Strengthening Europe's Semiconductor Sovereignty

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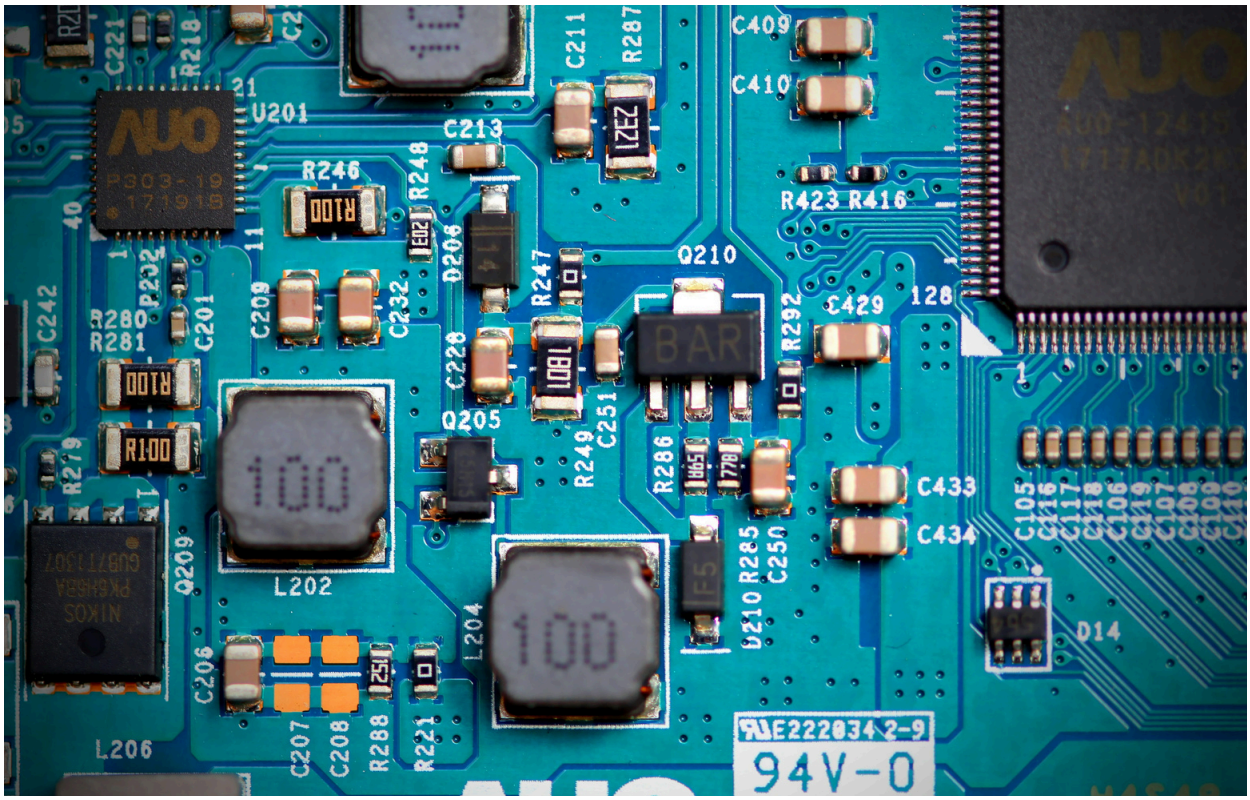

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Strengthening Europe's Semiconductor Sovereignty: The EU Chips Act and the Pursuit of Strategic Autonomy in the Semiconductor Tech Arena

Abstract

This study examines the EU Chips Act (2023), a crucial step by the European Union to bolster its semiconductor industry within the environment of global shortages and technological dependencies. The Act aims to bridge the gap in the EU's semiconductor production chain, shifting from research and development to actual manufacturing. Key initiatives include the 'Chips for Europe Initiative', a dedicated ‘Chips Fund’, and support for new production facilities. While the Act marks a significant move towards the EU's strategic technological autonomy, it also faces challenges like high costs and aligning new manufacturing goals with Europe's background strengths. The analysis underscores the Act as crucial in balancing self-reliance with global interdependence in the tech sector.

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1.0 Introduction

The semiconductor industry plays a crucial role in many global economies, being considerably relevant in geopolitical and technological matters. Semiconductor with its components integrated into a wide array of consumer and commercial products, that are crucial for the accomplishment of digital transformation. However, this industry's sector is characterized by a profound mismatch between increasing demand and the limited number of countries with specialized knowledge and heavy capital investment in manufacturing. (Cserantoni, 2022). Notably, according to the EU Parliament research service, Taiwan and South Korea produce roughly 80% of semiconductors market share; respectively 60% and 19%. (EPRS, 2022). This chip scarcity has escalated into a major concern for the EU, exposing its vulnerability due to a lack of major manufacturing players and a robust cross-border framework. To address this, the EU introduced the "EU Chips Act"[1] (2023), the first regulation specifically targeting the semiconductor industry. This analysis aims to provide a better understanding of the initiative aimed at enhancing manufacturing capacities and bridging the gap in internal production to achieve strategic semiconductor sovereignty. We will explore how these initiatives seek to convert research and development achievements into market breakthroughs, fostering a more resilient ecosystem.

2.0 The European Context

The EU Chips Act was implemented within the broader framework of EU Strategic autonomy (EU-SA), defined as "*EU's ability to act autonomously, without being dependent on other countries, in strategic policy areas*".[2] From 2020 two pivotal events, COVID-19 (February 2020) and the Russian war aggression against Ukraine (February 2022) reveal a significant vulnerability of European independence and capacity to handle external shocks. The disruption of several supply chains exposes to significant risks the European Industries and underscores the unsuitability of its logistic networks. Given these geopolitical upsets, the European Commission decided to widen the EU-SA framework's scope (Gehrke,2022). The focus was targeting the supply of industrial sectors crucial for national security such as healthcare technologies, energy provisions, raw materials, and semiconductors. (*Ibidem*)

Following those recent events, academic research and EU monitoring reports began to combine strategic autonomy with strategic sovereignty. (Duprè, 2022). In light of this, autonomy encompasses a dual approach: diversifying sources and managing dependencies to reduce reliance on single suppliers. Sovereignty, as part of this broader autonomy framework, refers to the EU's capacity to independently produce and regulate within specific sectors. This is accomplished through strategic legislative, policy, and budgetary measures that enhance the EU's self-reliance and decision-making autonomy. Together, these concepts embody the EU's

[1] (EU Regulation 2023/1781).
[2] (EPRS Briefing 2023, pg.1).

ambition to safeguard sovereignty while avoiding protectionism (Alcaro et al., 2021). The next section focuses on the Semiconductor industrial sector, underscoring the risks the EU is facing due to dependence on a few countries as suppliers amid an escalating technological cold war

3.0 EU Semiconductor R&D Strengths and Market Challenges

The semiconductor industrial process, once the raw materials are sourced, consists of two major phases: research and development (R&D) and production.

The EU is a world-leading hub for R&D, with expenditure contributions of EU member states that amount to 17.1% compared to a global average of 13.7%. Europe-based tech organizations and top universities excel in advanced chip production techniques.[3] This is evidenced by substantial EU investment initiatives that have recently bolstered R&D in the semiconductor sector. Notably, funding includes Public-Private Partnerships like ECSEL (€1.2 billion) and Key Digital Technologies JU (€1.8 billion). (EC, Q&A on Chips Act, 2022) Additionally, key design organizations such as IMEC in Belgium, CEA-LETI in France, and Fraunhofer in Germany play a significant role in defining the chip's system.[4] Despite these efforts, Europe holds less than 9% of the global semiconductor production market share. Therefore, the EU's semiconductor industry shows a significant shortfall in transitioning to two other phases of chip production: the fabrication and, to a lesser extent, the assembly process. Consequently, the EU continues to rely on external suppliers, mostly in the Global South, for these critical stages of production. This scenario is mostly the result of the prevalent *'Fabless-Foundry Mod*el' within the European chip industry. In this model, *fabless* companies focus solely on design and lack manufacturing capabilities, while foundries invest heavily in production. Europe's industry ecosystem significantly lacks the latter, which is essential for transitioning from research to commercialization.[5]

The immediate need for a substantial solution in the EU is further underscored by the aggressive strategies of major global players. The US, with its *'Chips and Science Ac*t' ($52 billion for internal production and R&D), and China, through the 'Made in China 2025' program ($118 billion investment), have both implemented robust roadmaps for the semiconductor sector. In this *"technological war"* context, geopolitical superpowers are launching investment programs to dominate every step of the semiconductor global value chain (GVC). The EU risks falling behind due to the lack of a coordinated strategy (Evers,2024). This disparity highlighted the urgent need for the EU to develop and implement an effective response to remain competitive in the global semiconductor landscape (Alcaro et al., 2021)

[3]Council of the European Union, Analysis and Research Team Report, 2022, Pg. 6
[4] Council of the European Union, Analysis and Research Team Report, 2022, Pg. 8
[5] DG Grow, European Chips Survey Report, 2022, Pg. 7

4.0 Key Pillars of the European Chips Act: Strengthening R&D, Manufacturing, and Supply Chain Resilience

The European Chips Act has three main pillars. The first one is centered on supporting R&D and innovation of small-scale enterprises in the medium term; the second includes measures that facilitate the *"from the lab to the fab"* process for EU foundries in the long term; the third sets up a system to monitor and address supply chain crises.[6]

The Act's first pillar brings together some existing schemes to financially support R&D and poses them under the *'Chips for Europe Initiative,'*[7]. The main aim of this set of measures is to enhance manufacturing capacities by developing advanced pilot lines[8] and establishing a Chips Fund for financing start-ups and SMEs (EC, Press release on Chips Act, 2023). The 'Initiative' calls for pilot lines that allow companies to test semiconductor designing and experimentation as well as small-scale production. These lines will be considered as a platform of R&D within the perspective of bridging industrialization. (EC Q&A Chips Act, 2023). Moreover, '*Chips Fund'*[9] is a structure that facilitates access to finance for small enterprises through equity investments and public-private funding guarantees (*ibidem*), to ease semiconductor industry market expansion. This fund is managed by the EU Innovation Council and the InvestEU program which forecasted an overall value of 2 billion for the project (estimated for the period 2028-2030). (*Ibidem)*

The second pillar of the European Chips Act incentivizes and regulates public and private investment in manufacturing facilities for chipmakers. Recognizing the high barriers to entry and capital intensity of the sector, this framework aims to enhance production capacities through a substantial system of State Aid investment towards companies willing to open new semiconductor foundries within the EU. Member states are also authorized to provide administrative support in the form of fast-tracking permit-granting procedures. (EC, Press Release, 2023). The subsidies would target developing Integrated Production Facilities (IPFs) [10]and Open EU Foundries (OEFs).[11] These facilities are crucial for ensuring a secure semiconductor supply and fostering a resilient ecosystem. (Cole et al., 2023)

The third pillar creates a coordination system between the Commission and member states to oversee the semiconductor supply chain and predict shortages. During emergencies, the Commission can impose conditions on supported companies and establish joint procurement systems.[12]

[6] ESPAS Report on Chips Act, 2022, Pg.1
[7] Regulation 2023/781, Art. 3
[8] Pilot lines facilitate pre-commercial phases that produce small volumes or new-technologies-based products.
[9] Regulation 2023/781, Art.4
[10] Regulation 2023/781, Art.13
[11] Regulation 2023/781, Art.14
[12] Regulation 2023/781, Section II

5.0 Structural Challenges and Strategic Misalignments in the EU Chips Act

Although the '*Chips Act'* is a well-organized framework that stresses the correct aspects to create a resilient ecosystem for the semiconductor industry there are two structural downsides. Firstly, the EU's strategy within the semiconductor sector faces significant limitations due to its funding structure. The Commission envisaged an overall funding of €43 billion for the EU Chips. (EC, Press Release, 2023). However, this amount is only forecasted, meaning that the funding relies on a mix of the EU budget, member states' contributions, and private investment. Given the Commission's lack of fiscal authority, it creates a dependency on member states for national subsidies, limiting its capacity to set and enforce industrial policy priorities. This dependence, coupled with varying fiscal capacities among member states, risks exacerbating economic inequalities and undermining the single market's cohesion. The complex funding mechanism and multi-level governance also complicate the identification of the main beneficiaries, further challenging the effectiveness of the Act.

The second critical aspect is the strategic direction of the Act. The main goal envisaged by the regulation is to increase Europe's global chip production capacity from 10% to 20%. (Di Paolo Emilio, 2023) For that reason, the majority of resources were directed to the first two pillars outlined to foster the productivity processes. However, the Act's emphasis on manufacturing may not align with the EU's historical strengths and current market dynamics. Redirecting resources to compete in an area where Europe doesn't have sound historical structures could be seen as a step away from a strategic approach and more toward an obsolete vision of self-sufficiency. Additionally, the rapid evolution of semiconductor technologies and the long time for fab construction further complicates things.

Therefore, in order to create a resilient ecosystem it would have been better to focus the resources on the third pillar, fostering partnership with producers to develop a reliant and affordable supply chain. This solution would have had an immediate return rather than begun a process of implementing a construction system within the EU with all the risks that this kind of investment has.

6.0 Conclusions:

Chips Act passed by European Union represents an exceptional proposal that concerns improvement of EU's autonomy in semiconductor industry. It draws a realistic way forward by addressing urgent dependencies that can result into threatened European independence within this area. In line with this, it recognizes an urgent need for increasing production powers, igniting creative thought as well as establishing resilient environments against global shocks/disruptions. These endeavors are leaned on the European Union Strategic Autonomy aimed at ensuring that within vital sectors such as semi-conductors, EU will be able to operate independently.

Despite its ambitious goals, the Act is not without limitations. The heavy reliance on a complex funding structure, dependent on contributions from member states and private investments, poses significant risks to the timely and effective implementation of its initiatives. This dependency may exacerbate economic inequalities among member states, complicate the enforcement of industrial policy priorities, and ultimately weaken the cohesion of the single market. Furthermore, the Act's strategic direction—focused heavily on increasing Europe's global chip production capacity—may not fully leverage the EU's historical strengths in research and development. Instead, it could divert valuable resources from more immediate and potentially impactful areas, such as strengthening the supply chain and fostering partnerships with global producers.

Further research could explore alternative strategies for strengthening Europe's semiconductor industry, such as investing in emerging technologies that could reshape market dynamics or developing models of international cooperation that strike a balance between self-reliance and global interdependence. For this reasons, the EU should adopt a more balanced approach that not only builds on its existing strengths but also anticipates future technological advancements. This might involve reallocating some resources from large-scale manufacturing projects to initiatives that better position the EU within the global semiconductor supply chain.

In conclusion, while the European Chips Act marks a significant step towards achieving strategic autonomy, it must be viewed as the beginning of a broader, more nuanced strategy. As the global semiconductor landscape continues to evolve, the EU will need to remain flexible, innovative, and collaborative to improve its competitive edge and ensure the resilience of its semiconductor ecosystem. By addressing the structural challenges and strategic misalignments identified in this report, the EU can enhance its position in the global semiconductor value chain and secure its technological future.

List of References:

1. Csernatoni, R. (2022, February 11). For the EU, microchips and geopolitics are two sides of the same coin. *Euronews*. From https://www.euronews.com/2022/02/11/for-the-eu-microchips-and-geopolitics-are-two-sides-of-the-same-coin-view.
2. European Parliamentary Research Service. (2022). The European Chips Act. *European Parliament*. From https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733589/EPRS_BRI(2022)733589_EN.pdf.
3. Gehrke, T. (2022). EU Open Strategic Autonomy and the Trappings of Geoeconomics. *Egmont Institute*. From https://www.egmontinstitute.be/app/uploads/2022/06/EU-Open-Strategic-Autonomy_Gehrke_2022.pdf.
4. Dupré, B. (2022, January 25). European sovereignty, strategic autonomy, Europe as a power: What reality for the European Union and what future? *Fondation Robert Schuman*. From: https://www.robert-schuman.eu/en/european-issues/0620-european-sovereignty-strategic-autonomy-europe-as-a-power-what-reality-for-the-european-union-and-what-future.
5. Alcaro, R., & Tocci, N. (2021, July). Seizing the Moment: European Strategic Autonomy and the Biden Presidency. *Istituto Affari Internazionali (IAI) Commentaries*, 21(37). From https://www.iai.it/sites/default/files/iaicom2137.pdf.
6. European Council. (2022, July 12). The Semiconductor Ecosystem: Global Features and Europe's Position. *European Council*. Retrieved from https://www.consilium.europa.eu/media/49404/strategic-autonomy-issues-paper-5-february-2021-web.pdf.
7. European Commission. (2022, July). European Chips Survey Report. *Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs*. From https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-chips-act_en.
8. van Wieringen, K. (2022). Global Semiconductor Trends and the Future of EU Chip Capabilities. *European Parliamentary Research Service*. From https://www.europarl.europa.eu/RegData/etudes/IDAN/2022/698852/EPRS_IDA(2022)698852_EN.pdf.
9. European Commission. (2023, November 30). European Chips Act - Questions and Answers. *European Commission*. From. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4518.
10. Evers, M. M. (2024, January 14). Why the United States is Losing the Tech War with China. *Lawfare*. From https://www.lawfaremedia.org/article/why-the-united-states-is-losing-the-tech-war-with-china.
11. European Commission. (2023, September 21). Digital sovereignty: The European Chips Act enters into force today. *European Commission*. From https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4518.

12. Cole, M., Kampouridi, J.& van den Bogart, F. (2023, September). EU Chips Act: Risks and opportunities for businesses. *Norton Rose Fulbright*. From https://www.nortonrosefulbright.com/en/knowledge/publications/f176610c/eu-chips-act-risks-and-opportunities-for-businesses
13. Di Paolo Emilio, M. (2023, August 3). EU's Strategy to Address Semiconductor Shortage. *EE Times Europe*. From https://www.eetimes.eu/eu-strategy-to-address-semiconductor-shortage
14. Timmers, P. (2022, August 9). How Europe aims to achieve strategic autonomy for semiconductors. *Brookings Institution*. From https://www.brookings.edu/articles/how-europe-aims-to-achieve-strategic-autonomy-for-semiconductors/.
15. Regulation (EU) 2023/781 of the European Parliament and of the Council of 19 April 2023 establishing measures for a high common level of cybersecurity at the institutions, bodies, offices, and agencies of the Union. From https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R0781.

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