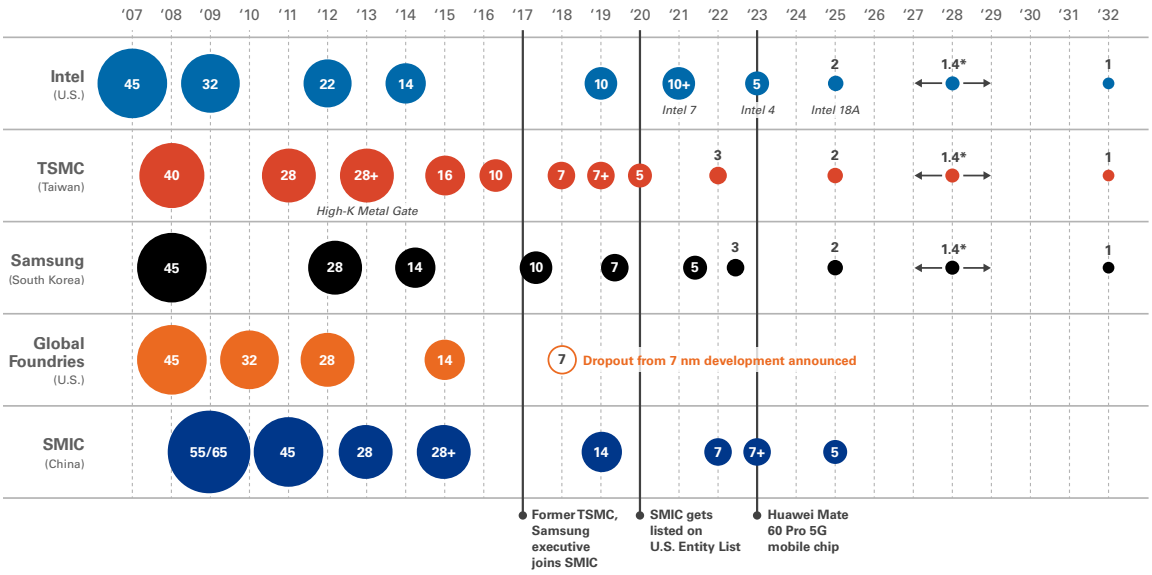
What's hot and happening – the race to 1 nm

Figure 20: Companies focused on 1 nm and completion projections



From 22 nm onwards, transistor structure changes from planar to 3D FinFET; Intel introduced first 3D transistor in 2012; 2024 onwards are projections
*+ Denotes enhanced | *Projected between 2027-29*

Source: Company announcements, Nikkei Asia research

Despite frequent declarations of Moore's Law being "dead," it remains a core principle in semiconductor technology, driving innovation with advancement toward 1 nm transistors. Although challenges persist, Moore's Law continues to shape the industry's evolution.

- **Technology trends:** Move toward gate-all-around structures and away from FinFETs.
- **Industry impact:** Major transitions in technology are challenging but crucial for future developments.

Historically, 2D planar transistors transitioned to vertical FinFET structures when planar designs proved inadequate at the 22 nm node. However, FinFETs are now reaching their limits at the 3 nm node, necessitating a shift to gate-all-around (GAA) technology. This transition represents a significant leap, moving toward fully 3D transistor structures.

Such major technological shifts often involve a challenging implementation phase. The industry typically experiences a period of difficulty and incremental improvement as new technologies are adopted. This period resembles the "sailing ship effect," where advancements are made to optimize existing technologies before fully transitioning to new methods.

Currently, Intel, TSMC, and Samsung are competing to lead this next-generation technology, a race that will determine control over the cutting-edge market for the next 10 to 15 years. The outcome of this competition is critical and remains uncertain.

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Conclusion

What's keeping chip industry executives awake at night?

The sustainability of the current value-based rebound

Current rebound in semiconductor value is not sustainable until IC unit growth returns. The value growth is expected to slow, with historical precedents indicating that such rebounds are often followed by corrections. A genuine market recovery cannot be declared until unit growth resumes.

Timing of semiconductor unit growth recovery

Semiconductor unit growth is unlikely to recover before 2025. The industry faces significant challenges, and a return to robust growth may be delayed until the first half of 2025.

Longevity of economic resilience

While the global economy has managed to defy severe downturns, signs of slowing consumer spending and rising job vacancies in the U.S. indicate that high interest rates and inflation control measures are having an impact. Despite these challenges, a recession remains unlikely, with a "soft-landing" scenario being the most probable outcome.

Potential for ASP surge as a false dawn

The recent surge in ASPs is part of the normal industry cycle following an ASP crash. Historically, sharp increases are often followed by corrections as ASP growth rates revert to more sustainable levels.

The prospect of a semiconductor super cycle

The claim that 2023 marked the beginning of a new semiconductor super cycle is unfounded. Super cycles are characterized by intense demand outpacing capacity, leading to extended periods of high prices and long lead times. The conditions observed in 2023 do not align with these characteristics.

The role of AI in the semiconductor industry

AI serves as an application enabler rather than a standalone industry disruptor. While AI will enhance existing products and enable new functionalities, its impact on semiconductor value will likely be incremental. AI's value lies in its ability to improve product performance and open new market opportunities, rather than directly generating high added value.

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Conclusion CONTINUED

What's keeping chip industry executives awake at night?

Impact of the CHIPS Act on the industry

The CHIPS Act is expected to both stimulate and potentially overstimulate the industry. While new factories are being established, concerns persist regarding the fundamental issues of offshoring and market-driven incentives. Historical challenges suggest that financial incentives alone may not address the root causes of offshoring.

Implications of U.S.-China policy

The current U.S.-China policy's impact will depend significantly on the outcome of the upcoming U.S. Presidential election. Trade embargoes and tariffs may drive China to accelerate its internal decoupling and develop alternative solutions, potentially creating new global competitors.

Q1's market decline – a train wreck or fender bender?

The market decline observed in Q1 appears more severe than a minor setback, though Q2 results will provide further clarity. Early indications are mixed, and while April showed positive results, uncertainty remains. Industry guidance is cautious, and the overarching advice is to proceed with caution. Future market growth will be influenced by unit shipments, inventory levels, and ASPs, with broader economic conditions playing a critical role.

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Strategic imperatives for revenue optimization and compliance

The semiconductor and electronic component industry remains a driving force in the modern world, yet it faces notable challenges.

The timing of the next industry super cycle remains uncertain, making it imperative for companies to prepare in advance. Key questions include whether unit demand will accelerate growth and how the current value-based fluctuations in ASPs will evolve. While answers to these questions will emerge over time, manufacturers can take proactive measures today to influence value creation and drive demand for their products. Leveraging actionable insights enables revenue and channel leaders to optimize revenue and ensure compliance effectively. Strategic market approaches, partnerships, and innovations can significantly impact market share and competitive positioning.

A 2018 study by Harvard Business Review[2] (HBR) highlighted that companies investing in automation, advanced analytics, and digital technologies during the Great Recession of 2008-2009 managed to increase productivity and reduce costs. Among 900 B2B companies analyzed by HBR, those that adopted these digital tools experienced substantial growth in absolute revenue and market share. These "winners" outperformed their competitors, who lagged behind and struggled to recover. The performance gap between these companies widened significantly during the subsequent recovery period.

Similarly, McKinsey's research identified "resilient" companies that, although initially affected by the 2008 recession, saw their earnings increase by 10% by 2009, compared to a nearly 15% decline for their less digitally advanced peers.[3] These "resilients" connected more closely with high-value customers, managed costs more effectively, and avoided costly emergency IT solutions during uncertain times.

Leading companies globally – identified as "resilients," digital "haves," and "winners" – continue to invest in their revenue optimization and compliance operations due to their proven effectiveness.

[2] Mark Kovac and Jamie Cleghorn. "What Sales Teams Should Do to Prepare for the Next Recession." Harvard Business Review, November 13, 2018. https://hbr.org/2018/11/what-sales-teams-should-do-to-prepare-for-the-next-recession

[3] McKinsey Quarterly. "Bubbles pop, downturns stop." May 21, 2019. https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/bubbles-pop-downturns-stop

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In the current economic climate, companies must enhance their revenue optimization and compliance operations to ensure future success. This involves refining sales execution, pricing strategies, incentive programs, and revenue data automation, including commercial intelligence and reporting. While these initiatives require broad stakeholder support and substantial investment, the potential return on investment is significant. Leading companies globally – identified as "resilients," digital "haves," and "winners" – continue to invest in these areas due to their proven effectiveness.

High-tech companies partner with Model N to address critical needs such as:

- Executing long-term agreements
- Optimizing ASPs
- Improving deal negotiation with intelligence
- Managing end-to-end channel incentives
- Obtaining, cleansing, and analyzing channel data

By focusing on these strategic areas, companies can better navigate industry challenges and capitalize on emerging opportunities. The semiconductor industry faces considerable challenges but offers long-term opportunities for growth with the right strategies. Companies should focus on leveraging digital tools and optimizing their operations to navigate current uncertainties and prepare for future growth.

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About Future Horizons

Established in April 1989, Future Horizons provides semiconductor and electronics industry consulting, market research reports, training, and business support services for use in opportunity analysis, business planning, and new market development. Emphasis is placed on the worldwide microelectronics industry and the European market environment.

Together with its wholly owned, Moscow-based subsidiary East-West Electronics, Future Horizons is the world's leading market research consultancy on the Russian and East European electronics industry.

Future Horizons publishes a monthly C-suite report that provides a view of the big picture and what is happening. The report tracks the key data each month to help you make better strategic decisions. For a back copy of the monthly report, email Future Horizons.

About Model N

Model N is the leader in revenue optimization and compliance for pharmaceutical, medtech, and high-tech innovators. Our intelligent platform powers your digital transformation with integrated technology, data, analytics, and expert services that deliver deep insight and control.

Our integrated cloud solution is proven to automate pricing, incentive, and contract decisions to scale business profitably and grow revenue. Model N is trusted across more than 120 countries by the world's leading pharmaceutical, medical technology, semiconductor, and high-tech companies, including Johnson & Johnson, AstraZeneca, Stryker, Seagate Technology, Broadcom, and Microchip Technology.

These data points demonstrate the scale and caliber of the global companies Model N serves:

- More than a trillion dollars in revenue managed within Model N
- More than $112 billion chargebacks processed
- More than $81 billion in rebates processed

To learn more about how Model N can help you, check out our Revenue Cloud for High Tech and Channel Cloud for High Tech solutions.