U.S. Semiconductor Policy: Actions for AI Competitiveness

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Executive Summary

Key Points

- **Challenge.** U.S. facilities produce 15% of advanced semiconductors while Taiwan manufactures 92% of cutting-edge chips. Whether this concentration justifies expanded subsidies beyond the $200B+ private investment already triggered by the CHIPS Act depends on three uncertainties: (1) Will AI compute demand grow 5× by 2030 or will algorithmic gains limit growth to 2-3×? (2) Does Taiwan vulnerability require domestic production or would allied coordination suffice? (3) Can subsidies overcome 30-50% U.S. cost disadvantages?
- **Recommendation.** Given current evidence—moderate Taiwan risk, mixed cost competitiveness signals, uncertain AI scaling—expand CHIPS Act subsidies by $40-60B over five years with explicit sunset provisions and cost-competitiveness benchmarks (within 15% of Taiwan by Year 5). Focus on acute bottlenecks: advanced packaging ($30-40B), workforce development ($5B annually), and streamlined permitting. However, pivot strategies if conditions change: to comprehensive permanent support if Taiwan risk exceeds 40%; to allied coordination if cost gaps persist after five years; scale back if AI demand grows 3×.
- **Key Actions.** Secure $40-60B congressional authorization for packaging and materials; triple workforce funding; compress construction timelines by 12-18 months through permitting reform; strengthen allied supply-chain agreements; codify automatic sunset after seven years; establish semi-annual monitoring of AI demand, Taiwan security, and cost competitiveness with explicit decision points for strategy recalibration.

Background

The United States' leadership in artificial intelligence depends on a resilient, advanced semiconductor base. Yet over the past three decades, most leading-edge chip fabrication has moved to East Asia. Today, U.S. facilities produce less than 15 percent of the most advanced process nodes, leaving critical AI hardware reliant on a small number of foreign fabs [1]. Meanwhile, compute demand for training and running state-of-the-art AI models is projected to grow dramatically through 2030 [2]. This growth, coupled with complex supply chains for photolithography equipment, rare-earth materials, and high-purity chemicals, exposes the U.S. to significant supply-chain and geopolitical risks.

Congress responded to these vulnerabilities with the 2022 CHIPS and Science Act, authorizing more than $50 billion for domestic manufacturing, R&D, and workforce development [3]. The Act has triggered substantial private investment exceeding $200 billion and created incentives for new fabrication and packaging facilities across Arizona, Texas, and New York.

Yet significant constraints remain. Long construction lead times, cost disadvantages of 30–50 percent compared with Asian foundries, and shortages of skilled engineers and technicians continue to constrain progress [4][5]. These persistent gaps raise a fundamental policy question: does the magnitude of remaining vulnerabilities justify additional government intervention beyond current CHIPS Act programs?

Three potential market failures support the case for further action. First, positive externalities from semiconductor R&D mean private firms cannot fully capture the societal benefits of innovation, potentially leading to underinvestment. Second, security externalities arise because firms do not account for national defense benefits when making production decisions. Third, coordination failures prevent any single firm from justifying investment in an entire domestic supply chain ecosystem—from fabrication through packaging to specialized materials—even when collective investment would be economically viable. However, critics contest both the magnitude of these market failures and whether subsidies efficiently address them. Cost disadvantages of 30-50% may reflect fundamental economic inefficiency rather than temporary barriers, and robust defense guarantees to Taiwan could make allied production adequately secure without costly domestic expansion.

Semiconductor policy responsibility is distributed across multiple actors. The Department of Commerce administers manufacturing incentives and R&D centers; the Department of Defense and National Security Council integrate export controls and security assessments; and Congress sets funding levels and oversight. This fragmented landscape complicates coordination and creates potential for duplicative or conflicting initiatives.

Internationally, the context has grown more complex. The Biden administration has tightened export controls on advanced chips and manufacturing equipment, coordinating with key allies including the Netherlands and Japan to restrict China's access to critical technologies [6]. Simultaneously, competitors are scaling their own interventions: China and the EU are rapidly expanding subsidies and building alternative supply networks [7]. These dynamics create both opportunities for allied cooperation and risks of subsidy escalation or supply-chain fragmentation.

Against this backdrop, U.S. policy faces a strategic choice. Simply building more fabs may prove insufficient if bottlenecks in advanced packaging, critical materials, workforce development, and international coordination remain unaddressed. The following analysis examines whether current policy momentum adequately closes these gaps or whether targeted reforms—or potentially more comprehensive interventions—are warranted to ensure semiconductor production can meet the demands of the AI era.

Analysis

Problem Definition

The CHIPS Act has catalyzed significant investment, but critical gaps persist. Despite new incentives triggering over $200 billion in private commitments, the United States faces a widening gap between domestic semiconductor capacity and the computing power required for next-generation AI systems. If current trends continue, U.S. fabs will supply well under half of projected 2030 demand for leading-edge chips [2]. Shortages of critical materials, limited advanced packaging capacity, and a projected shortfall of tens of thousands of skilled workers further threaten to delay production and raise costs [4][5].

The central policy question is whether these remaining gaps justify expanded federal intervention. Proponents argue that without additional targeted action to expand domestic manufacturing, packaging, and workforce development—while ensuring secure access to critical inputs and equipment—future AI innovation and key national-security capabilities will remain dependent on a fragile, largely overseas supply chains vulnerable to disruption, cost shocks, and geopolitical conflict. Critics counter that current market responses may prove adequate, and that further subsidies risk throwing good money after bad in an industry where the U.S. faces structural cost disadvantages.

Answering this question requires assessing three underlying uncertainties:

- First, **demand projection robustness**: Is the projected five-fold growth in AI compute demand by 2030 robust to uncertainty about algorithmic efficiency gains, architectural shifts, and potential scaling limitations? If compute requirements grow more slowly than projected, current capacity expansion may suffice.
- Second, **security-resilience tradeoffs**: Do U.S. security interests require domestic production, or would strengthened defense commitments to allied producers (Taiwan, South Korea, Japan) provide adequate resilience at lower cost? If allied supply chains can be secured through diplomatic and military means, expensive onshoring may be unnecessary.
- Third, **cost competitiveness**: Are the 30-50% cost disadvantages evidence of fundamental economic inefficiency that subsidies cannot overcome, or temporary gaps that strategic investment can close through learning effects and scale economies?

These uncertainties can be structured into testable thresholds. Specifically, if domestic capacity falls below 40% of projected U.S. AI compute demand by 2030, and if geopolitical risks to Taiwan intensify over the next decade, then the expected security costs may justify subsidy further expenditures of up to $50 billion. However, if AI compute demand grows more slowly than projected, if cost competitiveness gaps persist despite subsidies, or if allied supply chains prove resilient, the case for large-scale intervention weakens substantially. The analysis that follows examines available evidence against these criteria.

Evidence and Findings

Available evidence provides partial answers to the three core uncertainties, though significant gaps remain.

- On demand projection robustness (Question 1): **AI compute demand projections carry significant uncertainty.** The five-fold growth estimate assumes continued model scaling following current trajectories. However, recent breakthroughs in algorithmic efficiency (mixture-of-experts architectures, quantization techniques) have reduced compute requirements for comparable performance by 3-10×. Additionally, the economics of ever-larger models remain unproven: GPT-4 training costs exceeded $100 million, and it is unclear whether returns justify continued scaling. Alternative paradigms (neuromorphic computing, analog AI accelerators) could also disrupt current demand forecections. Base-case projections should be stress-tested against scenarios where compute demand grows 2× rather than 5× by 2030.
- On security-resilience tradeoffs (Question 2): **Strategic context reinforces urgency but also creates policy dilemmas.** Taiwan's concentration of advanced semiconductor production—manufacturing 92% of the world's most advanced logic chips, with TSMC controlling over 90% of cutting-edge 3 nm capacity—creates acute supply-chain vulnerability. Peer-reviewed analyses estimate economic losses of $2.7 trillion from a blockade scenario and up to $10 trillion annually from full Taiwan Strait conflict [8]. Security analysts identify 2025–2027 as a particularly dangerous window before allied reshoring efforts mature, with U.S. and European advanced fabs not expected online until the late 2020s and still lagging TSMC by 2–3 technology generations [9][10].

  However, policy responses face competing pressures. China, the EU, and key East Asian economies are rapidly expanding their own subsidies and alternative supply networks, creating a global subsidy race. U.S. export controls on advanced chips and manufacturing equipment, coordinated with the Netherlands and Japan, aim to slow adversary capabilities but create three tensions: (1) they tighten global supply of tools U.S. fabs need, adding cost pressure; (2) they may accelerate rather than delay Chinese indigenous development; and (3) allied commitment to controls remains fragile and could fracture under economic pressure.

- On cost competitiveness (Question 3): **Cost disadvantage sources remain debated.** U.S. semiconductor manufacturing faces a structural cost disadvantage of approximately 30% compared to Taiwan, South Korea, or Singapore, and roughly 50% compared to China over a 10-year fab lifecycle [11][12]. Even with CHIPS Act subsidies covering 40–70% of this gap, a U.S. fab remains approximately 35% more expensive than an equivalent Taiwan facility—a significant hurdle when cutting-edge fabs cost $10–40 billion over a decade. Four factors drive these disadvantages. First, scale economies: U.S. global fab capacity share has fallen from 37% in 1990 to roughly 12% today, preventing American facilities from spreading fixed costs across high volumes as Asian megafabs do. Second, learning curves: semiconductor manufacturing costs historically fall 20–30% with each doubling of cumulative output, but lower U.S. volumes slow yield improvements and keep defect rates higher. Third, regulatory timelines: U.S. fab construction takes 50+ months versus 28–32 months in Asia due to environmental permitting and compliance requirements, adding billions in capital costs and delayed time-to-market. Fourth, structural factors: labor and construction wages run 2–5× higher, weaker regional supplier clusters increase logistics costs, and higher energy and healthcare expenses compound the gap.

  Whether these disadvantages are surmountable through sustained investment remains contested. Proponents argue that learning effects, economies of scale, and supplier ecosystem development could narrow gaps over time, citing historical precedents in other industries. Critics counter that labor and regulatory cost differences are structural rather than temporary, that global competition may prevent U.S. firms from achieving the volume needed for learning-curve benefits, and that subsidies risk sustaining perpetually uneconomical production. Limited publicly available cost-benefit analyses make it difficult to assess which view is more accurate.

Implementation constraints affect all scenarios:

- **Domestic capacity remains limited.** Despite private investment commitments exceeding $200 billion, industry analyses indicate that by 2030 U.S. fabs will meet well under half of expected domestic AI compute demand at advanced nodes (<5 nm) [13]. Advanced packaging and critical materials—key to AI accelerator performance—remain especially thin in the United States.
- **Federal funding and incentives are significant but incomplete.** The CHIPS Act's $39 billion in direct manufacturing incentives and $13 billion for R&D and workforce programs have spurred new fab announcements in Arizona, Texas, and New York. Yet cost differentials of 30–50 percent compared with Asian foundries, long permitting timelines, and lagging incentives for packaging and upstream materials still impede full-spectrum supply-chain development [14].
- **Workforce shortfall is acute.** The Semiconductor Industry Association forecasts 36,000 to 67,000 unfilled high-skill semiconductor jobs by 2030 [5]. Even if every current training pipeline meets its targets, demand for process engineers, equipment technicians, and specialized AI-chip designers will outstrip supply, risking schedule delays and higher production costs.

Impacts

Economic Competitiveness. A robust domestic semiconductor base could anchor trillions of dollars in downstream AI-driven economic activity, from cloud infrastructure to advanced manufacturing. Proponents argue that reduced dependence on East Asian fabs would lower supply-chain shock risks and preserve U.S. leadership in AI-enabled industries. However, three counterarguments merit consideration. **First, opportunity cost:** $50–100 billion in federal subsidies could alternatively fund university R&D, infrastructure, or deficit reduction, each with measurable economic returns. **Second, allocative efficiency:** given persistent 30–50% cost disadvantages, subsidizing production may destroy rather than create economic value by diverting resources from more productive uses. **Third, subsidy dependence:** without sunset provisions, semiconductor firms may become perpetually reliant on government support, reducing long-term competitiveness. The net economic impact depends on whether positive externalities, learning-curve effects, and spillover benefits to downstream industries outweigh these costs—a calculation that requires explicit modeling not provided in available analyses, including this memo.

National Security. The evidence on Taiwan's supply-chain concentration and the 2025–2027 risk window presents stark national security implications. Advanced semiconductors underpin critical defense capabilities—encrypted communications, autonomous systems, intelligence infrastructure—making heavy reliance on production near geopolitical flashpoints a strategic vulnerability. Economic losses from Taiwan Strait disruption could reach $2.7–10 trillion, with U.S. domestic capacity unable to meaningfully compensate in the near term due to 3–5 year construction timelines and 2–3 generation technology gaps behind TSMC.

However, onshoring is not the only risk-mitigation strategy. **Enhanced defense commitments** and tripwire forces in Taiwan could reduce disruption probability sufficiently that continued dependence remains acceptable. **Strategic stockpiling** and surge capacity for critical defense chips could provide security at lower cost than full-scale domestic production. **Allied diversification** across Taiwan, South Korea, Japan, and potentially India may provide more resilience than U.S. concentration, especially given shared dependence on Dutch EUV equipment and Japanese materials. Each strategy involves tradeoffs: defense guarantees require credible military commitments; stockpiles face obsolescence in rapidly advancing technology; allied coordination remains fragile under economic pressure. A rigorous cost-benefit analysis quantifying disruption probabilities, comparing mitigation strategies, and accounting for intervention success rates would clarify optimal approaches but is not yet available in public literature.

Equity and Workforce Development. Semiconductor expansion promises tens of thousands of high-skill and middle-skill jobs, but distributional impacts warrant scrutiny. Announced fabs concentrate in Arizona, Texas, New York, and Ohio—regions with existing tech infrastructure but often high living costs. While programs like the NSTC Workforce Center of Excellence promote apprenticeships and community-college pipelines for underrepresented groups, three equity concerns emerge. **First, geographic concentration:** benefits may accrue primarily to already-prosperous tech hubs rather than economically distressed regions, exacerbating spatial inequality. **Second, skill barriers:** high-skill engineering roles may prove inaccessible to workers without advanced degrees, limiting broad-based opportunity despite technician-level job creation. **Third, displacement:** $50–100 billion in subsidies represents opportunity cost for alternative workforce investments (infrastructure, healthcare, education) that might generate more geographically dispersed or accessible employment. Without sustained funding, explicit regional equity requirements, and integration with broader economic development strategies, semiconductor policy risks becoming a regressive transfer to capital-intensive firms and high-income workers in select metros.

Feasibility and Implementation. Even if economically and strategically justified, scaling domestic semiconductor capacity faces formidable implementation challenges. Construction lead times of 3–5 years mean capacity additions cannot address near-term (2025–2027) vulnerability windows identified in security analyses. Fabs require enormous inputs—millions of gallons of water daily, stable electricity, specialty gases—creating competition with other uses and potential environmental conflicts. Capital intensity exceeding $20 billion per cutting-edge facility strains both federal budgets and private balance sheets, particularly if macroeconomic conditions deteriorate or AI demand projections prove overstated. Coordination across Commerce, Defense, State, and allied governments introduces principal-agent problems, potential for regulatory capture, and risk of duplicative or conflicting programs. Administrative capacity constraints may limit government's ability to efficiently allocate subsidies, monitor performance, and prevent waste. These feasibility concerns do not necessarily invalidate intervention, but they raise the bar for justification and underscore the importance of flexible program design with built-in evaluation and adjustment mechanisms.

Critical Dependencies and Monitoring Priorities. Several assumptions underlying this analysis merit continuous reassessment:

- **AI scaling trajectory:** If algorithmic efficiency gains or architectural shifts limit compute demand growth to 2–3× rather than 5× by 2030, required capacity expansion decreases substantially.
- **Taiwan security dynamics:** Changes in cross-strait military balance, U.S. defense posture, or Chinese coercive capabilities could increase or decrease urgency of onshoring relative to alternative strategies.
- **Cost competitiveness:** If learning curves and scale effects fail to narrow the 30–50% cost gap, subsidies may prove ineffective at enabling sustainable domestic production.
- **Allied coordination durability:** Fracturing of export-control agreements or supply-chain partnerships with Netherlands, Japan, or Korea would require strategy recalibration.
- **Technological disruption:** Breakthroughs in neuromorphic, analog, or quantum computing could alter semiconductor requirements and render some fab investments obsolete.

Given these dependencies, policy should incorporate **decision points and off-ramps:** annual reassessment of demand forecasts and cost competitiveness; semi-annual evaluation of geopolitical risk indicators; five-year reauthorization requirements with explicit performance metrics; and scenario planning for lower-probability, high-impact events (Taiwan conflict, major technological shifts). Rigid commitment to current projections risks either underinvestment if threats materialize faster than anticipated or wasteful overinvestment if demand or costs evolve favorably.

Policy Options

The following options are organized around two key dimensions: (1) whether to prioritize domestic production versus allied coordination, and (2) whether to pursue permanent subsidies versus time-limited market interventions. Understanding which approach is optimal requires explicit assessment of how the three core uncertainties are likely to resolve.

Option A: Allied Diversification Strategy

Core approach: Rather than subsidizing expensive U.S. production, strengthen defense commitments to Taiwan, coordinate export controls with allies, and diversify production across Japan, South Korea, and potentially India. Invest federal resources in strategic stockpiles, surge capacity for defense-critical chips, and diplomatic/ military guarantees rather than manufacturing subsidies.

This option is optimal if:

- Taiwan disruption probability remains low (¡20% over next decade) due to effective deterrence
- Cost disadvantages prove structural rather than temporary (subsidies cannot close 30-50% gaps)
- AI compute demand grows moderately (2-3× rather than 5×), making current allied capacity adequate

Pros:

- Leverages existing Asian cost advantages rather than fighting them
- Avoids $50-100 billion in subsidies that might sustain uneconomical production
- Preserves fiscal flexibility for other national priorities
- Maintains competitive pressure that keeps prices low and innovation high
- Diversification across multiple allied nations may provide more resilience than U.S. concentration

Cons:

- Maintains vulnerability if deterrence fails or allied coordination fractures
- Strategic stockpiles face obsolescence as technology advances rapidly
- Limited leverage to influence technology standards or prioritize defense needs in allied fabs
- Does not address workforce development or build domestic expertise

Implementation:

- Expand U.S. military presence in Taiwan as tripwire deterrent
- Negotiate guaranteed production allocations with TSMC, Samsung for defense-critical chips
- Create 3-6 month strategic stockpiles of key semiconductors
- Maintain CHIPS Act R&D programs ($13B) but scale back manufacturing subsidies
- Strengthen Quad and Chip 4 coordination mechanisms

Option B: Time-Limited Market Acceleration

Core approach: Expand CHIPS Act subsidies significantly but with 5-7 year sunset provisions and explicit cost-competitiveness benchmarks. Front-load support to help U.S. fabs achieve scale and learning-curve benefits, then transition to market-based competition. Focus incentives on measurable bottlenecks: advanced packaging, critical materials, workforce development.

This option is optimal if:

- Cost disadvantages reflect temporary scale/learning gaps rather than structural factors
- AI compute demand scales substantially (4-5×), creating market opportunity for expanded U.S. production
- Taiwan risk is elevated (¿30% disruption probability) but not imminent, allowing time for capacity build

Pros:

- Aggressive enough to achieve scale economies and learning effects within 5-7 years
- Sunset provisions prevent permanent subsidy dependence
- Maintains market discipline through explicit competitiveness benchmarks
- Addresses acute bottlenecks (packaging, materials, workforce) that CHIPS Act underfunds
- Creates off-ramps if AI demand or cost competitiveness evolves unfavorably

Cons:

- Requires substantial upfront investment ($40-60B beyond current CHIPS Act)
- Risk that 5-7 years proves insufficient to achieve competitiveness, creating pressure for extensions
- May not address near-term (2025-2027) Taiwan vulnerability window
- Political difficulty of enforcing sunset provisions against industry lobbying

Implementation:

- Add $40-60B in manufacturing incentives over 5 years, with 50% focused on advanced packaging and materials
- Establish explicit cost-competitiveness targets (within 15% of Taiwan by Year 5)
- Triple workforce development funding to $5B annually
- Automatic sunset after 7 years unless Congress reauthorizes based on demonstrated cost competitiveness
- Streamline permitting to compress construction timelines by 12-18 months

Option C: Permanent Strategic Industry Framework

Core approach: Accept that U.S. semiconductor manufacturing will require permanent government support due to structural cost disadvantages, but justify this as national security infrastructure similar to defense contractors. Create permanent tax credits, guaranteed government purchases, and ongoing subsidies to maintain domestic capacity regardless of cost competitiveness.

This option is optimal if:

- Taiwan disruption probability is high (¿40%) and imminent (within 3-5 years)

- AI compute demand scales dramatically (5×+) and proves essential for economic/security leadership
- Cost disadvantages prove permanent but national security benefits justify ongoing subsidies

Pros:

- Provides certainty needed for massive long-term private investment
- Maximizes likelihood of meeting aggressive 2030 capacity targets
- Creates comprehensive domestic ecosystem across entire value chain
- Positions U.S. to influence global technology standards
- Generates substantial high-skill employment (50,000+ jobs)

Cons:

- Requires $100-150B+ federal investment over decade
- Risk of market distortion, regulatory capture, and inefficient allocation
- May sustain perpetually uneconomical production
- Could trigger retaliatory subsidies and trade disputes
- Lacks flexibility to adjust if AI demand or security dynamics improve

Implementation:

- Establish National Semiconductor Corporation with $20B annual budget
- Permanent 25% investment tax credit for fab construction and advanced equipment
- Guaranteed government procurement of $10B annually in domestically-produced chips
- Mandate that 50% of federal AI compute infrastructure use domestic chips
- Expand export controls to comprehensively restrict competing nations' access to advanced technology

Decision Matrix

Scenario	Option A	Option B	Option C
Low Taiwan risk + structural costs	✓✓		
Moderate Taiwan risk + closeable costs		✓✓	
High Taiwan risk + moderate AI scaling		✓	✓
Imminent Taiwan threat + high AI scaling			✓✓
Low AI demand growth (2×)	✓✓		
Moderate AI demand growth (3-4×)	✓	✓✓	
High AI demand growth (5×+)		✓	✓✓

Table 1: Optimal strategy varies by scenario. ✓✓= strongly preferred; ✓= acceptable; blank = poorly suited.

This matrix illustrates that no single option dominates across all scenarios. The choice depends critically on assessment of the three core uncertainties. Given current evidence—suggesting moderate Taiwan risk (20-30%), uncertain cost competitiveness, and contested AI demand projections—Option B appears to offer the best risk-adjusted approach, though this assessment could shift as new information emerges.

Recommendation

Given current evidence, Option B (Time-Limited Market Acceleration) represents the most prudent course, though this recommendation is explicitly conditional on assessments of the three core uncertainties.

Option B is preferred because:

- Current Taiwan risk appears elevated but not imminent, providing a 5-7 year window for capacity development
- Evidence on cost competitiveness is mixed—some factors appear temporary (scale, learning) while others seem structural (labor, regulatory), suggesting targeted intervention may succeed but permanent subsidies are unjustified
- AI demand projections remain uncertain, making aggressive but time-limited support more prudent than permanent commitment

However, this recommendation should shift if evidence changes:

- If Taiwan disruption probability exceeds 40% within 3 years $\rightarrow$ pivot to Option C (permanent support) to accelerate capacity build
- If cost gaps persist after 5 years of subsidies $\rightarrow$ pivot to Option A (allied coordination) to avoid perpetual subsidization
- If AI demand grows ¡3× by 2028 $\rightarrow$ scale back to Option A to preserve fiscal resources

Conclusion

U.S. leadership in artificial intelligence depends on secure access to advanced semiconductors, but the optimal policy approach remains contingent on resolving three core uncertainties: AI compute demand trajectory, Taiwan supply-chain vulnerability, and the viability of achieving cost competitiveness through subsidies.

Current evidence supports targeted, time-limited intervention. The CHIPS Act has catalyzed substantial private investment, but persistent gaps in advanced packaging, critical materials, and skilled workforce threaten to constrain capacity growth. Taiwan's 92% concentration of cutting-edge production creates acute vulnerability, particularly during the 2025-2027 window before allied reshoring matures. However, significant uncertainties—algorithmic efficiency gains that could reduce compute requirements, contested evidence on whether cost disadvantages are surmountable, and debate over whether allied coordination provides adequate security—make permanent, comprehensive subsidization premature.

Option B (Time-Limited Market Acceleration) balances these competing considerations. By expanding CHIPS Act support by $40-60 billion over five years with explicit sunset provisions, this approach provides sufficient resources to address acute bottlenecks while maintaining fiscal discipline and market accountability. Focusing investment on advanced packaging, critical materials, and workforce development targets the highest-leverage gaps. Cost-competitiveness benchmarks and automatic reauthorization requirements create off-ramps if subsidies prove ineffective.

However, this recommendation is explicitly conditional. If Taiwan disruption probability exceeds 40% within the next three years—as could occur from intensifying cross-strait tensions or Chinese coercive actions—the urgency would justify pivoting to Option C's permanent strategic industry framework despite higher fiscal costs. Conversely, if AI compute demand grows more slowly than projected (2-3× rather than 5× by 2030) or if cost gaps persist despite five years of subsidies, Option A's allied coordination strategy would better preserve fiscal resources while maintaining adequate security through defense guarantees and diversification.

Immediate next steps include:

- Secure congressional authorization for $40-60B in expanded manufacturing incentives over five years, with 60% dedicated to advanced packaging and critical materials
- Triple workforce development funding to $5B annually, emphasizing apprenticeships and community-college pipelines
- Establish interagency task force to streamline fab permitting, targeting 12-18 month reduction in construction timelines

- Negotiate production allocation agreements with allied semiconductor manufacturers (TSMC, Samsung) for defense-critical chips
- Codify explicit cost-competitiveness targets (within 15% of Taiwan by Year 5) and automatic sunset provisions
- Create monitoring dashboard tracking AI demand growth, Taiwan security indicators, and fab cost competitiveness for semi-annual executive review

Critical dependencies require continuous reassessment. Semiconductor policy operates in a rapidly evolving landscape where AI scaling laws, geopolitical dynamics, and technological paradigms could shift substantially within 2-3 years. Rather than rigid commitment to current projections, policy should incorporate flexibility through annual demand and cost reviews, semi-annual geopolitical assessments, and five-year reauthorization requirements tied to demonstrated progress. This adaptive approach positions the United States to maintain semiconductor leadership while avoiding wasteful overinvestment or dangerous underinvestment as conditions evolve.

The stakes are substantial—semiconductors underpin AI capabilities that will shape economic competitiveness, national security, and technological leadership for decades. But policy effectiveness depends not on maximizing investment, but on calibrating intervention to match genuine market failures and security imperatives while preserving fiscal discipline and market accountability. Time-limited, targeted reform offers the best path forward given current evidence, provided policymakers remain prepared to adjust course as uncertainties resolve.

References

[1] S. Shivakumar and C. W. Wessner, "Semiconductors and national defense: What are the stakes?." CSIS Analysis, 2022. Accessed: 2024-09-29.

[2] J. Noffsinger, M. Patel, P. Sachdeva, A. Bhan, H. Chang, and M. Goodpaster, "The cost of compute: A $7 trillion race to scale data centers." McKinsey Quarterly, 2024. Accessed: 2024-09-29.

[3] M. Greenstone and V. Wilson, "Employment impacts of the chips act." Brookings Institution, 2024. Accessed: 2024-09-29.

[4] P. Singer, "Building fabs in the u.s. vs taiwan: Twice as long, twice as much." Semiconductor Digest, 2024. Accessed: 2024-09-29.

[5] Semiconductor Industry Association, "State of the u.s. semiconductor industry: 2024 report," 2024. Comprehensive industry analysis including manufacturing capacity, R&D investment, workforce trends, and policy recommendations. Accessed: 2024-09-29.

[6] J. Lind and M. Mastanduno, "Hard then, harder now: Cocom's lessons and the challenge of crafting effective export controls against china," *Texas National Security Review*, vol. 8, September 2024. Accessed: 2024-09-29.

[7] I. Hathaway, J. V. Patten, D. Castro, and M. Kleeman, "How innovative is china in semiconductors?." ITIF, 2024. Accessed: 2025-09-29.

[8] S. A. R., J. Martin, and N. Jhunjhunwala, "Semiconductors — the next frontier of geopolitics: Supply chain diversification." HFS Research, 2024. Published March 22, 2024; Accessed: 2025-09-29.

[9] Dimerco, "Taiwan's strategic role in the global semiconductor supply chain." Dimerco Blog, October 2024. Accessed: 2025-09-29.

[10] M. Spencer, “Tsmc’s role in the global ai and geopolitical future.” AI Supremacy, 2024. Accessed: 2025-09-29.

[11] L. Jones, S. Krulikowski, N. Lotze, and S. Schreiber, “U.s. exposure to the taiwanese semiconductor industry,” Economics Working Paper Series Working Paper 2023–11–A, U.S. International Trade Commission, Washington, DC, November 2023. Accessed: 2025-09-29.

[12] M. Ostertag, “Fact of the week: A significant disruption to taiwanese semiconductor production could increase the prices of u.s. logic chips by 59 percent.” ITIF, February 2024. Accessed: 2025-09-29.

[13] L. Maizland and C. Fong, “Onshoring semiconductor production: National security versus economic efficiency.” Council on Foreign Relations, January 2024. Accessed: 2024-09-29.

[14] Semiconductor Industry Association, “Semiconductor technology advancement and research (star) act: H.r. 802 one-pager.” Policy brief, 2024. One-page policy summary advocating for the extension of the advanced manufacturing investment credit and expansion to chip design and R&D. Accessed: 2024-09-29.