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Why Chipmaking Defies Old Antitrust Rules

TL;DR

Background: Semiconductors underpin the modern economy, from AI and cloud computing to cars, industrial systems, and medical devices. Because advanced manufacturing is costly and highly concentrated, policy debates often frame the industry in terms of monopoly, dependency, and vulnerability. That framing, however, starts from surface-level indicators—market shares, margins, and concentration ratios—rather than from how competition actually unfolds at the technological frontier.

But... The underlying reality is that concentration largely reflects extreme technological demands, not weak competition. Moore's Law and Rock's Law force firms into repeated, high-stakes races in which each new manufacturing node requires tens of billions of dollars in upfront investment, mastery of frontier physics, and early bets on demand that may not yet exist. Competition occurs "for the market," node by node, and leadership resets with every cycle. Firms rise or fall based on organizational capability and execution—how well they sense demand, commit capital, and deliver on schedule—not on durable market power.

Moreover... High profits and consolidation often reflect the rewards required to sustain innovation in a capital-intensive, sequential industry. Temporary returns from scarcity and successful innovation fund the massive R&D, fabs, and supplier ecosystems needed to keep advancing chip performance. Specialization, long-term partnerships, and concentrated scale help to manage risk and coordination, rather than exclude rivals. Competition policy that relies on static metrics risks misreads these dynamics, and in doing so, undermines the very investments that drive innovation and expand access to high-performance computing.

KEY TAKEAWAYS

Why Chipmaking Is a High-Stakes Race

Two intertwined technological imperatives shape competition in semiconductor manufacturing.

Moore's Law holds that the number of transistors on a chip roughly doubles every two years. In practice, it means customers expect steady, on-schedule gains in performance per watt and per dollar. That expectation forces the industry to move in a relentless cadence, where each new manufacturing node must deliver real, measurable improvements on time.

Rock's Law captures the flip side: as chips grow denser, the cost of making them rises exponentially. Leading-edge fabs now cost $10–20 billion, and a single high-NA EUV lithography tool can exceed $400 million. These costs reflect the price of pushing manufacturing toward atomic-scale precision, not inflation or inefficient scale.

Together, these laws turn semiconductor manufacturing into a series of high-stakes races. Firms must commit enormous capital years in advance, long before demand or yields are certain. Each new process node resets the competitive field, creating repeated "competitions for the market" in which incumbents can fall behind and challengers can leap ahead.

Why Each Node Is a Major Bet

Moore's Law, Rock's Law, and the sequential nature of semiconductor innovation force chipmakers into a recurring wager: invest enormous sums in the next manufacturing node years before demand and yields are clear, or risk falling behind. That wager carries three distinct risks:

Front-Loaded Capital Risk: Leading firms spend tens of billions of dollars long before returns materialize.

TSMC, for example, has devoted roughly 30–50% of revenue to capital spending since 2009, with R&D often consuming another 40–60%.

Technology and Execution Risk: Each node poses a complex, multi-front physics challenge, spanning lithography, transistor design, materials, power delivery, metrology, and advanced packaging. One flawed process decision can derail years of products and damage a firm's credibility.

Timing and Demand Risk: Firms must size capacity for future markets that may not yet exist. Miss the timing and an expensive fab sits idle; overshoot and excess capacity deepens the next downturn.

Why Leadership Keeps Resetting

In this environment, success depends less on static market position than on *dynamic capabilities*: the ability to spot opportunities, commit massive capital, and retool operations through each technological shift.

TSMC surged ahead by reading customer demand early and investing aggressively in EUV when Intel stumbled at 10nm, showing that leadership goes to firms that redefine the frontier and execute at scale. The same logic applies elsewhere: Samsung's rapid technology absorption and Intel's push into foundry services underscore that organizational capability—not market structure—drives outcomes. Each new node resets the race, rebuilding market positions at every break.

This churn makes it easy to misread profits. "Ricardian rents" are temporary returns from scarcity, where firms can earn more because capacity is limited at a moment in time. "Schumpeterian rents," by contrast, are temporary rewards for successful innovation, where firms earn more because they were first to solve a hard technical problem. Observers often mistake both for durable market power, or confuse efficient consolidation driven by scale economies with anticompetitive concentration.

From an innovation-policy perspective, these returns matter. They compensate firms for extraordinary risk and fund the massive R&D and capital spending required to compete at the frontier. Strip them away, and the incentives that sustain repeated entry, investment, and technological progress weaken.

Why Structural Metrics Mislead

Structural, snapshot-based critiques misread competition in advanced semiconductor manufacturing. Metrics like concentration, market share, or margins ignore the industry's core forces: Moore's Law's fixed cadence, Rock's Law's soaring capital costs, and the reset of competition at each new process node. In this market, structure follows risk. Firms scale up, specialize, and form deep partnerships to finance $10–20 billion fabs, coordinate complex supply chains, and solve frontier physics problems—not to exclude rivals.

Treating these arrangements as entrenched market power invites policy error. Efforts to break up scale, cap returns, or second-guess long-term contracts would weaken incentives for early, risky investment and erode the dynamic capabilities that let challengers leapfrog incumbents. The result would not be more competition, but slower innovation, fewer viable entrants at the leading edge, and less access to high-performance computing.

For more on this issue, see the ICLE white paper, "From Moore's Law to Market Rivalry: The Economic Forces That Shape the Semiconductor Manufacturing Industry" by Brian Albrecht, Geoffrey A. Manne, David Teece, and Mario Zúñiga.

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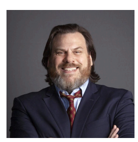
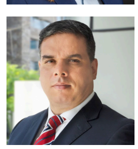


Geoffrey A. Manne
President and Founder
gmanne@laweconcenter.org

Brian Albrecht
Chief Economist
balbrecht@laweconcenter.org



Mario Zúñiga
Senior Scholar for Competition Policy
mzuniga@laweconcenter.org