

Groundbreaking Chip Sovereignty Europe's Strategic Push in the Semiconductor Race

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► Key Takeaways

- The EU Chips Act's enactment in September 2023 marks a major policy shift that revitalizes industrial policy in Europe. By allowing state subsidies for semiconductor projects, it has the potential to secure Europe's supply chain security and technological autonomy in an industry dominated by the United States and East Asia.
- European Union leaders have vacillated between (1) whether to incentivize foreign firms at the cost of subsidizing European champions and (2) whether to bolster existing strengths in mainstream chip production or attract cutting-edge technologies. Policymakers should focus Chips Act funds on domestic firms to catalyze long-standing vertically integrated European value chains in mainstream chip technology.
- The EU Chips Act is only the first step toward technological autonomy. Europe needs broader regulatory and tax reforms to create a conducive environment to help innovators create startups and for these startups to scale. These reforms are crucial to addressing the unique funding gaps that European startups face.

Introduction

Europe is a long-standing but stagnant force in the global semiconductor industry. Downstream manufacturing industries at the heart of the bloc's economy suffered amidst a global chip crisis during the Covid-19 pandemic. Meanwhile, the European Union (EU) is both less advanced and has a smaller market share than China and the United States (US) in semiconductor design and manufacturing, a status that undermines growing calls on the Old Continent to carve out niches of indispensability in the chip value chain. To secure access to the chips indispensable to European economic resilience and geopolitical autonomy, EU leaders have broken with decades of free-market, free-trade precedent to catch up with their American and East Asian counterparts in subsidizing innovation.¹

The EU Chips Act is the bloc's most ambitious post-pandemic effort to bolster the continent's technological prowess, but its goals remain ambiguous. Should the law support existing European champions, or should it attract investment from foreign firms? Should fortify existing chip supply chains for downstream European industries or focus on incentivizing innovation. And, if its focus is innovation, should the law cement the EU's few but significant niches of technological leadership, or should make bets on potential future giants? Underlying all these questions is the reality that the Chips Act alone is not enough to achieve any of the EU's ambitions in supply chain resilience and technological leadership.

This *memo* lays out what challenges Europe faces in computing, how disciplined implementation of the Chips Act can bolster the continent's existing strengths, and what further policy reforms could make the EU indispensable in broader swaths of the future chip industry. EU leaders must be honest with what the bloc's current levels of public funding can reasonably expect to achieve. If Europe is to build resilient supply chains and increase its technological autonomy *vis-à-vis* China and the US, the EU Chips Act must catalyze the continent's domestic virtuous cycle of upstream chip innovation and downstream chip implementation. Beyond targeted support for Europe's vertically integrated technology ecosystem, broader regulatory and tax reform must follow the Chips Act to create an environment fertile for growing more European champions.

Reviewing the EU Chips Act

The EU Chips Act entered into force in 2023 as a joint venture between the EU and Member States.² While EU Member States have traditionally been forbidden from subsidizing domestic industries, the Chips Act expands existing mechanisms to both allow multinational subsidies for semiconductor projects important for the wider EU market as well as to provide the bloc's central funds as a supplement.

1. N. F. Poitiers and P. Weil, "Fishing for Chips: Assessing the EU Chips Act", *Ifri Papers*, Ifri, July 2022, available at: www.ifri.org.

2. "European Chips Act", European Commission, September 21, 2024, available at: <https://commission.europa.eu>.

The law features three key elements to fulfill Brussels' goals: support for startups, relaxed state aid restrictions, and supply chain coordination measures. Pillar One, the "Chips for Europe Initiative", plans to offer partially subsidized software and facility access for startups while also easing their access to capital. Pillar Two relaxes restrictions on state aid for "first-of-a-kind" manufacturing capacities to attract leading-edge fabs. So long as the subsidy effort involves entities (public or private) from at least three EU countries, Member States may provide subsidies that close the cost difference of building facilities in Europe versus other regions. Lastly, Pillar Three is a coordination mechanism under the newly minted European Semiconductor Board. If it foresees a crisis, it could empower the Commission to purchase chips on behalf of the EU and require foundries that benefited from EU subsidies to prioritize EU customers. It also includes a proposal that would allow the Commission to curb exports from the EU if deemed appropriate, echoing measures used for vaccines during the Covid crisis.

The EU Chips Act relaxes restrictions on state aid for "first-of-a-kind" manufacturing capacities to attract leading-edge fabs

In addition to EU-level initiatives, it is important to note the national programs the EU Chips Act seeks to coordinate and integrate. Many European countries have sought to attract investments by attracting chipmakers with extensive subsidies. Overall, this seems to have been successful, with countries like Germany,³ Ireland, France,⁴ Poland,⁵ Italy⁶ and others attracting investment. Spain, on the other hand, while also announcing billions of Euros in subsidies to attract foreign investment, failed to win a bid by Intel against the German and US governments.⁷

Ambiguous goals

While introducing the proposal in February 2022, EU Commission President Ursula von der Leyen announced that with "the European Chips Act, we are putting out the investment and the strategy." The Commission aimed to increase Europe's share in global chip production from 9% to 20% by 2030, but since the law's adoption, key details remain unanswered.

3. "Intel Announces Major Investment Plans in Europe", Intel Newsroom, March 15, 2022, available at: www.intel.com.

4. S. Kar-Gupta and S. Mukherjee, "STMicroelectronics and GlobalFoundries Confirm Major New France Investment", Reuters, July 11, 2022, available at: www.reuters.com.

5. M. Grzegorzczak, "EU Chips Act Pays First Dividends, with Poland a Key Beneficiary", Emerging Europe, March 22, 2022, available at: <https://emerging-europe.com>.

6. E. Beer, "Intel Close to \$5bn Italy Chip Plant Deal", The Stack, August 4, 2022, available at: www.thestack.technology.

7. "Spain to Focus on Producing Simpler Chips After Losing Bids, Report Says", Automotive News Europe, July 11, 2022, available at: <https://europe.autonews.com>.

First, will the increase in Europe's share of global chipmaking consist of a boost to existing mainstream chip capacity, or will it consist of the pioneering and scaling of cutting-edge chipmaking on European soil? There are a few steps in the computing value chain where Europe is dominant. Although a Dutch company, ASML, is the world's only producer of the EUV lithography tools needed to fabricate the most advanced chips, not a single European chipmaker is yet capable of using them.

Many in Brussels want to change this. EU Commissioner for the Internal Market Thierry Breton, for example, proclaimed his dream of attracting cutting-edge, sub-2nm chipmaking to European soil, and the Commission last November announced a pilot line funding call to that effect.⁸ Domestic industry voices, however, have urged that the EU Chips Act target the larger, less advanced chips that European chipmakers can already make. The bloc's existing chip production capacity comprises precisely the mainstream nodes that downstream manufacturers on the continent need; for example,

three-fourths of France's 7 billion Euros in chip exports serve the domestic European market. Subsidizing smaller node production would not bring Europe the chips its economy needs.

Doubts over subsidizing cutting-edge chip production raise another of the EU Chips Act's unclarified goals. Should the Chips Act prioritize European companies, or should it secure chipmaking capacity at all costs? Member State governments and the Commission will have to decide with each deal whether

they would rather fund a foreign company that can bring a new chipmaking capability to the continent or whether their subsidies should go to strengthening a domestic firm. Either approach could serve the goal of increasing Europe's net share of global chipmaking. However, the former would more quickly bring smaller node production to the continent, while the latter may better foster an internal European semiconductor ecosystem.

The EU Chips Act and member states' subsidies should focus on bolstering Europe's existing strengths in the semiconductor industry, focusing the lion's share of funding on domestic European firms. In the medium term, such a disciplined approach will ensure Europe can both achieve indispensability⁹ in key niches of the industry and secure key downstream manufacturing industries' access to vital chip inputs.

Should the Chips Act prioritize European companies, or should it secure chipmaking capacity at all costs?

8. "Speech by President von der Leyen at the European Parliament Plenary on the preparation of the European Council meeting of 29-30 June 2023", European Commission, June 27, 2023.

9. T. Rühlig, "Reverse Dependency: Making Europe's Digital Technological Strengths Indispensable to China", German Council on Foreign Relations, May 6, 2024.

In the longer term, however, Europe needs more ASMLs, firms that are indispensable not only because of their capacity but also because of their uniqueness. Such monopolies on segments of such a geopolitically important industry will, in turn, lend greater weight to the EU as an autonomous force on the global stage. Beyond the direct chip value chain, Europe also needs to develop the tangential software technologies that support chipmaking and the downstream industries chips plug into. Grants guided by policymakers in Brussels, Berlin, Paris, Warsaw, and other political capitals are unlikely to guess rightly on the giants of the future, nor are they likely to send Euros to just the right software startups whose products a future chipmaker or telecommunications firm may need. To spur its future ASMLs and broaden its technological capabilities, Europe needs more than the Chips Act. The Old Continent needs a cohesive tax and regulatory environment that helps entrepreneurs innovate and scale in Europe.

The Old Continent needs a cohesive tax and regulatory environment that helps entrepreneurs innovate in Europe and scale in Europe

European chipmaking's global status

Europe has a relatively weak position in the global semiconductor industry. Apart from advanced lithography equipment (necessary for making leading-edge chips), the continent is dispensable to most parts of the global chip value chain. Its share of global chipmaking has remained stagnant for over two decades, and European entrepreneurs struggle to scale the ideas that could seed future giants.¹⁰ Some of these problems stem from internal problems Europe needs to solve, while others occurred because the EU did not keep in step with its American and East Asian competitors.

Limited indispensability and stagnant market share

Europe has notable strengths in certain segments of the semiconductor industry. Chipmakers like STMicroelectronics, Infineon, and NXP are global leaders in the sensors and power electronics needed for heavy industrial applications. The Netherlands' ASML is the world's sole provider of cutting-edge semiconductor manufacturing equipment, Germany's BASF is a key input materials provider, and Siemens offers critical chip design software. Beyond its private sector, Europe's public-private research centers are among the world's best, as institutes like CEA-Leti, Imec, and Fraunhofer have originated key breakthroughs in microelectronics for the global industry.

10. J.-P. Kleinhans, "Europe Didn't Have 44% Global Chip Production Capacity in the 90s", LinkedIn, May 15, 2023, available at: www.linkedin.com.

Europe's ship has some gaping holes, however. The continent currently cannot produce cutting-edge chips and plays a minor role in semiconductor design, accounting for only 9% of the latter.¹¹ Europe does not have cutting-edge chip designers and electronic design automation (EDA) software tool providers like the US's Nvidia, Qualcomm, and Synopsys. Such American firms accounted for 46% of the global chip design market in 2020, and the amount of intellectual property they develop gives the country powerful sway in global standards-setting organizations (SSOs). Downstream, the continent also lacks advanced node foundries like Taiwan Semiconductor Manufacturing Company (TSMC) in Taiwan, which boasts 92% of global leading-edge logic chip capacity, or Samsung in South Korea, occupying the remaining 8%. Beyond advanced chips, reliance on foreign semiconductor companies for mainstream chip inputs proved crippling during the global chip shortage of 2021 and 2022. The global auto industry suffered a loss of over \$210 billion, with Europe's original equipment manufacturers (OEM) manufacturing-reliant economy bearing an outsized impact.¹²

Europe is not likely to close the production and technology gaps that caused this crisis by subsidizing foreign firms to import cutting-edge chip-making into Europe, and doing so would also miss a key strength of the European technology ecosystem. In response to rising chip demand following supply-demand crises during the pandemic, leading European IDMs planned to increase their production capacity at current nodes, but they did not plan to invest in fabs capable of producing cutting-edge semiconductors. Only Intel, which currently operates a 14-nm fab in Leixlip, Ireland, has plans to build an advanced 7-nm fab on the condition of significant public contribution through state aid.¹³ Simply subsidizing foreign champions to expand the EU's advanced node manufacturing capabilities misses the nature of the continent's chip demand. Just as important, it also misses the history of how public research funding has historically supported Europe's vertically integrated technology value chain.

Vertically integrated domestic ecosystem

Europe's chip demand lies in the continent's own OEMs and software infrastructure providers. European chipmakers and public-private partnerships (PPPs) for chip research are closely integrated with their downstream OEM customers. As mentioned, three-fourths of French semiconductor exports are destined for the EU.¹⁴ Such a domestic focus on chip exports aligns with the organization of European innovation ecosystems. To map

11. R. Palma, R. Varadarajan and J. Goodrich "The Growing Challenge of Semiconductor Design Leadership", Semiconductor Industry Association, November 2022, available at: www.semiconductors.org.

12. T. Yost, "Shortages Related to Semiconductors to Cost the Auto Industry \$210 Billion in Revenues this Year, Says New AlixPartners Forecast", AlixPartners, September 23, 2021, available at: www.alixpartners.com.

13. N. Flaherty "Intel Installs First Tools in Fab 34 in Ireland", eeNews Europe, January 24, 2022, available at: www.eenewseurope.com.

14. "Des entreprises françaises au cœur des dynamiques industrielles en Europe", Chambre de commerce et d'industrie, February 2023.

out just one, the web of partnerships comprising CEA-Leti, STMicroelectronics, Valeo, and Volkswagen spreads the risk of chip development and integration vertically across a domestic value chain and ensures that the Euros spent at every stage serve the needs of the next-downstream European entity.

Europe's downstream chip customers offer the bloc an important voice before foreign regulators and standard-setting organizations, but these firms are integrated to varying degrees with European chipmakers. Whereas European automakers are closely integrated with domestic chipmakers like NXP, Infineon, and STMicroelectronics, telecommunication firms have historically relied on American designers and East Asian fabricators for the chips they need. Nokia, for example, relies on the software IP of American firms Marvell, Intel and Broadcom, which it then uses alongside Samsung to co-design chips that the Korean firm fabricates. Ericsson notably purchases Intel's CPUs for its cloud-RAN products, but over the past half-decade, both the Swedish and the Finnish companies have attempted to design more of their IP in-house.¹⁵ Their desire for tailor-made chips derives from the energy inefficiency of generalized field-programmable gate array (FPGA) chips in many 5G connectivity use cases, but this in-house approach is expensive. The vertically integrated cost-and-risk-sharing ecosystem analyzed later in this briefing that European public-private partnerships, chipmakers, and OEMs have used to great effect in the auto industry could help Europe strengthen its global share of the software and hardware needed for telecommunications.

Unlike European automakers, telecommunication firms have historically relied on American designers and East Asian fabricators for the chips they need

Becoming indispensable and fostering champions

Europe's limited strongholds on the semiconductor value chain and desire to foster a better-rounded domestic ecosystem each has its own path to remedy. The EU Chips Act may be the standard bearer of these efforts, but it is far from the sole vessel to a revitalized European chip ecosystem. Establishing indispensability in key parts of the chip value chain requires Europe to offer policy support to its existing areas of comparative advantage while fostering the "unknown giants of the future" requires broader strokes.

15. L. Li and C. Ting-Fang, "Ericsson and Nokia Branch Into Chip Design to Ride 5G and AI Waves", *Nikkei Asia*, June 15, 2023, available at: <https://asia.nikkei.com>.

Bolstering Europe's strengths and preventing subsidy leakage

Because the EU Chips Act has limited resources, it should focus on bolstering areas of “common European interest” and prevent the fruits of state aid from leaking out of Europe. In practice, such an approach involves subsidizing the continent's existing areas of competitive advantage, namely highly efficient, mainstream-node chips. This support will, in turn, catalyze the virtuous cycle linking upstream chipmakers and public-private partnerships to downstream OEM customers and their software integrators.

A guiding example of targeting state aid toward the “common European interest” and avoiding technology leakage can be found in Leti (*Laboratoire d'électronique des technologies de l'information*). This research institution was founded in 1967 by the French Atomic Energy Commission (CEA) to increase France's industrial competitiveness. It boasts substantial funding from the French state, with direct and indirect public support accounting for two-thirds¹⁶ of its 330 million Euros annual budget.¹⁷

In a pre-Chips Act world, Leti's careful adherence to EU regulations allowed France to support its industrial champions in a manner that was supportive of Europe's writ-large. While Member States cannot directly subsidize their champions, the EU permits support for public entities like Leti that conduct research in the general interest. Even when Leti conducts research with the private sector, as it did with French semiconductor materials company Soitec's “NanoSmart” project, the EU Commission does not consider such public funds to be state aid.

Having received significant government support, Leti's IP policies help to keep subsidized research results within the European and French ecosystems, and Chips Act support should similarly minimize innovation leakage. CEA, Leti's governing body, remains the owner of the results obtained by Leti researchers; it also retains the basic patents of bilateral projects. If external industrialists want to take full advantage of Leti's services, they must strengthen their presence, investments, and workforce in the region.

Leti's IP policy also has an openly protectionist dimension aimed at increasing the competitiveness of French and European firms, and the Commission should study this closely to determine whether future Chips Act funding recipients should instate similar measures. A former director of CEA's investment fund and head of Leti's microelectronics program stated that “Leti's objective is not to do research for research's sake but to help our industrial champions grow.” To do this, Leti not only keeps its patents in France but also grants preferential licensing terms to French and European companies over their non-European counterparts.

16. J.-C. Guibert, “Un grand campus d'innovation technologique : de MINATEC à GIANT”, *Le Journal de l'École de Paris du Management*, No. 87, January 1, 2011, pp. 37-44.

17. S. Dumoulin, “Le laboratoire d'électronique du CEA fête 50 ans d'innovations et d'essaimages réussis”, *Les Échos*, July 5, 2017.

An excellent example of European-European joint research supported by these preferential policies is the 2022 power electronics IPCEI between Leti and Valeo.¹⁸ Under this agreement, Leti offers its expertise in efficient microelectronics and materials technology, while Valeo leverages its role as an automotive parts supplier to target the project toward downstream needs. Between Leti, Valeo, government stakeholders, and downstream firms, the costs of this research are shared, and its benefits accrue to players across the European ecosystem.

Next steps to foster "future giants"

Despite not being the only source of innovation, startups are a model case study for policymakers seeking to help novel technologies scale into domestic champions. Notably, however, European chip startups face funding challenges beyond those faced by European non-chip startups. Examining the challenges these early-stage chip entrepreneurs face to reaching scale is instructive to shaping a policy environment that fosters future European giants in the chip sector.

While Europe births 36% of all startups receiving funding from venture-capital channels,¹⁹ a lack of chip-focused VC firms leaves the continent with only 8.6% of global semiconductor startups compared with the US's 18% and China's 60%. Among this low global share of chip startups, only 16% of European chip startups successfully achieve exits. While every major economy bemoans the startup "valley of death"—the late-stage funding round where VCs lose interest but firms are not yet willing to take risks—legal and tax barriers make Europe's "valley of death" particularly precipitous.

Restrictions on institutional investors leave European startups parched for capital by late-stage funding rounds, and European chip startups face an especially volatile late-stage funding landscape. Whereas total VC funding in the US falls 55% from Series B to Series E, VC funding in Europe falls 83%. Furthermore, European chip startups have seen their average late-stage funding fluctuate by as high as 56% annually from 2018 to 2023, while early-stage funding remained constant even throughout the pandemic.

Europe has a vibrant early-stage research sector, but these small companies struggle against their American and East Asian counterparts to reach their full potential

18. "Valeo and the CEA to Collaborate on Advanced Research in Power Electronics to Prepare for Tomorrow's Electric Mobility", Valeo, September 13, 2022, available at: www.valeo.com.

19. K. Baroudy and J. Janmark, "Europe's Start-Up Ecosystem: Heating Up, But Still Facing Challenges", McKinsey, October 11, 2020, available at: www.mckinsey.com.

A major reason for this gap and volatility in late-stage funding is that while pension funds and capital markets directly or indirectly supply the lion's share of VC funding in the US, most of Europe's VC funding comes from government and corporate coffers. Reliance on government funds ties VC funding to political climates, which may budget venture investments that are considered external to the chip industry. To illustrate, the VC fund in Europe that most actively invests in chip startups is the European Innovation Council (EIC) Fund, which operates off public funds from the Union's Horizon Europe program, a one-time injection spurred by the COVID-19 pandemic.²⁰ Similarly, reliance on large firms' venture funds makes entrepreneurs using incumbent technology frameworks more likely to receive funding than those with paradigm-shifting ideas that run against established chip hardware and software firms. The French startup SiPearl, for example, counted Arm first among its core investors, but the startup notably uses the Arm® Neoverse V1 platform.²¹ SiPearl shows how corporate VC funds are effective in developing innovative uses of existing technology, but these funds are not likely to seed the groundbreaking giants Europe needs.

To help startups ford Europe's late-stage funding challenges, member state governments should free institutional investors like pension funds to invest into domestic VCs. In 2022, only 0.01% of European pension funds' over 7.8 trillion USD in assets were invested into European VCs,²² a mere fraction of the 2.00% that at least 30 US state pension funds invest in VCs.²³ The French²⁴ and German²⁵ economy ministries have partnered with institutional investors to raise funds specifically for the purpose of investing in VCs, but policymakers at both the member state and EU levels should consider tax benefits that incentivize institutional investors across the bloc to prioritize VC funds.

Furthermore, unifying the affairs of startups seeking to expand across Europe would give entrepreneurs a much smoother path to scale. For example, a pan-European framework for companies that compensate their employees with stock options would lower hiring barriers within the Union for startups. Due to Europe's acute VC funding challenges, young firms may not have sufficient cash flow to compensate employees in salary alone, so they may prefer to issue stock for employees willing to take an early bet on the startup's growth. Different national laws regarding how stock options are taxed, however, make it more expensive for a Danish employee than a Belgian employee to accept stock-based compensation.²⁶ This effectively means that startups operating in Denmark need greater liquidity than startups operating in Belgium to compensate their employees.

20. "About the European Innovation Council", European Innovation Council, available at: <https://eic.ec.europa.eu>.

21. "SiPearl: Initial Closing of Series A With €90m Financing to Launch Rhea, the Energy-Efficient HPC1-Dedicated Microprocessor", SiPearl, available at: <https://sipearl.com>.

22. G. Rees and M. Ashworth, "Europe's Start-Up Ecosystem: Heating Up, but Still Facing Challenges", State of European Tech, 2023, available at: <https://stateofeuropentech.com>.

23. "The 2% Solution for Maryland: Increasing Pension Fund Investment in Venture Capital", The Abell Foundation, 2022, available at: <https://abell.org>.

24. "Financing the Fourth Industrial Revolution", Direction Générale du Trésor, May 10, 2024, available at: www.economie.gouv.fr.

25. "Future Fund", Federal Ministry for Economic Affairs and Climate Action, May 15, 2023, available at: www.bmwk.de.

European policymakers want to foster the giants of the future, but they should not do so by leaching on EU Chips Act funds. Bureaucrats are well enough positioned to leverage the grants from the Chips Act, which ought to narrowly bolster Europe's existing strengths. Broadly promoting grassroots innovation in semiconductors, however, requires unleashing free market forces. Tax incentives spurring investment by pension funds and regulatory reforms easing non-cash compensation would be a major step forward in helping European chip entrepreneurs commercialize and scale.

An independent third big power

Europe is not attempting to revitalize the chip industry with an empty hand. European public-private partnerships lead the world in key niches, including advanced lithography and Moore-than-Moore applications. The continent also has a clear market for chips, the needs of which its research infrastructure is already well organized to meet.

The EU Chips Act is the first step to securing European autonomy in the semiconductor industry, and policymakers must use this tool in a manner that fits its scale. More ambitious plans to catch up with the US and East Asian economies across the technological board will require broader policy strokes to make Europe a place where startups can become giants. The right combination of realism and ambition will allow European policymakers to catalyze the continent's unique configuration of research, chipmaking, and chip demand into a technological power with an independent voice on the global stage.

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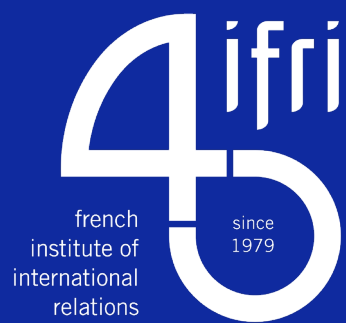
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