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Research Report

European industrial policy: A crucial element of strategic autonomy

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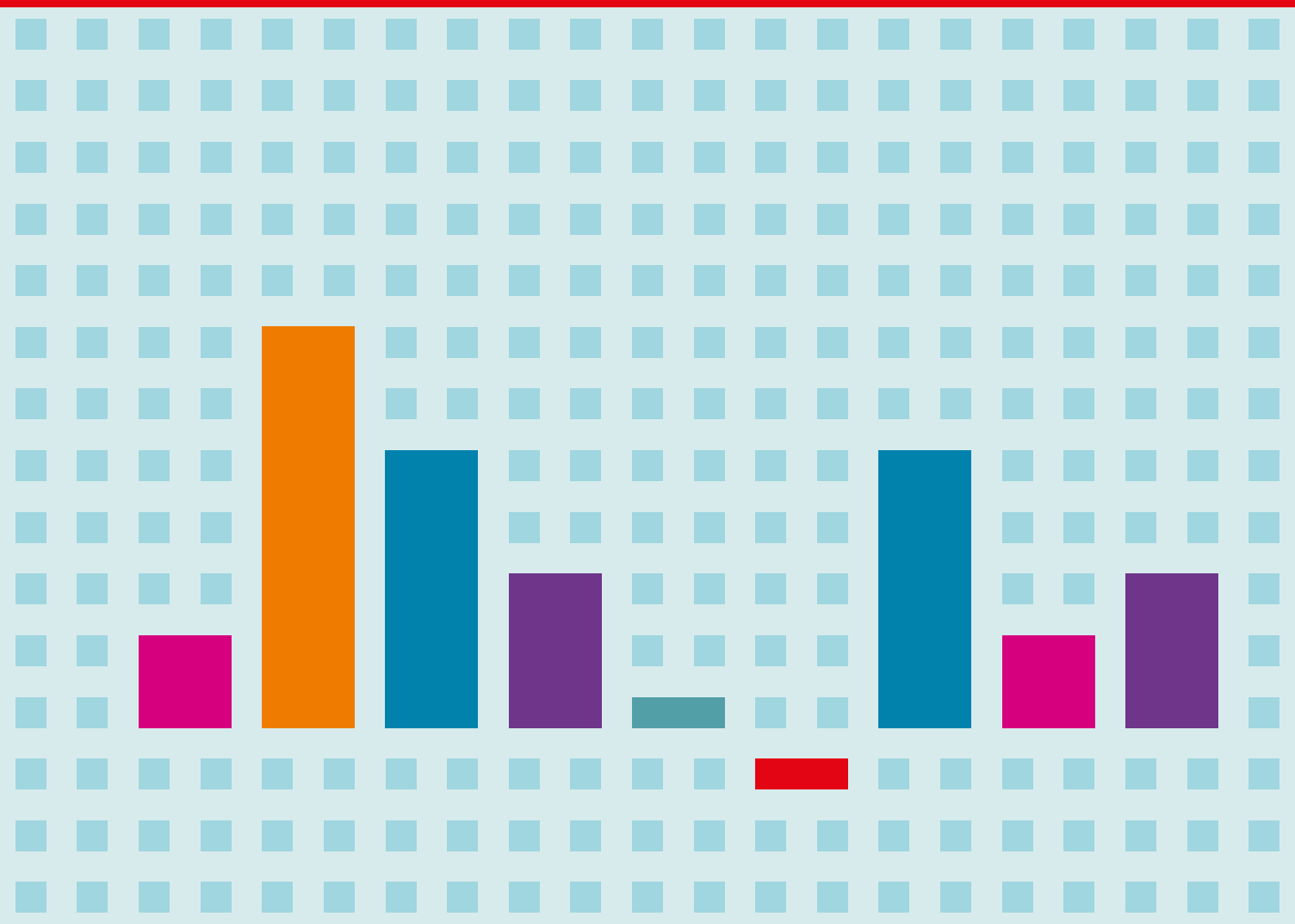
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EUROPEAN INDUSTRIAL POLICY: A CRUCIAL ELEMENT OF STRATEGIC AUTONOMY

Sebastian Dullien, Jonathan Hackenbroich



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Sebastian Dullien¹, Jonathan Hackenbroich²

Summary

A sea change in the geopolitical environment and the 'green and the digital revolution' are forcing Europe to rethink its approach to industrial policy. Russia's war in Ukraine has ushered in a new era for Europe's economic diplomacy, supply security, and military spending. The war poses a fundamental challenge, and the EU has also set ambitious goals on decarbonisation and digitalisation. The EU's past approach to industrial policy mostly assumes an absence of great power rivalry, a limited relevance of economies of scale, and benign approaches by other countries to international trade. But other countries are now weaponising economic dependencies and markets for many advanced and emerging technologies when these technologies are found in high concentration and have significant spillover effects within the home country of dominating firms. The EU needs to recalibrate its approach and focus on (the emergence of) key industries and key supplies, as well as provide key infrastructure in Europe. The right balance between selective protectionism and openness to trade and investment needs to be struck. The goal of industrial policy should not be to produce everything at home, but to preserve the capability of production. To this end, Europe should target new products or technologies rather than existing ones, enhance market competition rather than protect actors from it, and help more productive companies rather than unproductive ones. The EU could do this with strategic regulation, FDI screening, public procurement and other tools, all while shielding policies from special interest and inefficiency.

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Introduction

The European Union is being forced to shift core tenets of its foreign and economic policies on account of rising geopolitical tensions and Russia's war in Ukraine, and due to the urgency of rapid decarbonisation, and the need for comprehensive digitalisation. This potent three-pronged set of challenges also demands that the EU review its industrial policy. Specifically, the EU needs to evaluate its past approach, to acknowledge its current problems in the face of these new challenges, and subsequently to modify its existing approach accordingly.

Russia's invasion of Ukraine and the joint declaration of Vladimir Putin and Xi Jinping about a "new era" and a redistribution of power in international politics have indeed ushered in a new era. The new great power competition between the United States and China has replaced the post-cold war unipolar era on which the EU's liberal and open industrial policy approach was based. War in Europe is redrawing the geopolitical and geo-economic map: world trade is increasingly power-based, not rules-based, and Europe needs to prepare for more fragmentation and polarisation of its economic relations with third countries. In today's world, leveraging economic power has become a top foreign policy tool for countries to improve their geopolitical position, and to bolster as much as possible the rules of international relations.

This coincides with increasing signs that the globalisation of supply chains and the production of systemically relevant goods have passed the optimum level. Although the vertical, international division of production steps has brought new cost efficiencies for complex industrial products, it has also massively increased the vulnerabilities of the economies and societies involved. There are many indications that the marginal benefits of the last steps of globalisation can no longer compensate for the additional risk.

The effect of digitalisation on the ways we live and work has been a major driver of these shifts. Online platforms, for instance, tend to create monopolies, where winners can easily take all, or most, profits at the expense of suppliers, including those in other countries. While jobs in these monopolies are not as plentiful as in other industries, they still provide a tax base from which these firms' home countries benefit. In many key fields, the most successful firms have been non-European. Technological success often creates positive path dependencies, meaning that the actors which do best in the next wave of innovation are those that had already mastered the last one. The digital era also brings with it new types of critical goods, such as semiconductors, which are so central to European industrial production that dependence on other markets can quickly become a problem with macro-economic relevance. Covid-19 has shown similar dependencies – and thus vulnerabilities – of the European economies. During the first wave of the pandemic, Europeans faced a critical lack of protective gear and medical equipment. In addition to the life-threatening consequences, the shortages also had economic ramifications. This lack of protective equipment prolonged lockdowns and deepened the economic downturn. The pandemic also acutely demonstrated how health and economic vulnerabilities quickly turn into geopolitical ones – especially when China threatened to stop providing critical medical supplies to the Netherlands at the height of the first wave in April 2020 due to Dutch foreign policy choices.

In addition to these challenges posed by digitalisation, the EU also faces the challenge of decarbonisation. The bloc has pledged carbon neutrality by 2050 but making this promise a reality will be a substantial challenge over the next crucial years. Many industries have made little progress in reducing their CO₂ emissions over the last decade. In large part, this is because they

have reached a point where they would need to fundamentally transform their production technologies. To move beyond this impasse, they need investment security, support, and incentives. Prior to its Fitfor55 climate package,³ the EU relied too heavily on carbon pricing to regulate greenhouse gas emissions. As the green transition accelerates, a key challenge will be to preserve well-paid, high-quality manufacturing jobs that have formed the backbone of the European social model and prosperity since 1945.

Russia's threats to the European security order have meanwhile prompted German Chancellor Olaf Scholz to usher in a new era of military spending. While any one of the challenges in this potent three-pronged set necessitates a determined policy push to initiate the necessary adaptations in European economies, all three challenges taken together underscore even more the need for a proactive industrial policy. Other global powers have already reacted. Both the United States and China are now actively pursuing their industrial policies and trying to secure control and production of key technologies, making it necessary for Europe to hone its strategies and not be left behind in the race for 21st century economic and technological competitiveness.

Europe should focus its industrial policy on the development of key industries and the provision of modern key infrastructures. It could then draw on these when such interventions increase efficiency, and when they secure production capabilities and employment. In addition, Europe should target new products or production technologies rather than existing ones, using industrial policy to enhance market competition rather than to shield actors from it. It should also help more productive companies rather than unproductive ones (with some possible exceptions). The EU could do this through public procurement, strategic regulation, and effective foreign direct investment (FDI) screening, all while shielding policies from special interest.

Competitors' policy challenges

Other global economic challengers have made much more headway with industrial policy than Europe. With 'Made in China 2025', China has put in place a strategic investment and industrial policy plan to develop homegrown high-tech capacities rapidly, to decrease reliance on foreign products in key technological sectors, and to transform China into a manufacturing and high-tech hub. The country's dual circulation strategy aims to foster domestic demand and innovation, and to reduce its reliance on foreign markets, while still integrating ever more international trade into its supply chains in order to increase others' reliance on China.

Largely as a response to China's rapid rise, the United States has adopted an industrial policy for 'strategic competitiveness.' Under the 2021 Infrastructure Investment and Jobs Act, the US pledged \$1 trn to modernise America's outdated infrastructure and transport networks, boost investment in energy and digital infrastructure, and promote climate action. The US Congress is preparing a \$250bn Innovation and Competition Act, or America COMPETES Act, which aims to secure America's technological edge over China in what the US has identified as 'emerging

³ The EU's Fit for 55 climate package comprises a range of legislative proposals and policy initiatives for reaching a net emissions reduction of 55% by 2030. For the current state of play of the legislative process on this package see: www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/package-fit-for-55

technologies' through massive expansion of R&D and domestic production capacity funding, especially in the semiconductor sector.

If European countries want to be able to set their own foreign policy priorities in a geo-economic world, protect their capabilities to develop next-generation technologies, have a large number of high value-added jobs within their borders, protect the European social model (including social cohesion) and hence decide on their way of living, they quickly need to adapt their approach to industrial policy.

Past industrial policy approach: limiting industrial policy

For decades, the EU has pursued an approach to industrial policy that focused on *limiting* member states' industrial policies. The idea was that a strong and well-functioning market would create the right framework for robust EU industries and secure the global role that many Europeans desired: a place of economic strength which would naturally bring a degree of power and influence, without having to actively strive for 'hard power' capabilities. This case was made most forcibly by Anu Bradford (2020), who argued that the EU could become a 'regulatory superpower'. As one of the biggest markets in the world, whose relatively efficient and objective internal regulations and norms de facto set standards for (large parts of) the globe, it was believed that the EU had the potential to shape global politics through economic heft alone. Bradford argued that companies around the world would adapt to EU rules in order to access the European market, and that most would find it efficient to sell their European-standard products in many other markets.

In this context, industrial policy was seen from a rational choice perspective and perceived as little more than unproductive rent-seeking of national firms. Brussels focused heavily on competition policy, a realm in which it had the necessary competencies. And on the member state level, Europeans viewed themselves more as a collection of small (open) economies with their own policies (wherever Brussels did not see gross distortions of the level playing field).

The EU's past approach also relied on an absence of geopolitical rivalry, or at least assumed that global tensions mattered relatively little for economic policy. In a globalised world where reducing trade obstacles was the key paradigm for governments and companies, the EU could rather passively enjoy the benefits of the 'Brussels effect', because companies had economic incentives to produce according to European standards and governments had much less geopolitical reason to prevent them from doing so. Today, it is not guaranteed that the EU will preserve its status as a regulatory superpower. The ability to set standards and to facilitate interoperability and market access have become of prime geopolitical importance to states. China, in particular, is trying to create its own regulatory sphere and to shape global economics much more through its own standards.⁴

The EU has nevertheless made some changes to its industrial policy already. Since 2018 it has therefore allowed groups of member states to provide state aid for specific projects that are

⁴ This has led European employers' federations to warn of China's growing ambitions to challenge European standards and set its own – see for instance BDI (<https://english.bdi.eu/article/news/chinese-creative-drive-china-standards-2035/>)

geared towards breakthrough innovation in cutting-edge fields like microelectronics and battery value chains. At the beginning of this year, new rules on Important Projects of Common European Interest (IPCEI) also entered into force, allowing more state aid in areas of the green and digital transformations. These initiatives might significantly expand the number of projects that Brussels approves, especially where this serves the EU's stated objectives of open strategic autonomy, and green and digital transformation. The European Commission explicitly mentions health, hydrogen, cloud, and microelectronics as promising areas for greater member state industrial initiative. This revision of its industrial policy reflects the fact that the EU is in the process of departing from its past approach to industrial policy. The war in Ukraine and the consequences of this are likely to precipitate the EU's revision of its industrial policy. Besides Olaf Scholz's "Zeitenwende", (in other words his declaration of the "start of a new era" in Germany's security policy, which will now require a vast military spending expansion), the EU has drawn up an ambitious plan (called REPowerEU) to facilitate the geopolitically induced transition away from Russian energy. This contemplates a new framework for state aid in crisis situations.

But the EU's industrial policy approach is not fundamentally European. Europe's governance system has a unique structure, of course. While there is a centralised government in the US that can more easily craft holistic industrial policy (despite the US system being highly fragmented), and while China is even more centralised (even if the importance of regional initiatives in policymaking should not be underestimated), Europe's industrial policy is largely the domain of member states. And although it appears in existing EU treaties, European industrial policy is too much a collection of national projects. Many of the most recent developments, like the European Recovery Fund/NextGenerationEU, thus remain largely national projects that the EU tries to pull together under a (lightweight) common umbrella. The Recovery Fund's primary goal is to help countries during the Covid crisis, which explains its bottom-up approach. But this approach comes with the dangers of ill-coordinated subsidy policies, and even subsidy overlap. More broadly, it creates tensions between Brussels' declared ambitions and the actual policy measures meant to achieve them. Such ill coordination can be a significant disadvantage in geostrategic competition over technology, value chains and jobs, with Europeans trying to spur innovation or 'reshore' supply chains in uncoordinated ways. To avoid this situation, the EU needs a much more comprehensive and coordinated strategy.

Problems with the past policy approach

Given that the EU's current set of policies ignores findings about the 'China (trade) shock' felt in the US, which Europe too could soon experience, and given that the EU's current set of policies assumes a level playing field that no longer exists, it is clear that the new era of international economics and politics demands a new policy approach from the EU. Indeed, recent research into industrial policy and technological progress shows that this level playing field may never even have existed in fields of rapid innovation and transformation.

In fact, the textbook focus on efficiency and a level playing field does not match reality when it comes to the development of key technological capacity. This is because high and emerging technology industries often enjoy significant economies of scale and/or spillovers – which means production will concentrate in only a few clusters globally. Many standard economic models,

however, usually assume markets in which there is perfect competition, so that there are many suppliers and much demand, none of which can influence the price.

For many, if not most, relevant markets in the areas of the digital and green transformations the model of perfect competition is not appropriate. Instead, models for monopoly markets, or at least models for markets characterised by monopolistic competition, should be used because of increasing economies of scale in the production of many modern goods in today's world. These economies of scale can be both static (a larger factory operates more efficiently than a smaller one) and also dynamic (a company becomes more efficient the more of a product it has already sold). In the presence of such economies of scale, there is inevitably at least a partial monopolisation of the markets concerned.

Companies that benefit from such economies of scale can charge their customers prices that are significantly above average costs. This enables them to generate higher profits, pay better wages, and also have the means to invest more in research and development – or to invest more in attempts to achieve market power in adjacent markets as well. At Google, it is not just the programmers who earn more than those at smaller companies; the controllers and assistants also earn more than those in other industries. Google's accumulated profits are regularly used to buy up new technologies and strengthen Google's market position, thus contributing to an increasingly uneven playing field.

With growing returns to scale, the location of a company no longer depends on superior geographic conditions or lower local labour costs. Rather, historical coincidences play a major role: the location where a company originally emerges in an industry characterised by such returns to scale is very likely to remain the centre of the industry for a long time. This is true even if other countries or regions offer better conditions, because companies in those countries or regions would simply not reach the size and economies of scale to match the returns of the original company. Due to these forces, it is unclear whether the existing distribution of firms in markets across different countries and regions is still economically efficient. But where the economic literature is fairly clear, however, is on the subsequent spillover effects that the original location is likely to enjoy: large corporations usually conduct their research and development in the geographical vicinity of their headquarters, which in turn usually has positive spillover effects on other companies as well. In this way, entire regions or countries can easily benefit in the long run from the presence of companies with high economies of scale. The future income levels of these regions or countries, and possibly also their growth rates, will be higher.

This is particularly significant for Europe because the tendency towards monopolistic competition or oligopoly markets means that companies will only have a limited number of competitors per industry worldwide. If China succeeds in acquiring technological leadership in important future markets, it is quite likely that Europe will no longer have (any) significant companies in these sectors. This will cause corresponding negative consequences for income and prosperity in the EU.⁵ There is a risk of losing 'good jobs' as job creation in new and highly

⁵ Incidentally, a similar argument, with a slightly different rationale, is also provided by Gomory and Baumol (2000), who show that under the assumption of capital mobility, economies of scale, and large entry investments for certain technologies, it can be disadvantageous for developed countries if catching-up economies poach certain industries.

innovative sectors will take place elsewhere while old industries in Europe then create fewer jobs or even go out of business.

This challenge of company location is compounded by the EU's promise to decarbonise by 2050, and the need for new technologies to actually make it possible. The challenge of reaching this ambitious decarbonisation goal places additional strains on Europe's existing key industries, which are already at a disadvantage – for example, due to geopolitically motivated subsidies in other countries. At the same time, however, decarbonisation also comes with opportunities. If the EU manages to push its key industries to decarbonise better and earlier than competitors outside the bloc, these European key industries might enjoy first mover advantage and be in a better position when other parts of the world follow, aiming at lower emissions themselves. The EU's green deal also therefore comes with the potential to spur innovation and actually make Europe the leader in some future key technologies. In its overall approach, the EU needs to reconcile these benefits with the adverse effects for other industrial areas.

A European China shock?

Recent empirical studies have shown that China's entry onto the world market (following its accession to the WTO in 2001) has led to persistent structural weakness and unemployment in some US regions as a result of increased imports from China. While China's manufacturing clusters have developed into a significant centre of gravity for the world economy, US competitors have in turn suffered, US employment and wages have decreased, and US poverty rates have increased significantly.

America's new emphasis on creating trade and economic policies for the working and middle classes is a reaction to this 'China shock'. Upholding America's past approach to industrial policy would continue to benefit one part of society, while structural weaknesses and job losses would likely further worsen the situation of the rest. The Biden administration has announced a new focus on (and investments into) protecting American jobs, including a 'Buy American' policy in public procurement (but with some exemptions for products from allies). Biden's policies grant such great political importance to American manufacturing that quite a few of Donald Trump's tariffs, which were meant to protect American industries, continue to remain in place. While European policy should not attempt to emulate this approach in all of its dimensions, it could nevertheless place renewed emphasis on the *negative* effects of the EU's past policy approach.

In fact, there is a danger that Europe could experience its own 'China shock', although on this side of the Atlantic it might not manifest itself through a rapid industrial decline, as happened in the US following China's sudden WTO accession. Instead, China's industries could easily, if gradually, push European competitors to the brink and could develop key industry clusters. European industry and employment could face erosion in the medium term, especially if Europeans face significantly tougher CO₂ requirements and no adequate industrial policy to address the effects of these policies. Some studies already show this type of effect on European industries, albeit not to the same extent of erosion as in the United States. Furthermore, a second shock is also possible because while the globalisation of trade in goods is regressing, the globalisation of trade in services is forging ahead, meaning that Europe could see a greater trend towards the offshoring of services if it does not prepare for global competition over nascent services industries and key players in new areas of growth – for example, digital health services.

A geopolitical shock

The war in Ukraine, the joint Sino-Russian declaration on a new era of power relations, and the West's sanctions against Russia have the potential to change international economic relations profoundly. Sanctions against Russia have demonstrated how far economic punishment – that is, the exploitation of critical vulnerabilities – can go. Indeed, the sanctions are likely to give the geopolitically motivated race for industrial capacity even more the character of an arms race. Yet this should not be the logic Europe follows. Undoubtedly, however, Europe will have to deal with the consequences of these sanctions: if national security is an ever bigger motivating factor for other countries like China to build defences, and to support structures for their own industries and their independence, Europe risks losing out if it does not invest strategically, too. If countries want to see key players in a given industry on their soil and in their jurisdiction for *security* reasons (in addition to, or even without attention to, social reasons like job creation) they will press ahead even more powerfully with strategic subsidies and the promotion of key industries in order to make sure that they are the place where good jobs are created and where new sectors thrive.

Europeans need to realise that 'just in time' production and reliance on a small number of providers can make supply chains highly efficient, but that it also leaves them vulnerable to disruption. In the new geopolitical environment, efficiency comes at the price of vulnerability. While the risks are not entirely new, they are much more acute now that the unidirectional quest for greater market opening and ever more efficient and fragmented value chains has partly been reversed. The Covid pandemic has underscored these vulnerabilities, including the possibility for third countries to weaponise supply chains and cut a certain actor off access to critical materials – as was seen in the case of China threatening the Netherlands. But it is Europe's dependence on Russian gas and, to a lesser degree, oil, that powerfully shows how a lack of domestic supply, or a lack of a diversified supply, can be very costly in times of crisis. While the EU has enacted economic sanctions of unprecedented scale against Russia, it nevertheless provides one of the two critical lifelines to the Russian regime by continuing its energy purchases. This in turn is due to a lack of alternatives, and a lack of strategic steering of Europe's energy policy over the last decade. Industrial policy might now have to contribute to correcting this.

Beyond these dependencies, there may be further, more complex security implications directly linked to the (tech) clusters that form in a country where the original company once pioneered a technology thanks to increasing economies of scale. These clusters enjoy significant network effects – at least where they pertain to services – and such dynamics boost the value of these cluster companies' products, as more customers will buy or use them because so many others are already doing so.

These network effects also come with very significant geopolitical value in an age of economic great power competition because countries can weaponise their own centrality (or that of one of their companies) in an economic network. With effective jurisdiction and appropriate institutions, these countries enjoy two power effects: a panopticon effect – that is, insights into data and information that go through the central hub; and a chokepoint effect – that is, they can make access to the central product, service or technology conditional upon a certain behaviour by another country or its businesses (Farrell and Newman 2019). Given the fact that the product, service or technology is so central to a wide range of applications or transactions, countries can afford to lose access (or to protect their data) even less than in the case of a critical dependency.

This might be true for critical financial services, for instance, or a key technology like quantum communications or key operating systems.

The EU's past policy approach lacks an analytical understanding of economic networks as tools of power, and thus it also lacks an understanding of the incentive for other states to use industrial policy to establish network centrality in their own favour. It therefore also lacks the means to address these economic networks.

As a result of all these dynamics, the US and China tend to have control of high-tech supply chains. If these actors use their industrial policy to build and keep these cluster and network effects (as is currently the case, in principle), while the EU does not, the EU risks losing out – economically, socially, and geopolitically.

Towards a recalibration: key industries and infrastructures

The question of 'key industries' is closely linked to dynamic scale effects and clustering, both of which determine technology leadership. Such key industries have a particularly large number of linkages with suppliers and customers, through which technical know-how is transferred and innovations take place. Key industries are thus also characterised by the fact that their technologies are central to the next big innovations – in the same sector or creating technology that is then used in other industries, with possible spill-over effects on yet other industries. Falling behind in a particular sector can easily create a path dependency and structural weakness for a long time, possibly across sectors. These key industries are therefore far more important for the growth and development of an economy than the directly measured value-added of the relevant industry would suggest.

Economic history shows that this is not a new phenomenon. Each historical period has seen key industries rise and determine the fate of many economies with much the same characteristics as today. In the early phase of industrialisation, it was the textile industry, for instance, that was key to the emergence of other industries. And the German automobile industry is a particularly illustrative example of a key industry from the recent past. The much-praised 'hidden champions' – German medium-sized companies in mechanical engineering that are world leaders in a niche market for a specific application – would never have emerged without the existence of the larger key automobile industry in Germany. Car production in that country has also crucially contributed to the development of other supply industries, from tools and machinery to steel and chemical engineering.

Given that the most important industries will tend to concentrate in one or a few countries, it makes a difference whether these industries are located in California, Shanghai or Hesse. If the government in Beijing does not shy away from trying to 'grab' such industries for its own country, especially through its Made in China and dual circulation strategies, there is a risk that technological progress and economic growth in other countries will become weaker as a result. The concept of key industries helps explain the discomfort increasingly on display when certain parts of production and whole industries (seem likely to) relocate to a different part of the world.

There are both economic and strategic reasons for this discomfort at the potential loss of key industries. Indeed, in the case of Chinese acquisition of European companies, there are indicators that China's strategy to acquire important technologies and production is behind the takeovers of

European companies by Chinese businesses or state-owned enterprises (SOEs). Chinese investors, especially those with close ties to the Chinese state, are systematically prepared to pay more than the market price for takeover candidates from developed countries. Furthermore, this premium is particularly high in sectors that the Chinese government has defined as critical for its country's technological development, as takeover candidates can enhance the establishment of key industries for China, with the result that these industries will then be more difficult to develop elsewhere. This establishment of key industries in China also explains why even subcontracting critical production to China can solicit European concerns about subsequent erosive effects on the prosperity of the original European location in the medium to long term.

From a European perspective, limiting globalisation – in the form of corporate takeovers, and the migration of important production in key industries to China – may thus not only be an insurance against disruptions in world trade, but can also be important for securing future prosperity. It can also ensure Europe's capacity to act in a world where economic dependencies are regularly exploited to alter foreign and domestic policy choices.

But what specifically constitutes a key industry? The following characteristics are particularly vital: (i) industries with strong market power, (ii) industries on which future technologies (products; services) are built, (iii) industries with large spillover effects, and (iv) industries which produce vital parts and components that might be difficult to procure. The last category of key industries is slightly different from the first three because, depending on the vital part or component, it may be possible to build strategic stockpiles (eg, for protective respiratory masks). This may nevertheless be much less viable for other vital components (eg, for semiconductors). Despite some limitations, the potentially significant and long-term effects on prosperity of losing key industries of the first three categories make these industries particularly important.

The concept of key industries, however, does not mean that a new industrial policy should facilitate politically motivated state interventions to protect every big company or industry. This would create a danger of overuse, especially if relevant policy tools were too easily available for actors with special interest. It would also create a danger of overprotection. By contrast, however, policymakers with a pure focus on avoiding protectionism to safeguard European innovativeness, need to be aware that Europe's innovativeness could suffer tremendously from key industries moving to China or elsewhere, given the subsequent spillover and innovation effects.

Researchers and policymakers have now started to identify some of the key industries in a world of digital, green, and geopolitical transformation. Examples of such key industries include cloud services, semiconductors, renewable energies, and e-mobility and batteries.

Furthermore, key (public) infrastructures may also have much the same effect on a country's innovativeness, jobs, and vulnerabilities as that of key industries. While infrastructures like transport or energy will not of course move to other countries, their condition and efficiency, as well as the state's efforts to adapt to new technology (not least as part of the digital transformation), will determine the extent to which they facilitate spillover effects, and thus the presence of key industries. Energy networks, transport connections, broadband networks, and universities and colleges – which the state has a central role in developing – therefore need to be an integral part of the EU's industrial policy strategy.

However, Europe has several deficiencies when it comes to building pan-European infrastructure. While energy networks are more integrated than in the past, they need

reinforcements for north-south power flows and in eastern and southern Europe, and they lack important cross-border connections for natural gas. Similarly, connecting Europe's rail systems more intensively and rapidly could help build greener and better transport infrastructure across the entire continent. In addition, overcoming physical obstacles like different railway track gauges, and different electrification systems, could also provide more efficient cargo capacities – especially when coupled with the construction of many more truly high-speed lines.

While many of the concrete industrial policy tools provoke controversial debate among economists, the provision of infrastructure (described as 'horizontal industrial policy') is in fact largely uncontroversial. However, the EU must improve at including new infrastructures brought about by the digital transformation in its horizontal industrial policy.

Even if central bank digital currencies (CBDCs) and other digital currencies are fundamentally within the purview of the European Central Bank, they also provide an illustrative example of a key infrastructure with dynamic scale effects, spillover and clustering. While a digital euro may not necessary, or even difficult, from a financial (stability) policy and technical point of view, a key infrastructure like a CBDC could create the necessary context for new key industries to establish in a certain currency area. China could enjoy a first-mover advantage in this domain if it is not just relatively fast, but also relatively successful in creating a well-functioning and stable CBDC with its digital RMB, as this could spark innovation and enable or shape new products such as smart contracts.

EU industrial policy for the new era

Industrial policy will thus clearly have to play a larger – and different – role in the EU's economic policy than in the past. New empirical and theoretical insights – rendered possible by using digitised data, historical 20th century natural experiments, and microeconomic approaches, among others (Lane 2020) – show that industrial policy can have long-term positive effects. These new insights also provide for much more nuance about the benefits and costs of industrial policy than used to be the case in economic science (ibid) and they also offer guidance on when industrial policy does and does not provide positive long-term results.

Choi and Levchenko (2021) and Kim, Lee and Shin (2021), for instance, have investigated the “heavy and chemical industries drive” in South Korea in the 1970s, where the government aimed to boost these industries' development through strictly regulating, and subsidising, foreign credits. Choi and Levchenko found that the subsidies persistently increased sales of this key industry's firms – not just in the 1970s, but also until very recently (even after subsidies had been phased out for about three decades). They also found that subsidies significantly increased South Korea's overall wealth. Kim, Lee and Shin meanwhile concluded that South Korea's industrial policy in the 1970s led to a significant positive impact of output and labour productivity in targeted regions and industry. They also found that it led to a growing weight of these industries in the economy, even if this came at the expense of total factor productivity. Choi and Levchenko nevertheless concluded that the benefits have outweighed the costs. Moreover, many other parts of the South Korean economy also benefited from the cheaper outputs of targeted sectors, increasing for example the number of exporters and even their downstream counterparts (Lane 2019, Lane 2021). Still newer research suggests that Korean industrial policy ultimately at least contributed,

if not shaped, the country's manufacturing shift to more advanced industries and a more advanced economy.

If South Korea has been able to achieve these positive effects of industrial policy, then there is no fundamental reason why Europe should not be able to do the same. Any additional costs to domestic customers potentially resulting from industrial policy would certainly have weighed heavier in 1970s South Korea with its low-income levels than they would in the EU today with Europe's much higher per capita incomes. Moreover, it can be assumed that administration capacities in the EU are more capable and developed today than they were in South Korea in the 1970s.

Some argue that industrial policy can work well for economies that are catching up, but not for many technologically advanced countries in the EU. However, in many sectors Europe is not in fact the technological leader. The EU lags several years behind the US in cloud computing for instance, both with regards to programming and data centre design. The same tools that made emerging markets successful have the potential to work for Europe in these areas, too. Furthermore, finely tuned and selective industrial policy interventions have been heralded a success even in technologically well-advanced countries like the US. This is corroborated by many observers, such as the economist Mariana Mazzucato (2013) who assessed that industrial policy could benefit the US economy and the relevant sectors even where the US has already produced cutting-edge technology.

New findings and research over the last decade or so show when industrial policies are likely to yield success. One key precondition for success is that industrial policy should target new products or production technologies rather than subsidise existing industries or structures. Hausmann, Hwang and Rodrick (2017) argue that this kind of targeting helps the cost discovery process and that new production technologies ultimately spread in the economy, increasing productivity.

A fundamental criterion to determine the likely success of an industrial policy is whether the policy measures uphold or actually create the necessary competition to facilitate productivity growth. It is thus important to evaluate the subsidies, tax breaks, public-sector loans, or even tariffs that the state uses in its industrial policy with regard to their effects on competition. For instance, where they allow for important competitors to stay in a market that might otherwise turn more monopolistic, and therefore probably less innovative, industrial policy has great potential to succeed. Logically, a tax break or similar measure would need to be applied to the broader sector, rather than one particular company or an established champion. The EU could particularly target younger and more productive businesses directly to achieve such positive industrial policy effects on competition (Aghion et al 2012).

This also underscores the importance of targeting subsidies or other industrial policy tools at more productive companies rather than less productive ones. Not only will this incentivise greater productivity, but it will also avoid market distortions. In fact, industrial policy should generally avoid subsidising the entry of new actors onto a market as this could fragment the market and lead to a situation that promotes a market structure with many small and inefficient firms that do not enjoy the scale effects necessary to bolster productivity and create spillover, and thus the establishment or preservation of key industries (Barwick, Kalouptsi and Bin Zahur 2019). The EU could even

think about increasing subsidies in exchange for increased productivity, where this would seem to promise success.

The EU's rethink of its industrial policy could involve a range of possible tools such as the provision of infrastructure, strategic public procurement, strategic regulation, intervention in attempted foreign takeovers of key enterprises, and state participation in risky large-scale investment.

With regard to the use of public procurement in industrial policy, one possibility would be to make public procurement conditional on a share of value added of products purchased originating in the EU. Such a condition would be fully compatible with World Trade Organization rules and would come with the potential of securing strategic production in the EU.

Strategic regulation is another industrial policy tool to keep or support manufacturing in Europe. The EU could set production or safety standards, for example, in such a way that European manufacturers would have competitive advantages in the EU market. Since the EU market is large enough to make it economically viable to have manufacturers in Europe in virtually every industry, this approach of strategic regulation could be very promising. The EU could, for example, announce that from a certain year onwards only steel produced in a carbon-neutral way would be allowed for construction work in the EU, or that only cars produced with carbon-neutral steel would be allowed to be sold on the EU market. Both announcements would create a reliable demand for carbon-neutral steel in the EU, thus stimulating the development of corresponding technologies and giving European companies a head start in this future market.

In certain cases, the prevention of takeovers can also be an important industrial policy tool for key sectors of central companies because certain takeovers could lead to a technology drain and could thus damage the European economy even without a relocation of companies. The EU has already largely recognised this risk and has established an FDI screening mechanism. However, it may be necessary to push for full implementation across the EU, as there are still several member states that continue to exercise their right not to follow the suggestions of the EU level and that still do not review takeovers in strategic sectors.

Research by the United Nations Conference on Trade and Development (UNCTAD) shows that there are also many factors of economic policy more broadly that are important for the success of industrial policy. These include a capable and stable public administration that is independent of political influence in its day-to-day business. Similarly, the involvement of all stakeholders in the development of industrial policy strategy is important, as is an avoidance of the excessive influence of special interest, and thus preventing specific business sectors from benefitting from the policies for protectionist reasons. Industrial policy should furthermore link support and protection to industries according to their performance based on clear criteria, and the policy should reliably and predictably reduce such support over time.

Although the EU faces a particular challenge in industrial policy stemming from its own unique institutional arrangement, the bloc cannot afford to remain fragmented or to content itself with a loose coordination of what is otherwise a collection of 27 individual industrial policies. If Europeans want to be present in key industries, they need to establish some central financing coordination policies as part of their industrial policy on the European level. Furthermore, it would advance the EU's innovativeness and capacity to secure good jobs in Europe if European industrial policy increasingly focused on European capabilities that create spillovers and positive

external effects on the EU market. This is distinct from the debate about allowing the establishment of European champions through changes in the EU's competition policy. With the establishment of a more strategic European industrial policy, the EU's role would not be limited to its strong competition competencies.

Conclusions

The goal of industrial policy should not be to produce everything at home. Instead, the goal needs to be to preserve the *capability of production* for all key technologies in the EU. In today's world of multipolar strategic competition, as well as of the digital and green transformations, the EU needs to rethink its industrial policy strategy. There would be a significant cost to pay if it focused solely on securing a 'level playing field' and regulating a 'large internal market', without a new emphasis on 'strategic production capabilities.'

In the new geostrategic competition, Europe must ensure key value chains on the EU market, as well as strong key infrastructures and the capability of production in the EU for all key technologies, because third countries will increasingly seek to leverage these against the EU. Europeans are currently discussing whether the EU should build a Resilience Office, or resilience architecture, to counter (economic) hybrid threats and coordinate the EU's economic policies more strategically for greater resilience in a geo-economic age. This resilience architecture needs to include an emphasis on building economic strength in a digital and green era, and this emphasis needs to include the newest findings on industrial policy.

Europe could make more active use of the wide range of tools at its disposal for securing strategic production capabilities. Recent research shows that this could create more efficient results and increase European prosperity. Failure to update its approach in order to make it more strategic and European could leave Europe and European businesses and workers worse off. With the EU's past industrial policy approach Europe will not be sufficiently equipped to deal with the triple challenge of geopolitics, digitalisation and decarbonisation.

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