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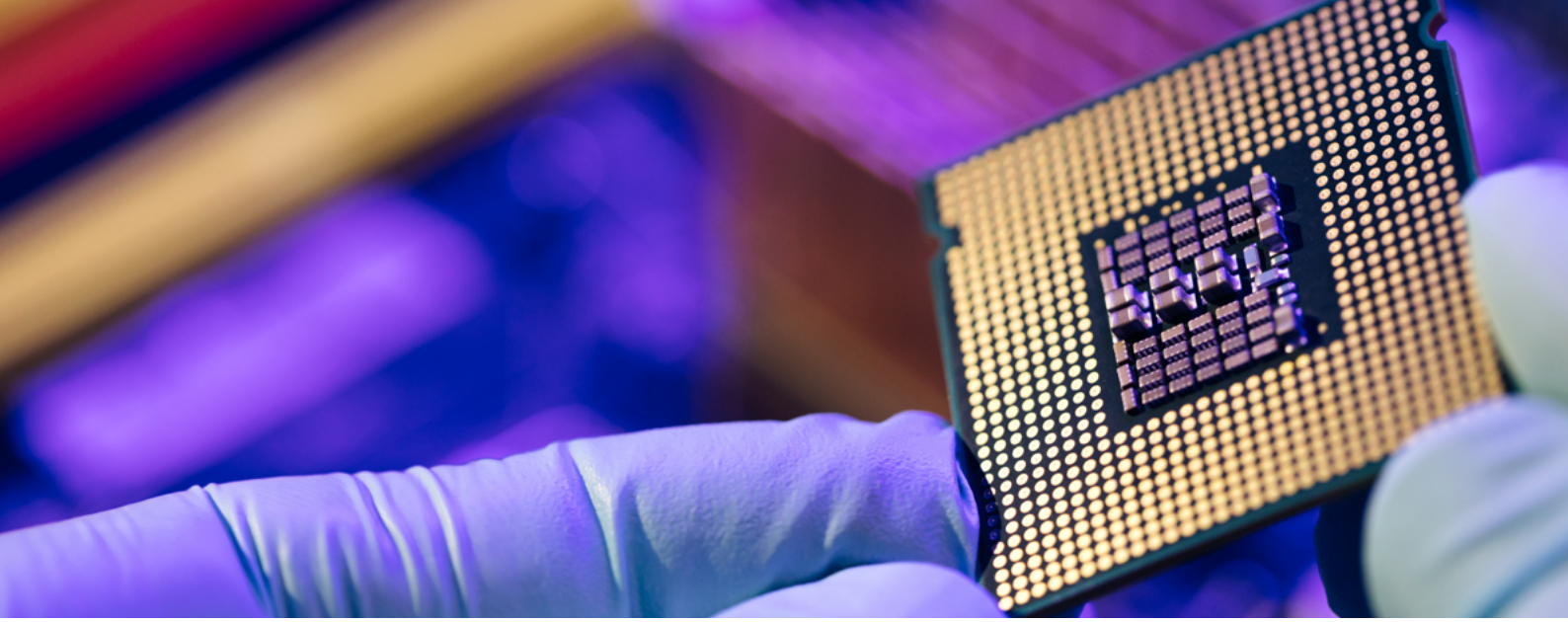
Securing European Chip R&D as Chinese Competition Intensifies

Arrian Ebrahimi



Securing European Chip R&D as Chinese Competition Intensifies

Recent announcements by Chinese automakers that they will launch cars powered entirely by domestically produced chips mark another step in the gradual erosion of a historically vital market[1] for European chipmakers. The European Union now faces pressure from China on two fronts.

First, China's accelerated drive for self-sufficiency in mature-node chip production is steadily pushing European suppliers out of a key market. Second, Chinese original equipment manufacturers (OEMs) are gaining ground in downstream industries, especially electric vehicles, where European firms are being displaced. These trends threaten not only the commercial outlook for Europe's leading semiconductor companies but also the innovation capacity of the wider value chains they support.

Unlike the highly specialised ecosystems of the United States or Taiwan, Europe's semiconductor value chain is relatively evenly spread across upstream and downstream segments, from materials suppliers and equipment manufacturers to integrated device makers (IDMs) and OEMs. But as European chipmakers lose access to Chinese customers and face weakening demand from their own OEMs at home, their ability to sustain investment in research and development (R&D) is at risk.

Trade policy could, in principle, address the impact of Chinese state support. Yet divisions among EU member states make trade policy a difficult tool to use. Even if consensus remains out of reach, the EU and its member states can still act through domestic policies that safeguard firms' ability to invest in R&D. To do so, while remaining compliant with EU state-aid rules, policymakers can use two levers:

1. **Reinforce national public–private partnerships (PPPs)** that anchor upstream R&D. Flagship institutions such as CEA-Leti and Fraunhofer should receive increased funding, coordinated with national industrial priorities. Additional public resources should target downstream applications in carbon efficiency and defence, which would also qualify under the revised public procurement policies described below.
2. **Expand public procurement policies** to create stable domestic demand for European chips. While the EU remains bound by its WTO commitments to treat foreign and domestic suppliers equally, Brussels can build on member states' readiness to use exemptions in climate and defence. Procurement rules that factor in carbon efficiency can give European chipmakers an advantage, since their strengths lie in production and compute efficiency.

By aligning public funding with the needs of upstream players and using procurement to encourage downstream innovation, European policymakers can reduce the risks of global fragmentation and strengthen the resilience of Europe's semiconductor value chains.

1 https://asia.nikkei.com/Business/Technology/China-s-automakers-aim-for-cars-with-100-domestic-chips-from-2026

European Value Chains

Unlike economies like Taiwan or even the United States which dominate certain parts of technology value chains while outsourcing others, Europe's value chain stretches evenly upstream and downstream. The EU's value chain begins at upstream firms like Soitec, which produces semiconductor materials and wafers, ASML, which produces semiconductor manufacturing equipment (SMEs), and Zeiss, which supplies ASML with optics technology for lithography machines. It proceeds to the bloc's numerous integrated device manufacturers (IDMs), which design and produce mature-node semiconductors. Furnishing local demand for European IDMs' chips, companies like Valeo and Continental produce parts to be incorporated into cars, planes, and medical devices. Lastly, original equipment manufacturers (OEMs) like Volkswagen, Airbus, and Philips buy parts from their suppliers to build the final products that are sold to consumers, militaries, and hospitals.

Each step of these supply chains requires research and development. Because European technology value chains mostly target end-uses that interact with the physical world, semiconductor research along the value chain focuses on increasing energy efficiency at mature nodes.

Recognizing the importance of supporting semiconductor research, EU member states have established public-private partnerships (PPPs) to support the different stages of technology value chains. As cross-value chain players, PPPs allow EU countries to support their industrial champions without violating EU regulations. The EU Framework for State Aid to Research, Development, and Innovation (R&D&I Framework) provides exceptions to EU prohibitions on state aid.[2] While member states cannot directly subsidize their champions, the R&D&I Framework permits support for public entities that conduct research in the general interest. Even when such research is conducted with the private sector, as was the case for Soitec's "NanoSmart" project, the EU Commission does not consider such public funds to be a prohibited form of state aid.[3]

Public Private Partnership Deep Dive #1

— CEA-Leti —

CEA-Leti is a French public-private partnership (PPP) founded in 1967 by the French Atomic Energy Commission (CEA) to strengthen the country's industrial competitiveness in high-tech sectors.[4]

With an annual budget of €330 million, Leti operates on a diversified funding model: roughly one-third comes from direct public subsidies—mostly for academic research and education—another third from publicly funded research contracts, and the remaining third from private industry.[5] This segmentation allows the French state to channel significant research funding to national technological priorities without violating EU state aid rules.

Leti's research priorities are shaped its institutional structure. The CEA is governed by a board of directors composed of representatives from key French government ministries (economy, energy, defense, etc.) and labor stakeholders.[6] This board sets budgets, scientific direction, and appoints directors of CEA subsidiaries, including Leti. CEA Investissement, an investment mechanism founded in 1999, further influences the consortium's agenda by investing in startups across sectors like microelectronics and materials.[7] CEA Investissement can act as a strategic investor that considers national priorities beyond financial criteria, particularly when market-based funding is insufficient. Startups in CEA's strategic portfolio benefit from privileged access to CEA infrastructure, researchers, and IP, including from Leti.

2 https://eur-lex.europa.eu/legal-content/FR/TXT/?uri=CELEX%3A52014XC0627(01)
3 https://ec.europa.eu/competition/state_aid/cases/219688/219688_751661_47_2.pdf
4 https://www.leti-cea.fr/cea-tech/leti/Pages/Leti/a-propos-du-Leti/histoire.aspx
5 https://www.cairn.info/revue-le-journal-de-l-ecole-de-paris-du-management-2011-1-page-37.htm
6 https://www.legifrance.gouv.fr/codes/section_lc/LEGITEXT000006071190/LEGISCTA000019910143/#:~:text=2-,Le%20Commissariat%20%C3%A0%20l'%C3%A9nergie%20atomique%20et%20aux%20%C3%A9nergies%20alternatives,d%C3%A9cret%20en%20Conseil%20d'Etat.
7 http://www.cea-investissement.com/

To understand the interplay between Europe's mature-node semiconductor and downstream manufacturing ecosystems, it helps to sample some of the value chain connections that link PPPs to SME/materials companies, to chipmakers, to OEM suppliers, to OEMs:

- Automotive Value Chain: CEA-Leti, France's microelectronics PPP, in 2018 provided its Substrate Innovation Center prototyping line to Soitec (a French semiconductor materials company that originally spun out of Leti) to develop a new silicon carbide (SiC) substrate.[8] Then in 2022, the French chipmaker STMicroelectronics worked with Soitec to adopt its SiC technology for its future 200mm wafer manufacturing line.[9] And most recently in 2024, STMicrolectronics and French automaker Renault announced a multi-year agreement on the supply of SiC power modules for the carmaker's EV powerbox.[10]
- Internet-of-Things Value Chain: Aixtron, a German semiconductor deposition equipment manufacturer, in 2014 worked with Germany's Fraunhofer Institute (discussed in the call-out box below), to develop 150 mm Silicon Carbide (SiC) epitaxy processes.[11] These SiC epitaxy processes then fed into TRANSFORM, a consortium funded by the European Union and the German Federal Ministry of Education and Research, to research SiC-based power electronics for energy infrastructure, automobile, industrial automation, and other applications.[12], [13]

Public Private Partnership Deep Dive #2

— Fraunhofer —

Founded in 1949, the Fraunhofer Society represents the cornerstone of Germany's applied research infrastructure.[14] Operating 76 institutes and research units across the country, Fraunhofer operates a highly decentralized model of sector-specific innovation, ranging from renewable energy and microelectronics to information technology and automotive systems.[15] Each institute focuses on a particular technological vertical, often building regional clusters of innovation that bring together universities, SMEs, and global industrial players.

This model serves as a way for Germany to support domestic firms in bolstering key steps of the semiconductor value chain. One recent example is the Bavarian Chip Design Center (BCDC), a state-backed initiative launched in 2022 with initial and follow-up funding totaling €50 million.[16] This effort aims to expand Germany's talent pipeline in integrated circuit (IC) design, as well as support startups' access to IC design tools.

Beyond supporting local firms, Fraunhofer also connects German government and industry research to EU-level agendas. As part of the APECS pilot line under the Chips for Europe initiative, Fraunhofer IAF is developing hybrid chiplets using materials like InGaAs-on-silicon and GaN-on-SiC. These technologies, which offer superior performance for high-frequency and radar applications, are supported by €4.35 million in funding from Baden-Württemberg and co-financed by multiple EU member states and the Chips Joint Undertaking to a total of €730 million over 4.5 years.[17]

8 https://www.leti-cea.com/cea-tech/leti/english/Pages/What's-On/News/SiC-electromobility-CEA-Leti-supporting-Soitec-with-Smart-Cut-technology.aspx
9 https://www.soitec.com/home/group/newsroom/press-releases/2022/12/02/stmicroelectronics-and-soitec-cooperate-on-sic-substrate-manufacturing-technology
10 https://compoundsemiconductor.net/article/120702/Renault_and_ST_collaborate_on_SiC_supply
11 https://www.aixtron.com/en/investors/AIXTRON%20Partners%20with%20Fraunhofer%20IISB%20to%20Enhance%20Silicon%20Carbide%20Production%20Technology_n341
12 https://www.iisb.fraunhofer.de/en/research_areas/materials/silicon_carbide.html
13 https://sic-transform.eu/en
14 https://www.fraunhofer.de/en/about-fraunhofer.html
15 https://nap.nationalacademies.org/catalog/18448/21st-century-manufacturing-the-role-of-the-manufacturing-extension-partnership
16 https://www.iis.fraunhofer.de/en/pr/2024/20240118_BCDC.html
17 https://www.eurekalert.org/news-releases/1068543

Risks for These Value Chains

China has historically been a more important market for upstream companies in EU chip value chains than downstream companies. However, as Chinese firms increasingly dominate their domestic market and make major inroads in other export markets, EU firms have lost share to PRC competitors.

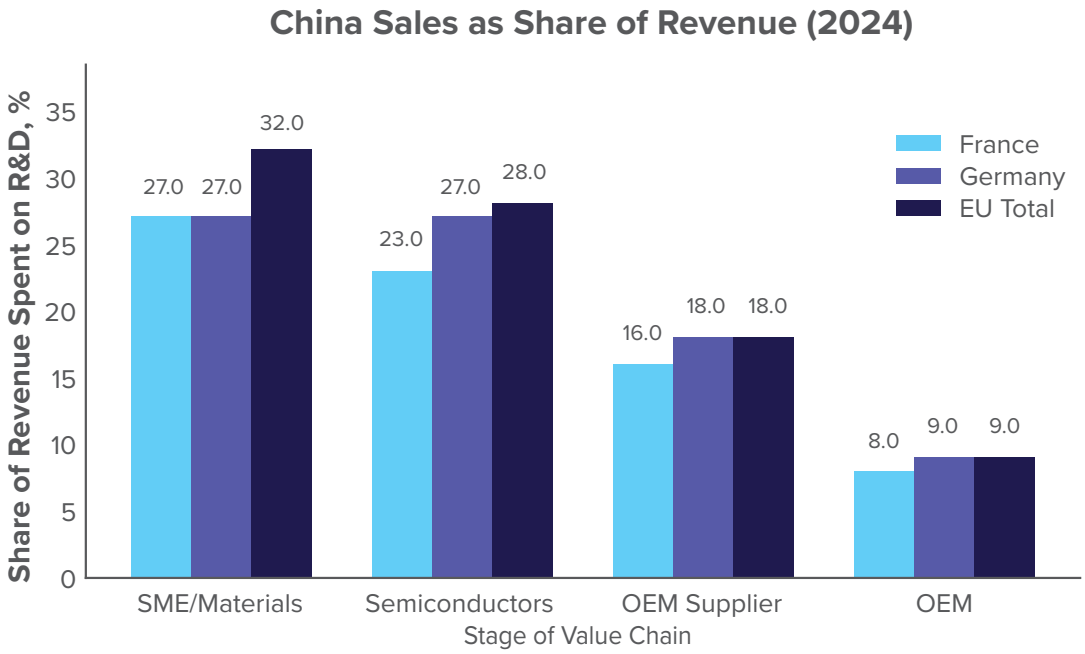


Fig 1: Source: Author's estimations based on company financial filings and UN Comtrade statistics.

As the EU's upstream firms spend disproportionately more on R&D than their downstream customers, upstream firms also rely more heavily on China for revenue than their downstream counterparts do. Upstream firms, which spend disproportionately more on R&D, rely on China for a much larger share of their revenue than downstream firms. Because of this, when Western governments have called for reducing reliance on China, technology companies often protest, saying that losing the China market would undermine their ability to fund R&D.

However, European firms have had to face the consequences of an increasingly autarchic China because the mature-node chipmaking and electric vehicle (EV) industries that the PRC has targeted strike at the heart of EU value chains. To illustrate, Infineon derived 27% of its 2024 revenue from China, and one of its domestic customers, Volkswagen,[18] derived approximately 8% of its 2024 revenue from China. As a result, Infineon is exposed to losing market share directly to subsidized Chinese chipmakers like SMIC, China's chipmaking champion, and indirectly as customers like Volkswagen lose share to subsidized domestic Chinese automakers like BYD.

We look at SMIC (Semiconductor Manufacturing International Corporation), China's largest chip foundry to understand how European chipmakers are being pushed out of the PRC market. At a 2024 operating revenue of $8.05 billion,[19], [20] SMIC is the only Chinese firm to list among the top 30 global semiconductor companies.[21] It accounted for 6% of global wafer capacity in 2024 and was the largest chipmaker in the PRC.[22] This predominance in the Chinese market means that SMIC's sales trends reflect those of the entire Chinese chip industry.[23]

18 https://www.infineon.com/cms/en/about-infineon/press/press-releases/2019/INFATV2010905-069.html
19 57,795,570,000 RMB, using an average 2024 RMB-USD exchange rate of 0.1393.
20 https://vip.stock.finance.sina.com.cn/corp/view/vCB_AllBulletinDetail.php?stockid=688981&id=10814201
21 "Assessment of the Status of the Microelectronics Industrial Base in the United States," Bureau of Industry and Security, 2023.
22 https://www.chinabaogao.com/baogao/202406/712340.html
23 Ebrahimi. China's Mature Node Overcapacity: Unfounded Fears. Ifri. Available at: https://www.ifri.org/en/memos/chinas-mature-node-overcapacity-unfounded-fears

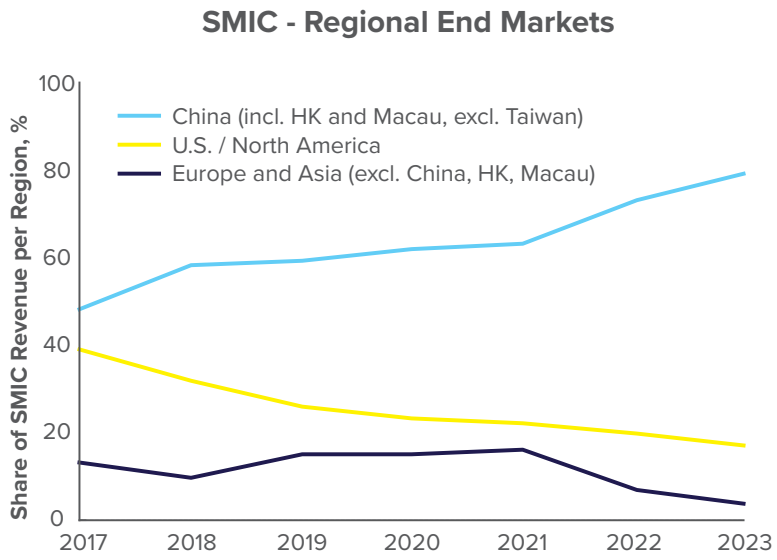


Fig 2: Source: Ebrahimi, Ifri[24]

The red line in the graph above shows that SMIC's share of sales to domestic customers has increased steadily since 2017, growing from 47% in 2017 to over 80% in 2023. There was a sharp jump in 2022 where its share of domestic demand jumped 10%.[25] As the next graphs will demonstrate, SMIC's increased dominance of China's domestic semiconductor market has cut into EU chipmakers' revenue.

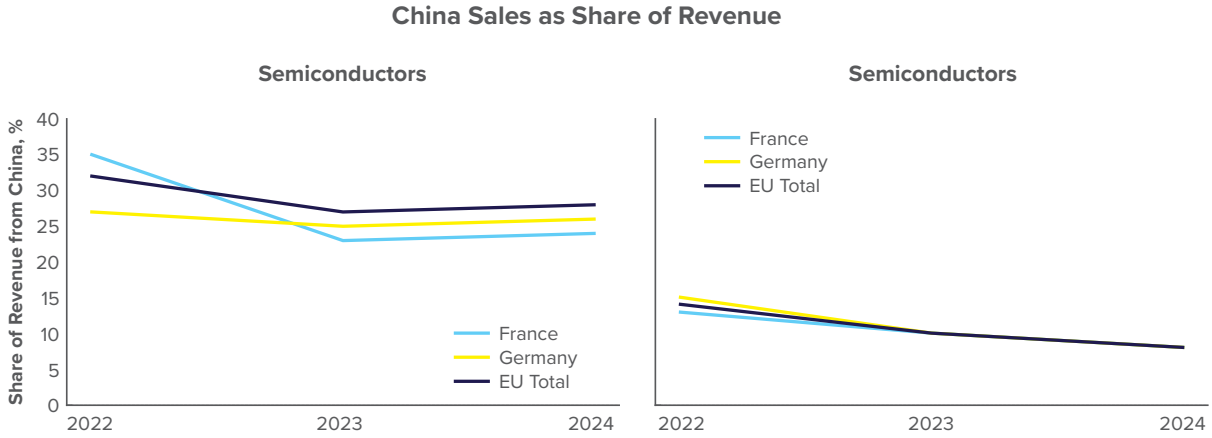


Fig 3: Source: Author's estimations based on company financial filings and UN Comtrade statistics.

European chipmakers' China sales as a share of their annual revenue have fallen since 2022. While German chipmakers only saw a 2% decline, French chipmakers' China share fell 11%. Downstream, these chipmaker's end customers, European OEMs, saw their China shares halved from 14% in 2022 to 8% 2024. Elsewhere in the EU value chain, SME/materials firms and OEM suppliers did not see significant reductions to their China share, though the value of the China sales among the firms analyzed in this study shrunk in absolute terms from $144.7 billion in 2022 to $109.0 billion in 2024.

Facing declining shares in one of their largest markets, European chipmakers and OEMs have defied their shrinking China sales with unexpected R&D intensification, while downstream OEMs have seen their R&D levels stagnate.

24 Ebrahimi. China's Mature Node Overcapacity: Unfounded Fears. Ifri. Available at: https://www.ifri.org/en/memos/chinas-mature-node-overcapacity-unfounded-fears

25 Ebrahimi. China's Mature Node Overcapacity: Unfounded Fears. Ifri. Available at: https://www.ifri.org/en/memos/chinas-mature-node-overcapacity-unfounded-fears

Importance of R&D Through the Value Chain

Key to the strength of a value chain is how research and development (R&D) expenditure is spread across the chain. R&D is expensive. To prevent any single company from bearing the brunt of R&D expenses, EU value chains spread the risk of uncertain technological pursuits across upstream and downstream companies. To illustrate with an example mentioned earlier, Soitec, STMicroelectronics, and Renault developed different stages of the new substrate used in power modules for Renault's EV powerbox. Within such value chains, EU companies also receive support at key points from government-backed PPPs. For example, France's Leti provided its Substrate Innovation Center prototyping line to Soitec, allowing the firm to start the value chain leading to Renault's new power modules. The next section discusses what policies Europe should implement to address the risks to these value chains. However, this section first examines how firms' loss of market share to Chinese competitors is undermining European innovation.

Semiconductor R&D is funded by actors starting from semiconductor manufacturing equipment (SME) and materials companies, continuing on to chipmakers, the makers of industrial electronics inputs (OEM suppliers), and finally the producers of cars, planes, and medical devices (OEMs).[26]

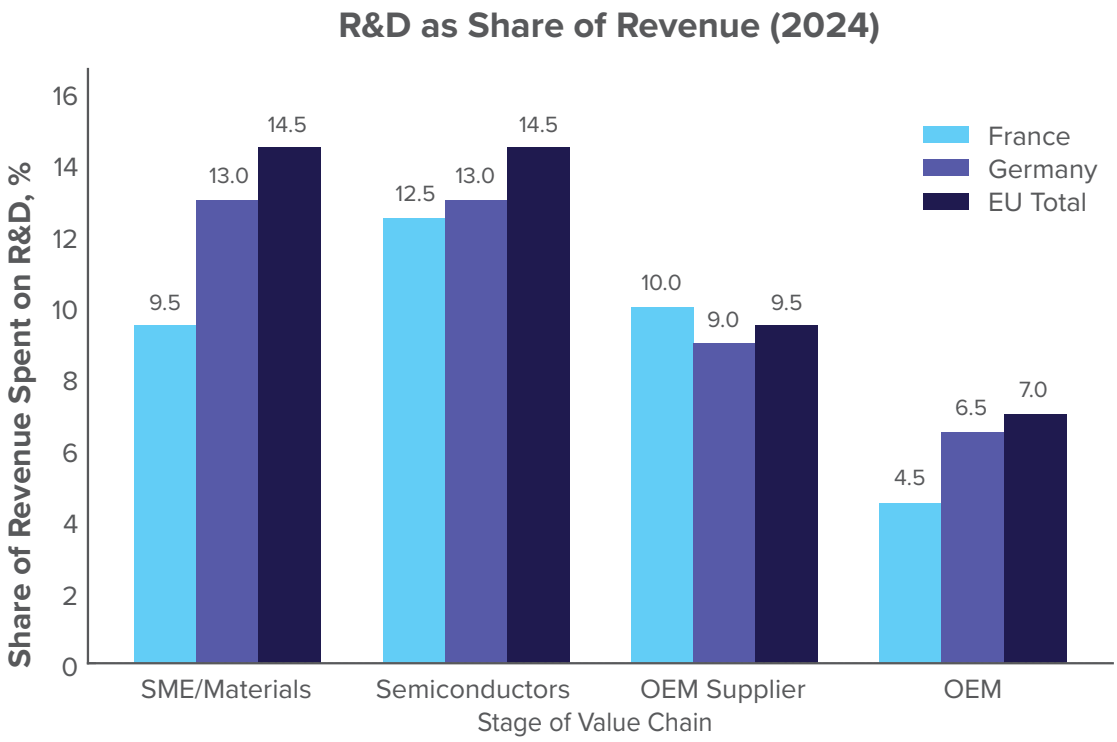


Fig 4: Source: Author's calculations based on company financial filings.[27]

26 This paper examined the following companies to inform statistics for each value chain category:

SME/Materials: Soitec (France), ASML (the Netherlands), Aixtron (Germany), Zeiss (Germany), Trumpf (Germany).

Semiconductors: STMicroelectronics (France), NXP (the Netherlands), Infineon (Germany)

OEM Suppliers: Valeo (France), Bosch (Germany), Continental (Germany)

OEMs: Siemens (Germany), Volkswagen (Germany), Daimler (Germany), Philips (the Netherlands), Nokia (Finland), Airbus (France), Renault (France)

27 ASML's 15% R&D as Share of Revenue in 2024 was the primary factor pulling the EU Total above that of France and Germany.

Upstream chipmakers and their suppliers carry the brunt of R&D expenses. In 2024, companies in those two categories spent approximately 15% of their annual revenue on R&D, while OEM suppliers spent just over 9% and OEMs lagged behind at 7%. Between chipmakers and further upstream SME/materials companies, chipmakers generally have higher R&D rates.[28]

Given the R&D intensity of semiconductor value chains' upstream players, EU countries' support for these companies by way of PPPs like Leti and Fraunhofer help lower their disproportionately high burden. However, upstream companies can only finance R&D when they are confident in their future revenue. Both Europe and China are critical sources of this revenue, but Chinese firms' growing market shares put EU firms ability to continue R&D funding levels at risk.

Opportunities for These Value Chains

Since 2022, European semiconductor companies have grown their R&D expenditures despite shrinking China market shares. This is partially due to growing local revenue in 2023 that led French and German firms to invest more resources into R&D. Notably, as EU chipmakers become less dependent on China and focus their sales on local customers, targeting research toward the needs of the domestic European value chain becomes more important.

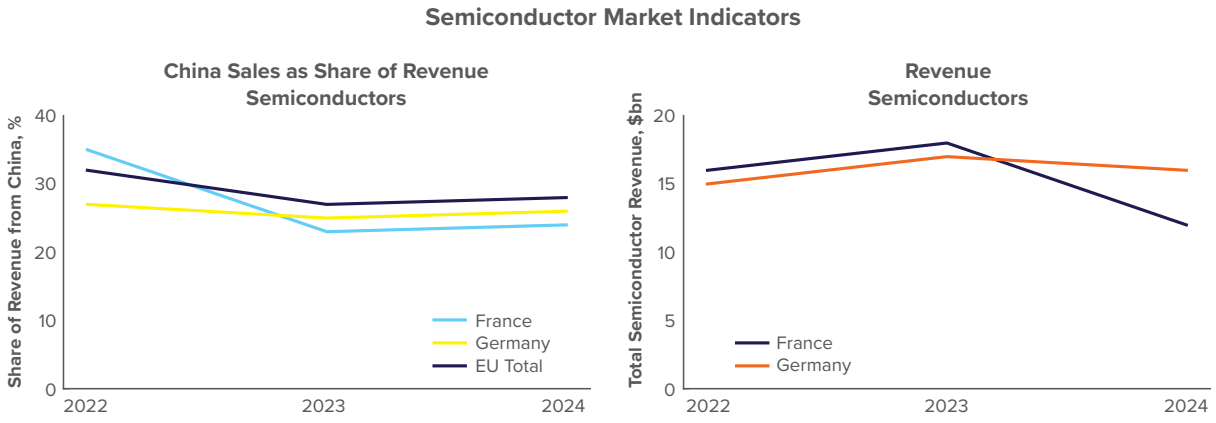


Fig 5: Source: Author's calculations based on company financial filings.[29]

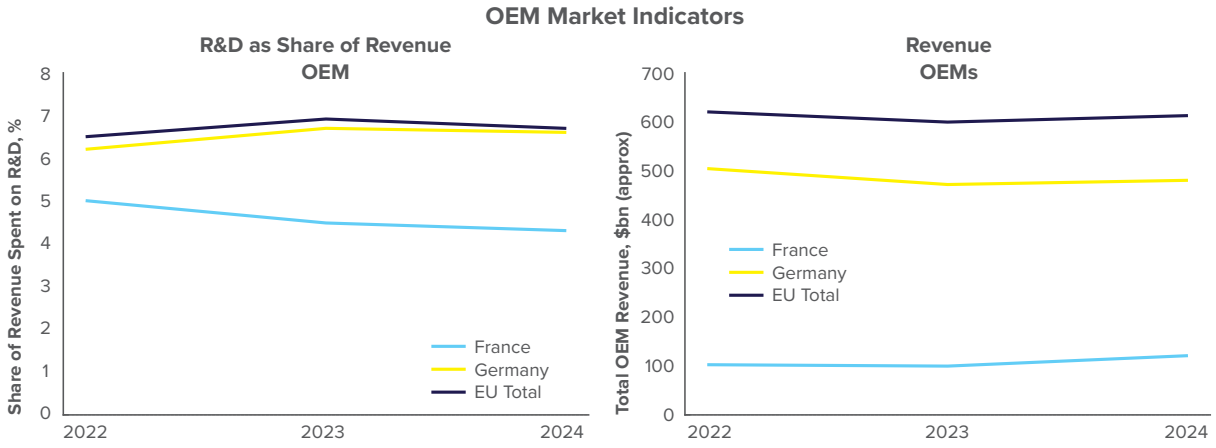


Fig 6: Source: Author's calculations based on company financial filings.

28 The EU-wide average R&D level for SME/materials firms is higher due to ASML's disproportionately high spend on advanced-node equipment research, which is a segment of its business that does not feed into European supply chains.

29 Not showing overall EU revenue because ASML's scale makes French and German revenue hard to distinguish.

OEMs also did not cut their R&D spending even as their China shares shrunk. As with semiconductor firms, OEMs' overall revenue did not shrink, meaning a larger share of their revenue is comprised of non-Chinese, especially local European, demand. However, OEMs' R&D spending did not increase as the non-Chinese share of their stable revenue grew. In contrast, upstream chipmakers have needed to increase their R&D as domestic clients down the EU value chain demand more value-additive work from their chipmaker suppliers.

Lastly, after SME/materials firms saw a recovery spike in 2023 following China's pandemic-induced slug in 2022, their China shares and overall revenue remained stable from 2023 to 2024. OEM suppliers' China shares and overall revenue also remained consistent through the period of 2022 to 2024. Just as these firms' saw few shake ups to their income, their R&D levels also stayed stable over that period. This demonstrates that semiconductor and OEM firms, not their respective suppliers, are the first to feel the brunt of shifting global supply chains. Although SME/materials firms are even further upstream than chipmakers, the heaviest burden of a more local customer base's demand for R&D falls on semiconductor companies.

How European Governments Should Respond

As Chinese competitors crowd European firms out of the PRC market, European policymakers should support their domestic champions who carry the greatest R&D burden that these shifts entail. Semiconductor companies will be less able to fund R&D budgets by selling to the Chinese market, so they will have to more intensely calibrate their products to the efficiency-focused European value chain.

Two European and national level policy agendas would help the European chip value chain maintain its competitiveness despite shrinking China revenue:

1. Support National PPPs

EU members states should take advantage of the EU state-aid exception granted to member states' support for PPPs to funnel research support to the semiconductor and SME/materials sectors. The end-uses targeted by these research efforts should be the end-uses of European OEMs who are increasingly the primary customer base of upstream firms. Governments can set a domestic end-use agenda either by the French method, whereby a domestic industrial board sets CEA-Leti's general research priorities, or by the more free-market German method, whereby Fraunhofer offers outsourced R&D services to domestic firms.

2. Expand EU Public Procurement Policies

In addition to supporting semiconductor companies with a second EU Chips Act,[30] the EU should revise its government procurement policies to allow member states to bolster European chipmakers' R&D budgets with domestic demand. Although certain countries in the bloc are hesitant to drop their commitment to WTO principles requiring equal treatment of third countries in government procurement, policymakers in Brussels could use member states' expressed willingness to exempt environmental and defense procurement. These domestic preference policies would increase the domestic demand for EU chipmakers as their China market share declines, helping them continue funding their R&D in a rapidly decoupling world.

(a) Climate Preference

EU semiconductor materials companies and chipmakers already focus their R&D efforts on increased energy efficiency, and Europe ranks highest among the world's major semiconductor-producing regions in low-carbon energy availability.[31] Therefore, if member states strengthen the climate-based preference policies used in awarding government contracts, they would implicitly favor domestic chip suppliers. Notably, the EU Commission's February 2025 Clean Industrial Deal included a commitment to revise the EU's public procurement policies in 2026 to allow

30 https://www.reuters.com/technology/semiconductor-firms-call-eu-chips-act-20-2025-03-19/
31 https://discover.semi.org/rs/320-QBB-055/images/Transparency-Ambition-and-Collaboration-BCG-SEMI-SCC-20230919.pdf

members states to favor suppliers with better life-cycle carbon emissions performance.[32]

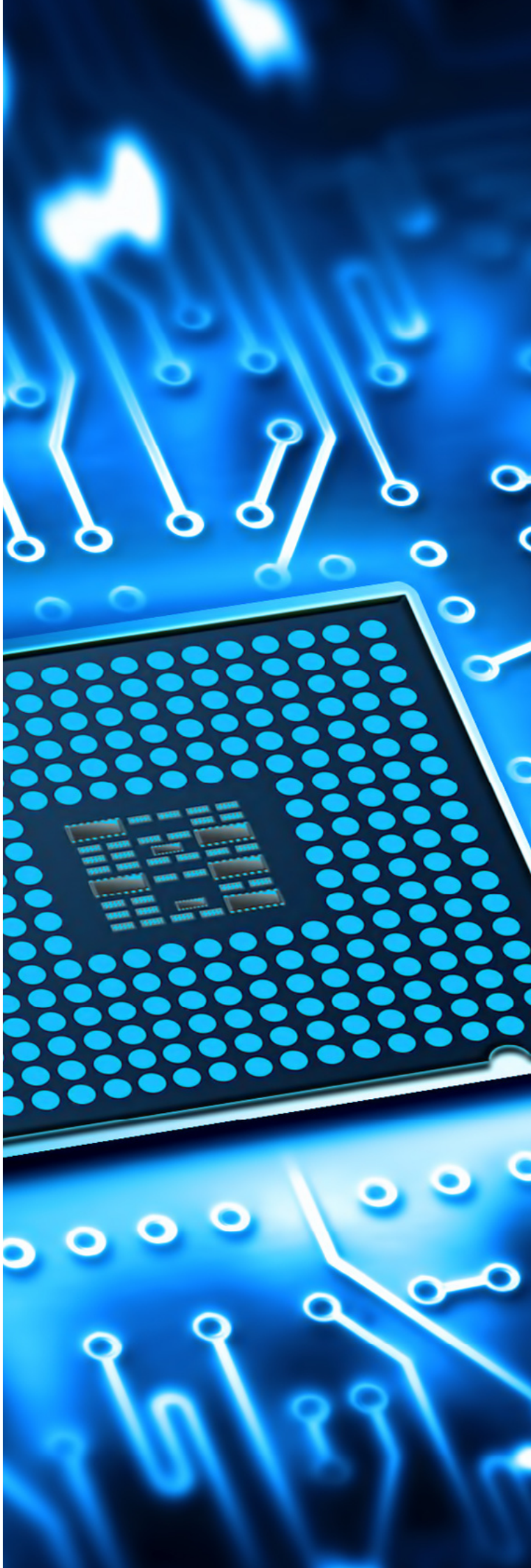
(b) Defense Preference

Defense OEMs like Airbus, KNDS, and MBDA constitute major sources of downstream demand for European chipmakers. Expanding domestic preference in military procurement is therefore an important outlet for driving resources into domestic EU value chains. SAFE is a 150 billion-euro loan program approved by the European Council to support the bloc's joint defense procurement.[33] Notably, SAFE included a "Buy European" clause, requiring 65% of the value of weapons to come from the EU, Ukraine, or the European Free Trade Association. Ten EU countries opposed the "Buy European" clause,[34] and SAFE still needs to be negotiated with the European Parliament to enter into force. As noted in a recently publicized German parliamentary report, SAFE's "Buy European" clause is already barely enough to prevent the plan's economic benefits from leaking beyond the EU.[35] Its 65% requirement should therefore be strengthened, not cut out.

Conclusion

Europe's semiconductor ecosystem is at a crossroads. As China's push for self-sufficiency in chips and downstream manufacturing crowds European firms out of the PRC market, the EU's chipmakers, who already bear the heaviest R&D burden across the bloc's value chains, must recalibrate. In the absence of trade policies targeting the bloc's subsidized PRC competitors, the EU must support its domestic firms' R&D capacity with domestic policies.

Public-private partnerships like CEA-Leti and Fraunhofer have proven effective vehicles for sustaining industrial R&D without breaching EU state aid rules. EU member states should increase their funding of these consortia and ensure their R&D agenda targets the needs of downstream European OEMs. Meanwhile, reforming public procurement rules, particularly in climate and defense, can stimulate domestic demand in sec-



32 https://commission.europa.eu/topics/eu-competitiveness/clean-industrial-deal_en

33 https://www.consilium.europa.eu/en/press/press-releases/2025/05/27/safe-council-adopts-150-billion-boost-for-joint-procurement-on-european-security-and-defence/

34 https://www.reuters.com/business/aerospace-defense/eu-countries-reach-deal-new-defence-funding-programme-2025-06-18/

35 https://www.politico.eu/article/flagship-eu-defense-plan-faces-legal-scrutiny-german-bundestag-report-warns/

tors where European semiconductor firms have a competitive advantage.

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