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From Washington to Brussels, the Inflation Reduction Act and its Impact on the European Automotive Sector

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Introduction

Imagine a world where environmental responsibility and economic growth go hand in hand, shaping a sustainable future for generations to come. One year ago, on 16 August 2022, the United States made a groundbreaking move by signing the Inflation Reduction Act (IRA) into law, a milestone in the country's climate policy. With its substantial budget and ambitious goals, the IRA is hailed as a powerful weapon in the fight against climate change. While its focus is primarily on the domestic front, its far-reaching effects on the global market economy and its influence on the European Union's political and industrial decisions cannot be ignored.

In recent years, the global automotive industry has witnessed a remarkable shift towards embracing sustainability and adopting green technologies. Nations and economic powers worldwide, including the European Union (EU or Union), have been grappling with environmental challenges, acknowledging the pressing need to address climate change. As a result, industrial policies have emerged as crucial instruments to guide economic development towards a more sustainable and environmentally responsible trajectory.

The IRA's introduction was initially met with approval from the European Union, which viewed it as a positive step in the collective global effort to fight against climate change. However, amidst the applause, concerns began to surface regarding the potential ramifications of certain protectionist elements within the IRA. The fear of a potential flight of investment from the European Union to the United States emerged, but what impact will this have on the European automotive sector?

This thesis embarks on an exploration of the profound impact the Inflation Reduction Act will have on the European automotive industry, with a particular focus on the rapidly evolving landscape of electric vehicles (EVs) and the necessary infrastructure to support them. As the world transitions towards a more sustainable future, understanding the interplay between these two economic powerhouses becomes essential in fostering global cooperation and achieving collective environmental goals.

Research Question and Methodology

Therefore, the Research Question of this thesis is: "**What could be the impact of the Inflation Reduction Act on the European automotive sector?**"
To address the research question effectively, the following specific objectives will be pursued:

1. Understanding the revival of (green) industrial policies in Europe and their links with the automotive sector.
2. To assess the current state of the European automotive sector, including its economic importance, market trends, and challenges.
3. To examine the key provisions and mechanisms of the Inflation Reduction Act and understand its intended effects on the European and American automotive sector.
4. To examine the current European response and the position of European stakeholders of the automotive market.
5. To assess the potential future reactions of the EU through medium-term scenarios.

To begin, we will lay the groundwork by emphasising the importance of industrial policy in determining national economic strategies. After that, we'll look at the industrial policy of the EU for the automotive industry before exploring the Inflation Reduction Act of the US and how it affects electric vehicles market in the US. The impact of the IRA on the EU's automotive sector will then be examined, and the EU's response and adaptation will be covered in chapter 6. The final chapter offers potential long-term scenarios for the EU to keep its automotive sector competitive despite the impact of the IRA.

The methodology employed in this thesis follows a two-pronged approach, combining description and exploration of the impact of the Inflation Reduction Act on the European economy. While numerous think-tanks have previously studied this subject, this dissertation aims to contribute by offering a comprehensive representation of the phenomenon and conducting an in-depth analysis that establishes connections among the various components of the research.

To gather relevant data, the primary focus was on qualitative sources. A comprehensive review of scientific literature and academic works was undertaken to identify research hypotheses, particularly concerning industrial policy and the European automotive sector.

However, due to the limited availability of literature on the specific topics covered in the thesis, an extensive exploration was carried out through various channels. This involved consulting a wide range of books, reports from professionals and think-tanks, and publications from European institutions.

Limits

The complexity of industrial policies, particularly those within the European Union, was the first obstacle I ran into while writing this thesis. The EU has many tools at its disposal to shape its industries and economy, some of whose budgets and roles overlap. So, it was initially difficult for me to navigate and understand what was impacting on the European automotive sector. Moreover, the automotive industry is also complex: it is an interconnected sector with many different stakeholders. It can therefore be difficult to isolate the impact of the IRA from other factors likely to affect the industry.

Secondly, I encountered some restrictions in terms of the data's accessibility. There were few data on the Inflation Reduction Act's effects on the European automotive industry because it is a relatively new piece of legislation.
This restriction makes it challenging to accurately compare the amounts specified in the Inflation Reduction Act with Europe's green industrial policy, which is comprised of numerous instruments.

The final limitation concerns the scope of my research, which may be somehow limited. I have tried to be as comprehensive as possible in my analysis, but I have deliberately not taken certain factors into account, such as the impact of the price of electricity on production costs and consumer demand, the European elections, which could perhaps change the European approach, inflation trends, disruptions in the supply chain, geopolitical developments (the China-US trade war, the war in Ukraine), and so on.

Chapiter 1: The Roles of the Industrial Policy

1.1 Back to Industrial Policies

In today's rapidly changing global landscape, the resurgence of industrial policies is visible in great economic powerhouses like the United States and China, as well as in the European Union. This trend reflects a growing understanding of the value of strategic intervention and support for key industries. In this chapter, we look at the role of this resurgent industrial policies, the arguments in favor for its implementation in the economy, and its relevance for the European automotive industry. We uncover the driving forces behind the reinvigoration of European industrial policy by examining the European Union's economic challenges, the widening technological gap with other economic powers and the imperative of addressing environmental concerns.

The development of the recent industrial policy in this chapter is rooted in an observation about the European economy. The Sapir Reports (Sapir et al., 2004) highlighted the fact that the European Union of the early 2000's is lagging behind the US regarding the growth of its economy. The authors states that the social and economic model of the EU is not sustainable anymore. The technology gap is widening between the US and the EU in today's cutting-edge technologies, namely ICT, nanotechnology and biotechnology. Although some of the report's conclusions may be biased, notably due to an overestimation of US growth (Aglietta, 2009), the increasing digitalization of the economy, the emergence of American Big tech, and the increase in the technological content of services and manufacturing emphasize the need for a strong European industrial policy. (Defraigne and Nouveau, 2022).

It is in this context that we are seeing the re-emergence of a horizontal European industrial policy through the Lisbon strategy and the Europe 2020 programs. With globalization progressing and emerging countries – such as China gaining in economic importance and putting pressure on European industries – certain politicians and industries wanted to develop a more active industrial policy in the 2010s. This is notably the case of former Commissioner Mario Monti, and later still, the German government, supported by the Federation of German Industries. (BDI 2019; Federal Ministry for Economic Affairs and Energy, 2019) (Defraigne et al., 2022)

Another factor in favor of a European industrial policy is the international commitment to fight global warming and the resulting need to decarbonize European industry. Under the Juncker Commission (2014-2019), horizontal European initiatives are emerging to increase investment

in digital technologies (notably through the Digital Single Market), as well as to develop a low-carbon and circular economy.

Among the initiatives put in place by the Juncker Commission there are "industrial alliances" between the private and public sectors to develop strategic supply chains, particularly for battery production. (EC, 2017)

The von der Leyen Commission of today is going even further to encourage the digital and ecological transition of the European economy. The Green Deal, approved in 2021, notably aims to encourage the technological modernization of European industries so that they can gain a greater share of high added-value markets in the first neutral climate continent.

1.2 What is an Industrial Policy?

The objective of the EU industrial policy is juridically based on the article 173 of the Treaty on the functioning of the European Union (TFEU). This article states the following objectives: 1) speeding up the adjustment of industry to structural changes; 2) encouraging an environment favorable to initiative and to the development of undertakings throughout the Union, particularly small and medium-sized undertakings; 3) encouraging an environment favorable to cooperation between undertakings; 4) fostering better exploitation of the industrial potential of policies of innovation, research and technological development.

In other words, the objective of the European industrial policy is to create a framework for industrial competitiveness. According to the Commission, the Industrial policy of the EU is horizontal. It means that measures impact various domestic industries through the support, the coordination or complementarity of the policies and actions carried out by the Member States (Szczepański & Zachariadis, 2019). However, this horizontal policy must also consider the need and specific features of the different sectors in order to produce specific rules. It is the case in Europe for some sectors such as the automotive sector, tourism, defense industry, etc. EU industrial policy can be thus considered as horizontal based policy but with sectorial application.

In the book "*Introduction to EU Industrial Policy in the Multipolar Economy (2022)*", the authors cite and develop several arguments in favor of an industrial policy. The first one is "*the necessity of protecting a national industry in its infancy stage*", a theory first developed by Friedrich List. Although some authors have turned to Ricardo's theories of comparative advantage, Friedrich's theory and the protection of infant industries can enable the industry to

develop and benefit from the principles of economy of scale, learning by doing and therefore lower production costs.

Another argument pro-industrial policy developed by Brander & Spencer as well as by Krugman is the "strategic trade policy". A national intervention on an industry can be justified in the case of imperfect competition (presence of monopoly or international oligopoly) and when it is beneficial for the domestic welfare. In this respect, industrial policy has the objective of repatriating the foreign firm's profits to the domestic firm. It also can strengthen competition and thus increase consumer welfare. (Spencer and Brander, 2008)

An economic concept developed by Alfred Marshall also argues in favor of state intervention. Marshallian districts explain why firms in a similar industry tend to gather in a geographic area and benefit from external economies of scales (at level of an industry). According to this theory, the geographical clustering of firms operating in a same industry has many positive effects on the industry. For instance, in a Marshallian district, local schools and universities are becoming more specialized, attracting skilled workers/qualified labour from all over the world and generating informal transfers of useful information between companies. Marshallian districts also allow local authorities to give a special and industry-specific attention through the supply of public good. A last example of external economies of scales is the positive effects for suppliers and transport companies who can reduce their costs due to the proximity of the companies in the industry. (Krugman and Obstfeld 2009; Dicken 2015; Defraigne et al. 2022)

The term "knowledge spillovers", particularly developed by Romer in 1986 and 1990, refers to a phenomenon where ideas, skills and information move between economic actors, fostering innovation and economic growth. These "knowledge spillovers" are crucial in the context of industrial policy for encouraging collaboration and share of information between businesses, research institutions, universities and governments. These knowledge transfers have many advantages. For starters, they allow companies to benefit from new ideas and advanced technical skills, encouraging competition between actors and promoting innovation and improvement in products and manufacturing processes. Furthermore, knowledge spillovers can help overcome barriers to entry in the automotive industry by allowing new companies to benefit from established players' knowledge. Knowledge transfer also contributes to the growth of industrial clusters and innovation ecosystems. This entails building strong networks between

carmakers, parts manufacturers, technology suppliers and research centers in Europe. These collaborations promote the best practices sharing, the rapid dissemination of new technologies and the development of skilled talent.

State support is also important when knowledges spillovers do not encourage companies to invest in research and development. By benefiting from the advantages developed by other companies, some competitors may tend to reduce their investments in research. For all these reasons, government support seems to be essential to maintain an industry at the top of its game.

1.2.1 A Green Industrial Policy in the EU

In January 2020, “the new President of the European Commission” published her plan to make Europe the first climate-neutral continent by 2050. This can be seen as an industrial revolution with a deadline, where Europe could make profound changes to its economic structure, moving away from fossil fuels to renewable energies and swapping diesel cars for electric ones. The European Green Deal also can be seen as a challenge to transform decarbonization into an opportunity for the European economy, as it ensures long-term economic growth and job creation. A "green industrial policy" will therefore be critical to Europe's climate change ambitions in this context of broad, paradigmatic change for European industry. (Tagliapietra & Veugelers, 2020)

A green industrial policy must provide the opportunity and the necessary support for the European automotive industry to face current challenges, such as the rise of the Chinese electric vehicle market or the IRA's protective measures in the United States. As a result, this policy framework will not only support the European Green Deal's climate change objectives, but it will also position European automotive manufacturers and suppliers as global leaders in the market for electric vehicles and sustainable mobility solutions.

Chapter 2: The European Industrial Policy and its Automotive Sector

Several goals have been established by European policies for the automotive industry over the years. This industry is shaped to be competitive with other markets such as the United States, Japan and more recently, China. The goal has also been to transform the sector so that it is in tune with its environment and times, for example to transform the car industry into a less polluting and a safer model to deal with the 1970s crisis or, more recently, to meet the Green Deal objectives.

For this purpose, European automotive policies have taken different forms: European standards, protectionist trade policies (high tariffs or quotas), exemptions from competition rules, or massive transfers of FDI to Southern and Eastern Europe. (Klebaner & Ramirez, 2022)

2.1 General overview of the European Automotive Industry

2.1.1 European Car Market

The European automotive market, like many other sectors, has suffered from the Covid-19 crisis, with fewer vehicles produced and sold than before the crisis. However, this is the case all over the world, which does not affect Europe's share of the global total. (ACEA, 2022) Despite challenges (rising oil prices, decarbonisation, supply-chain shocks, etc.), the European automotive industry continues to represent a strategic and crucial element for Europe’s prosperity.

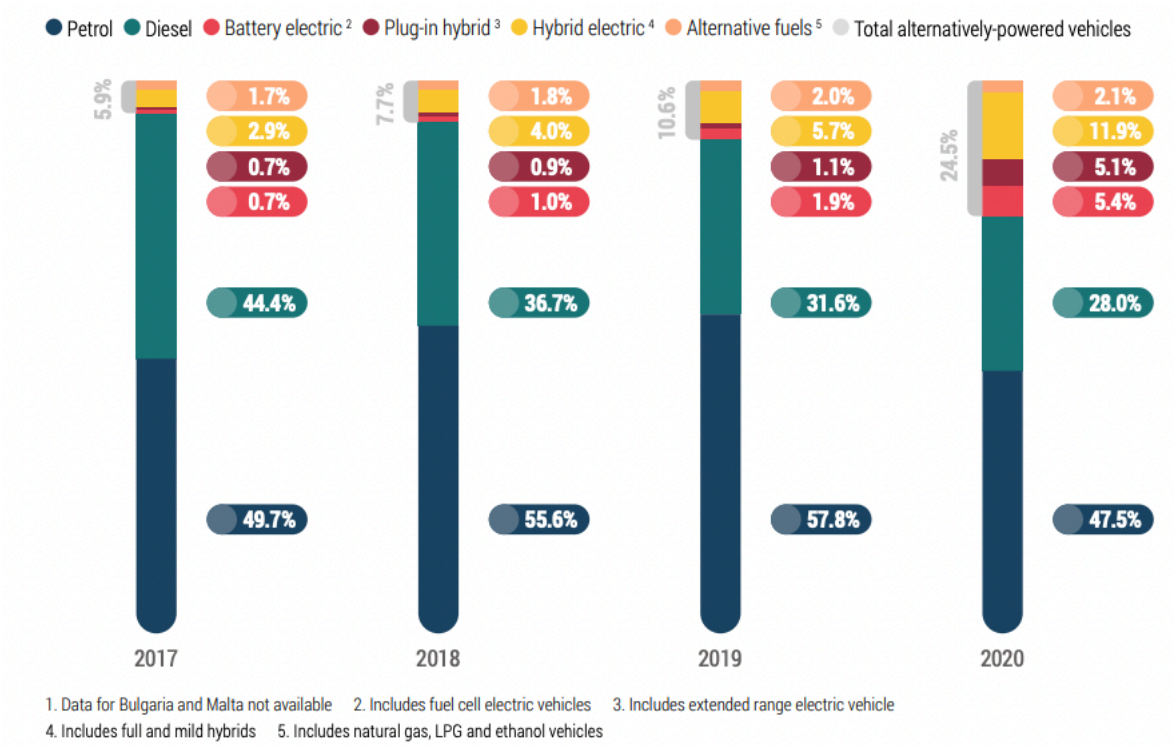
With almost 12.9 million vehicles produced in 2020, Europe is the world's second-largest automotive production region behind China, accounting for 22% of global production. China produced 25.5 million vehicles in 2020, or 33% of global production. With a market share of 17% and 13.4 million vehicles produced in 2020, North America completes the top three. In terms of market volume, European Union recorded 11.6 million new vehicles in a year, placing itself third after China (25.5 million) and the United States (15.05 million).

The automotive industry remains the biggest employer of the EU with 12.6 million workers employed directly and indirectly, accounting for 6.6% of total employment in the EU in its entire ecosystem. The automotive industry has also a significant multiplier effect on the economy and generates a lot of positive spillovers. It is essential for both upstream industries like steel, chemicals, electronics and textiles and for downstream industries like ICT, repair and mobility services. Its turnover represents 7% of EU GDP. (European Commission, 2023)

Moreover, the automotive industry makes a major contribution to Europe's balance of trade, with net exports of €96 billion in 2022 (Eurostat, 2023). The main destinations are the United Kingdom and the United States (17.9% of European exports).
In addition to representing €398,4 billions in taxes in 2019, the automotive industry is also Europe's leading industry for R&D expenditure with €62 billions, much more than any other regions in the world.

In terms of electric vehicles, European automotive industry is still in the early stages, with only a small percentage of production and an even smaller percentage of the global car fleet. According to ACEA, battery-electric, plug-in hybrid and hybrid electric vehicles accounted for only 22.4% of all vehicles produced in 2020 in the EU. However, as shown in figure 1, strong growth is operating in this type of vehicle. In 2019, these cars accounted for only 8.6% of the total. However, we can note that the development of electric vehicles slowed in that year due to the Covid-19 crisis. This figure will continue to grow significantly over the years.

Figure 1: New Cars in the EU by Fuel Type (ACEA, 2022)

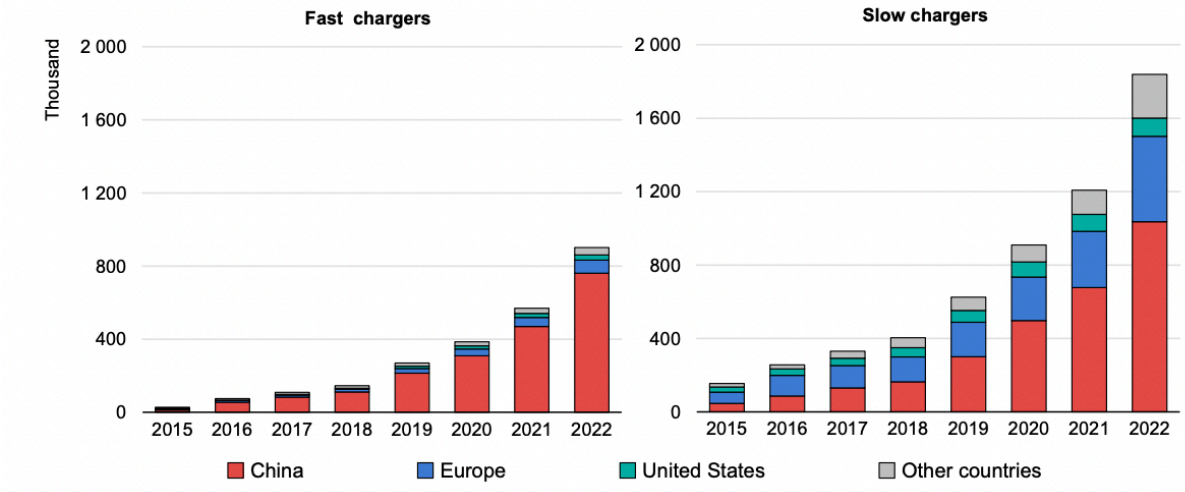


It is also interesting to look at the European battery industry, given that batteries are an essential component of electric cars. In 2022, 14% of all new cars sold all over the world were electric, up from around 9% in 2021 and less than 5% in 2020. As previously stated, China dominates in terms of market share, followed by the EU and the United States. However, unlike the global car market, China's share of global electric car sales accounts for around 60% by 2022. Electric car sales in the United States increased 55% in 2022, reaching a sales share of 8%. (Internal Agency energy, 2023)

2.1.2 Charging Infrastructure

Having a green car fleet is great, but having the infrastructure needed to run it efficiently, particularly charging infrastructure, is crucial and will necessitate significant investment in Europe. Although most charging needs can be met at home, public chargers are required. Europe is still second, just behind China, in terms of slow charging points, as showed in table 2, with almost 460,000 on its territory, a 50% increase on last year. By contrast, the US is lagging behind, with an increase of just 9% on last year. Meanwhile, only China has a significant infrastructure in terms of fast chargers. (ICEA, 2023) Moreover, by the end of 2022, Europe's total fast charger stock had surpassed 70 000, representing a 55% increase over 2021. The total number of fast chargers will reach 28,000 by the end of 2022, with Tesla accounting for almost 3/4 of those installed this year.

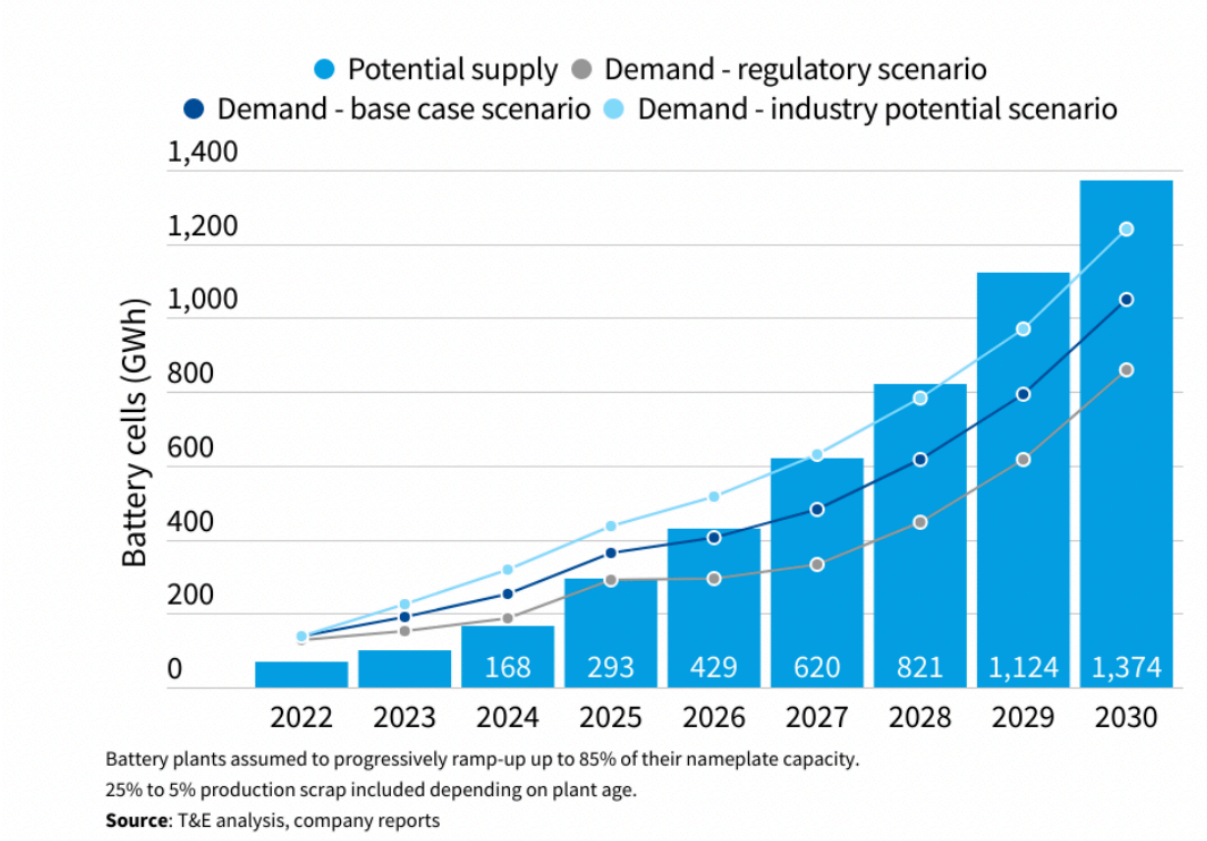
Table 2: Installed publicly accessible light-duty vehicle charging points by power rating and region, 2015-2022 (ICEA, 2023)



2.1.3 European Battery Industry

According to Transport & Environment (2023), Europe is on track to produce 6.7 million battery electric cars by 2030, meeting the recently agreed -55% CO2 target for car manufacturers by 2030. Currently, half of the batteries used in electric vehicles are produced in the European Union, and the organisation believes that by 2027, the EU could produce 100% of its battery demand, as showed in Table 3. The EU's phase-out of diesel and petrol cars and vans is expected to boost demand for lithium-ion batteries over the next decade. For now, two-thirds of all active cathode materials in these batteries are already produced in Europe.
China currently dominates the rare metals market, but according to the same report, 50% of the demand for refined lithium could come from European projects, significantly reducing reliance on China.

Table 3: Battery cell production output and demand scenarios in Europe (Transport & Environment).



In the EU, an agreement between the European Commission and the European Investment Bank will make over EUR 1.5 billion available for alternative fuel infrastructure, including electric fast charging, by the end of 2023 (European Investment Bank, 2021). This is in accordance with the Alternative Fuels Infrastructure Regulation (part of Fit for 55) which will establish requirements for electric charging coverage across the trans-European network-transport.

2.2 The Evolution of the Automotive Industry

The European automotive industry has undergone profound structural changes in its value chain over the last 25 years. The 2000s saw a transfer of FDI from Central Europe to Southern and Eastern Europe, made possible by the gradual liberalisation of their economies in the 1990s. Slovakia, the Czech Republic, Poland and Turkey have become as important producers as traditionally productive nations. Production of light commercial vehicles (LCVs) and passenger cars (PCs) increased by a factor of 3.1 between 2000 and 2017, representing 28.7% of European production compared with 9.9% in the 2000s. Slovakia produces 450% more vehicles than in the 2000s, and the Czech Republic produced almost as many as the UK in 2018. (Frigant and Jullien, 2018)

The value chain was transformed when these new countries joined the European Union in 2004. Following the opening up of their markets to the European internal market, combined with the financial crisis of 2008, which did not allow for a strong increase in salaries, the market for locally produced cars found itself in competition with that for second-hand cars. As a result, the multinational car companies have reorganised their production strategies within the European continent. As a result, smaller and cheaper cars are produced in peripheral countries (Spain, Turkey, Eastern Europe) while more expensive cars with higher added value are produced in Central Europe (France, Belgium, Germany and the UK). (Frigant and Jullien, 2018)

The European automotive market has also undergone changes in its distribution between manufacturers. In the 1990s the European market was made up mainly of French, German and Italian car manufacturers. However, Japanese and US foreign direct investment in Europe and the opening up of the European market have altered this balance. Indeed, as the European car market is highly fragmented and mainly dominated by the German car industry, the penetration of non-European individual brands has remained relatively low. (Klebaner & Pérez, 2022)

To summarize, the influence of policy decisions on structural transformations, production strategies, distribution patterns, and the overall competitiveness of European and non-European automakers in the European market demonstrates the close relationship between European industrial policy and the evolution of the automotive industry. The EU and its member states' policies have shaped the European industry's trajectory and played a critical role in its development.

2.3 The Role of Car Manufacturers in Industrial Policy

Historically, car manufacturers have always been involved in the creation of industrial policies. Already at the beginning of the European project in the 1950s, the price control policies of the European Coal and Steel Community, directly affected car manufacturers because of their intensive use of steel in their production. Then, as some of them were state-owned companies, they were directly involved in the negotiation leading the creation of the European Economic Community (EEC) in 1957 and the policies subsequently developed by the ancestor of the EU. Other examples highlight the involvement of car producers in European policies, like one of them is the role of the large French car producers in monitoring non-European FDI, to "control" investment by US companies whose financial capabilities threatened the sector. Discussions were also held on common trade policies, such as quantitative restrictions or high foreign trade tariffs, as well as on technical regulations in the event of tariff cuts. Finally, a new lobby was created in 1972: the Committee of Common Market Automobile constructors (ancestor of the European Automobile Manufacturers' Association). Its objective was to discuss and propose common standards for the European automobile market. (Klebaner & Pérez, 2022)

The progressive deterioration of the automotive sector has prompted the European Commission to develop a long-term plan for the industry. A first roadmap, CARS 21, was published in 2006 after consultation with all EU institutions and industry stakeholders. After a review in 2012, the final report came the same year under the name of CARS 2020. Then the Dieselgate scandal in 2015 prompted the Commission to adapt its roadmap, resulting in GEAR 2030. This High-level group on Automotive industry ensures that Europe has the most competitive, innovative and sustainable automotive industry of the 2030s and beyond". (DG Grow, 2017)

The group, composed of many stakeholders such as Member States or industrial and societal stakeholders, established objectives, defined responsibilities and made recommendation to reinforce the competitiveness of the European automotive industry. (Meyer, 2018) In the context of global transformation of the automobile industry, the purpose of the report GEAR 2030 is to deal with the environmental, safety and traffic challenges by developing a coordinated and effective approach for electric and autonomous vehicles. (Covarrubias and Ramirez Perez, 2020)

Through the GEAR2030 roadmap, the European Commission identifies five keys trade and challenges: new business models and technologies; environmental issues; societal changes; globalization; and rise of new players. Environmental issues are not the only driving force behind the future of the European car industry. The roadmap therefore aims to establish systemic policies to develop internal capabilities for innovation and manufacturing.
The internal policies focus on four objectives (Klebaner and Ramirez Perez, 2018): the profitability of zero emission vehicles; the acceptability of autonomous vehicles; the supply chain (raw materials and batteries); as well as the automation and digitalization of manufacturing. Each of these objectives is addressed through five instruments, which constitute the policies. These are the regulatory impulse; the framework and infrastructure; the supply side policy; the demand side policy; and employment policy.

In concrete terms, this initiative serves to boost electric vehicles production in Europe and to develop battery production, which was not strongly developed at the time the report of the Commission was published. This roadmap seems to be necessary to develop the environment both on the producer side (in terms of R&D programs, infrastructure development, regulatory frameworks, etc.), and on the consumer side so that they all can use electric vehicles.

2.4 The EU Green Deal and Fit for 55

The Green Deal industrial plan can be viewed as a response to the IRA, an attempt to keep clean tech and clean energy companies from leaving for the United States. We will discuss about this European plan in a further section. Before the IRA's announcement, there were two main policies dealing with climate issues in the European Union: The European Green Deal, which set out the path for the green transition, and Fit-for 55, which aims to reduce EU emissions by at least 55% by 2030.

For several years now, as part of these policies, the European Union has been directly proposing investments in the battery and electric vehicles value chains. The most important projects include the adoption of two packages of Important Projects of Common European Interest (IPCEIs) in 2019 and 2021. As a result of investment from Member States and private investors, the battery value chain has attracted €8.2 billion in 2020 and €11.9 billion in 2021 (European Commission, 2019). Horizon Europe allocated €925 million in Research and Development funding, primarily for battery-related projects through the BATT4EU Partnership (BATT4EU, 2023). In 2020, the European Investment Bank (EIB) has committed €1 billion to battery-related projects, with projects such as a €350 million loan to support Northvolt's gigafactory for lithium-ion battery cells in Sweden or a €125 million loan to Belgian company Umicore to finance a cathode manufacturing plant in Poland. (EIB, 2020). In the future, the EIB and other European public banks hope to mobilize more than €372 billion in public and private investment across Europe through the InvestEU programme, which runs from 2021 to 2027.

Chapter 3: The American Industrial Policies regarding Electric Vehicles

3.1 The Inflation Reduction Act

In 2021, the average price of a new electric car in the United States was $US 10,000 higher than a conventional car (Lindwall, 2022), implying therefore that it was not advantageous for Americans to trade in their petrol car for an electric car. However, with the Inflation Reduction Act of 2022 and other policies that aim to encourage consumers to buy electric vehicles, these price disparities could be much smaller. According to the *New York Times*, the price of electric vehicles could fall to the same level as the petrol cars in 2023, while according to others, we will have to wait a few years to see the impact of the IRA's measures.

The American Inflation Reduction Act is seen as a major breakthrough in US climate policy as it represents the country's largest single investment in the fight against climate change, to the tune of $US 369 billion. This legislative package combines large-scale green subsidies, healthcare savings and new revenue measures. The IRA is expected to close two-thirds of the gap between the US's current greenhouse gas emissions and its 2030 climate target. (Kleimann & all 2023) The aim is to develop a supply chain for sustainable and green technologies in the United States and to encourage the purchase of these technologies and materials domestically, while reducing American dependence on Chinese products such as batteries. In concrete terms, the Inflation Reduction Act consists of three sets of measures: tax reform, healthcare reform and energy and climate legislation. For the purposes of this report, we will mainly analyse the measures specific to the electric vehicle and battery markets.

The combination of the IRA's consumer and manufacturing policies, such as tax credits for consumers or for individual and commercial charging infrastructure, will undoubtedly speed up the switch to zero-emission vehicles. (Slowik et al., 2023)
In practical terms, energy and climate measures can be divided into three categories: vehicle purchase subsidies; production and investment subsidies for manufacturers of clean technology products; and subsidies for producers of carbon-neutral energy. As part of this thesis, only the first two measures are of interest.

The provisions of the Clean Vehicle Credit offer consumers tax credit subsidies of up to $US 7,500 for the purchase of an electric vehicle if certain conditions are met, in particular

local content requirements (IRA Title 26 USC §30D). These subsidies can also be applied to "clean" commercial vehicles with a tax credit that can rise to 30% of the purchase price of the vehicle (26 USC §45W). The various vehicles considered "clean" in the IRA include plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs) and fuel electric vehicles (FCEVs) (Slowik, 2023).

To be able to benefit from part of these subsidies, carmakers must invest in the United States or in its Free Trade Agreement partners because of local content requirements conditions. The $US 7,500 of consumer tax credit would indeed apply only to electric cars whose final assembly took place in North America (USA, Canada or Mexico).
Currently, 50% of the tax credit ($US 3,750) is granted if at least 40% of the minerals in the battery are extracted, processed or recycled in the United States or in a US free trade partner country. This threshold is set to rise each year, reaching 50% in 2024 and 80% in 2027. The remaining 50% are subject to the same local requirements but for the composition and manufacture of the battery. Thus, in 2029, 100% of the value of the battery components will have to be manufactured or assembled in North America to benefit from the subsidies (US Department of energy, 2023). Furthermore, from 2024 and 2025, any use of batteries or critical minerals from China, Russia, Iran or North Korea will exclude the vehicle from the tax credit.

On the producers side, to encourage domestic production of certain components, particularly batteries, the Advanced Manufacturing Production Credit (26 USC §45X) offers a 10% tax credit on the production costs of critical minerals and another 10% tax credits of the costs of active materials for battery electrodes. In addition, if the cells and modules for battery production are produced together, producers can be subsidized to the extent of $US 45 per kilowatt-hour (kWh). (Transport and Environment, 2023) This means that if a manufacturer produces an electric vehicle in the US with a mid-sized 75 kWh battery, including cells and modules, it would receive a direct subsidy of $US 3,375. For larger capacity vehicles, these direct subsidies can be as much as $US 3,600. Importing into Europe a vehicle produced in the United States worth $US 36,000 can therefore be more advantageous, even with a 10% tariff.

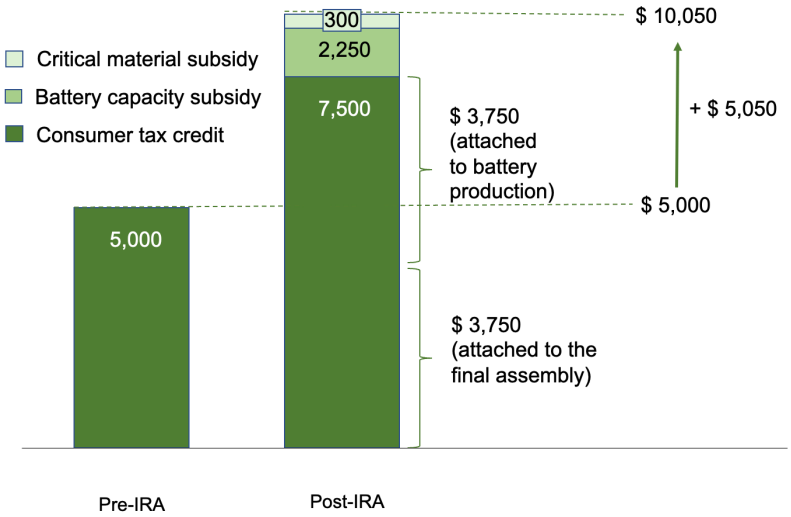
Those direct subsidies seem to indeed attract foreign direct investments in the US. More than $US 13 billion worth of investments have already been announced since the IRA came into force, in other words in less than three months. These funds are mainly invested in the production of raw materials for batteries and in the manufacture of batteries and electric

vehicles (Trudell & Coppola, 2022). While Volkswagen and Mercedes-Benz quickly signed agreements to acquire mining and refining resources in Canada, BMW announced that it would invest $US 1.7 billion to increase the size of its SUV plant in South Carolina and that its battery supplier would build a new facility nearby. (Trudell & Coppola, 2022)

3.1.1 A Concrete Example

Næss-Schmidt et al. (2023) calculated the direct impact of IRA measures on a car model: the Volvo S60 from 2019. Before the IRA, some car models were already eligible for federal support, as in the case of the Volvo S60 plug-in hybrid, currently priced at $US 52,000. It was eligible for a consumer tax credit of $US 5,000, accounting for 9.6% of the retail price.
Now with the IRA, the subsidies include a consumer tax credit of $US 7500, a $US 2,250 subsidies for a battery of 50 kWh, as well as a credit of 10% for the production cost subsidy for critical materials (approximately $US 300). The IRA subsidy rises to $US 10,050, which represents 19% of the car's selling price: that's an increase of just over $US 5,000. These subsidies are only available if the Volvo meets all the local requirements.

Table 4: Example of IRA subsidies (Vovlo V60 from 2019) (from Næss-Schmidt et al., 2023)



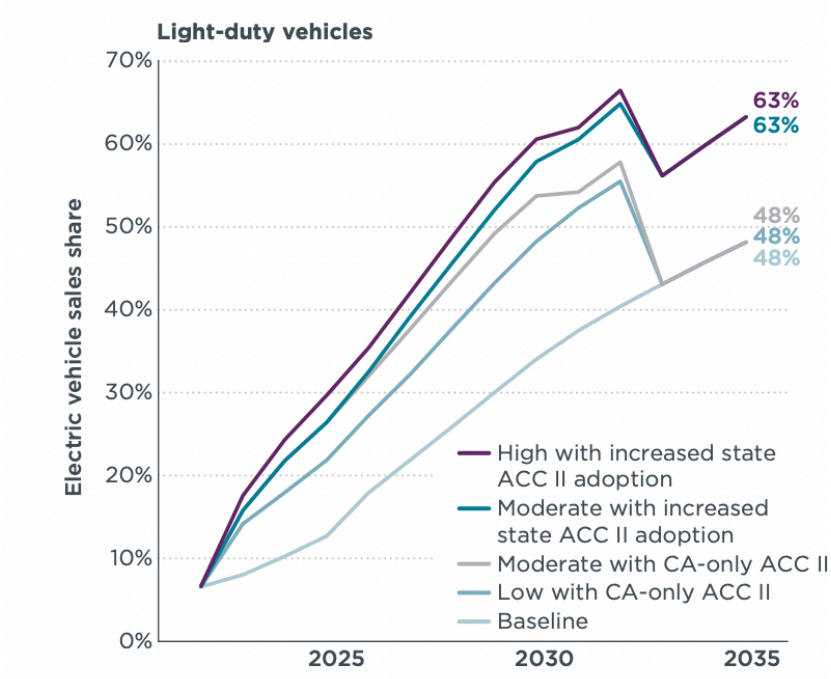
3.1.2 Impact of IRA on the Electric Vehicles Market in the US

According to Slowik et al. (2023), the Inflation Reduction Act should definitely accelerate electrification in the US. The authors made predictions about the adoption of light and heavy-duty electric vehicles, which is expected to occur as a result of manufacturing cost reductions and IRA incentives.

They anticipate a 48%-61% EV sales share in the light-duty sector by 2030, increasing to 56%-67% by 2032, the final year of the IRA tax credits. As shown in the Figure 5, the share of electric sale in the baseline scenario (without any IRA measures) would increase from 7% today to 34% by 2030 and 48% by 2035. With the IRA measures, the price of electric vehicles is expected to diminish and the share of sale, to increase. Furthermore, more stringent action on the part of states, such as the Advanced Clean Car standards (ACC II), could increase the proportion of electric vehicles in the total number of cars sold. ACC II is a set of regulations adopted by the California Air Resources Board (CARB) which requires a ramp-up of Zero Emission Vehicules (ZEVs) from 35% in 2026 to 100% in 2035 (Harris, K., 2023). Under the IRA high scenario with more states adopting ACC II, national electric vehicle sales share shall increase to about 61% by 2030.

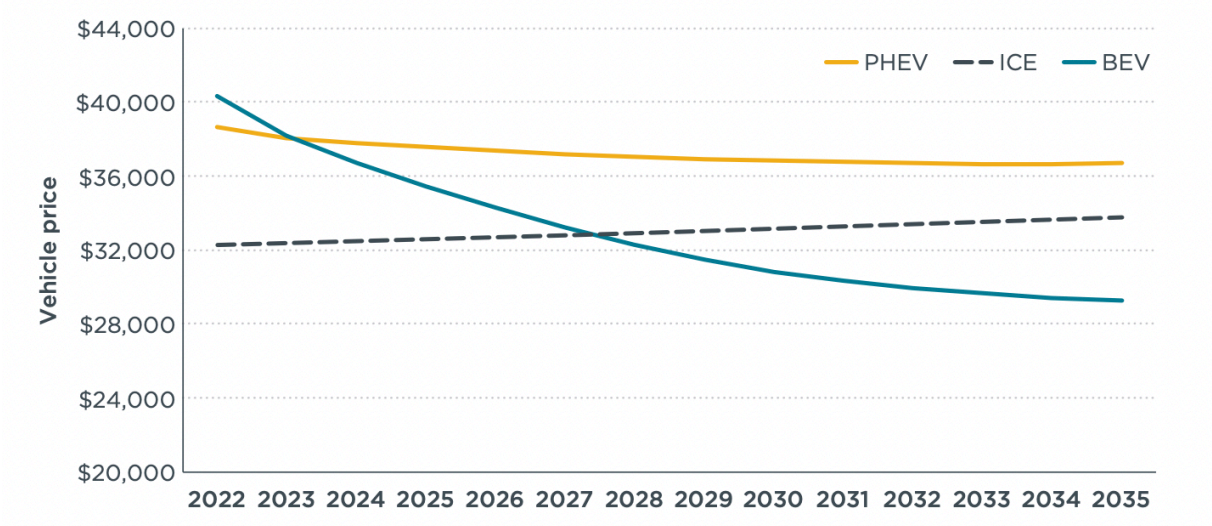
The difference between the shares of electric vehicle sales in the baseline scenario without IRA and with the IRA scenarios shows the impact of purchase incentives and battery tax credits on consumer purchasing decisions. Under the IRA, projected electric vehicle sales shares are almost doubled compared to the baseline scenario.

Figure 5: light-duty electric vehicle shares for 2022 through 2035 for the five scenarios (Slowik et al., 2023)



As we have seen, the measures in the US legislation, both on the part of producers and in terms of incentives for consumers, could significantly reduce the price of electric cars, notably for Battery Electric Vehicles (BEVs). The figure 6 illustrates the trend in average prices for conventional and electric vehicles between 2022 and 2035. According to Slowik et al (2023), the average price of BEV would decline from $US 40,300 in 2022 to $US 29,200 by 2035. The authors expect that the price parity would be achieved in 2027-2028, thanks to further technological advancements and reduced battery costs. However, the price of traditional cars should continue to rise over the years.

Figure 6: Price trends for electric and conventional cars (Slowik et al. 2023)



Since the IRA is based mainly on tax breaks and has no ceiling, it can be a victim of its own success. The danger of the IRA is the pression that could occur for the national debt. It risks indeed to considerably increase debt in a country where the government is already heavily indebted, which would require corrective measures in the event of pressure from the financial markets. The final tax cost will depend on how these subsidies are used by households and businesses. Some studies, including Bistline et al. (2023), estimate that the costs could be higher than the figures announced by the government when the act was launched, and could vary between $US 800 billion and $US 1.2 trillion. The political debates at the end of May 2023 and the refusal of the Republicans to raise the US debt ceiling showed certain limits to the absorption capacity of an uncapped policy.

However, these figures need to be put into perspective, according to Jansen et al. (2023), given that the US economy is very large, with a GDP of 26 trillion in 2022, and given that these measures should be implemented over a decade.

3.2 Comparison between IRA and EU Green Subsidies

The Covid-19 pandemic and the war in Ukraine demonstrate once again the vulnerability of international supply chains (Export restriction, bilateral dependencies, etc.). The industrial policies of the US and the EU, which look like a subsidy race or even a trade war, could be seen as a way of reducing these vulnerabilities by diversifying strategic supply chains and asserting their strategic autonomy and independence in areas linked to the economy of tomorrow.

One of the main differences between the Inflation Reduction Act and European climate measures is that Europe supports its players through funds, which are frequently financed through debt, whereas the IRA does not. If Joe Biden's climate policy does not generate funds, it may have a significant impact on the US government's tax collection. Indeed, when the measures are implemented (tax credits for consumers and producers), a significant tax cut may take place and should therefore be financed by the US debt. In fact, the difference lies in the philosophy behind the plan: while Biden administration trying to re-allocate existing resources within its budget, by cutting on old priorities in favour of new ones, the EU is simply adding new political priorities, where the additional expenditure is borne by the taxpayers.

According to Scheinert (2023), there is another difference: the macroeconomic implication. As the name of the policy implies, the Inflation Reduction Act's aim is to support the Federal Reserve Board (Fed) in reducing inflation (by reducing prices on energy and drugs, closing tax loopholes, etc.). On the contrary, the EU's approach involving debt-financed funds raises current purchasing power, which contradicts the Eurosystem's effort to keep inflation near 2% and may force it to conduct even more restrictive monetary policy.

The exact comparison in number is very difficult, not least because the size of the IRA is not known with certainty, but because of divergence in time horizons and instruments. For example, the IRA is not the only new US industrial policy act. While the NextGenEU program supports investment spending on infrastructure and electricity networks, these are supported in the US with the Infrastructure and Jobs Act, a package introduced in 2021 that adds another $US 1.2 trillion in federal investment. Comparisons are also hampered by a scarcity of systematic data on green industrial policies at the Member State's level in the European Union (Jansen et al., 2023) and on the measures taken at the state's level in the US. As an example, the subsidies for the purchase of electric cars and their batteries in the EU are decided at the

Member State's level based on their rules and budgets. Today, according to the ACEA (2022), 21 EU Member States offer incentives for the purchase of electric cars, six provide tax reductions or exemptions and only one – Estonia – does not offer any fiscal stimuli at all.

However, it is interesting to examinate some estimates that have been made, notably by Bruegel (2023) when it comes to measuring results, qualitative factors are frequently more important than quantitative ones.

According to the think tank, the green subsidies provided by the IRA and those provided by the EU are roughly of the same order, with the exception of renewable energy production for which EU subsidies remain much higher. However, some IRA subsidies discriminate against foreign producers while it is not the case of EU subsidies. There is also a significant qualitative difference: the IRA clean technology subsidies are simpler and less fragmented, focusing on mass deployment of green technologies, whereas EU support is more focused on innovation and new technologies.

The purchase subsidies for electric cars in the European Union amount to €6 billion, giving an average of €6,000 in subsidies per vehicle in 2022. Unlike the IRA measures, they do not generally discriminate between different producers.

For European producers, clean-tech manufacturing is supported through a variety of instruments and programs such as the EU Important Projects of Common European Interest (IPCEIs) that support battery and hydrogen manufacturing, the EU innovation Fund that encourages the development and early implementation of clean technologies and processes in energy-intensive industries, there is also the European Innovation Council which aims at scaling-up break-through technologies, or the European Investment Bank and the InvestEU program that also offer loans to clean technology projects.

Table 7: US vs EU Green subsidies (Bruegel, 2023) [1]

Category	IRA	EU
Electric Car purchase	$US 7500/car	€6000/car
Clean-tech manufacturing	$US 37 billion	€35 billion

The table 7 shows that IRA and EU subsidies for the purchase of electric vehicles and the manufacture of clean technologies are similar in scale. The primary distinction between the United States and the European Union may not lie in the overall anticipated amount of green subsidies, but rather in their qualitative aspects. To begin with, the subsidies provided by the IRA show discrimination against foreign producers, unlike the subsidies offered by the EU. Additionally, the IRA offers straightforward clean-tech manufacturing assistance through 10-year tax credits, whereas EU support is often fragmented, perceived as slower and more bureaucratic and sometimes, of shorter duration. Lastly, concerning clean-tech advancements, the IRA concentrates mainly on widespread implementation of current generation technologies, while EU support tends to prioritize innovation and early-stage adoption of new technologies. (Kleimann et al., 2023)

[1] *The comparison is fraught with difficulties. First, estimates for EU clean-tech manufacturing support and renewable energy subsidies are based on approved aid volumes and on the extrapolation of recent aid, while the IRA estimates are based on the take-up assumptions in CBO (2022). Second, support items are missing on both the EU and the US sides. Estimates for clean-tech manufacturing support exclude national-level state aid (except for the IPCEIs). IRA figures obviously exclude state- and local-level support, and federal programmes outside the IRA. Given these uncertainties, the numbers in the table should be interpreted as illustrative*. (Kliemann and all, 2023 for Bruegel p. 6.)

Chapter 4: The Impact of the IRA on the EU

The White House's announcement of the IRA prompted a two-pronged reaction from the European Union. First of all, Biden's climate plan was warmly welcomed by Europeans, who saw in this policy an ally for the ecological transition. Secondly, this massive plan with local requirements conditions was seen as a new shock for European industry, after Covid-19 and the war in Ukraine. Many stakeholders therefore called for a rapid and appropriate response from the European institutions.

4.1 The Impact on EU Battery Production

One of the European sectors linked to the electric car industry that could be severely impacted by the IRA is the battery value chain. According to the European Federation for Transport and Environment, if no action is taken, 68% of potential battery production capacity in Europe could be delayed, reduced or not realised, mainly because of the subsidies provided by the US Act.

Indeed, China's long-standing support for its battery and electric vehicle sectors, together with the recent US IRA, could result in a syphoning of investment away from batteries and essential metals in Europe. Only a few months after the launch of the IRA in the US, investments in battery factories, new metal processing facilities and electric vehicle factories has grown dramatically in North America. At the same time, the European media are making headlines by announcing that companies such as Tesla, Northvolt and Iberdrola will prioritise the construction of factories in the United States (Euractiv, 2023). Volkswagen says it is suspending plans for a battery plant in Eastern Europe and is prioritising a similar plant in North America, after estimating that it could benefit from €10 billion in incentives in the US (FT, 2023).

In 2021, China and Europe dominated global investments in lithium-ion batteries, according to BloombergNEF analysis (2023). However, the landscape changed significantly in 2022, as overall investment nearly doubled. The United States experienced substantial growth in absolute terms, while maintaining a consistent global share. Conversely, Europe's share of global investments plummeted from 41% in 2021 to just 2% in 2022, with China leading the way in terms of investment. The US is expected to increase its share further in the coming years, thanks to a growing number of battery cell projects. This points to a global reprioritisation of battery investment, with a shift from Europe to the US.

Developing two parallel value chains for batteries on either side of the Atlantic appears to be a zero-sum game: benefiting from the shared learning and support of each seems difficult. Financial resources, natural resources and raw materials (lithium and nickel) as well as labour and skills are limited and would make it impossible to duplicate the value chain. (Transport & Environment, 2023)

Competition could therefore be much fiercer between European and American battery manufacturers. According to a study by the Hertie School (2023), if American battery producers can benefit from all the subsidies, batteries could be up to 30% cheaper in the United States than in Europe. The fact that the US provides direct production subsidies rather than simply supporting capital investment will make the expansion of advanced technology production much more attractive than in the EU.

4.2 The Impact of the IRA on the EU Automotive Industry

It is difficult, if not impossible, to quantify the actual impact of the IRA on the European electric vehicle production and value chain. We can however draw certain qualitative hypotheses. While China and the European Union have introduced supply and demand policies to stimulate EV markets, the lack of policy in the United States has so far been the main obstacle to its delay.

Today, the IRA seeks to increase EV sales as well as the production in the United States. Its main weapon, as we have seen, is the tax exemption, which can be a direct response to consumer concerns about price as much as $US 7,500. This aid is conditional on three factors: the final assembly of the vehicle in North America; the use, in the vehicle's battery, of a specific percentage of critical minerals from countries that have concluded free trade agreements with the United States; and the fact that part of the battery's components are manufactured in North America.

In other words, these new requirements immediately made ineligible many foreign-made electric vehicles that previously benefited from US EV tax credits (Guix, 2023). Thanks to IRA’s $US 7,500 consumer tax credit, the cost of a car eligible for the subsidy could be reduced by a fifth compared with a car not eligible for the subsidy. This could have a significant impact on foreign automakers' ability to maintain their current market share in the United States. The result for the EU could be significant losses in exports to the US (Kleimann, 2023).

The EU therefore fears that these major car manufacturers will relocate part of their production chain to the United States.
Another problem is that this situation is taking place at a time when the proportion of Chinese electric vehicle imports into Europe is increasing and, conversely, the proportion of European vehicle exports to the Chinese market is falling.

4.2.1 Positive Impact for the EU

The IRA could also have a positive impact for the European Union and its automotive industry. In a paper, Huther, M. & Mattes, J. (2022) argues that the German economy could finally end up benefiting from the IRA instead of losing out: boosting the American economy should benefit German exports. Indeed, according to the authors, most of German cars exported to the US are too expensive to fall out to the subsidy scheme anyway because taxes breaks are only granted to products under a certain price. As a result, local content requirements don't seem to affect German cars, at least the more expensive ones. Moreover, shifting a big part of the supply chains in the US is too expensive and the authors think it's not worth taking so many risks.

The US under the Biden administration has already introduced several comprehensive fiscal packages. These include the American Rescue Plan (ARP) of $US 1,7 trillion, whose short-term objective is to counter the negative effects of the COVID-19 pandemic, and the more medium- to long-term Infrastructure Investment and Jobs Act (IIJA), with a budget of $US 550 billion over ten years. The US economy has benefited greatly from the ARP, which has also benefited the German economy. The ARP would have actually increased US economic output by almost 7% in 2021 alone, and thanks to a significant positive spill-over effect, German output would have grown by 1,4% due to German exports. Almost half of Bavaria's 3.0% growth in 2021 is due to the ARP. This is also the case for the IIJA, albeit to a lesser extent but with a longer-term impact (Bavarian Industry Association).

The administration of Biden is in fact expected to respond to European concerns and a part of solution has already been found. According to media reports, EU cars (including exported ones) leased as company cars in the United States may be classified as commercial vehicles, to which the local-content requirement applies (Fasse et al., 2022). Through such a

"leasing solution," a significant proportion of German exported electric vehicles should therefore be able to benefit from IRA funding. According to experts, roughly half of the German electric vehicles registered in the United States are leased.

The IRA's impact on the automotive sector could also be limited simply by the structure of the automotive market. This industry, like many others, is spatially structured, on the basis of (macro)regional areas. (Carrillo et al., 2004 ; Freyssenet et Lung, 2000).
Cars do not move easily from one continent to another. Exports are limited and generally concentrate on niche vehicles or penetrating new markets. Local production is favoured for several reasons. On one hand, Firstly, it reduces logistics and customs costs. On the other hand, markets have their own specific characteristics and local consumer preferences, which means that vehicles have to be adapted to local standards and consumer preferences. (Frigant & Jullien, 2018).
Despite the idea of a "global car", this remains a myth. Generalist carmakers are present on a global scale in competitive terms, but they also operate in a multi-domestic way in terms of production and marketing. (Belis-Bergouignan *et al.*, 2000)

The car market is therefore primarily a continental market. Vehicle sales in the main countries are mainly focused on vehicles produced in the same major continental region. As Table 8 shows, 82% of vehicles sold in Germany, 83% in Italy and 81% in France come from continental Europe, including Turkey. In Asia, between 82% (for South Korea) and 97% (for China) of vehicles sold were assembled there, with the vast majority produced in the consumer country itself, unlike in European countries (Mayer & Vicard, 2023).

Table 8: domestic, intracontinental or extracontinental origin of vehicles sold in 2022 (in %) (Mayer & Vicard, 2023)

Country	National (%)	Intracontinental (%)	Extracontinental (%)
Germany	33	49	18
France	15	65	19
Italy	15	67	17
China	96	1	3
Japan	92	0	8
South Korea	79	3	18
USA	53	21	26

In addition to the high cost of transporting the finished product, customs duties can also be high. While the rate for importing an electric vehicle is only 2.5% in the United States, customs duties can be as high as 10% in the European Union (Tariffs EU). Once customs duties are taken into account, as well as the costs and risks associated with relocating the supply chain, the subsidies would have to be relatively higher for it to be really profitable to produce vehicles in the United States for the European market.

Europe currently does not export many electric cars to the US, and conventional EU cars accounts to only 6% of US sales (accounting for 7% of EU production).

The problem with the IRA today seems therefore to lie solely in the fact that the US market is difficult to access for European manufacturers, while competition is strengthened on the other side of the Atlantic by the conditional subsidies.

For that reason, the challenge for the electric vehicle sector today is to attract investment in order to develop the continental clusters that will serve the region. While the low level of inter-regional trade in the automotive industry appears to limit the risks of production being relocated to the US following the IRA, this is not necessarily true in other sectors more tradable such as solar panels or hydrogen, which may require dedicated support. Such measures, however, must be part of a genuine industrial policy strategy that considers the unique characteristics of each sector and technology.

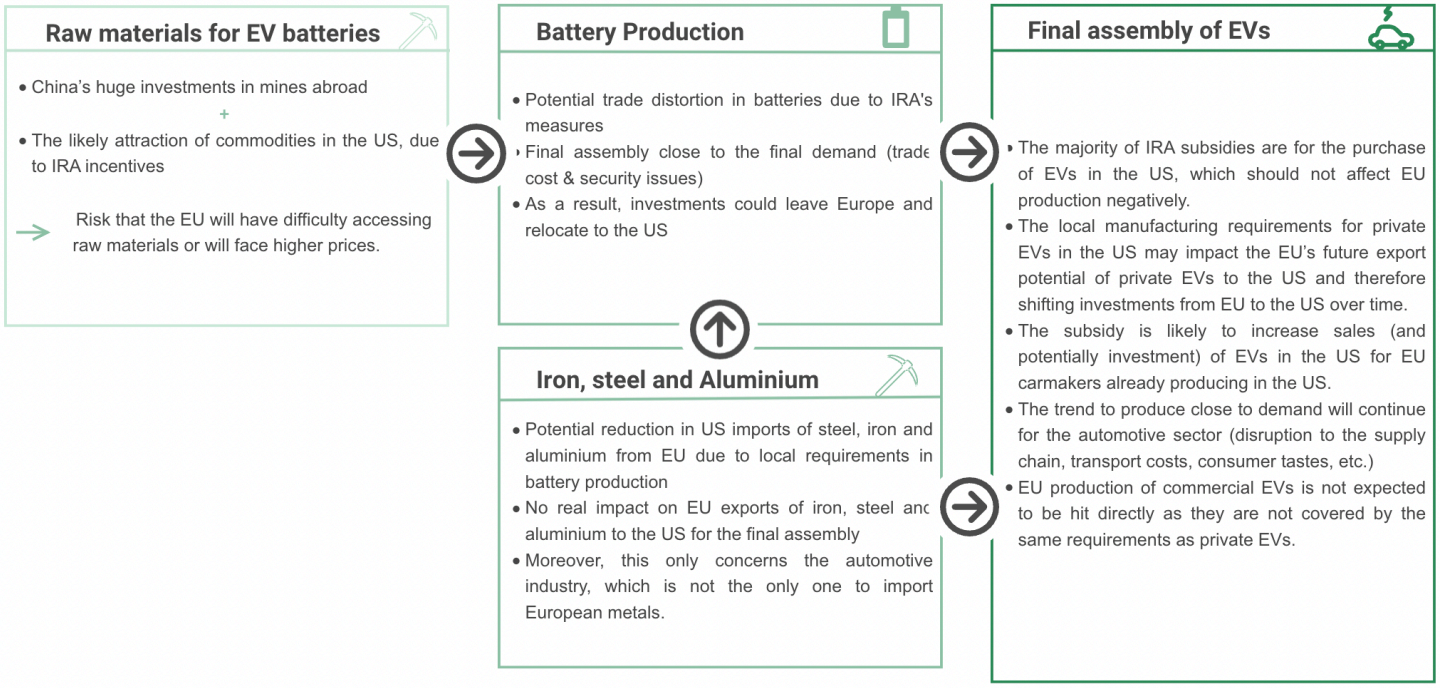
4.2.2 Impact of the IRA on the Value Chain

The automotive industry still accounts for 6.1% of total EU exports (Eurostat, 2023). Because of the local requirements, both for battery production and for the assembly of finished

products, it is questionable how much value European production will remain after the IRA. It should be remembered that cars with higher added value are not subject to IRA subsidies, nor are non-battery components. In reality, these components other than batteries, as well as the many services included in the value chain, make up a significant proportion, ranging from 50% to 60%, of inputs to the automotive value chain, which are not affected by the IRA (Copenhagen Economics, 2023). This means that all sorts of intermediate products and services, especially the digital inputs of today's connected vehicles, will not be affected. With the development of electric, autonomous and technology-packed cars, a large part of the growth in added value in the automotive sector over the next few years will be in this area.

Table 9 summarises the impact of the Inflation Reduction Act on the value chain of the European automotive Industry (a bigger version provided in p. 53).

Table 9: Impact on EU trade, FDI and Competitiveness. (From Næss-Schmidt et al., 2023)



Chapter 5: The European Response

The discussion of a response to the Inflation Reduction Act is deeply linked to the fundamental debate on the future of European economic and industrial governance. Should the single market and a free market economy be left to their own devices, or should the economy be supported through a European industrial policy? At the heart of these debates is the desire of the Commission, on the one hand, to create new policy instruments and increase European budgets and funds to shift economic decision-making from the national to the European level and, on the other hand, to shift power from the Council to the Commission. (Scheinert, 2023)

The European economy has already been recently damaged by the Covid-19 pandemic and then by the conflict in Ukraine. The EU has already invested €723 billion in the transition to green energies and asserted its energy independence from Russia (IEA, 2022). Although everyone agreed on a European response to the IRA, the Member States remained divided on how to go about it. While Member States such as France and Germany have proposed relaxing the framework for State aid in the green energy sector, other economic liberals in countries such as Netherland and Sweden (the “frugal countries”) fear that Brussels will end up fragmenting the market in its haste to compete with massive subsidies from the US, (and in China) (Flemming et al., 2023). As far as Spain is concerned, it has said that it is not opposed to a joint European response, which could take the form of a financing instrument at European level financed by common debt. (Euractiv, 2022)

Some Member States have expressed their opposition in January 2023 to the new common EU funding for the IRA in a letter to the European Commission vice president responsible for trade, Valdis Dombrovskis. These Member States, that includes Czech Republic, Denmark, Finland, Austria, Ireland, Estonia and Slovakia, would prefer to use existing funds rather than seek new financing. (Euractiv, 2023)

5.1 The Green Deal Industrial Plan

Finally, the European response became very quickly known as the "Green Deal Industrial Plan", in an effort by the EU to keep up with a global race in green industry subsidy schemes. However, the first drafts of this proposed EU plan have caused the more economically liberal EU Member States to cringe. Changes to the regulation of clean energy projects appear to mimic US protectionism, while plans to reform State aid rules threaten to fuel further divisions

between Member States. (Crawford, 2023). The discussions between the Member States and the Commission have borne fruits and the proposed measures aim to preserve the EU's industrial ambitions and supply-chain security while also ensuring the fairness of its internal and external trade.

The Green Deal Industrial Plan (GDIP) was presented by the Commission on the 1st February 2023 with the objective to enhance the competitiveness of Europe's net-zero industry and support the fast transition to climate neutrality (European Commission, 2023). In order to meet the Europe's climate target, the GDIP will provide a more supportive environment to increase the EU's manufacturing capacity for net-zero technologies and products. The plan, that complements ongoing efforts under the European Green Deal and REPowerEU wants to create an updated plan that promotes the EU's transition to energy while responding to the IRA.

The GDIP is based on four pillars:

1. *Simplifying the regulatory environment*

The first objective is to simplify the regulatory framework through two acts: The Net-Zero Industry Act (NZIA) and the Critical Raw Materials Act (CRMA). These two pieces of legislation amend the regulatory framework for the clean energy and raw materials industry, to enable a faster government approval process for new plants, power stations, mines, etc. CRMA also aims to ensure a sustainable and competitive value chain for essential raw materials in Europe. (European Commission, 2023)

2. *Accelerating access to finance*

The second pillar seeks to facilitate access to finance and investment for the production of clean technologies in Europe, in particular through the deployment of the "Capital Market Union", which could eventually free up large volumes of private finance. The Commission will also make it easier to access existing European aid and funds. In the medium term, the Commission intends to provide a structural response to investment needs by proposing a European Sovereignty Fund. The main source of capital will be the remaining €225 billion in loans and €20 billion in grants from the EU's €800 billion post-pandemic NGEU fund. (Villoslada & Saz-Carranza, 2023)

3. Enhancing skills

According to the Commission, the green transition should affect 35% to 40% of current jobs in Europe, and this is what this pillar intends to focus on, for example through the development of Net-Zero Industry Academies. It aims to facilitate the transition of skills and knowledge to align with the requirements of a European green industry. By equipping workers with the necessary expertise and training, the aim is to ensure a smooth and successful transition towards a sustainable and environmentally friendly economy.

4. Opening up trade for resilient supply chains

The fourth pillar will be devoted to global cooperation and the proper functioning of trade in support of the ecological transition. To this end, the Commission will continue to develop the EU's network of free trade agreements and other forms of cooperation with its partners in order to support the ecological transition.

EU auto industry welcomes Green Deal Industry Plan (ACEA, 2023). According to the European Automobile Manufacturers' Association, Europe needs a strong response to the challenges imposed by the IRA and the risks of investment leaving Europe. Among other things, it expects the GDIP to simplify administrative procedures for access to finance, lower energy prices, support for large-scale manufacturing projects (not only scale-up companies), and no discriminatory elements such as those that condition the granting of subsidies under the IRA.

Regarding the funding, Ursula von der Leyen proposed different options (Packroff, 2023) such as the possibilities provided by REPowerEU, InvestEU and the Innovation Fund. According to the President of the European Commission, the fund under REPowerEU initially to get rid of fossil fuel imports from Russia but which went much faster than expected can be reoriented to net-zero industries. A €250 billion in funding, which some believe will be difficult to redirect given that it was not originally intended for a European response to the IRA.
Therefore, funding for European industrial policy could come from the Member States. This is why the rules on State aid, which normally restrict national subsidies, should be relaxed on a temporary basis. However, funding by the Member States can sometimes be dangerous for European unity, as we will see.

5.2 The Industrial Policies at Member States Level

Industrial policy is traditionally the responsibility of the Member States. However, since the Maastricht Treaty in 1992, it has been a “support” competence of the European Union, that can intervene "*to support, coordinate or supplement the action of countries*" in this area (TFEU article 6).

The European Union is characterised by a plethora of green industrial policy initiatives implemented at the regional, national and EU levels. We have seen that the main support for the production or/and purchase of an electric car, for the production of batteries and components, and for wider sectors such as chemicals and metallurgy, is provided at national level. Although the EU regulates those state-aid schemes, the deployment of the IRA has led to fears of a subsidy race within the Member States.

A number of examples illustrate the diversity of support available in the Member States. According to the French Government (2023), support for carmakers in France since 2020 has amounted to around €12 billion. This aid includes €7 billion for electric vehicles and the battery industry, as well as €3 billion of tax breaks for the manufacturing industry. On its side, Germany intends to spend at least €5.6 billion on electric vehicles in 2023, a €500 million subsidy for battery research and another €150 million for battery production investment. (German Ministery for economic affairs, German Federal Ministry of Education and Research, 2022). Italy also intends to support its industry with, for example, €1.5 billion to strengthen the automotive supply chain (Italian government, 2021) and a further €8.7 billion up to 2030 for the ecological conversion of the automotive sector. In total, the organization Transport & Environment estimates the Italian government to allocate over EUR 15 billion during 2019-2030 (T&E, 2023).

The major problem with these different green industrial policies is that they are generally uncoordinated and may even conflict, fragmenting the EU's single market and disrupt the level playing field. The fragmentation of the European single market for green technologies prevents innovative European cleantech firms from developing in the same way as their American and Chinese competitors on their home markets (Tagliapietra & Veugelers, 2019).
The European Commission's proposal to relax national subsidies raises fears that the richest Member States will subsidise their national champions and thus create unfair competition.

(Guevska, R, 2023) This is the fear expressed by the Czech Republic through Czech MEP Luděk Niedermayer: "*If we get into a spiral of 'who gives the most', the Czech Republic will not come out the winner*". (Packroff & Noyau, 2023*).* One statistic shows that the Franco-German duo has already monopolised almost 80% of the €672 billion in State aid granted since March 2022. (von Thun, 2023)

Some also believe that these subsidies are often disproportionately allocated to large companies which, thanks to their resources, administrative know-how and the weight of their lobby, find it easier to obtain public money. These large companies, often more profitable, theoretically require less support than promising SMEs in the development phase.
Moreover, two other problems arise when funding is focused on large companies. Firstly, given the size of these companies, the subsidies required are much greater, leaving less for other companies. The second problem is that these subsidies could replace investment rather than increase it.

Chapter 6: Scenarios on Medium- and Long-Term European Response

Given that only a small percentage of electric cars are exported from the European market to the US market, it is clear that the tax credit for the purchase of electric vehicles is not the real issue for the EU. The long-term tax credits given for batteries and the supply chain for raw materials are where the real danger lies.

At European level, several billion euros have already been invested, including €20 billion allocated to European battery production and the value chain, through the IPCE framework and the European Investment Bank. A further €12 billion has been invested through the Invest EU programme and the EU recovery and resilience facility fund.

Finally, most of the support for the production of batteries and electric vehicles is provided at national level, with wide variations between countries.

In the next section we will analyse three potential scenarios for Europe's long-term response.

The European Union currently has many other ways than subsidies, of dealing with the Inflation Reduction Act. For example, it can improve its global competitiveness by taking advantage of its internal market. This would enable it, for example: to reduce its electricity costs through an efficient market, reduce regulatory costs between technology transfers between Member States, deal with labour shortages, benefit from a banking union and capital market and thus have access to cheaper and more accessible private finance, make strategic use of public procurement, strengthen European standards in terms of sustainable technology, etc.

Scenario 1: No aid at European level

The first possible scenario is one in which the European Union does not increase European aid to the battery and electric vehicle production chain. There are therefore two possible responses for the Member States: either set up domestic subsidy programmes and keep the technology at national level, or do nothing and companies relocate to the US to gain access to IRA subsidies.

The assumption that could justify this scenario is that the EU would consider it more important to focus its response to the IRA on other sectors affected by the IRA. For example, it could focus its response on the development of renewable energy, which is the main factor in reducing the EU's carbon footprint and achieving the targets set out in the Green Deal. Examples of this type of green energy production include solar panels, whose industry has already been hit hard

by competition from China, wind turbines, and the production of green hydrogen, which is also seen as a strategic issue for the EU. Given that the majority of IRA subsidies are allocated to clean energy (some 64% more or less according to McKinsy, 2022) and that only a small fraction is allocated to electric cars and batteries, it is in the EU's interests to focus on the production and expertise of renewable energies in order for example to reduce its energy and technology dependence but above all to offer green energy at the same price as on the American market. If the US takes the lead in green energy production and develops its technology, it could have a major impact on energy-intensive industries. Other sectors could also attract the attention of the European Union, such as sustainable road infrastructure (rail network, buses, etc.) or focusing investment on renovating buildings to minimize their ecological impact.

Therefore, if the European Union does nothing, it would be in its interest to loosen state aid regulations in order to keep its electric vehicle industry relatively competitive in comparison to the USA. In this situation, national level implementation of subsidies and aid for the electric vehicle and battery production chain would be required. Indeed, if the Member States do nothing for their companies, there is a risk that they will relocate to the United States in order to benefit from the subsidies.

However, as we have seen, this aid at national level leads to considerable disparity between the different Member States. In this case, we could see Member States where the automotive industry represents a significant part of their GDP and employment rate increasing their investment in this sector considerably. In order to keep their companies on their soil, the member states will have to subsidise between $US 35 and $US 45 (around €40) for each KWh of energy produced by the battery. According to the Transport and Environment report on battery production in Europe, European production could reach 293 GWh by 2025. If the Member States want to offer these companies the same level of subsidies as in the United States, this represents a total of €11.720 billion in subsidies between the various Member States. This production is set to increase significantly between now and 2030, with battery production expected to reach 493 GWh in Germany, 122 GWh in France and 217 GWh in Hungary. If these Member States still decide to subsidise the production of these companies in the same way as the US, this would represent an amount of €19.720 billion for Germany, €4.880 billion for France and €8.680 billion for Hungary, just for the production of batteries for electric vehicles. These figures suggest that it is realistic and feasible to maintain battery production capacity for electric vehicles on European soil.

Nevertheless, I find it difficult to imagine a scenario where support for the European car industry would come mainly from the Member States, for several key reasons. Firstly, there is a clear desire within the European Union to transform the European car fleet into a green fleet by 2035. To achieve this ambitious goal, a common and structured approach is needed to support the automotive industry in developing its expertise in clean vehicles, while reducing its potential dependence on the US and Chinese markets. By concentrating efforts and resources at EU level, the Member States can strengthen their competitiveness on the world stage and create a solid internal market for the European automotive industry.
Another reason, closely related to the first, is the risk of seeing the emergence of a "Marshallian district" in the supply of materials and the production of batteries. It is possible to see such a Marshallian district developing in the United States thanks to IRA subsidies, just as it already exists in China for battery production. In this case, if the European industry does not manage to adopt a common and structured approach to support its development in the electric vehicle sector, there is a real risk of dependence on these Marshallese districts. European companies could find themselves in a weak position in terms of supplies of key materials and essential technologies, which could harm their competitiveness and their ability to innovate.

Scenario 2: European Sovereignty Fund

A second scenario, which in my view is more plausible, is one where the EU sets up a new structural fund to support the sustainable innovation needed for the ecological transition and therefore indirectly for the European automotive industry. This scenario could be envisaged in order to prevent the fragmentation of the European market resulting from national subsidy programmes. This new instrument could take the form of a new joint European sovereignty fund.

Funding to develop a robust value chain for batteries and electric vehicles must be significant to maintain production capacity in Europe. According to the European battery alliance, €380 billion is needed to create a self-sufficient battery industry by 2030. Financing could be provided via a new joint bond issuance programme managed by the European Commission for the European Union, as was already the case for the NextGenEU. The advantage of a joint bond issue for the Member States is that the cost of borrowing is lower. The Commission, together with the governments of the Member States, and EU bodies such as the European Investment Bank through the European Sovereign Fund, could then offer aid, on

a par with that offered by the IRA, in the form of loans, guarantees, subsidies or even production loans for companies deemed strategic for maintaining the EU's technological and industrial capacities in the field of ecological transition and, more specifically, batteries and electric vehicles.

The key to being able to put in place this large-scale structural instrument is to have a union of capital markets, allowing access to a large amount of 'patient' private capital. Unfortunately, such a capital market union, like the one that currently exists in the United States, has not yet been finalised at European level. It would therefore be essential to continue efforts to harmonise financial regulations across Member States and to create incentives to encourage private investors to commit to sustainable projects. The European Union must also continue to facilitate cross-border investments by removing bureaucratic obstacles and promoting greater capital mobility.

In addition, the establishment of a European Sovereignty Fund requires the agreement of the Member States, which is not yet the case. At present, the poorest Member States might prefer benefit instruments targeted at their needs, while the richest Member States would see no point in a European fund. Moreover, the fund would have to be financed by these Member States, and there is still a risk of a subsidy race where Member States compete to subsidise their own industries.

When it comes to financing through joint debt, not everyone agrees either. Thierry Breton, for example, has expressed reservations about contracting new common debt. According to the Commissioner, it would be preferable to commit the 200 billion or so of the unused NextGen plan (Euractiv, 2023), which could already offer a faster response to the IRA. On the other hand, it could be an alternative of a new joint debt. Indeed, member states might be reluctant to offer more money, through new taxes (and borrowing tomorrow) or borrowing today, when we are in an inflationary period with a high cost of living.

However, another option that could be considered to finance a European Sovereign Fund that would tackle climate change is an increase in Europe's own resources. Discussions are underway in the European Parliament to find new sources of revenue, initially to replace the interest on the NGEU debt. But even in this case it could be difficult to reach an agreement, and

it will probably take a long time. Time enough for the United States to develop its Marshallese districts in green technologies.

Scenario 3: Cooperation and Negotiation with the US

There is a third option before the European Union decides to go on the defensive by increasing the budgets designated for green transport. This third scenario is one of cooperation and negotiation between the United States and the EU. Although President Biden is taking a less aggressive approach to the Union than his predecessor, he is still putting the United States first with buy America provisions. Meanwhile, there are several channels for discussion between the 2 economic powers that could undoubtedly mitigate the impact of the IRA on European industry. Since 2009, for example, there has been the EU-US Energy Council, a coordination forum dealing with energy issues, and the Joint Energy Security Task Force, set up in 2022, which aims to reduce the EU's dependence on Russian energy.

The EU-US Trade and Technology Council (TTC) was created on 15 June 2021. This forum will enable the 2 economic powers to "*coordinate approaches to key global technology, economic, and trade issues; and to deepen transatlantic trade and economic relations, basing policies on shared democratic values*", according to the inaugural joint statement. Although the fight against climate change and the protection of the environment are among the shared values on which the 2 powers undertake to coordinate, in reality, on 16 August 2022, the American Inflation Reduction Act was promulgated.
A little later, in October, a high-level task force was set up. The Task Force on the Inflation Reduction Act, set up on 25 October 2022 to address the specific concerns raised by the EU regarding the IRA (European Commission, 2022). This task force also aims to negotiate on behalf of the EU that the critical minerals extracted or "processed" in Europe, form part of the conditions for granting subsidies for the purchase of electric vehicles in the United States.

The TTC does not seem to be fulfilling all its coordination objectives and is generating frustration on both sides of the Atlantic. The major political issues are absent from these discussions, which does not encourage confidence in a genuine institution capable of moving forward in a coordinated manner.

But where do relations between the US and the EU really stand? This American unilateralism is nothing new, but we have to wonder whether the Americans are really taking European economic interests into account when making decisions in their competition with China. This debate on US-EU relations is even referred to as "ex-post co-ordination" in Financial Time (2023). During the American discussions and even when the IRA was published, the potential impact on American allies, such as Europe, was never considered or mentioned.
An option for the European Union to show its concern, could have been to take the US in front of the World Trade Organisation. Although this would certainly not have had any major consequences, at least not the expected ones, it would have sent out a clear message.

Finally, it is difficult to imagine that the US would later include the EU in the IRA, despite some concessions having been made, such as allowing European commercial cars to benefit from IRA measures. Now that the law has been passed, most of the protectionist provisions for the green technology sector are firmly rooted in the law and seemed difficult to be altered after the fact. Furthermore, as we can already see, there hasn't been much advancement in these discussions since they started last year.

Conclusion

The European automotive sector is facing major challenges, such as the transition to a fleet of green vehicles in Europe, fierce competition from China in the field of electric vehicles, rising energy prices, and then there are the conditional US subsidies that distort competition. The Inflation Reduction Act is undeniably a game changer for the European automotive industry. Although it will have a significant impact on the entire value chain, its influence may be less than expected.

On the one hand, the impact of the IRA on the European automotive sector is real and happening. The local content requirement in the IRA poses a significant problem for European companies, impacting the sector. The final outcome on the electric vehicle production chain will largely depend on the European Union's response. If the EU fails to provide a comparable alternative to the affected companies, there is a risk of gradual relocation to the US, resulting in outward foreign direct investment. The fear that some European producers will relocate is all the greater given the increasingly fierce competition from Chinese cars on both the European and Chinese markets. The market share of European companies could also suffer a significant loss, with the IRA measures making American vehicles up to one-fifth cheaper.

Our research also indicates that the battery industry will be the most impacted component of the European electric vehicle value chain. This sector, which is already under pressure from fierce Chinese competition, could seriously see European investment go to the US, particularly as the development of two parallel value chains for batteries on either side of the Atlantic seems to be a zero-sum game.

On the other hand, our analysis suggests, that there are a number of factors which mitigate the impact of the IRA on the European automotive sector.
There is the spatial structure of the automotive market in general, based on (macro)regional areas, that could limit the influence of the IRA. Because of this structure, the EU already exports only a small proportion of its production to the United States (7%), and it is this small proportion that is discriminated against on the American market.
Furthermore, European cars exported with high added value do not benefit in any way from US aid, as is the case for this type of American vehicle. This type of car is therefore not subject to unfair competition.

Finally, all the other components of electric cars, apart from the batteries, are also ineligible for US subsidies. These components, like the services associated with electric cars, actually represent most of the added value of a car, and this added value is ultimately unaffected by US subsidies.
On a positive note, the IRA could potentially make certain European companies more competitive against Chinese counterparts and benefit European exports by boosting demand for green technologies.

Several scenarios for the EU's long-term response are possible. To compensate for the EU's lack of response, there could be an increase in national subsidy programmes, but this would fragment the single market. Another option would be to establish a European Sovereignty Fund, which would allow the fragmentation of the single market to be limited, but this has been met with some difficulties. Finally, a last scenario, based on cooperation and negotiation could be considered, but it also faces certain challenges.
The big difficulty in these green industrial policy issues is the challenge that it poses for the EU to coordinate a green industrial policy that does not undermine the internal market. The Green Deal Industrial Plan is a good first response, but it is not enough. Ensuring effective coordination will be crucial for the success of the European automotive industry in the face of these challenges and opportunities.

Our analysis attempted to provide an analysis of the European electric vehicle sector as well as a response to the IRA's impact on it. It may now be worthwhile to examine the Chinese electric vehicle sector and how it is positioned in relation to the IRA, as well as whether and to what extent it may be impacted. It might also be interesting to analyse to what extent these green economic policies, both in Europe and the US, have a positive impact on the environment.

"*We have no choice. The United States voted for the IRA. China is helping its companies massively and trying to attract ours. It is up to us alone, and no one else, to devise our response. The fate of Europe is in our hands.*" This statement by Thierry Breton in 2022 serves as a powerful reminder of the urgency and responsibility that lies ahead for Europe to safeguard its automotive industry, environment, and economic future through well-crafted and decisive green industrial policies.
This thesis has shed light on the critical significance of green industrial policies in shaping the trajectory of the European automotive sector. By fostering innovation, fostering sustainable

practices, and promoting collaboration between industry stakeholders and policymakers, Europe can not only maintain its competitiveness but also serve as a global leader in sustainable automotive technologies. The success of this endeavor will not only drive a cleaner, more resilient automotive sector but also contribute significantly to the overall sustainable growth and prosperity of Europe as a whole.

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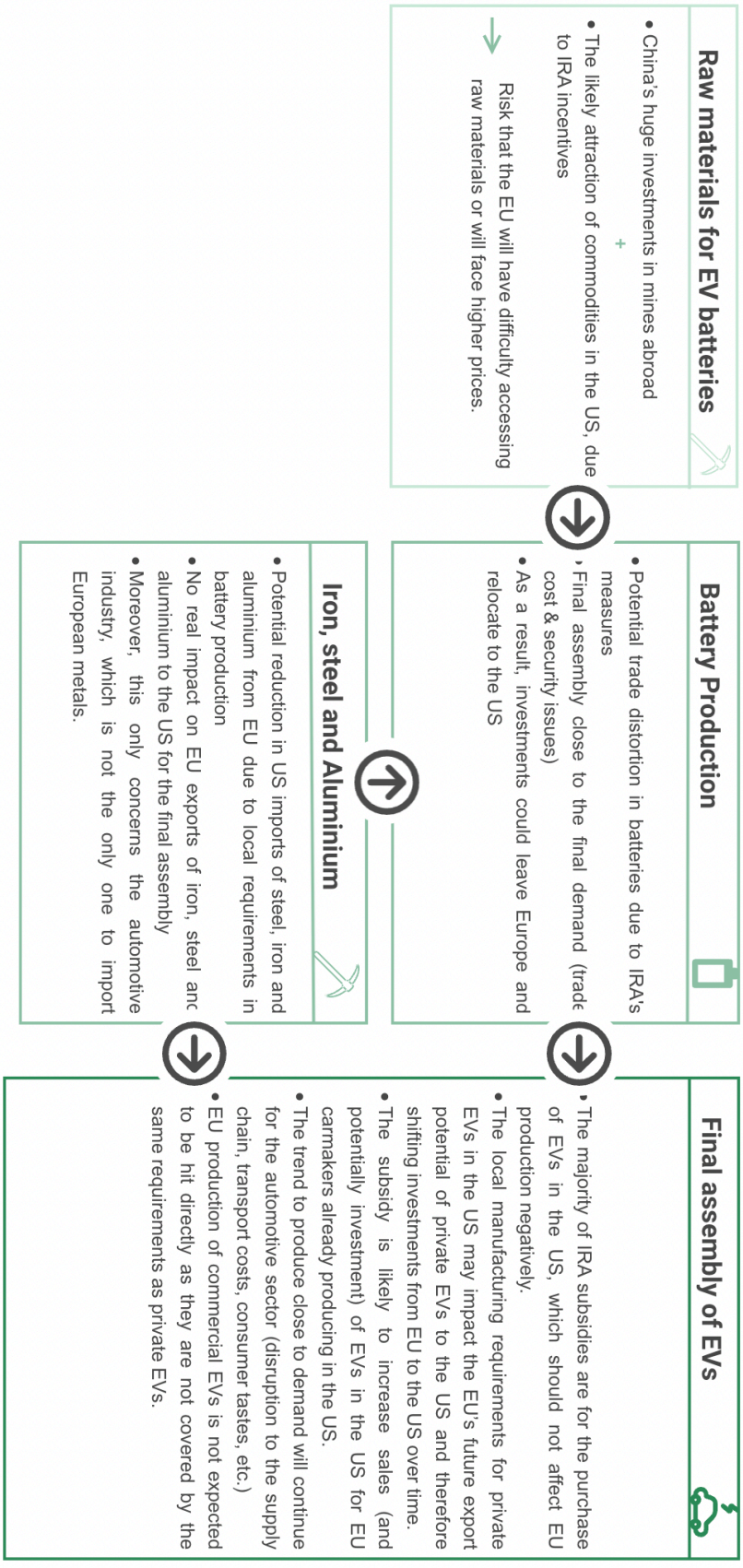
Appendix

Table 9: Impact on EU trade, FDI and Competitiveness. (From Næss-Schmidt et al., 2023)



This thesis demonstrates that the Inflation Reduction Act (IRA) is undeniably a game changer for the European automotive industry. Although it will have a significant impact on the entire value chain, its influence may be less than expected. Our study begins by examining the resurgence of industrial policies in Europe and the arguments in favour of their implementation. An overview of the European automotive sector is then put into perspective with Europe's green industrial policy. The analysis then looks at the IRA and its impact on the US electric vehicle market, before comparing it with European industrial policy. Finally, this paper examines current European responses to the IRA and proposes scenarios for a European response in the medium and long term.

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