

The Structural Transformation of the Memory Semiconductor Market Driven by AI Data Center Demand, Supply Constraints, and Policy Implications

The memory semiconductor market has recently entered a new phase of rapid growth, driven primarily by the expanding demand from data centers and advancements in artificial intelligence (AI) technologies. The dynamic interplay between supply constraints and surging demand is reshaping the industry's economic structure. Leading technology companies such as Nvidia and Google are spearheading the AI semiconductor ecosystem, while Samsung Electronics and SK Hynix have emerged as dominant players in the memory semiconductor sector, surpassing TSMC in sales and operating profit. This shift underscores the critical role of memory semiconductors as foundational infrastructure supporting AI computing platforms.

In the first quarter, Samsung Electronics and SK Hynix reported operating profits of approximately 57 trillion and 38 trillion Korean won, respectively, with projections indicating further increases in the second quarter. These improvements reflect significant price increases in DRAM and NAND flash memory—estimated at over 40% and 60%, respectively—alongside growing shipment volumes. The price escalation is largely attributed to the accelerated replacement cycle of servers in data centers and the rising CPU demand within AI data centers. Concurrently, the ongoing sophistication of CPUs and GPUs within the AI semiconductor ecosystem is driving parallel growth in memory semiconductor demand.

Samsung and SK Hynix exhibit complementary strengths within the market. SK Hynix leads in the high-bandwidth memory (HBM) segment and has achieved notable success with data center-oriented NAND flash products. Samsung maintains a high market share in NAND flash and holds a leading position in controller IC technology, while also investing heavily in HBM development. Both companies are reinforcing their product competitiveness to meet the evolving requirements of AI and data center applications, thereby maintaining their leadership in the memory semiconductor market.

Short-term supply expansion faces constraints due to delays in data center construction and power supply challenges within the United States. However, these issues represent deferred sales rather than

diminished demand. Cloud service providers and AI enterprises continue to plan substantial data center expansions, and the integration of AI into routine business operations suggests sustained demand growth. Additionally, bottlenecks in semiconductor equipment supply are expected to persist until at least the latter half of 2028, reducing the likelihood of a rapid price decline caused by oversupply in the near term.

While memory semiconductors currently dominate in terms of market growth and profitability, the leadership of the semiconductor industry as a whole resides in logic chips, particularly AI semiconductors. Major technology firms develop AI computing platforms, with TSMC serving as the primary manufacturer. Samsung's competitiveness in logic chips remains limited, but efforts to revitalize the domestic ecosystem and foster collaboration aim to achieve gradual improvements. Within this industrial framework, memory semiconductors function as essential infrastructure supporting AI computing, benefiting from the current "gold rush" phase driven by AI demand.

The improvement in operating profit margins for Samsung and SK Hynix is largely attributable to increased market demand and supply shortages that have driven up prices. This contrasts with TSMC's margin enhancement, which primarily stems from product price increases rather than supply constraints. Consequently, Samsung and SK Hynix have surpassed TSMC in sales scale this year, charting an independent growth trajectory within the semiconductor industry.

The rapid expansion of the memory semiconductor market and the growth of the AI semiconductor ecosystem introduce a new paradigm across the semiconductor sector. Although supply-side limitations related to equipment and infrastructure persist, demand fueled by AI and data center proliferation is expected to continue its upward trajectory. These developments underscore the increasing importance of strategic focus, technological innovation, and national-level ecosystem support for semiconductor companies.

Understanding the current economic environment and the transformations within the semiconductor industry benefits from the perspectives of economic experts, each emphasizing different aspects of these complex changes. Comparing their viewpoints provides a multifaceted understanding of how AI-driven technological innovation and supply constraints influence economic cycles, macroeconomic policy, and market dynamics.

Expert	Core Perspective	Keywords	Interpretation Point
Ray Dalio	Economic cycles shaped by technological innovation and demand shifts	Cycle transition, technological innovation, demand shock	AI and data center demand alter traditional cycle patterns, creating a new growth phase intertwined with supply constraints
Paul Krugman	Macroeconomic growth driven by policy support and infrastructure investment	Policy support, infrastructure investment, supply chain	Short-term constraints like power shortages can be mitigated through government and corporate collaboration; AI industry development is a key growth driver
Milton Friedman	Long-term growth and innovation propelled by market self-regulation and competition	Market autonomy, competition, innovation	Supply shortages and price increases serve as market signals that stimulate competition and innovation, fostering industrial advancement

These expert perspectives collectively indicate that the current economy is undergoing a structural transformation beyond typical cyclical fluctuations, driven by technological innovation and evolving demand patterns. Dalio highlights the role of AI and data center demand in redefining economic cycles, while Krugman emphasizes the importance of policy and infrastructure investment in supporting this transition. Friedman focuses on the market's self-correcting mechanisms, viewing supply constraints and price signals as catalysts for innovation and competition. Together, these views deepen the understanding of how semiconductor industry developments and AI technology influence broader economic trajectories.

Given these interpretations, the critical question arises: How should one assess the current economic direction in light of these intersecting technological, policy, and market forces?

This topic reveals something that is easy to overlook if viewed only as information. The fundamental shift lies in the evolving role of memory semiconductors from mere components to indispensable infrastructure underpinning AI-driven computing platforms, signaling a structural realignment within the semiconductor industry. For individual investors and general observers, this implies that market dynamics are no longer governed solely by traditional supply-demand balances but are increasingly influenced by technological ecosystems and strategic national interests. Looking ahead, sustainable growth will depend not only on technological innovation but also on the capacity to navigate supply chain complexities and policy environments. This necessitates a nuanced approach to investment and management strategies, emphasizing adaptability to technological trends and regulatory shifts rather than relying on historical market patterns alone.

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