GLOBAL EUROPE

EXPLAINER

Strategic Dependencies and the Single Market

The Irish Semiconductor Industry

By Alexander Conway | January 2023

IIEA
Sharing Ideas
Shaping Policy

The supply-chain shocks of Covid-19 have been further exacerbated by the impacts on global trade and diplomacy of the Russian invasion on Ukraine. Identifying, mitigating, and countering geopolitically motivated disruptions to critical trade links and value-chains are now a priority for the EU and require industry and government to work together to manage these changes and risks.

While industries are often the best judges of their own strategic dependencies in terms of supply-chains, potential chokepoints, critical inputs, and logistics networks,[1] the context in which they hitherto operated of free-and-fair trade is contested. The politicised nature of international trade and the trend towards increased public intervention into industrial policies such as the designation of certain sectors and products as "strategic" demands officials to work closely with industry to identify and mitigate these new risks. Public policy has a critical role to play in addressing dependencies and mitigating potential market failures, as well as offering expert guidance in the increasingly intertwined political aspects of trade, competition, and production.

This explainer identifies some of Ireland's potential strategic vulnerabilities, and the risks and possible opportunities it faces, with a specific focus on the critical semiconductor. It outlines the role which government and public policy can play in addressing the dual commercial and political nature of the challenges for industry in a world of weaponised interdependence and politicised trade.

The Global Semiconductor Industry

Semiconductors (or microchips) are fundamental to the modern economy and at the heart of future economic production and innovation. They are vital components for cutting edge research such as quantum computing and artificial intelligence. They also are essential components of modern electronic devices from computers to phones, to batteries and underpin four key sectors: financial service, medical device, energy generation and transport.

Given their critical relevance across the entire economy with monthly European sales in July 2022 worth €4.3bn,[2] semiconductors are at the heart of global competition to ensure sufficient supplies of high-quality chips. As a highly globalised sector with value and supply-chains stretching around the globe, any disruptions in their flows can have dramatic impacts be they export control measures, curbs on raw material exports (like silicon) or limitations on the use of critical technologies (like deep ultraviolet lithography machines).

The semiconductor value-chain is highly disaggregated, with a small number of specialised firms focused on discrete steps in their production from their design, fabrication, and assembly to the raw material inputs and the underlying technologies incorporated into their designs. While the entire process is broadly dominated by the United States, Taiwan, Korea, China, Japan, and the European Union, no one region or firm has the entirety of the process located within their territory given the premium placed upon economic efficiency in the initial establishment of value chains.

This division of labour has been highlighted by the restrictive trade measures which the US and China have imposed on one another to curb one another's economic and technological progress, and

1 STRATEGIC-DEPENDENCIES-2022.pdf (wec-italia.org) p.5
2 ESIA_WSTS_PR_2207.pdf (eusemiconductors.eu) p.1

the Made in China 2025[3] strategy, and the US Chips and Science Act[4] to foster respective domestic semiconductor production stacks. This geopolitical rivalry has significant repercussions for other key semiconductor production locations such as the EU, Japan, Taiwan, and Korea who are intertwined with both the US and China and may be increasingly forced to integrate or disengage with either the US or China as a result.

This situation presents a critical challenge for firms and policymakers within the EU. A stable semiconductor supply is vital for the EU's strategic autonomy ambitions in realising the Green Deal and Digital Transition ambitions, and the EU has set itself a goal of reaching a 20% share of global semiconductor production by 2030 to realise these them.[5]

Foreign, trade and industrial policy decisions will be increasingly critical in ensuring that countries can maintain sufficient access to semiconductor supplies in the face of politically motivated disruptions to supply- and value-chains. However, insulating vulnerable segments of value-chains and building on existing relative comparative advantages may reshape supply-chains. For example, the EU provides a considerable amount of primary design, chemicals and machines needed to manufacture chips, but lacks the manufacturing and assembly capabilities to build semiconductors, while the inverse is broadly true for China.

Addressing these vulnerabilities will require both the prompt identification of vulnerabilities, a strategic approach to forging alliances with potential partners to mitigate risks and concerted industrial policy decisions to develop autonomous capacities or strategic redundancy provisions. While the EU may well be a global regulatory leader establishing norms, this normative power on its own is an insufficient remedy.[6] The EU will require similarly ambitious production and innovation capacities to its competitors, in order to achieve technological strategic autonomy.

The central instrument to achieve this is the EU Chips Act,[7] which is based around three pillars, namely: R&D investment, foundry, (chip manufacturing for multiple clients), and production subsidies. Investment in these three areas could enable the EU to secure 20% market share, while supply-chain monitoring would help to secure sufficient semiconductor supplies. However, any further measures such as introduction of quotas, tariffs, or export restrictions could exacerbate tensions between trading blocs.

The Taiwanese contract chip manufacturer TSMC, originally conceived of and developed the innovative foundry model to scale and to a level of sophistication which was hard to match. This made TSMC effectively indispensable as the central global manufacturing hub for the chip industry. In contrast, the Dutch firm ASML focused on excellence in complex supply-chain mastery and manufacturing efficiency and carved out a niche as a key manufacturer of the highly advanced machinery and precision parts needed to produce the most advanced semiconductors, like ultraviolet lithography machines

3 How China's 'Big Fund' is helping the country catch up in the global semiconductor race | South China Morning Post (scmp.com
4 FACT SHEET: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China | The White House
5 Subscribe to read | Financial Times (ft.com)
6 Referees don't win games: Europe and the digital great game – European Council on Foreign Relations (ecfr.eu)
7 European Chips Act | European Commission (europa.eu)

which can cost over US$100mn each.

The Irish Semiconductor Sector

Given the strong presence of semiconductor facilities in Ireland, reshaping the global semiconductor supply- and value-chains may present considerable risks as well as opportunities, such as establishing Ireland as a European foundry hub for semiconductor manufacturing facilities.

Two main broad risks can be identified: First, disruptions in the supply of critical raw materials or chemicals which input into semiconductor manufacture processes, such as silicon wafers, could severely disrupt production and imperil commercial viability. Second, a potential lack of financial resources in Ireland or the Single Market could skew their capacity to match the fiscal resources put forward by the US or China in terms of state aid subsidies for the capital-intensive semiconductor industry.

Geopolitical Supply- and Value-Chain Disruptions

One internal risk to Ireland's semiconductor industry is that it is distinct from continental Europe in that it is structured around foreign direct investment (FDI) rather than domestic firms, with US companies Intel, Analog Devices, Qualcomm, Microchip, AMD, and Dell all present, as well as the Chinese Huawei and German Infineon. In this regard, any disruption to the FDI model could negatively impact future business decisions by firms or even prompt their potential exit. Securing access to raw material inputs like boron, cobalt, gallium, germanium, silicon, lithium, tungsten, and rare earth metals, will be essential to maintain and grow Ireland's extant semiconductor manufacturing and assembly facilities as well as Ireland's broader digital and tech-based industries.[8]

In terms of the external risks facing semiconductor manufacturers, there is a noticeable concern by firms based in Europe regarding export restrictions, supply disruptions, relative competitiveness and the potential for reputational damage as key concerns for their business.[9] These concerns may prompt firms to minimise their relative exposure to political risks and relocate operations or processes where possible to other jurisdictions, and the EU Chips Act supply-chain early warning provisions may prompt reticence about disclosure of sensitive industrial or commercial information.[10]

Fiscal Capacity and a State Aid Race to the Bottom

Semiconductor manufacturing is a time-consuming process, with plants and foundries taking several years to construct. This time-delay may render projects effectively moot in future, if demand reduces, making these plants economically unviable against competing plants which are already in operation elsewhere in the Single Market and globally. In semiconductor production, manufacturing has the lowest profit margins, the highest entry barriers and is most dependent on state aid. Ireland's model of manufacturing has been largely driven by FDI by US firms, such as Intel, attracted by corporation tax schemes and a highly educated workforce, so any changes in state aid policies within the Single Market, and on the global scale, could have a negative impact on Irish firms, if larger Member States with more fiscal resources can comparatively outspend Ireland and attract firms to relocate their facilities.

8 CRMs_for_Strategic_Technologies_and_Sectors_in_the_EU_2020.pdf (europa.eu) p.57
9 WTW's 2022 Global Semiconductor Survey Report p.8
10 european-chips-act-public-consultation-report.pdf (enterprise.gov.ie) p.13

Opportunities: Ireland as a Semiconductor Foundry for the Single Market?

The stated EU objective to secure 20% of global semiconductor manufacturing share could prove a significant opportunity for Ireland. The decision by Intel to allocate €12bn to upgrade its Fab 34 facility in Ireland, will effectively double the firm's manufacturing capacity in Ireland[11] for producing both more advanced 7 and 14 nanometre (nm) semiconductors for industrial and commercial applications. Ireland's already significant extant role in the semiconductor manufacturing process offers a basis on which to further build and complement existing industries across the Single Market and contribute towards the strategic green and digital transitions in Europe. Those key industries where the Single Market is particularly strong, such as the automotive, industrial electronic, and wireless telecommunications sectors, are highly reliant on the supply of both standard and more advanced semiconductors for their present competitiveness and future relevance for key trends such as clean electricity generation or autonomous vehicles. In this context, the relative closure of manufacturing facilities in mainland China may also offer an opportunity for an Irish manufacturing foundry/capacity to fill this strategic niche within the context of a broader Single Market industrial ecosystem.[12]

The entwined and potentially competing interests of economic actors could be more profitably focused into local chip manufacturing venues, supported by state aid investment and tax breaks, to offset risks.[13] This is effectively what the European Single Market, the United States and China, have all established via their respective legislative policy strategies, such as the EU Chips Act, the Chips and Science Act, and Made in China 2025. This approach could also be supported by the imposition of export control measures, such as the EU's Single Market Emergency Instrument (SMEI) or other tools, to shield critical semiconductor production.

Another key feature in this strategy would be the further development of the EU Critical Raw Materials Alliance which relies on: the diversification of third-country suppliers to the EU, the potential of increased domestic extraction and production within the Single Market, and greater efficiency in recycling and reducing the quantities of rare earth metals and critical materials needed in production processes.

Conclusion: The Challenge for Global Diplomacy in the Competition for Chip Sovereignty

Global competition for supremacy or self-sufficiency in the semiconductor chip industry is at the core of the discussion on semiconductors as a critical input for future technologies at the heart of modern economic production. Building an autonomous and self-sufficient semiconductor supply- and value-chain entirely within the Single Market is an unlikely prospect, as it is highly complex process, and involves reconciling customers, manufacturers, and governments, but it may also be unnecessary if the European semiconductor sector can remain suitably competitive and attractive.

Working with like-minded and not like-minded partners will be essential for the future of the EU industry. The maintenance of close diplomatic ties within the Single Market and with third-countries from Argentina to Australia will be crucial for securing the requisite critical raw materials, preserving vital global supply-chains, and avoiding economic fragmentation. Ireland's place in the Single Market, its strong semiconductor industry and significant diplomatic soft power, could offer a unique opportunity for Ireland to forge a role in global chip diplomacy.

11 Ireland wins €12bn Intel investment, but not new plants (rte.ie)
12 Joint declaration on processors and semiconductor technologies | Shaping Europe's digital future (europa.eu)
13 The great chip war — and the challenge for global diplomacy | Financial Times (ft.com)

The Institute of International and European Affairs (IIEA) is Ireland's leading international affairs think tank. Founded in 1991, its mission is to foster and shape political, policy and public discourse in order to broaden awareness of international and European issues in Ireland and contribute to more informed strategic decisions by political, business and civil society leaders.

The IIEA is independent of government and all political parties and is a not-for profit organisation with charitable status. In January 2021, the Global Go To Think Tank Index ranked the IIEA as Ireland's top think tank.

The IIEA acknowledges the support of the Europe for Citizens Programme of the European Union

IIEA
Sharing Ideas
Shaping Policy

The Institute of International and European Affairs,

8 North Great Georges Street, Dublin 1, Ireland

T: +353-1-8746756 F: +353-1-8786880

E: reception@iiea.com W: www. iiea.com