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硕士研究生学位论文

题目：反思经济发展与政策：波兰如何实现中国的新结构经济学范式？

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摘要

在过去几个世纪中，发展中国家与发达国家之间几乎没有融合，而在 2008 年全球金融危机中，许多国家已经开始寻找新的发展模式。彼时，新结构经济学（NSE）– 由林毅夫教授提出的中国发展理论 – 开始在世界范围内引起越来越多的关注。不仅许多发展中国家开始决定实施 NSE，而且一些发达国家对这一框架也越来越兴致勃勃。波兰就是一个例子。

基于理论框架与实际案例并结合波兰的经济发展轨迹，本文对波兰实施新结构经济学的缘由进行了探讨。依据“波兰重大发展战略”中定义的发展陷阱，笔者研究了新结构经济学如何帮助波兰避免或应对当前的经济挑战。本调查是基于“增长甄别与因势利导”（GIFF），该框架有助于判断波兰政府定义的具有潜在比较优势的行业是否符合新结构经济学。

由于波兰政府表示电动汽车领域具有潜在的比较优势，因此本文使用两个案例研究来检验这种说法是否符合新结构经济学。依据 GIFF 标准，第一个案例集中在德国的电动汽车上，因为它是波兰的基准市场。第二个案例研究电动汽车市场的世界领跑者 —— 中国市场。这两个国家实施的发展战略及其当前面临的挑战，可以为波兰在该领域取得成功提供重要参考价值。 同时，案例研究结果挑战了该领域与新结构经济学范式一致的观点。

通过对参与在波兰推广新结构经济学的中波专家进行半结构化深入访谈，进一步从这两个案例中得到更多发现。研究结论使我们得以重构波兰如何实现中国新结构经济学范式。本文阐明了波兰 – 一个发达的多党制民主国家 – 在应用新结构经济学时面临的机遇和挑战。因此，这些发现不仅对解释波兰实施新结构经济学有影响，而且更大程度上为后续对这个发展框架感兴趣的国家提供了借鉴意义。

关键词：新结构经济学、NSE、波兰、中国、增长甄别与因势利导

RETHINKING DEVELOPMENT AND POLICY: HOW DID POLAND IMPLEMENT THE CHINESE PARADIGM OF NEW STRUCTURAL ECONOMICS?

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ABSTRACT

Along with little convergence between developing and developed countries in the last centuries and the 2008 global financial crises, numerous countries have started to look for new development paradigms. New Structural Economics (NSE) – a Chinese development theory introduced by Professor Justin Yifu Lin – has gained more attention around the world. Developing countries decided to implement NSE, but developed states also present avid interest in this framework. Poland is a case in point.

This thesis is an inquiry into the nature of New Structural Economics implementation in Poland. The theoretical framework introduced and later combined with practical case studies in this thesis starts from Poland's economic development trajectory. Based on development traps defined in the "Polish Strategy for Responsible Development," this thesis examines the application of New Structural Economics to the Polish case. This investigation is based on the Growth Indication and Facilitation Framework (GIFF). GIFF helps to understand whether sectors defined by the Polish government as having a latent comparative advantage are in line with New Structural Economics.

Since the Polish government indicated the electromobility sector as having a latent comparative advantage, this research used two case studies to examine whether this choice is in line with NSE. The first one is focused on electric cars in Germany since, according to GIFF, it is a benchmark country for Poland. The second case study considers China, a world leader in the electric car market. Development strategies implemented by the two examined countries and challenges they currently face provide essential information on whether Poland could

succeed in this sector. Simultaneously, the case studies challenge the idea that choosing this sector is consistent with NSE paradigm.

The two cases' findings are further contextualized by semi-structured elite interviews with Chinese and Polish experts involved in New Structural Economics promotion in Poland. Conclusions of the research allowed to reconstruct how NSE was realized in Poland. The thesis sheds light on opportunities and challenges that Poland – a developed, multiparty democratic state – faces applying a New Structural Economics approach. Therefore, these findings have implications for interpreting NSE implementation in Poland and, more widely, for other actors interested in this development framework.

KEY WORDS: New Structural Economics, NSE, Poland, China, GIF

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Chapter 1: Introduction

Global governance is a framework of international organizations, acknowledged laws, norms, and practices. Within this broader framework, nation-states are part of the system (He, 2015). Historically speaking, the current global governance system was built upon the Washington consensus – an architecture created by the United States of America and other Western nations (Lin, 2010). In this way, the consensus creators gained more power in the international organizations and continue to dominate the global stage.

As a semi-colony, in 19th century imperial China was incorporated into the global governance system against its will (Li, 2016). However, along with its economic success that started with the Reforms and Opening Up (改革开放) initiated by Deng Xiaoping (邓小平) in 1978, the People's Republic of China decided to take an active approach to the global governance (He, 2017). The main change to the status quo came in 2008 with the global financial crisis. From the Chinese perspective, the situation uncovered the Washington consensus's inefficiency and revealed that developing countries, including China, deserve more attention (Lin, 2010). After years of passiveness, the government finally declared "taking an active part in leading the reform of the global governance system" and readiness to "co-rule together with the United States" (He, 2015). In this way, China aims to accomplish "the Chinese nation's great rejuvenation" (Xi, 2014).

China's evolving approach to global governance is particularly noticeable in international organizations. Under Xi Jinping's rule, the Chinese government often stressed the importance of "democratization of international relations" by giving greater voice to developing countries in the global governance system (Huotari, 2017). In this way, an increasing number of developing countries and catching up economies look at China's economic development and strive to draw conclusions that might be useful in their path to prosperity (Lin, Nowak 2017). That is why economic theories introduced by the leading Chinese economist – Professor Justin Yifu Lin – find fertile ground in many countries that actively look for new development strategies (Lin, Nowak 2017).

The main theoretical framework of New Structural Economics (NSE) was based upon

the observation that little economic convergence between prosperous and emerging economies took place under the Washington consensus (Lin, 2010). This new approach underscores the free market's central role in resource allocation, supported by the governments' proactive approach. Professor Lin paid much attention to the active government, highlighting that it should define the economy's latent comparative advantages (Lin, 2016). Besides that, the government should compensate the country's pioneer companies that entered new sectors for information they provide and improve soft and hard infrastructure. Only a government with a clearly defined industrial policy can push the economy up the industrial ladder and enhance diversification. In this way, Lin's theoretical framework became an attractive alternative for developing countries and catching up economies that could not grow as fast as Western countries after World War 2 (Lin, Nowak, 2017).

This way, New Structural Economics has become one of the most prominent Chinese economic theories with strong international influence (Lin, Nowak 2017). Although it mostly attracts developing countries such as Nigeria, Tanzania, Brazil, and Indonesia, the approach is welcomed in developed countries as well (Lin, 2016). An avid interest in Lin's legacy that arose in Poland is a case in point. In 2016, Mateusz Morawiecki, former vice prime minister and minister of development and the current prime minister of the Republic of Poland, introduced the country's "Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030)" ("Polish Strategy") (Morawiecki, 2016). The document defined the current state of affairs in the Polish economy. It highlighted the necessity of defining the economy's latent advantages, improving soft and hard infrastructure, enhancing the government's proactive role, attracting selected foreign direct investments, and supporting the Polish companies' international expansion. This strategy resonates with New Structural Economics. Notably, there is a direct reference to Lin's theory on page 9 of the "Polish Strategy" (Morawiecki, 2016). Common points with Lin's idea in the document should be stressed. These include the government's dynamic character in the country's economy, clearly defined industrial policy, infrastructural improvements, reindustrialization, and support to the most innovative companies (Morawiecki, 2017).

1.1 Research Justification

This thesis addresses the possibility of implementing New Structural Economics in the developed world, in Poland specifically. Many researchers focused on the theory's possible performance in developing countries, including Nigeria (Lin & Treichel, 2012), Nepal (Xu & Hager, 2017), and Uganda (Lin & Xu 2016). However, little research was conducted on a possible adjustment of New Structural Economics beyond the Global South. Therefore, Poland was chosen as an examined country due to several reasons. Firstly, it reveals how New Structural Economics operates in development economics research. Secondly, Poland is the only European country that officially expressed its willingness to implement Professor Lin's economic solutions. Therefore, by investigating opportunities and challenges in Poland's theory implementation, one can verify whether New Structural Economics – a framework highly effective in Asian and African economies – applies to European circumstances (Lin, Nowak, 2017). Thirdly, in the "Polish Strategy," the Polish government has indicated electromobility as a potential driver of the country's future growth. Such an idea also appeared in the 12th Five-Year Plan (2011-2015) (Fan & He, 2011). At present, China has already become a leader in this field (Fan & He, 2011). Thus, Poland could learn from China which policies are worth adaptation and what to avoid when promoting electric vehicle transportation. At the same time, studying electromobility provides a wide range of information on public-private economic interactions. Thus, it is the right sector to investigate in the light of New Structural Economics' assumption of the governments' active role in economic development. Fourthly, Poland recognized its latent comparative advantage in a sector related to the fourth industrial revolution (Lin, 2016). This is an uncommon case in Growth Indication and Facilitation Framework (GIFF) methodology under New Structural Economics. Finally, Poland and China are "transition economies" that abandoned the planned economy in favor of the market economy (Rapacki & Heiduk, 2009). Such a shared legacy justifies the mutual interest in development trajectories between Poland and China.

1.2 Research Aim

This thesis investigates the nature of New Structural Economics in Poland, as the European Union Member State. To achieve this aim, the following questions are addressed:

1. How has New Structural Economics framework adapted the European economic, political, and legal circumstances?
2. Was the electric vehicles sector – having the latent comparative advantage according to the Polish government – chosen in line with GIFF methodology?
3. What are the main opportunities and challenges for implementation in Poland?

1.3 Methodology

This thesis uses qualitative and quantitative methods to address the research questions. The combination of these two research approaches enables the author to investigate how NSE operates in Polish circumstances, examine whether sectors with the latent comparative advantage are in line with GIFF, and navigate primary successes and challenges for NSE in Poland.

The author uses semi-structured interviews with leading Polish and Chinese experts on New Structural Economics to address the first research question. The interviews were conducted online between October 2020 and March 2021 (see Table 1.1). Some of the interviews had a form of informal conversations. In total, 8 people were interviewed. All of them represented various sectors – from academia, research institutions, public offices, to think tanks. For a variety of reasons, the interviewees preferred to remain anonymous. However, they were mainly people who publish regularly on topics discussed, which eased safety concerns.

Table 1.1 Interviews conducted for the purpose of this thesis

No.	Name	Affiliation	Time and place
1	Interviewee 1	Analyst at Polish public think-tank	October 2020, online
2	Interviewee 2	Representative of Polish ministry	October 2020, online
3	Interviewee 3	Professor at Polish university	December 2020, online
4	Interviewee 4	Researcher at European research institution	March 2021, online
5	Interviewee 5	Professor at Chinese university	November 2020, online

6	Interviewee 6	Professor at Chinese university	January 2021, online
7	Interviewee 7	Researcher at Chinese think tank	January 2021, online
8	Interviewee 8	Analyst at Chinese think tank	January 2021, online

Source: own study.

Besides interviews, the qualitative component of this research also draws on the information gathered through the author's participation in a meeting with Professor Lin at the University of Warsaw in May 2018. As a representative of the Polish Research Centre for Law and Economy of China at the University of Warsaw, the author listened to Professor Lin's speech on *China's Rejuvenation and its Implications for the World Development and Economics.*

This approach is supplemented by data analysis of Poland's economic and political development trajectory after 1989 from existing international and Polish datasets. Additionally, the author investigates how Poland's leading development document – "Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030)" – defines the country's main economic challenges and confronts them with existing literature on New Structural Economics.

The second research question is related to Growth Indication and Facilitation Framework. In this way, the author examines whether benchmark countries for Poland and its sectors with the latent comparative advantage were based on this policy tool. Furthermore, the author checks whether any country-specific circumstances appeared when selecting electric vehicles as a promising driver of Poland's future economy. As such, the author pursues a mixed-method approach and considers both qualitative and quantitative components.

Finally, to answer the third research question, a case study on electric vehicle adoption in Poland, Germany, and China is performed. This analysis investigates how New Structural Economics theoretical framework operates in practice. This sector was selected

since the Polish government defined it as having a latent comparative advantage (Morawiecki, 2016). Besides that, the electric vehicle industry demonstrates a multi-actor dynamic, in which collaboration between public, private, and academic sectors is a prerequisite to success. Therefore, the case study on this industry defines the main opportunities and challenges for New Structural Economics performance in Poland in a wide range of spheres, such as politics, economy, and culture.

Chapter 2: Theoretical Context

2.1 What is New Structural Economics?

New Structural Economics is an economic theory introduced by Professor Justin Yifu Lin from Peking University, a former Senior Vice-President and a Chief Economist of the World Bank. Lin's most important factor behind this theory was the ineffectiveness of the existing development models (Lin, 2010). Although developing countries made various attempts to catch up with developed economies and international organizations strived to reduce poverty in the developing world, little convergence signals the current development patterns are insufficient. This reflection, combined with the 2008 global financial crisis that revealed the Washington consensus's inefficiency, has motivated Lin to create a new framework for more inclusive and sustainable international growth (Lin, 2010).

2.2 New Structural Economics in light of other economic approaches

New Structural Economics is rooted in two concepts: development economics and the structural approach to economics (Lin, 2010). That is because Professor Lin's idea focused on development enriches the structuralist school of thought.

After Adam Smith, a Scottish philosopher introduced the notion of an "invisible hand" that drives the market in *An Inquiry into the Nature and Causes of the Wealth of Nations published* in 1776, the *laissez-faire* approach has dominated economic thought in the West. Only at the beginning of the 20th century was his approach recognized as insufficient (Lin, 2010). Along with the rapid development of science, Smith's theory has become outdated. That is because, in Smith's judgment, he omitted one factor that determined a country's

economic growth in the 20th century, namely technology and its role in industrial upgrading (Lin, Nowak 2017).

Rosenstein-Rodan (1943) introduced a new economic thought approach in light of a rapidly changing economic framework. He was the first modern theorist to shed light on development (Lin, 2010). Rosenstein-Rodan strove to explain how a country can transform its economy to combat poverty and underdevelopment. In his article, *Problems of Industrialization of Eastern and Southeastern Europe,* he stated that effective industrialization helps countries avoid the poverty trap (Rosenstein-Rodan, 1943). According to Rosenstein-Rodan, there are three prerequisites to obtain "an optimum size" of industrialization. Firstly, the market must be sufficiently big. Secondly, international investments or capital lending are essential. Thirdly, a state is to organize labor training. Under such conditions, the simultaneous industrialization of numerous sectors is possible. Notably, only by concurrent industrialization can all sectors benefit, since, in this way, they create a "complementary system." Consequently, if a state fails to coordinate comprehensive industrialization, a country faces an underdevelopment trap (Rosenstein-Rodan, 1943).

As such, the development economics introduced by Rosenstein-Rodan can be considered a foundation for the structuralist approach (Lin, 2010). According to Rosenstein-Rodan and other structuralists, structural challenges made it difficult or even impossible for developing countries to empower and modernize their economies (Rosenstein-Rodan, 1943). Importantly, these structural challenges were different from the challenges faced by developed countries. That is why Rosenstein-Rodan claimed there is no point for developing countries to navigate their development strategies by imitating the developed states (Rosenstein-Rodan, 1943).

A common point that linked all structuralists was the significant role of structural challenges in a country's development. However, there was no consent on which solution would be the most effective in providing continuous, long-term economic growth. On the one hand, Rosenstein-Rodan was a proponent of the idea that high-valued government investments are necessary for comprehensive industrialization and limiting labor

emigration (Rosenstein-Rodan, 1943). Nurske (1953) presented the "vicious circle of poverty" theory. According to his framework, since underdeveloped states cannot gather capital, only foreign investments could boost their growth. On the other hand, Hirschman's approach (1970) went beyond the financial capacity and assets. According to Hirschman, developing countries' lack of entrepreneurship was a source of their inability to implement long-term economic strategies.

As indicated in Lin's book (2010), the structuralist approach to economic development is connected mostly with Walt Rostow's (1960) and Alexander Gerschenkron's (1962) legacies. Rostow's practice underscored a concept called *Stages of economic growth*, according to which there were five separate stages of society's development. These social circumstances were closely linked with economic growth:

1. "Traditional societies" were characterized by the existence of barter in trade and labor-intensive agriculture's dominant role in the state,
2. "Societies with preconditions to growth" were defined as states with increasing capital use in agriculture supported by developing mining sector and growing amounts of savings and investments in households,
3. "Societies in take-off mode" were already industrialized, with declining role of agriculture and significant amounts of investments and savings, relatively high levels of industrialization, accumulation of capital, and little labor force in agriculture),
4. "Societies that drive to maturity" understood as societies that implement advanced technologies and have multi-faceted industries,
5. "Mass-consumption societies" framed by Rostow as having a dominant, well-developed service industry with high output.

According to Rostow, these stages do not overlap, and the preconditioning phase is necessary before takeoff (Rostow, 1960).

However, only two years later, Gerschenkron noticed Rostow's framework was insufficient to explain economic development. According to Gerschenkron (1962), the classification based on economic growth stages was false since there was no uniform path for achieving development. Gerschenkron perceived time, space, and social background as essential factors to consider when analyzing a country's growth. Therefore, after having

decided to focus his research on Europe, Gerschenkron divided European countries into three categories:

1. Advanced countries (represented by England),
2. Moderately backward countries (represented by Germany),
3. Very backward countries (represented by Russia).

As such, in each of these countries, the development path was different. While in an advanced state, accumulation happened within an industry, banks played a leading role in the industrialization process in a moderately backward state. Once banks started to industrialize a relatively backward country, industry eventually became independent of the banks at later stages. In backward countries, the state is to initiate industrialization, then it is followed by banks, and finally, the industry becomes independent from banks and the state (Gerschenkron, 1962).

2.3 Main differences between traditional structural economics and NSE

To understand New Structural Economics, one should analyze what links and differs it from the conventional structuralist approach. In terms of similarities, Lin highlights two factors in his theory according to other previous structuralist frameworks (Lin, 2010). First, both traditional and New Structural Economics assume structural differences between developed and developing states. Secondly, governments play essential roles in transforming a country from a developing to a developed stage under both frameworks.

However, there are significant differences between the old and the new structuralist framework from a nuanced perspective. Traditional structuralists think developing countries should introduce capital-intensive industries to catch up with their developed counterparts. Secondly, according to the conventional structural theory, markets fail due to monopolies and factors' immobility. Thirdly, the old approach is conservative in its clear division between developing countries (perceived as periphery states) and developed countries (core states). Finally, although both theories indicate that an active government is a prerequisite to economic growth, only traditional structuralists claim the state should actively intervene in the market's resource allocation. According to their understanding,

imposing import tariffs protect domestic industries and promote state-owned enterprises (Lin, 2010).

In contrast, Lin is a proponent of the free market's leading role in resource allocation (Lin, 2010). According to him, developing countries cannot effectively create high-capital industries not due to existing monopolies or factors' immobility, but only because of their endowment structure (Lin, 2010). With underdeveloped infrastructure and relevant scarcity of capital, low-income countries cannot compete with developed states in capital-intensive sectors. Secondly, New Structural Economics perceives economic growth as a non-linear and continuous spectrum. That is why in Lin's framework, there is no clear line between high-income and low-income states (Lin, 2010). Lin acknowledges the complexity of development dynamics and states that there are plenty of stages of development. No matter its historical background, every country can succeed in its development path under the condition that it correctly defines and follows its comparative advantage. Thirdly, Lin's perception of the government's role in the country's industrial upgrading is different (Peng & Jie, 2019). While he highlights that an active government is essential to development, its function is to facilitate, not lead. As such, the government should continuously improve soft and hard infrastructure. Moreover, its role is to provide information to companies about the new industries and compensate leading enterprises for their high cost of pioneering in the most promising sectors (Lin, 2010).

It is also crucial to comprehend two more factors that enriched Lin's framework, namely "latecomer advantage" (后发优势论); also called "advantage of backwardness") and the impact of fast wages increase in emerging economies. In terms of the "latecomer advantage," Lin states that a developing country can benefit from its technological backwardness by "borrowing" technology from developed states (Lin, 2010). In contrast to developed states, at this point, the developing country does not have to invest and take the risk of innovation. Instead, it can directly apply already existing solutions to its industry. Given the "latecomer advantage," Lin assumes that a developing country can perform its industrial upgrading faster and boost the economy more effectively than high-income economies (Lin, 2010). When it comes to fast wages increase in emerging economies, Lin concludes that labor-intensive production must eventually be moved out of

emerging economies. As such, lower-income countries should take this chance and attract labor-intensive manufacturing since this provides them with an opportunity to get onto a fast development track (Lin, 2010).

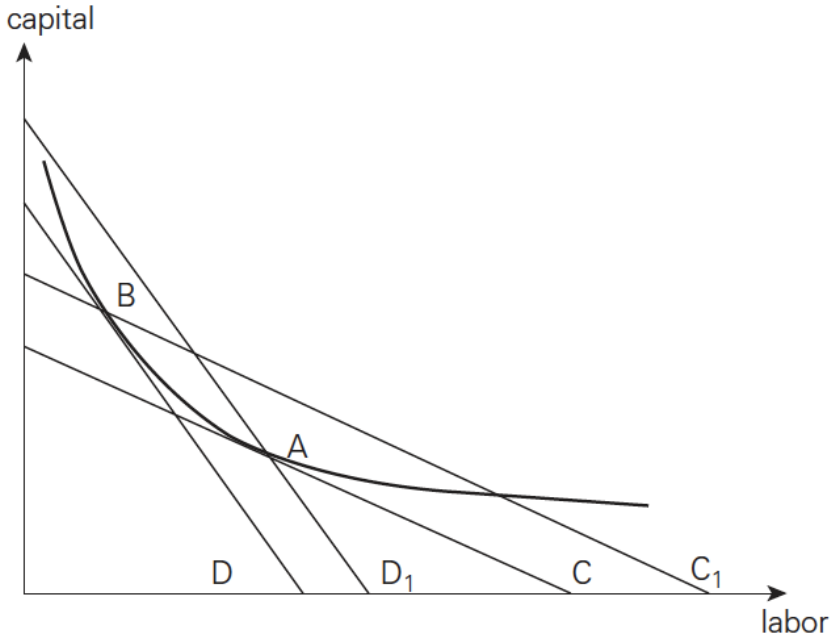
2.4 Factor endowments in New Structural Economics

New Structural Economics framework goes beyond theoretical assumptions and provides specific, universal tools for governments to define their latent comparative advantages. According to Lin, a country's industrial structure should be shaped in line with its endowment factors (Lin, Nowak, 2017). The endowment structure changes together with technological advancement and capital accumulation in a country. Thus, a state should rightly choose specific sectors in which a country has a latent comparative advantage to catch up with more advanced economies.

To understand the notion of structural endowment, two factors must be considered – capital and labor. Traditionally, factor endowments include land as well, however Lin does not consider the land in his study. In a dynamic market, a country's development pace is determined by whether it prefers technologies based on the lowest cost lines defined by its relative factor endowments (Lin, 2010). To understand the dynamics between technology, capital and labor, one should examine the following example from Professor Lin's book (Lin, 2010).

In a country or a company that considers only capital and labor, and produces only one product, one can check the technology required to produce certain amount of this good. Where A represents technology, it is more labor intensive in comparison to B. Furthermore, isocost lines are C, C1, D, and D1. The relative prices of capital and labor are represented by the slope of an isocost axis. The implementation of technology A to generate a given amount of production would require the lowest cost in an economy where capital is scare and labor is abundant. Isocosts C and C1 portray this finding. As the relative price of labor rises, as seen by the isocost lines D and D1, technology B would be the most cost-effective. A company would be viable only if it uses the less cost-intensive technologies in its production in a free, transparent, and competitive market economy that produces only one

commodity. When the relative costs of capital and labor are represented by C, the introduction of technology A is the least costly. Any other technologies, such as B, would be more expensive to implement. This dynamics proves that the relative surplus or lack of capital and labor in the economy's factor endowments afftects the relative prices of capital and labor in a dynamic market. The isocost line would be close to line C when labor is relatively plentiful and capital is rarely available (Lin, 2010).



source: J.Y., Lin, New Structural Economics: A Framework for Rethinking Development and Policy, World Bank, Washington 2010, s. 293.

Figure 2.1 Relative Price of Production Factors and Technique Choice

2.4 Methodology of New Structural Economics

Growth Indication and Facilitation Framework (GIFF) - a "practical policy tool" of New Structural Economics is core to navigate a country's comparative advantages, follow them in its development path and grasp the opportunities related to its latecomer advantage (Lin, Xu 2016). Based on GIFF, policymakers can shape tailor-made development policy to ensure they make proper use of a country's endowment structure. Lin and Xu stated that GIFF could only be effectively implemented once policymakers focus on "what a country *has* instead of what it *lacks"* (Lin, Xu 2016).

As such, GIFF consists of six steps introduced by Treichel and Lin (2010):

1. The government should embark on choosing the "right target" (Lin, 2012b) by recognizing goods and services produced in rapidly developing countries. Importantly, these countries should have a similar endowment structure to the analyzed state and have around 100%-300% higher income per capita, or an equal per capita income around two decades ago.

Lin explains this take-off step by pointing out wage increases. Together with economic development, wages gradually increase. Consequently, a country specializing in certain goods and services around two decades earlier is likely to lose its comparative advantage (Lin, 2012).

2. The next step is to "remove binding constraints." According to Lin, if unnecessary, there is no point in defining all promising sectors from scratch. Since in Lin's framework market plays a dominant role in resource allocation, it is better to examine the industries that domestic private companies have already entered spontaneously. In this case, the state's role is to navigate obstacles that prevent these companies from improving their products or stop other private companies from entering the same industry. As such, the government is responsible for removing the obstacles these companies face to facilitate their future growth.

3. The state should also strive to draw the attention of foreign investors. In this way, the developing country can receive the capital necessary to breed its strategic sectors and start incubation programs to protect domestic companies.

4. Besides the state's right target according to step one, the government should also navigate its distinctive endowments that might be of utmost importance in their industrial upgrading. This can only be achieved by tracing private companies' choices to support them in scaling up innovations and fostering technological advancement in these industries. This step is "scaling-up self-discoveries" (Lin, Xu 2016).

5. Industrial parks and special economic zones are practical tools to boost foreign investors' interest, build national industrial clusters, and support companies that face entry barriers.

6. Finally, according to Lin, the facilitating state should also provide "limited incentives" to selected sectors, for example, in the form of compensation for risk and costs

undertaken by pioneering firms, time-limited tax incentives, investments loans, and access to foreign exchange.

GIFF was used to define comparative advantages of several developing countries, including Nigeria, Kazachstan, Cook Islands, Fiji, Kiribati, Uganda (Lin, 2012; Lin & Wang, 2014; Lin & Dinh, 2014; Lin & Xu, 2016). In subsequent chapters of this thesis, I will use this tool in a case study on Poland.

Chapter 3: Poland's economic structure

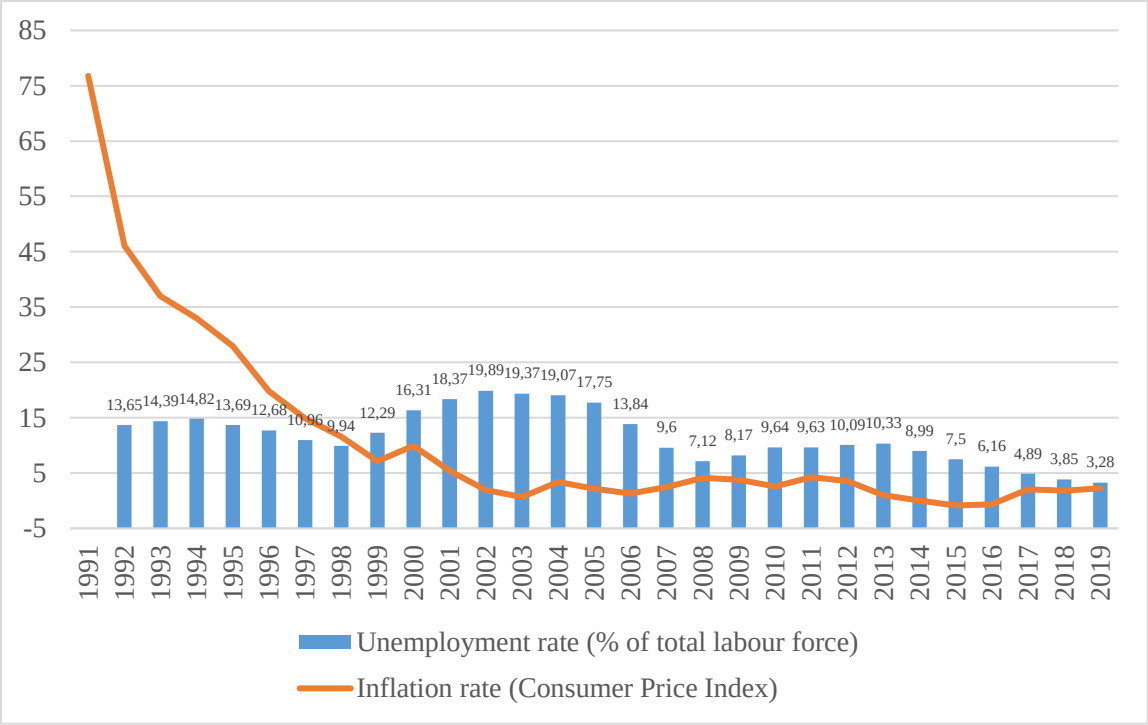
Poland's interest in New Structural Economics is rooted in the country's economic development trajectory. Therefore, this chapter examines Polish economic structure in different periods, starting from a political and economic transition in 1989, through accession to the European Union, and finally, development traps that the country currently faces.

3.1 Polish economy in transition, 1989-2004

Due to a shock therapy implemented in the transformation period, Poland faced dramatic inflation and an economic collapse at the beginning of the 1990s (Malaga, 2017). Given fundamental and fast changes implemented in Poland during the reforms period, drastic deflationary measures were necessary. That was mostly due to immediate and comprehensive price liberalization that increased prices much more significantly than forecasted. While the standard price shock in the first year of the reforms was estimated to be less than 100%, it reached 250% (Wiercinski, 2020). In 1991 the inflation was as high as 76,77. In this way, controlling inflation has become a primary goal during the transformation. However, it took almost a decade to bring a healthy balance to the economy – only in 1999 inflation did not exceed the double-digit level for the first time since the beginning of reforms and amounted to 7,15 (Wiercinski, 2020). Another pressing issue in that period was increasing unemployment. According to the World Bank data, the unemployment rate was equal to around 14% of the total labor force in 1992 and reached almost 15% in 1994 (see figure 3.1). Such a high unemployment rate was due to

restructuring and employment reduction in significant industries, such as the mining and steel industries. In these two sectors, between 1992-2003, the Polish government reduced employment by 62% and 64%, respectively (Kawecka-Wyrzykowska et al., 2005).

In this way, Polish society's high social costs accompanied the positive economic changes in line with the transformation (Interviewee 1, 2020). At that point, the society was not adapted to the market economy (Malaga, 2017). At the beginning of the 1990s, most Polish economists agreed that quick and profound changes in the liberal spirit were necessary to modernize the Polish economy. However, from a contemporary perspective, the transformation was too radical and should have been carried out in a more reasonable manner (Wiercinski, 2020). Had it been implemented following the post-Keynesian model – based on gradual evolutionary trends and institutional changes – the social costs could have been reduced (Kołodko, 1992; Malaga, 2017).

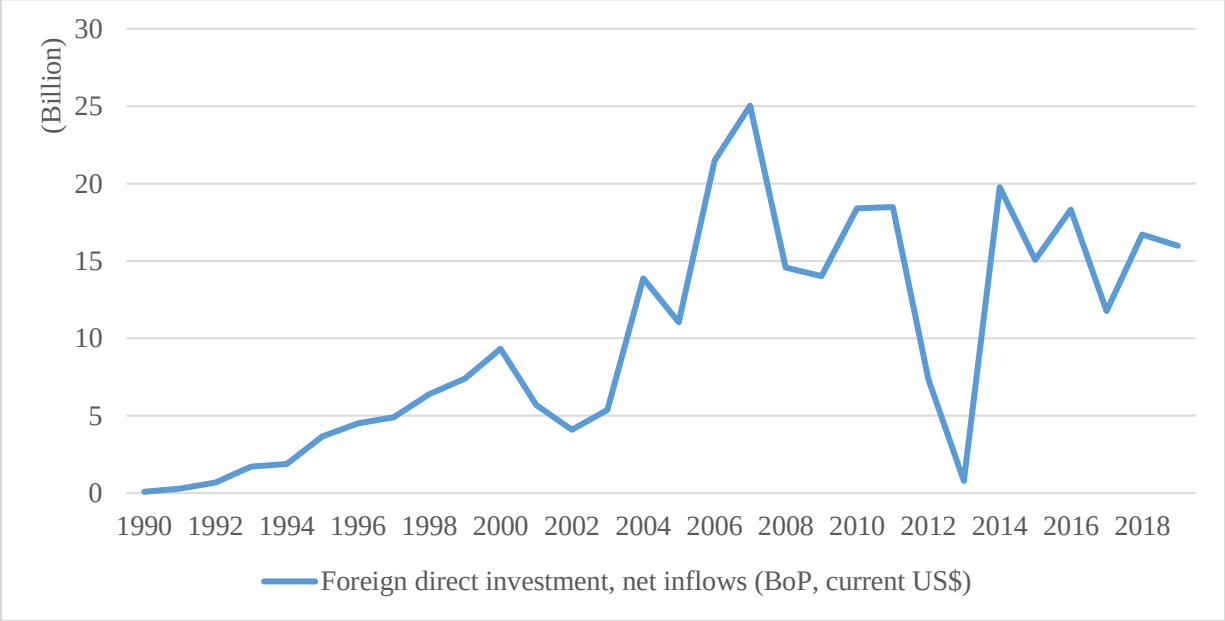


source: own study based on the World Bank data.

Figure 3.1 Inflation and unemployment rate in Poland between 1991-2019

3.2 Influence of the EU accession on the Polish economy

To understand the current Polish economy, one should consider the influence of Poland's access. The acquisition in 2004 contributed to the Polish economy's overall rapid growth. Additionally, the pre-accession measures in line with membership conditionality positively influenced the domestic economy (Interviewee 4, 2021). The pre-accession process started in 1991 when Europe Agreements between Poland and the European Commission entered into force (Grabbe, 2015). Since then, Poland was obliged to abolish all tariffs, establish a free trade area in goods and liberalize its capital flows within ten years. Besides economic requirements, the European Union set political goals, including respecting human rights, the rule of law, promoting a multi-party system, and arranging free elections (Grabbe, 2015). In general, Poland's entry into the path of political and economic reforms and the European Commission's determination to ensure political stability and the rule of law as a condition for Poland's accession to the Union increased Warsaw's international credibility (Myck, 2018). Consequently, following a stable and predictable political and business environment in Poland, the inflow of foreign investments has increased by around 16% between 1990 and the accession year of 2004 (World Bank, 2020) (see figure 3.2).



source: own study based on the World Bank data.

Figure 3.2 Foreign direct investments net inflow to Poland between 1990-2019 (BoP, current $, in billions)

Poland was positioned well for joining the European Union and took full advantage of it. The EU accession was a foundation for structural adjustment stability, and European funds became an additional catalyst of economic development after 2004 (Myck, 2018). As a result, since its access to the European Union in 2004, Poland was one of the fastest-growing economies in Europe (World Bank, 2020).

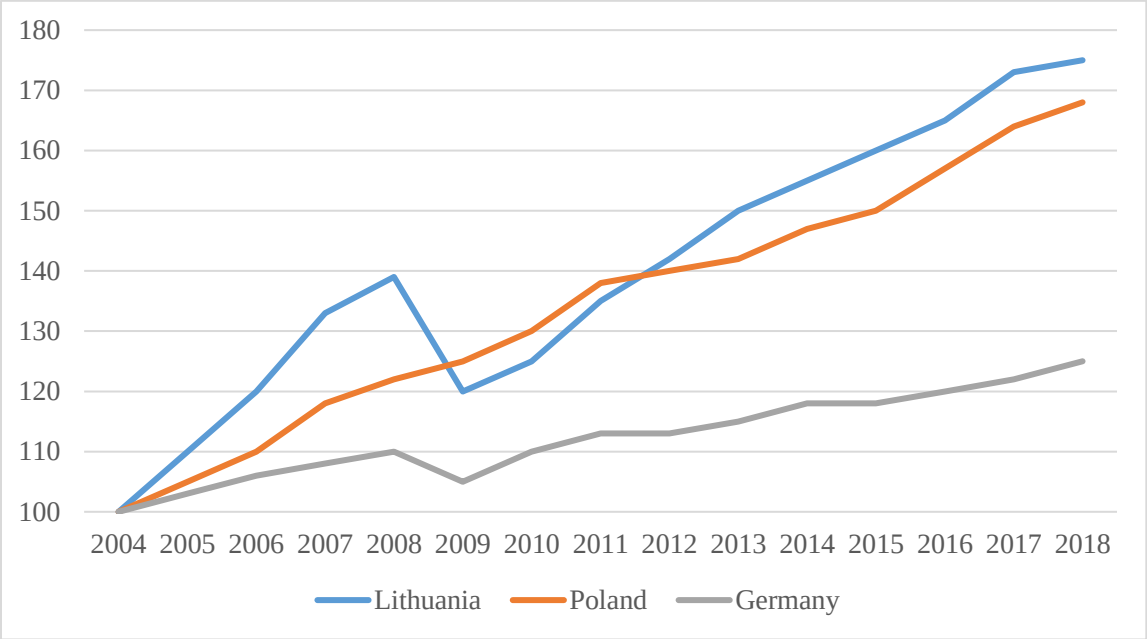
Table 3.1 Macroeconomics aggregates of Poland

Year	GDP growth annual	Current account balance (% of GDP)
1991 (the beginning of economic reforms)	-7,01	-2,51
1992	2,51	-3,29
1993	3,74	-6,03
1994	5,29	0,57
1995	7,10	0,60
1996	6,12	-2,04
1997	6,45	-3,60
1998	4,64	-3,95
1999	4,65	-7,34
2000	4,56	-6,01
2001	1,25	-3,11
2002	2,04	-2,78
2003	3,49	-2,51
2004 (accession to the EU)	4,98	-5,43
2005	3,51	-2,61
2006	6,13	-4,03
2007	7,06	-6,39
2008	4,19	-6,71
2009	2,83	-4,06

2010	3,74	-5,39
2011	4,76	-5,17
2012	1,32	-3,73
2013	1,13	-1,29
2014	3,38	-2,10
2015	4,24	-0,55
2016	3,14	-0,52
2017	4,83	0,02
2018	5,35	-0,99
2019 (most recent available data)	4,54	0,41

source: own study based on the World Bank data.

Poland noted the second-highest economic growth in the region (Myck, 2018). In fact, out of the ten countries that joined the EU in 2004 (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia), only Lithuania recorded higher economic growth than Poland between 2004-2019 (see figure 3.3). While Germany's GDP per capita growth dynamics in this period was equal to 21%, Poland and Lithuania outperformed Berlin with 65% and 75% dynamics, respectively (Czernicki, Czerwiński, Kukołowicz, Kutwa, Lewicki, 2019).



source: own study based on the World Bank data.

Figure 3.3 GDP per capita growth dynamics (annual %) in Poland, Lithuania and Germany between 2004-2018 (2004=100)

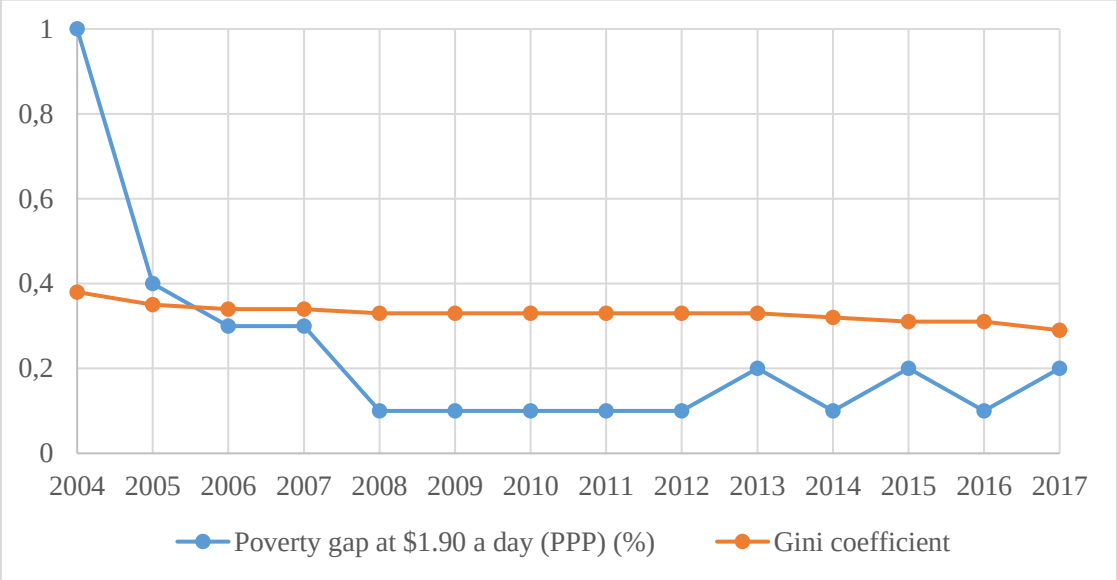
3.3 Accomplishments of Polish economic development

Accession to the European Union boosted Polish economic growth. As a result, in 2003, the World Bank recognized Poland as a middle-income country (World Bank, 2003). Therefore, it took Warsaw only fifteen years to climb up to high-income country status (World Bank, 2018). This accomplishment deserves attention since, in its way to high-income country status, Poland managed to maintain a low level of social inequality, stable employment growth, and nourish a large proportion of a well-educated labor force (Myck, 2018).

In Poland, the overall poverty gap of people living at $1.90 a day dropped from 1% in 2004 to 0,2% in 2017 (see figure 3.4). Increased earnings enabled significantly limiting the poverty gap. As such, labor earnings increase fueled wage rise. However, the employment rate rose mainly among older age groups. The state's labor market strategy has contributed to the dramatic increase in the national minimum wage level, which jumped in real terms

by 65% between 2005 and 2015, almost half as quickly as the average wage between 2005 and 2015 (Myck, 2018).

Simultaneously, the Gini coefficient remained low and decreased marginally from 0,38 in 2004 to 0,29 in 2017 (World Bank, 2018). It was the tax and benefits program that led to reducing income disparities. According to national estimations, approximately half of the Gini coefficient decline was due to tax and benefits system modifications over 2004-2017 (Myck & Najsztub, 2017) (see figure 3.4).

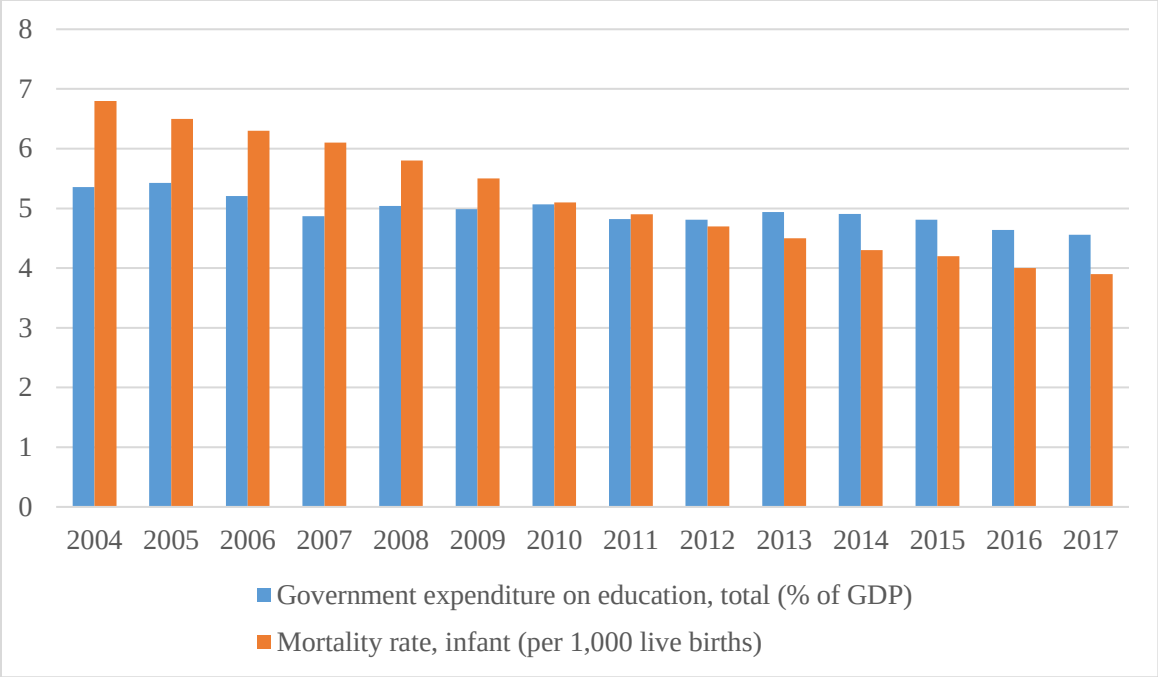


source: own study based on the World Bank data.

Figure 3.4 Poverty gap at $1.90 a day PPP (% of the population) and Gini coefficient in Poland, 2004-2017

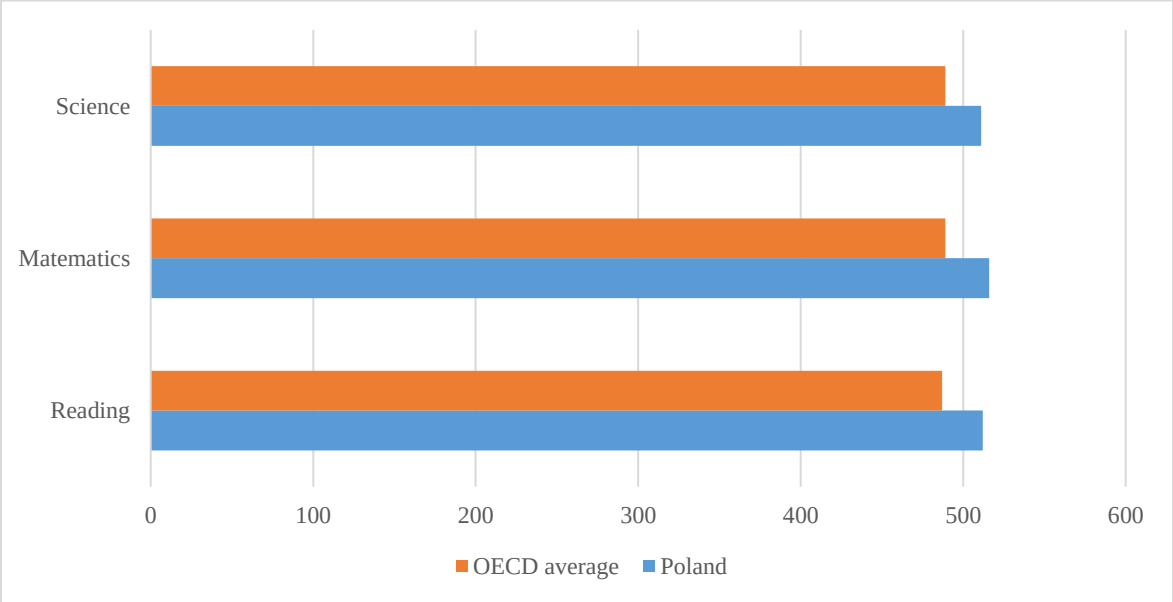
Intellectual capital has been one of the main pillars of Poland's economic performance in recent years (Myck, 2018). State-covered tuitions for primary, secondary, vocational, and higher education contributed to a high level of government expenditure on education that varied between 5,35% and 4,56% of GDP between 2004 and 2017 (see figure 3.5). The low infant mortality rate per 1000 live births dropped from 6,8 in 2004 to 3,4 in 2017 supported this trend (see figure 3.5). The broad access to education and healthcare system across society and a series of well-structured educational reforms have created a well-educated labor force. According to the OECD Program for International Student Assessment (PISA) issued in 2018, Polish students ranked high above the world average

in all researched categories, namely reading, mathematics, and science (see figure 3.5).



source: own study based on the World Bank data.

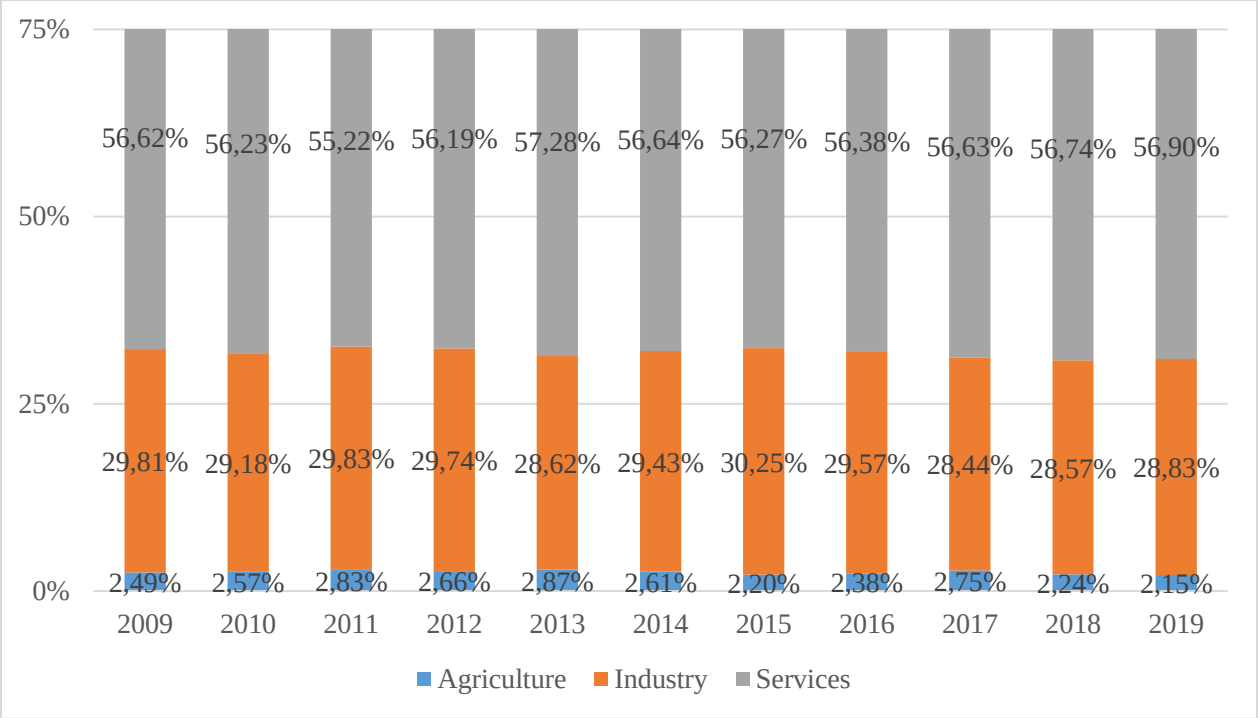
Figure 3.5 Government expenditure on education (total % of GDP) and infant mortality rate (per 1000 live births) in Poland between 2004-2017



source: own study based on the World Bank data.

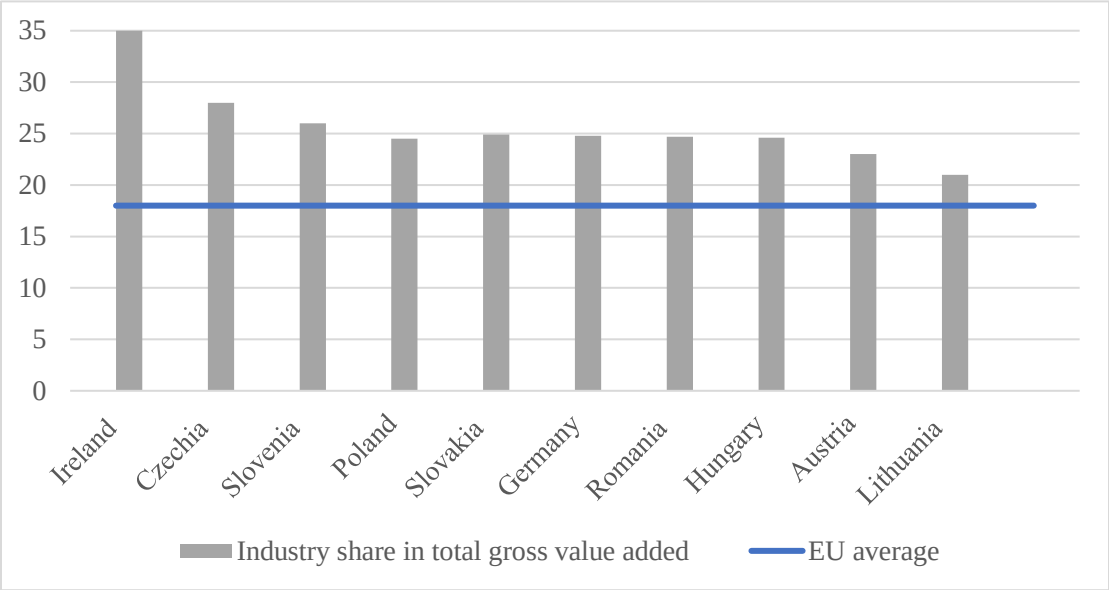
Figure 3.6 Polish students' skills in reading, mathematics, and science according to the OECD Programme for International Student Assessment (PISA), 2018

Besides having a well-educated labor force, Poland is a highly industrialized country (Golik, 2016). Within a decade (2009-2019), industry accounted for approximately 30% of Poland's GDP across all economic sectors (see figure 3.6). Furthermore, the Polish economy was distinguished by one of the largest proportions of industries in terms of GDP and added value among the European Union countries (see figure 3.7).



source: own study based on the Statista's data (Statista, 2020).

Figure 3.7 Distribution of gross domestic product (GDP) across economic sectors from 2009 to 2019 in Poland



source: own study based on the Eurostat data (Eurostat, 2019).

Figure 3.8 Top ten countries with the highest share of industry in total gross value added in the European Union 2019

3.4 Challenges ahead for Polish economic growth

Poland's development trajectory included significant accomplishments, such as social inclusiveness, a well-educated labor force, and a high industrialization level. Nonetheless, the national economy currently faces various challenges. These challenges were defined by the Ministry of Economic Development in the "Polish Strategy." Council of Ministers adopted the document and characterized five development traps that Poland needs to address urgently: middle-income trap, imbalance trap, average product trap, demographic trap, and institutional weakness trap. All of them are introduced in this chapter.

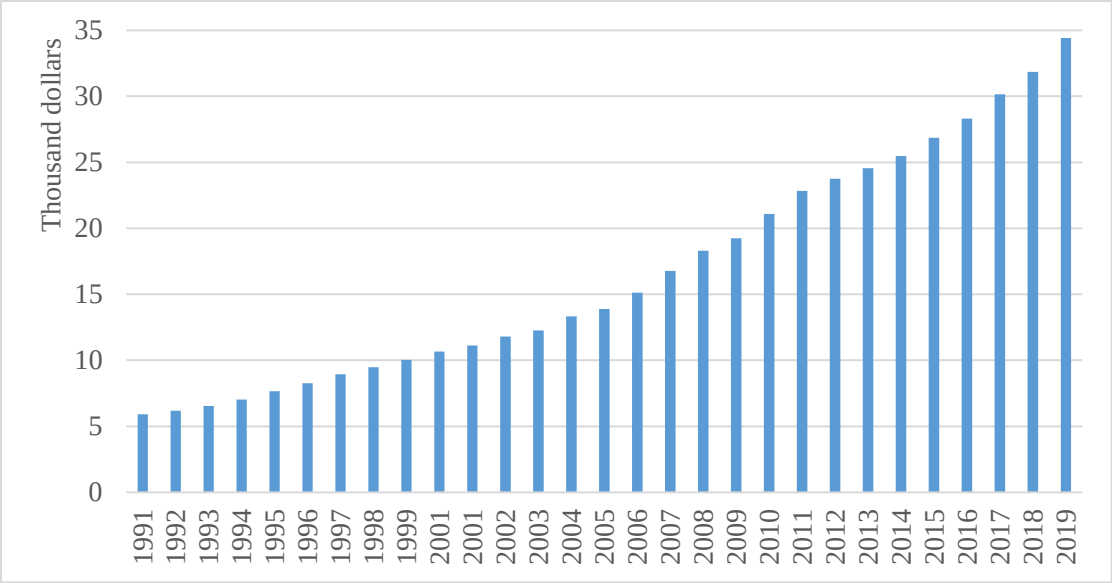
3.4.1 Middle-income trap

According to the Polish Ministry of Development, the Polish economy's primary challenge is the middle-income trap. The *middle-income trap* theory was introduced in 2007 by the World Bank economists Indermit Gill and Homi Kharas. The fact that not all Asian developing countries repeated the successes of the Asian Tigers motivated the authors to formulate the theory (Gill & Kharas, 2007). According to them, after achieving

a particular growth stage, developing countries' economies remain stagnant due to the lack of competitive advantage arising mostly from cheap labor. Thus, the middle-income trap appears when states proliferate due to comparatively low salaries, urbanization, migration, and resources from low-productivity industries. However, they are unable to catch up and compete with high-income countries. On the one hand, the critical characteristic of countries caught in the middle-income trap is the shaping of salaries at a level sufficiently high to prevent the preservation of global competition in the production and export of essential goods and services. On the other hand, due to their low technological level, these countries are incapable of competing in high-tech areas (Gill & Kharas, 2007).

Numerous researchers further developed the middle-income trap concept. However, Polish and Chinese scholars' definitions will be dominant in this thesis. In Poland, the most well-known depiction of the middle-income trap is "the long-term slowdown in economic growth after a period of relatively fast development due to a country's inability to catch up with highly developed countries" (Ciesielska, 2014). At the same time, Chinese scholars characterize the middle-income trap as "a country's failure to have a faster labor productivity growth through technological innovation and industrial upgrading than high-income countries" (Lin, 2017). According to both characterizations, an outdated structure of the economy, an unfavorable demographic situation, a high degree of market regulation, a low level of innovation in the economy, and a small share of high-tech products in exports raise the risk of falling into the middle-income trap.

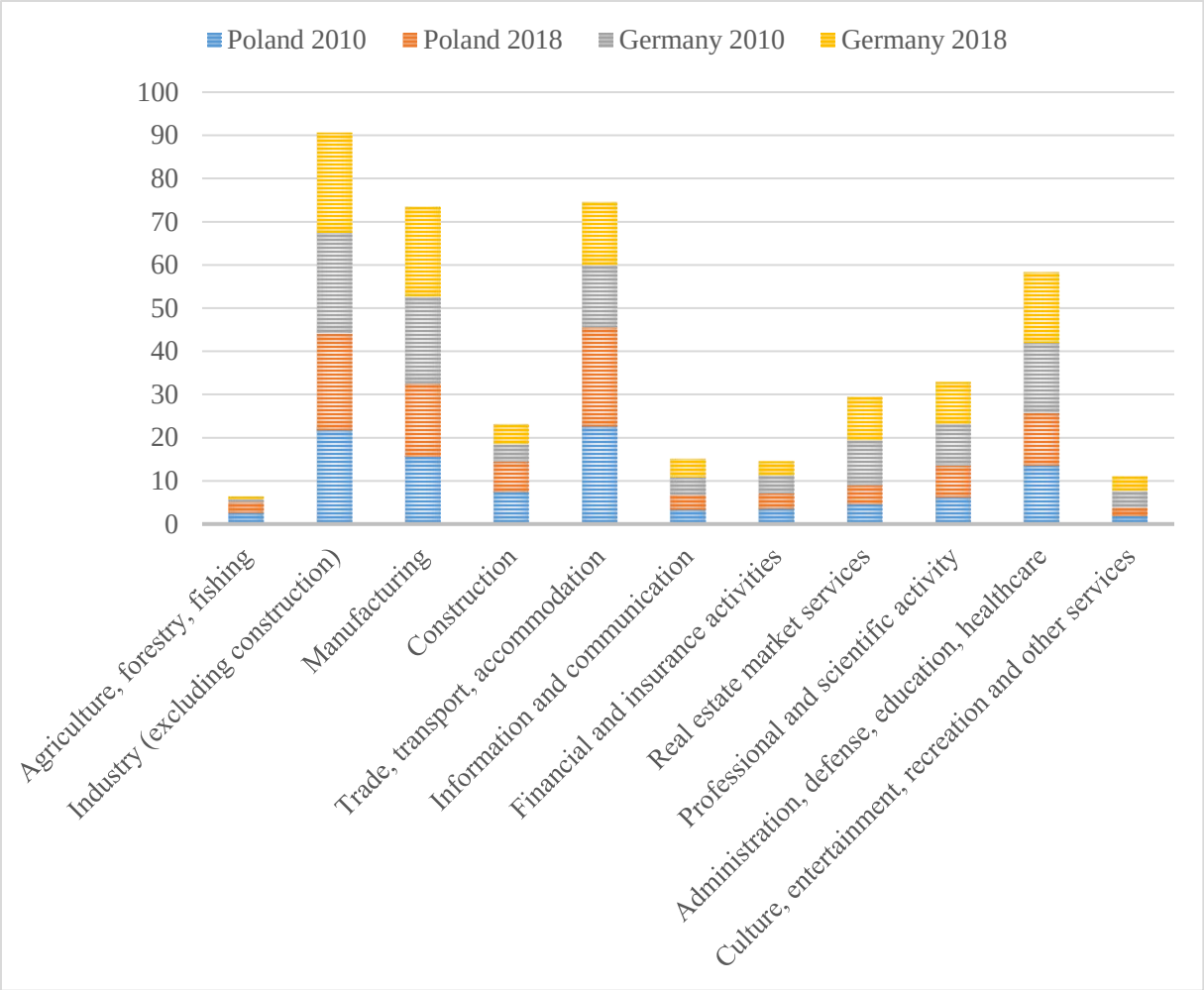
To estimate the risk of falling into the middle-income trap, one should examine a country's GDP per capita growth. That is since the trap primarily endangers 60 countries from the medium-high income category, varying from USD 3996 to USD 12 375 GDP per capita (Gill & Kharas, 2007). According to the World Bank data, Poland's GDP per capita (PPP) is highly above this range – in 2019, it was equal to 34431,16 USD, thus higher by 178% than the World Bank's scope (see figure 3.9). Therefore, in light of the GDP per capita high level, as well as a dramatic increase of around 482% (28 518 international US dollars) between 1991 and 2019, the risk of Poland's fall into the middle-income trap is marginal.



source: own study based on the World Bank data.

Figure 3.9 GDP growth per capita PPP (current international $) in Poland, 1991-2019

However, the GDP per capita (PPP) is not the only factor to consider when analyzing the risk of falling into the middle-income trap (Gill & Kharas, 2007). Owing to an outdated structure of the economy, where sectors based on knowledge and new technologies play a relatively minor role, in contrast to low-productivity sectors, a country is prone to falling into the middle-income trap too (Eichengreen, 2012). The Polish economic structure's analysis proves that industries based on knowledge and advanced technology play a relatively insignificant role. Although overall, between 2010-2018, Poland made a step forward to catch up with modern economies, such as Germany, the gradual increase in innovative sectors' role is still too modest to exclude the middle-income trap's risk.



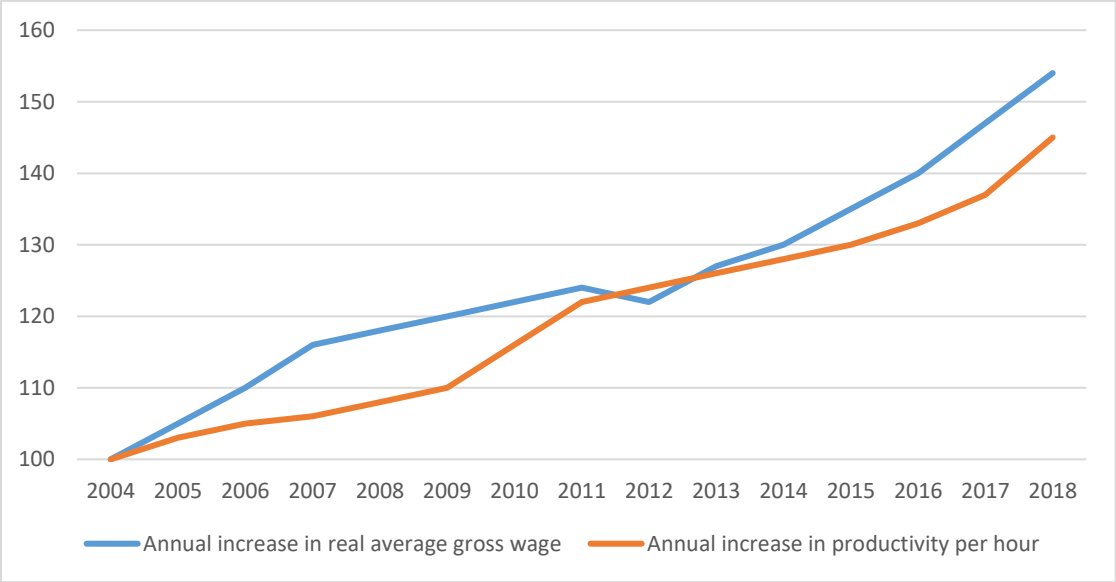
source: own study based on the Eurostat data.

Figure 3.10 The structure of the Polish economy in comparison to the German economy (by value-added, in %), in 2010 and 2018

Innovation is the key to avoiding the middle-income trap (Gill & Kharas, 2007). However, Poland's performance in the international innovation rankings is unsatisfactory. In the 2019 Global Innovation Index, Poland was ranked in 39th place out of 129 countries included in the report, while the 2019 Bloomberg Innovation Index placed Poland 22nd out of 60 countries. Simultaneously, in the 2019 European Innovation Scoreboard, Poland ranked 25th out of 28 EU Member States. In other words, Poland finds it challenging to compete globally. Given the high level of innovativeness in other European countries, competing in Europe is demanding as well.

3.4.2 Average product trap

The average product trap is closely related to the middle-income trap and appears when a country loses cost advantage without obtaining a technological advantage in return (Matsuura, 2016). Given substantial wage growth in Poland, relatively low innovation capacity, and limited productivity growth, the average product trap is very likely to slow down the Polish economy for years to come ("Polish Strategy, 2016). This phenomenon is already noticeable in the wages and productivity ratio. Due to little technological improvement in the Polish economy, the wage growth rate has surpassed the productivity growth rate since 2013 (Czabańska-Zielińska et al., 2019) (see figure 3.11).



source: own study based on McKinsey & Company report (Czabańska-Zielińska, et al., 2019).

Figure 3.11 The annual increase in real average gross wage compared to annual growth in productivity per hour (2004 = 100)

The industrial sector portrays the repercussions of such a ratio. While the industrial sector's share in the added value production in Poland is close to that of the German economy, the Polish workforce generates around three times less annually than the German workforce. For example, the Polish workforce produced EUR 19 000 per year compared to EUR 64 000 per year produced by the German workforce (Bogdan, Boniecki, Labaye, Marciniak, & Nowacki, 2015). Such a difference is a direct consequence of less efficient technology and production techniques.

3.4.3 Imbalance trap

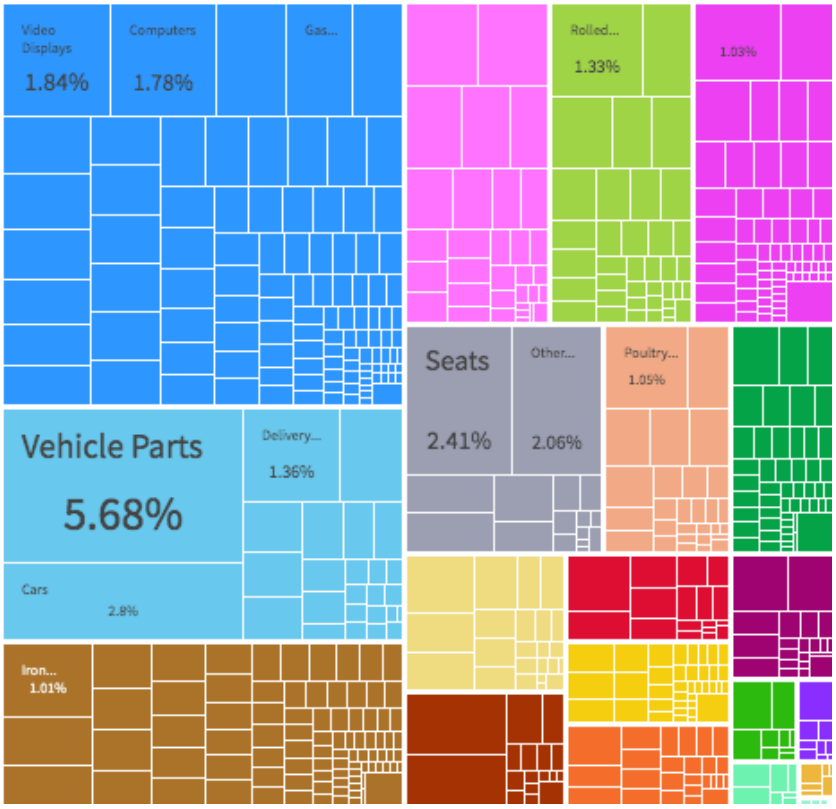
The imbalance trap is the third development trap defined in the "Polish Strategy." During the transformation period, foreign investments boosted the Polish economy (see figure 3.2). However, since Poland already accomplished its transition from a planned economy to a market economy, it is necessary to rethink the foreign capital influence.

The Polish government acknowledges that foreign investments and foreign companies' presence on the Polish market positively affected the transition period's domestic economy ("Polish Strategy," 2016). Due to low wages, in the 1990s, foreign companies located numerous investments in Poland. They took advantage of the concept and R&D, as well as sales and service stages of Stan Shih's smiling curve, while Poland's role was limited to cheap manufacturing. In the short term, such cooperation enhanced economic growth. However, the foreign investors did not share their knowledge, technology, and management techniques with Polish entrepreneurs ("Polish Strategy," 2016). As a result, such internationalization did not ensure long-term economic growth (Rahman & Zhao, 2013).

Moreover, the imbalance trap appears due to the Polish companies' little presence on the international market ("Polish Strategy," 2016). In this way, Polish enterprises abroad' equivalent activity does not compensate for foreign-owned corporations in Poland. Besides that, Polish businesses mostly internationalize through exports, with a few investing abroad or developing R&D or joint venture collaboration with foreign partners (PARP, 2014).

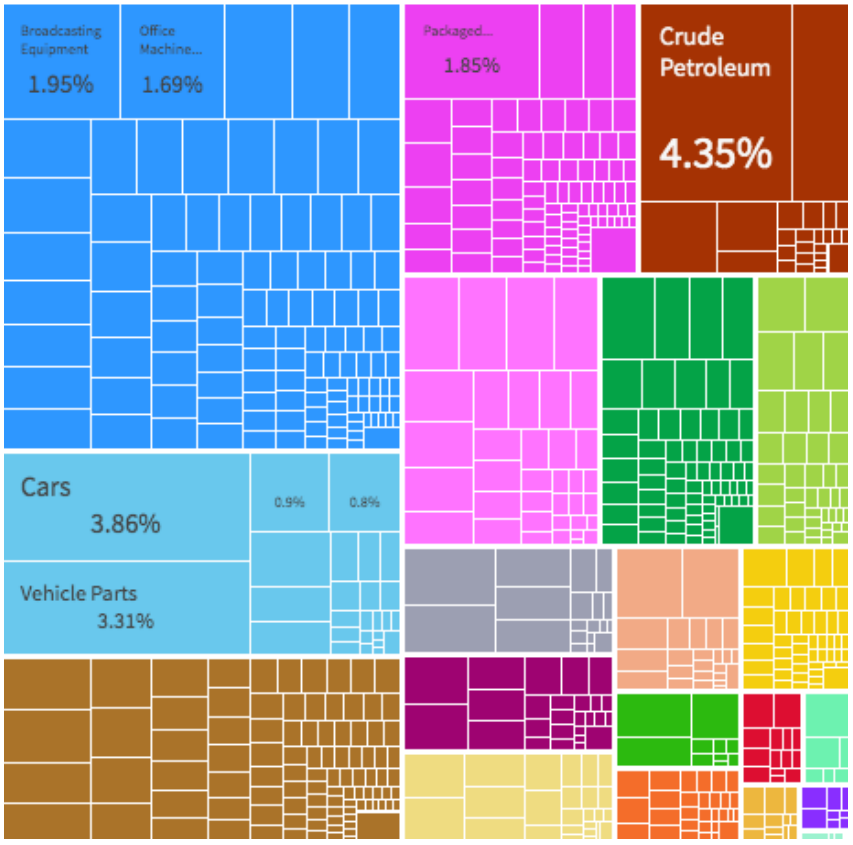
Furthermore, the structure of Polish exports is distressing. The share of exported high-tech products remains marginal, while medium and low-tech goods prevail. According to the Observatory of Economic Complexity, in 2018, Poland was the world's biggest exporter of razor blades ($940M), wood crates ($628M), frozen fruits and nuts ($554M), rye ($97.8M), and wood stakes ($38.6M). All of these products are low-tech goods. At the same time, the top exports of Poland included vehicle parts ($14.7B), seats ($6.24B), furniture ($5.33B), and video displays ($4.77B), which are middle-tech products (The Observatory of Economic Complexity, 2020) (see figure 3.12). Additionally, besides raw materials (primarily crude oil that dominates Polish export [$12.1B]), Poland imports

technologically advanced products, such as cars ($10.7B) and broadcasting equipment ($5.4B) (see figure 3.13). In this way, Poland is a producer of low and middle-tech goods, while it imports technologically advanced products. Such export-import structure makes it an "economy of a subcontractor" (also called "a dependent economy"), mainly to its most prominent export and import partner – Germany (Gromada, Janyst, & Golik, 2015).



source: The country profile, Observatory of Economic Complexity, MIT.

Figure 3.12 Composition of Poland's Exports by 4-digit HS code, 2018

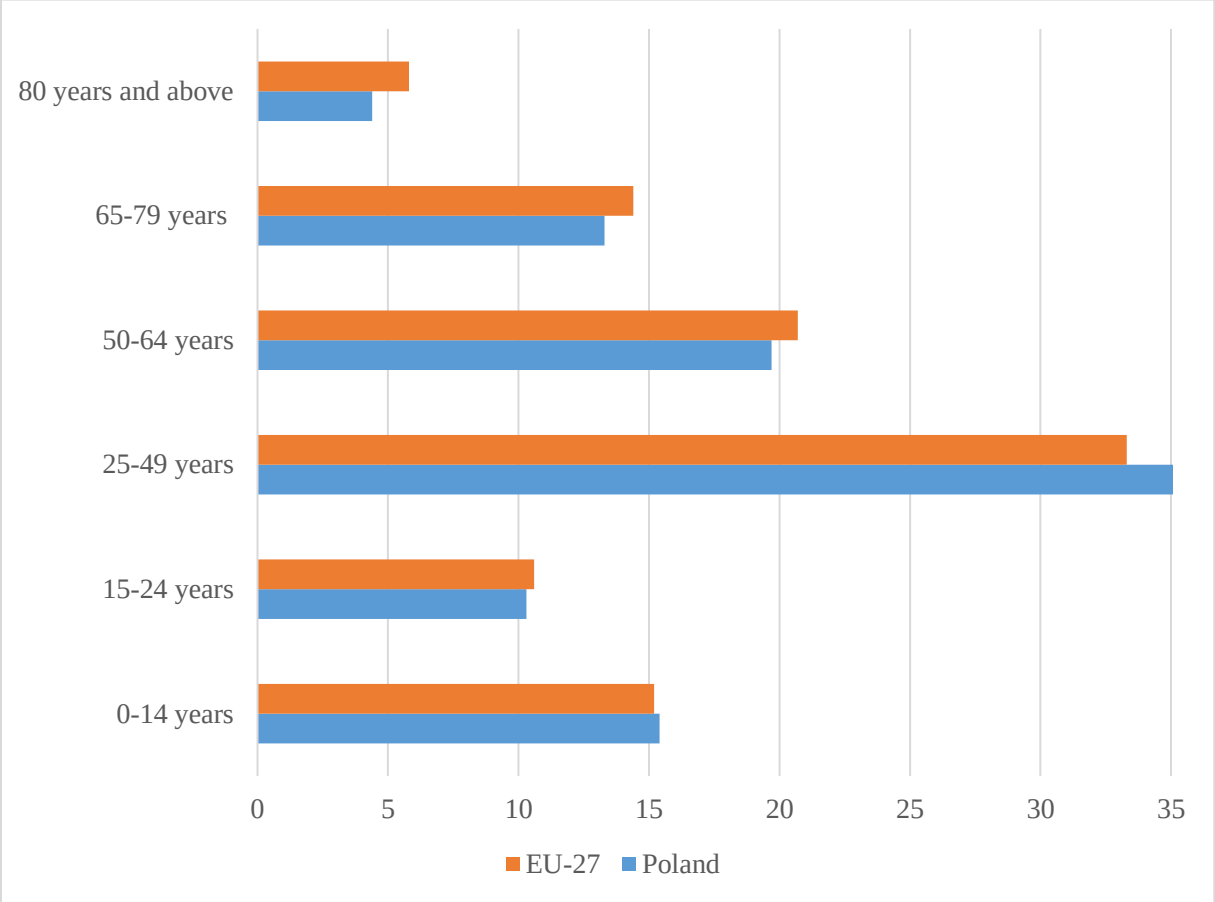


source: The country profile, Observatory of Economic Complexity, MIT.

Figure 3.13 Composition of Poland's Imports by 4-digit HS code, 2018

3.4.4 Demographic trap

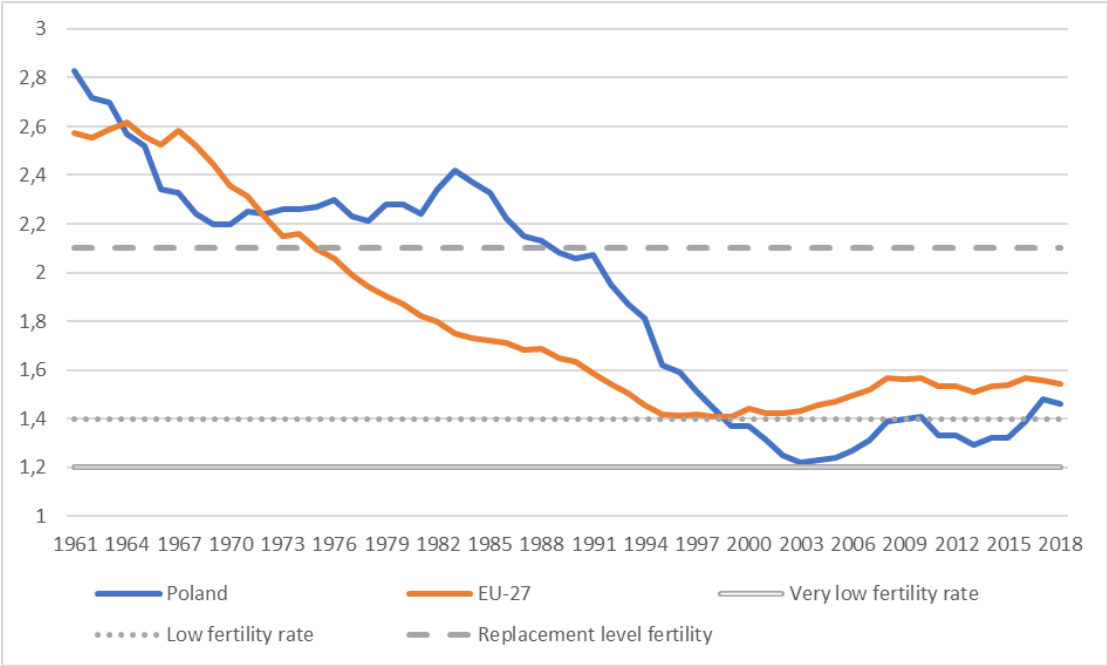
Poland's demographic problems are the outcome of changes in the population reproduction process and their enduring influence on population growth dynamics. As such, low fertility rates and lengthening life expectancy significantly change European societies' landscape. This is because the numbers of newborns shrink, while the proportion of older people (above 60 years old) increases (Sonik, 2013). In Poland, 4,4% of the society is above 80 years old, while 15,4% of Poles are aged 0-14. People between 25-29 years old prevail and account for 37% of society. As such, these trends are comparable to the European Union's ratio, which has 1,4% more above 80-year old citizens, 0,2% fewer citizens aged 0-14, and 3,7% fewer people in the range of 25-49 years old (see figure 3.14).



Source: own study based on Eurostat data.

Figure 3.14 Population by age group (% of the total population) in Poland and the 27 European Union countries in 2019

Although the population by age group ratio is comparable to the European Union's, the dropping fertility rate is particularly alarming in Poland. While in 1961, there were 2,83 live births per Polish women in childbearing years, this number dropped to 1,62 in 1995. In the following decade, the decreasing trend prevailed, with only 1,24 children per woman in 2005 (Eurostat, 2020). In the 27 EU Member States, the fertility trend is decreasing as well. While in 1961 2,57 children were born per European woman, by 1995 this number declined to 1,4 children. In 2005 the ratio improved slightly to 1,46 and in 2017 was equal to 1,55 (Eurostat, 2020). As such, both Poland and the European Union currently experience low fertility rates (below 1,5). Such a ratio indicates that the replacement of generations is insurmountable (Abramowska-Kmon, 2020). In other words, fewer children are born than in their parents' generation. Therefore, the population is decreasing in the long run, which is disturbing for sustainable economic growth.



Source: own study based on Eurostat data.

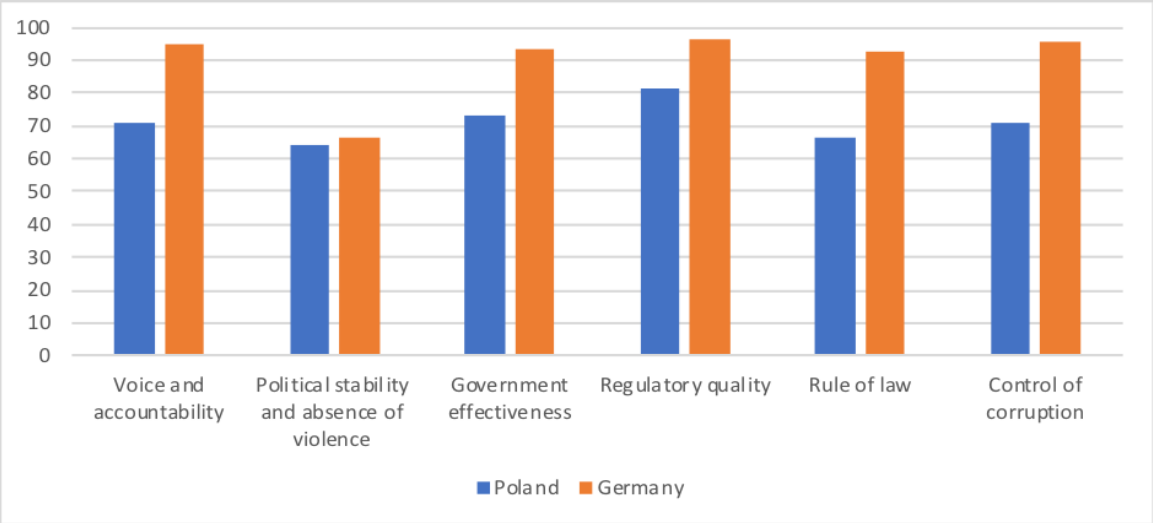
Figure 15. Fertility rates in Poland and 27 European Union's Member States between 1961-2017

3.4.5 Institutional trap

Institutions are permanent elements of social order, controlled and authorized modes of action, known methods of solving co-operation problems and coexistence, and specific structured organizations performing unique roles within society (North, 1990). The institutional framework strongly influences a country's legal system and business environment. As a consequence, overall national economic performance depends on the institution's quality (Helpman, 2008).

Polish government indicated in the "Polish Strategy" that institutions fail due to revenue discrepancies, vague tax legislation, the absence of efficient public policy coordination, extensive judicial and administrative processes, and the government agencies' poor performance (Morawiecki, 2016). Such diagnosis is in line with international indicators on institutions' efficiency. According to Worldwide Governance Indicators data, in government effectiveness, Poland scored 73,08 out of 100, while Germany's result was

20,19 percentile higher. Similarly, in terms of regulatory quality, Germany outperformed Poland by 14,9 percentile, while in the rule of law, the difference reached 25,96 (see figure 3.16). These numbers indicate that weak institutions endanger Poland's rapid economic growth.



source: own study based on Worldwide Governance Indicators data.

Figure 3.16 Quality of institutions in Poland in comparison to Germany, 2019 (percentile rank 0-100)

Chapter 4: New Structural Economics in Poland

4.1 Introduction

To understand Poland's interest in New Structural Economics, one needs to examine the trajectory of Sino-Polish relations. As a part of the Soviet bloc after World War 2, Poland was one of the first countries that recognized Mao Zedong's government in 1949 (Song & Ding, 2020). Moreover, both Poland and China have experienced an economic transition in a similar period. China's reforms and opening-up were initiated by Deng Xiaoping in 1978, while Poland embarked on its transition to market economy and democracy in 1989 (Song & Ding, 2020). Although the transition trajectory differs significantly, this shared legacy deserves attention when analyzing bilateral relations.

From the beginning of the 21st century, there was a significant increase in the mutual interest between the two countries, which led to rising Sino-Polish relations to the level of

a strategic partnership in 2011 (Kaminski, Skorupska, Szczudlik, 2019). Along with enhanced bilateral cooperation, China has started to look more attentively at the Central and Eastern European regions (Interviewee 7, 2021). During his visit to Warsaw in 2012, Premier Wen Jiabao announced the '16+1' CEE-China cooperation platform launch (Kaminski, Skorupska, Szczudlik, 2019). Three years later, mutual relations were enhanced further when Poland joined the Belt and Road Initiative and the Asian Infrastructure Investment Bank (Kaminski, Skorupska, Szczudlik, 2019). At that point, the Polish establishment started to analyze New Structural Economics and its potential implementation in Poland to counter the middle-income trap (Lin, Nowak, 2017). Thus, to provide a comprehensive background of these developments, I will briefly analyze Sino-Polish relations in this chapter.

4.2 Sino-Polish relations in light of New Structural Economics

After Chairman Mao Zedong proclaimed the People's Republic of China on 1st October 1949, Poland was one of the world's first countries to establish diplomatic relations with Beijing (Song & Ding, 2020). In the 1950s, Sino-Polish bilateral cooperation developed rapidly, with high-level mutual visits being an illustrative example. Premier Zhou Enlai, minister Peng Dehuai and vice-chairman Zhu De visited Poland in the 1950s, while General Secretary Boleslaw Bierut and his predecessor, Edward Ochab, paid a revisit to Beijing (Song & Ding, 2020). Although cultural cooperation thrived, Moscow limited political and economic ties between China and Central and Eastern Europe. In light of the Sino-Soviet split, Moscow's pressure significantly constrained the Central and Eastern European relations with China(Song & Ding, 2020).

This dynamic changed when China and Poland embarked on their market reforms in 1979 and 1989. Although both countries decided to start their transition in a similar period, their chosen approach varies significantly. While China was a proponent of "dual-track" (shuāngguǐzhì: 双轨制), gradual economic changes, Poland chose a "shock therapy" (xiūkè liáofǎ: 休克疗法) to modernize its economy (Cornia, 1994). Immediate and comprehensive price liberalization resulted in a real increase in prices much more significant than forecasted. Deflation was necessary since price shock in 1990 reached 250%

(Wiercinski, 2020). Simultaneously, due to the "dual-track," China avoided large price shocks while ensuring the continuity of supplies critical for production and the essential consumer goods. Thus, it was possible to adapt to new conditions and develop market mechanisms in a situation of sustained economic growth (Interviewee 6, 2020). Double prices, and some restrictions attached to them, were an effective instrument in easing the problematic transition (Cornia, 1994).

However, it was the political, not economic, nature of the transition process that mostly influenced Sino-Polish relations (Interviewee 3, 2020). Poland based its approach upon political reforms and firm rejection of the government leadership in a country's economy (Wiercinski, 2020). Thus, Poland chose a path offered by Western economists who stated that the market was to replace the government, while "the best industrial policy was no industrial policy" (Sachs 1994, Sachs 2005). In contrast to Poland, in China, the market transition did not substitute the government but strengthened its state's power (Song & Ding, 2020). Although the Chinese Communist party promoted decentralization by halving the national income's central budget share, it retained the monopoly of power supported by internal reforms (Poznanski, 2012). The most critical was the ideological change initiated by Deng Xiaoping, who renounced extreme Maoism and promoted the market's increased role under the "bird-cage economy" framework introduced by Chen Yun (where a cage symbolizes the state limiting the scope of the market) (Song & Ding, 2020).

In light of China's dynamic growth during the reforms and opening-up period and an economic slowdown in Poland, Warsaw was particularly interested in opening a new chapter in its economic and political relations with Beijing. However, such attempts ended up in June 1989, when Poland held its first partially free elections (Brona, 2020). Simultaneously, the protests in Tiananmen Square empowered the Chinese Communist Party's rule. As such, the two countries took strikingly different directions in their political agendas (Interviewee 2, 2020). As a result, the mutual interest decreased.

After 1989, Poland focused its diplomatic efforts on joining NATO and accessed the transatlantic organization in 1991. Simultaneously, China negotiated its access for almost 15 years to finally join the World Trade Organization in 2001 (Brona, 2020). Both countries

were thus placed low in one another's political and economic agendas. A small number of mutual high-level Chinese official visits is an illustrative example. While none of the prominent Chinese political figures visited Poland in that period, there were merely two high-level Polish visits to China between 1989-2004 – premier Waldemar Pawlak visited Beijing in 1994, while president Aleksander Kwasniewski went to China in 1997 (Brona, 2020).

Poland's accession to the European Union in 2004 has become a new driving force of the Sino-Polish interactions (Interviewee 8, 2021). Together with joining the European Union, Poland has become a part of the EU's single market. Due to trade relations (according to Eurostat data, in 2004, the EU imported goods from China accounted for 129 billion euros), the EU and China were essential partners, Poland has climbed higher in Beijing's agenda (Kaminski, Skorupska, Szczudlik, 2019). At the same time, Poland's interest in China has increased significantly too. Since most of Poland's export destinations were in Europe, the severe recession after the 2008 financial crisis motivated Warsaw to diversify its export partners (Brona, 2020). Given the size and increasing interest of Chinese consumers in foreign goods, China attracted Poland (Interviewee 3, 2020).

A series of high-level diplomatic visits expressed the willingness to enhance mutual relations. Within two years, premier Donald Tusk, minister Bogdan Klich and marshal of the Sejm Grzegorz Schetyna visited Beijing. Soon after, secretary Jia Qinglin, secretary He Guoqiang, and minister Yang Jiechi paid revisits to Warsaw in 2010 and 2011 (Brona, 2020). An increased number of bilateral interactions resulted in signing a joint declaration on Poland and China's strategic partnership in 2011, which opened a new chapter in Sino-Polish relations(Kaminski, Skorupska, Szczudlik, 2019).

Along with intensified Sino-Polish cooperation, Beijing has started to initiate new cooperation formats in Central and Eastern Europe. '16+1' Central and Eastern Europe Cooperation platform with China is an illustrative example. China selected the 16 countries, namely Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Czech Republic, Estonia, Lithuania, Latvia, Macedonia, Poland, Romania, Serbia, Slovakia, Slovenia, Hungary, to form a new cooperation platform together with Beijing. Notably, Premier Wen

Jiabao officially launched the platform during his visit to Warsaw. Thus, Poland was said to be the format's unofficial European leader (Przychodniak, 2017).

Despite the change of Poland's ruling party due to parliamentary elections in 2015, Poland continued to enhance its relations with Beijing. During President Andrzej Duda's visit to Suzhou on the '16+1' summit, Warsaw officially joined the Belt and Road Initiative (Pendrakowska, 2019). In 2016, Warsaw became the Asian Infrastructure Investment Bank's founding member as well (Pendrakowska, 2019).

At this point, the Polish government demonstrated avid interest in New Structural Economics (Lin, Nowak, 2017). Prime minister Mateusz Morawiecki referred to Justin Yifu Lin's legacy on several official occasions and stated that Lin's ideas are guidelines allowing the Polish Ministry of Development to search for industries where the most significant productivity gains could occur (Janus, 2016). In 2016, Morawiecki and Lin met at the World Economic Forum in Davos. After talking to the Polish deputy prime minister, Lin stated in his interview for PolskaTimes.pl that Morawiecki has "a clear idea for Poland's economic development" (Lin, 2016). In the interview, Lin suggested that "for Poland, the point of reference should be Germany, where labor productivity is higher [than Polish case]. Therefore, the Polish government should select a few industrial areas and support them to reach the German level" (Lin, 2016). Professor Lin also indicated that the fourth industrial revolution brings new opportunities for Poland, since "new areas for development [would appear] that, for example, the Germans have not yet managed to dominate" (Lin, 2016).

There is a direct reference to New Structural Economics on page 9 of the "Polish Strategy." The document is of critical importance for Poland's medium and long-term economic policy (Lin, Nowak, 2017). The paper, unofficially called "Morawiecki's Plan," was published in 2017 and contains numerous ideas in line with New Structural Economics. Among them, supplementing infrastructure gaps, striving to achieve economies of scale innovative sectors, and new prospects for Poland in line with the fourth industrial revolution are the most illustrative examples. In the subsequent subchapter, Growth Indication and Facilitation Framework is used to check whether Poland implemented New

Structural Economics' policy tool to define its latent comparative advantages.

4.3 Applying GIFF to Poland

Since the "Polish Strategy" refers to Professor Lin's theory, in this subchapter Growth Indication and Facilitation Framework (GIFF) – a "practical policy tool" of New Structural Economics – will be used (Lin & Xu, 2016). In this way, the author navigates industries with the latent comparative advantage that Poland should follow to achieve industrial upgrading. To compare them with sectors indicated in the "Polish Strategy," the author uses 2016 data since Prime Minister Morawiecki worked on the document at that time.

4.3.1 Choosing benchmark countries for Poland

The first step of GIFF is to choose the proper target, namely, identify products and services created in countries with fast economic growth (Lin & Xu, 2016). These countries ought to have an endowment system comparable to that of the studied country, have a per capita income around 100% to 300% higher than the examined state, and a growth rate of real GDP in the past two decades of at least 5% (Xu & Hager, 2017). Following these criteria, two lists of countries appear - a list of countries with a per capita income 100-300% above Poland's and a list of countries with a similar per capita income 20 years ago as Poland in 2016.

Table 4.1 Selected indicators of countries with GDP per capita, PPP, 100-300% higher than Poland's (constant 2017 international $)

Country	GDP per capita	Ratio to Poland's GDP per capita	Growth rate of GDP per capita, 2006-2016	Growth rate of GDP per capita, 1997-2016	Growth rate of real GDP, 2006-2016	Growth rate of real GDP, 1997-2016	Manufacturing value added, % of GDP, 2016
Poland	*28773,87531*	*1,0*	*3,30*	*3,65*	*4,43*	*4,04*	*17,97*
Germany	52098,4996	1,8	1,20	1,31	1,96	1,93	20,66
United States	59043,2115	2,05	0,59	1,32	1,47	2,29	11,20

Brunei	60865,9869	2,11	-1,48	-0,67	-1,46	3,52	11,46
Norway	62010,3398	2,15	0,04	0,80	1,12	3,27	6,56
United Arab Emirates	66510,8675	2,31	-2,10	-2,09	1,36	4,78	8,98
Switzerland	66570,6166	2,31	0,52	1,01	3,29	3,05	18,10
Ireland	73034,5132	2,54	2,36	3,51	5,85	6,64	33,12
Singapore	91075,5353	3,17	2,39	2,86	4,18	6,80	17,55
Qatar	95601,9874	3,32	0,22	-*	8,14	16,40	8,48
Luxembourg	113553,6	3,95	0,50	1,79	3,99	4,87	5,32

*data unavailable in the World Bank Indicators base.

Source: own study based on World Bank GDP per capita, PPP (in constant 2017 international $), Penn World Table version 10.0 rgdpe data, and World Bank Manufacturing value added (% of GDP).

Table 4.2 Countries with a similar per capita income level 20 years ago to Poland's in 2016 (constant 2017 international $)

Country	GDP per capita	Ratio to Poland's GDP per capita	Growth rate of GDP per capita, 2006-2016	Growth rate of GDP per capita, 1997-2016	Growth rate of real GDP between 2006-2016	Growth rate of real GDP between 1997-2016	Manufacturing value added, % of GDP, 2016
Poland	*28773,87531*	*1,0*	*3,30*	*3,65*	*4,43*	*4,04*	*17,97*
Slovenia	22285,32533	0,77	0,62	2,08	1,58	2,34	20,17
Malta	22988,7552	0,80	2,91	2,71	4,94	4,42	7,18
Czech Republic	23847,9462	0,83	1,27	2,30	2,82	2,75	24,03
Portugal	26351,933	0,92	0,11	0,78	0,65	1,96	12,15
Cyprus	28477,9608	0,99	-0,47	1,25	1,55	3,17	4,58
New Zealand	29898,8819	1,04	0,90	1,58	2,95	2,90	10,09
Finland	32476,6724	1,13	0,02	1,52	1,43	2,42	14,57

Sweden	35247,80915	1,2	0,78	1,85	2,68	2,89	13,91
Canada	35935,7947	1,25	0,85	1,70	1,35	2,16	9,93
Germany	39735,5017591172	1,4	1,20	1,31	1,96	1,93	20,66
Spain	29725,82504	1,03	1,17	-0,06	1,07	3,05	11,28
Ireland	34455,0774292332	1,2	2,36	3,51	5,85	6,64	33,12

Source: own study based on World Bank GDP per capita, PPP (in constant 2017 international $), Penn World Table version 10.0 rgdpe data, and World Bank Manufacturing value added (% of GDP).

In Poland's case, it is challenging to select a benchmark country that meets all GIFF requirements. Nonetheless, GIFF is a flexible tool that can be modified following an analyzed country's specific characteristics. A paper *Applying Growth Identification and Facilitation Framework to Nepal,* written by Xu Jiajun and Sarah Hager, is a case in point (Xu & Hager, 2017). In the report, China was a benchmark country for Nepal with a GDP per capita ratio of Nepal equal to 1.00 and China's 5.79, which is excessive compared to a conventional GIFF standard (Xu & Hager, 2017). Similarly, in GIFF, factors that go beyond the GDP per capita and a growth rate in the recent two decades can be considered, including political, socio-cultural, and historical characteristics (Kharki, 2017). As such, Germany, with its current 1,8 GDP per capita ratio to Poland's, a similar manufacturing value-added percent of GDP, is a natural choice for Poland's benchmark country. It is worth mentioning that besides the GDP per capita ratio, Germany possesses double labor productivity per hour in comparison to Poland. According to the University of Oxford's platform Our World in Data, Germany's labor productivity accounted for 66.71 dollars per hour worked and Poland's merely for 31.06 dollars per hour. Moreover, if one goes beyond economic analysis, Germany was indicated as a benchmark country for Poland by Professor Lin (Lin, 2016).

Another benchmark country for Poland is Ireland. Ireland meets the essential requirement of GIFF – it has 254% higher GDP per capita than Poland. With Ireland's GDP per capita growth equal to 3,5% in the last two decades, it did not meet the standard GIFF

5% growth standard. However, in comparison to other possible benchmark countries, Ireland's GDP capita growth was significantly higher. Moreover, Ireland demonstrated almost doubled manufacturing value-added as a percentage of GDP (33,12%) when compared with Poland (17,97%). Finally, with its 99.13 dollars per hour, Ireland presents a remarkably high productivity per hour work ratio (Our World in Data, 2017).

Once the benchmark countries for Poland are selected, one should define star sectors that helped them develop effectively in the last ten to twenty years (Lin & Xu, 2016). To do so, we compare the top 10 exports of a given benchmark country almost every five years, in 2000, 2005, 2010, 2015, and 2018. This approach enables to recognize which sectors are losing their competitive benefits and which sectors are developing in this way (Xu & Hager, 2017).

Table 4.3 Identifying Sectors for Growth: Key Exports of Germany, 2000-2020, selected years

Ranking 2000	**HS4 ID**	**% of total export value**
1	Cars 178703	11,9%
2	Vehicle parts 178708	3,87%
3	Packaged medicaments 63004	1,76%
4	Computers 168471	1,73%
5	Planes, helicopters, and/or spacecraft 178802	1,65%
6	Integrated circuits 168542	1,57%
7	Broadcasting equipment 168525	1,23%
8	Office machine parts 168473	1,07%
9	Low voltage protection equipment 168536	1,01%
10	Machinery having individual functions 168479	1%
Ranking 2005	**HS4 ID**	**% of total export value**

1	Cars 178703	11,8%
2	Vehicle parts 178708	4,1%
3	Packaged medicaments 63004	3,33%
4	Computers 168471	1,6%
5	Broadcasting equipment 168525	1,36%
6	Refined petroleum 52710	1,34%
7	Integrated circuits 168542	1,32%
8	Engine parts 168409	1,25%
9	Machinery having individual functions 168479	0,94%
10	Low voltage protection equipment 168536	0,86%
	Office machine parts	0,82%
Ranking 2010	**HS4 ID**	**% of total export value**
1	Cars 178703	10,9%
2	Packaged medicaments 63004	4%
3	Vehicle parts 178708	3,43%
4	Planes, helicopters, and/or spacecraft 178802	1,91%
5	Machinery having individual functions 168479	1,16%
6	Engine parts 168409	1,07%
7	Refined petroleum 52710	1,06%
8	Industrial printers 168443	0,94%
9	Medical instruments 189018	0,93%
10	Computers 168471	0,91%
	Integrated circuits 168542	0,89%

	Broadcasting equipment 168525	0,37%
	Office machine parts 168473	0,28%
Ranking 2015	**HS4 ID**	**% of total export value**
1	Cars 178703	12,4%
2	Vehicle parts 178708	4,53%
3	Packaged medicaments 63004	4,05%
4	Planes, helicopters, and/or spacecraft 178802	2,55%
5	Blood, antisera, vaccines, toxins, cultures 63002	1,32%
6	Machinery having individual functions 168479	1,08%
7	Engine parts 168409	1,06%
8	Computers 168471	0,99%
9	Integrated circuits 168542	0,99%
10	Refined petroleum 52710	0,97%
	Office machine parts 168473	0,19%
Ranking 2018	**HS4 ID**	**% of total export value**
1	Cars 178703	10,03%
2	Vehicle parts 178708	4,53%
3	Packaged medicaments 63004	3,71%
4	Planes, helicopters, and/or spacecraft 178802	2,06%
5	Blood, antisera, vaccines, toxins, cultures 63002	1,98%
6	Machinery having individual functions 168479	1,32%
7	Integrated circuits 168542	1,12%
8	Medical instruments 189018	1,03%

9	Low voltage protection equipment 168536	1,02%
10	Valves 168481	0,95%
	Computers 168471	0,79%
	Broadcasting equipment 168525	0,75%
	Office machine parts 168473	0,74%

Source: own study based on the Observatory of Economic Complexity (OEC) data.

In Germany's export, cars and vehicle parts were dominant over 2000-2018, and these sectors played a role of motors of the German economy. In 2000 vehicles accounted for 11,9%, while vehicle parts for 3,87% of total German export. By 2018, these shares were relatively stable, and the car industry reached 10,3% of German export, while the vehicle parts sector grew to 4,53%. Similarly, packaged medicaments' share in Germany's export raised from 1,76% in 2000 to 3,71% in 2018. Simultaneously, several sectors' influence was diminishing, with computers, broadcasting equipment, and office machine parts as representative examples. While in 2000 computers constituted 1,73% of total Germany's export, which decreased to 0,79% in 2018. Between 2000 and 2018, broadcasting equipment share dropped from 1,23% to 0,75%. In a similar manner, office machine parts compromised 1,07% of German's export in 2000, but this number decreased to 0,74% in 2018 (The Observatory of Economic Complexity, 2018) (see table 4.3).

Table 4.4. Identifying Sectors for Growth: Key Exports of Ireland, 2000-2020, selected years

Ranking 2000	HS4 ID	% of total export value
1	Nitrogen heterocyclic compounds 62933	20%
2	Computers 168471	12,4%
3	Office machine parts 168473	6,13%
4	Nucleic acids 62934	4,88%
5	Packaged medicaments 63004	4,21%
6	Sound recordings 168524	3,56%

7	Integrated circuits 168542	3%
8	Telephones 168517	2,39%
9	Antibiotics 62941	2,06%
10	Medical instruments 189018	2%
Ranking 2005	**HS4 ID**	**% of total export value**
1	Nitrogen heterocyclic compounds 62933	15,6%
2	Packaged medicaments 63004	15,1%
3	Computers 168471	10,3%
4	Nucleic acids 62934	5,16%
5	Scented mixtures 63302	4%
6	Medical instruments 189018	3,14%
7	Office machine parts 168473	3,08%
8	Integrated circuits 168542	2,61%
9	Sound recordings 168524	2,38%
10	Orthopedic appliances 189021	2,55%
Ranking 2010	**HS4 ID**	**% of total export value**
1	Packaged medicaments 63004	19,9%
2	Nitrogen heterocyclic compounds 62933	16,5%
3	Nucleic acids 62934	4,91%
4	Scented mixtures 63302	4,22%
5	Computers 168471	3,96%
6	Orthopedic appliances 189021	3,21%
7	Medical instruments 189018	2,61%
8	Blood, antisera, vaccines, toxins, cultures 63002	2,46%

9	Integrated circuits 168542	2,19%
10	Other edible preparations 42106	1,99%
	Broadcasting equipment 168525	1,75%
	Office machine parts 168473	0,83%
Ranking 2015	**HS4 ID**	**% of total export value**
1	Packaged medicaments 63004	19,9%
2	Nitrogen heterocyclic compounds 62933	13,7%
3	Blood, antisera, vaccines, toxins, cultures 63002	9,2%
4	Scented mixtures 63302	5,29%
5	Orthopedic appliances 189021	3,74%
6	Computers 168471	3,52%
7	Sulfonamides 62935	3,13%
8	Medical instruments 189018	3,1%
9	Nucleic acids 62934	2,16%
10	Broadcasting equipment 168525	1,91%
	Integrated circuits 168542	1,24%
	Office machine parts 168473	0,45%
Ranking 2015	**HS4 ID**	**% of total export value**
1	Blood, antisera, vaccines, toxins, cultures 63002	18,8%
2	Packaged medicaments 63004	16%
3	Nitrogen heterocyclic compounds 62933	10%
4	Scented mixtures 63302	5%
5	Medical instruments 189018	3,77%
6	Orthopedic appliances 189021	3,39%

7	Integrated circuits 168542	3,28%
8	Sulfonamides 62935	2,33%
9	Nucleic acids 62934	1,98%
10	Planes, helicopters, and / or spacecraft 178802	1,7%
	Computers 168471	1,46%
	Office machine parts 168473	1,66%
	Broadcasting equipment 168525	1,44%

Source: own study based on the Observatory of Economic Complexity (OEC) data.

In the Irish economy, the chemical sector, including pharmaceutical products, played an essential role in driving the economy from 2000 to 2018. Throughout all analyzed periods, chemical goods constituted the top export industry. At the beginning of the 21st century, nitrogen heterocyclic compounds composed 20% of Ireland's total export value, while in 2018, its share dropped by 10%. Packaged medicaments and nucleic acid played an essential role in the last decade as well, since in 2000 they accounted for 4,21% and 4,88% of total Irish export respectively. While the share of packaged medicaments increased significantly and reached 16% in 2018, nucleic acids gradually decreased over the years to get merely 1,98% in 2018. Simultaneously, several sectors shirked in the given period, with computers and office machine parts being illustrative examples. While in 2000 the share of computers was equal to 12,4%, office machine parts to 6,13%, in 2018 it dropped to 1,46% and 1,66% respectively (The Observatory of Economic Complexity, 2018) (see table 4.4).

Once we analyzed the two selected benchmark countries – Germany and Ireland and compared their economic ties with Poland, it transpires that Poland and Germany are much more interdependent than Poland and Ireland. As a neighbor country, in 2000, Germany was already the number one export and import partner for Poland, with 34,5% (10,9 billion dollars) of total Polish export directed to Germany and 25,1% (12,5 billion dollars) of Polish import arriving from Germany. Similarly, in 2018, Germany was still the top destination of Polish export and import, with 27,3% (70,7 billion dollars) of Polish products

sent to Germany and 25,5% of Polish imports being German goods (The Observatory of Economic Complexity, 2018). In the case of Ireland, in 2000, it composed only 0,34% (109 million dollars) of Poland's total export destinations and 0,67% (336 million dollars) of Poland's whole import countries. The situation has not evolved much until recently, since in 2018 Ireland accounted for merely 0,46% (1,18 billion dollars) of Poland's total export, while Irish goods were 0,6% (1,67 billion dollars) of all imported goods by Poland (The Observatory of Economic Complexity, 2018).

Due to Poland and Germany's strong economic ties, the two economies are more similar and interdependent than Ireland's case. The car industry has driven the German economy's growth for almost two decades, while in Ireland, the chemical industry was a motor for economic growth (see table 4.3 and 4.4). While Poland possesses a well-developed car sector and specializes in manufacturing vehicle parts for exports, its chemical capacity is limited. Vehicle parts and cars compromised 5,68% and 2,8% respectively of Poland's total export in 2018 (The Observatory of Economic Complexity, 2018). On the other hand, packaged medicaments and blood, antisera, vaccines, toxins, cultures accounted for merely 1,03%, and 0,27% respectively of Polish 2018 export (The Observatory of Economic Complexity, 2018). In light of solid economic foundations and similarity of economies, Germany appears to be a natural model for Poland in economic development. Such a view was confirmed by Professor Lin, who highlighted that "Germany should be the reference point for Poland" (Lin, 2016).

4.3.2 Identifying star sectors in benchmark countries

Once Germany is set as a benchmark country for Poland, it is essential to ask which sectors the fourth industrial revolution highlights so that Poland could correctly define its latent comparative advantages regarding Germany.

Based on GIFF, one can adapt the "flying geese model," according to which a country should prioritize sectors that its benchmark countries lose competitive advantage. In such a case, Poland would have a latent comparative advantage in producing computers, office machine parts, broadcasting equipment, and potentially also integrated circuits. However,

in light of global value chains' complexity, such a simplistic approach would be insufficient (Lin, Nowak, 2017). The flying geese model is useful in considering manufacturing-based industries' transformation, with wages being the most significant factor driving the transition. Specifically, the model claims that the primary factor to follow when shifting industries to developing countries is the wage gap (Lin, 2016). Therefore, due to higher wages, Poland cannot compete with its Asian counterparts. Taking China as an example, all sectors mentioned above play a vital role in its total export. Broadcasting equipment composes 8,64%, computers 5,69%, office machine parts 3,87%, and integrated circuits 3,51% of the Middle Kingdom's total export in 2018 (The Observatory of Economic Complexity, 2018). Moreover, Poland is already an industrialized country with accumulated capital (Golik, 2016). Thus, producing semi-advanced products such as the goods mentioned earlier cannot meet its industrial upgrading goal defined as having technologically-advanced and capital-intensive goods. Poland is currently a productive yet imitative economy, while it aspires to build innovation-led growth (Kurtyka, 2017). Poland should therefore, look for other sectors to achieve industrial upgrading in light of wages disadvantage and capital accumulation.

Since the market plays a dominant position in the distribution of capital, another way to discover latent comparative advantages is analyzing sectors in which domestic private enterprises have already spontaneously joined (Lin, 2010). The "successful self-discoveries" reflect private businesses' ability to create products that are valuable in the international market but are held back due to various constraints (Xu & Hager, 2017). Poland should focus on the industries naturally selected by entrepreneurs and look for new sectors that appear along with the fourth industrial revolution (Lin, 2016). In this way, the Polish government appointed the electromobility sector and a potential motor for the future innovation-led economic development (Electromobility Development Plan in Poland "Energy for the Future," 2017). According to Polish officials, the electromobility industry indeed meets the two requirements mentioned above. Firstly, Poland already has a well-developed car production sector, with vehicle parts compromising 5,68% and cars 2,8% of Poland's total export in 2018 (The Observatory of Economic Complexity, 2018). Besides that, Poland has been one of the European producers of buses, including electrical buses (Kurtyka, 2017). Secondly, the electromobility sector is promising in terms of the fourth

industrial revolution since it provides ecologically-friendly and technologically-advanced solutions (Lin, Nowak, 2017). It is estimated that by 2027 electric vehicle market size would reach USD 802.81 billion, which portrays this industry's tremendous potential (Bloomberg, 2020).

Nonetheless, although Germany – Poland's benchmark country according to GIFF – is a champion in car production, Berlin's electromobility sector still lags behind world leaders, such as China and the United States (Statista, 2019). On the one hand, this creates a chance for Poland to become a European leader in the electric vehicles sector. On the other hand, choosing electromobility as a potential "winner" is risky since even the most advanced economies in Europe, including Germany, found it challenging to compete internationally (Golik, 2020).

4.3.3 Binding constraints for electric vehicles sector development in Poland

Once a benchmark country and a prospective sector is chosen, the government's task is to facilitate the smooth development of the selected by removing biding constraints that slow down its growth (Lin, 2012). In terms of Poland, the electromobility sector was chosen as one of the ten most promising drivers of the economy in the 2016 "Polish Strategy." As such, in 2018, the Polish Ministry of Energy issued a specific document – "Electromobility Development Plan in Poland *Energy for the Future*" – dedicated to stimulating growth of electric car technology, supply, and demand. The project indicates several biding constraints that threaten the sector's growth.

Firstly, more funding for research and development must be accumulated in this sector to surmount technical obstacles. Judging by a number of vehicle parts, electric cars are less sophisticated vehicles than conventional cars, as merely 1000 parts are required to produce an electric vehicle compared with 3500 parts needed to manufacture a traditional car (Kurtyka, 2017). Such a difference translates into lower amortization costs, lower operating costs, and less likelihood of a breakdown. However, one of the critical challenges the electromobility sector faces is supplying and storing energy in an electric vehicle. The main factor is the battery (a power supply cell). China ranks first among battery manufacturers,

followed by the United States, followed by Korea and Japan, whereas LG Chem, Panasonic, Samsung, SK, and CATL are the major players in this market. In this way, other countries, including Poland and Germany, need to import the batteries, which significantly slows down the industry's development (Kurtyka, 2017). Polish science has the potential to intensify work on more effective methods of energy storage in vehicles. Nonetheless, currently, there is a lack of a demand which would warrant a significant investment in the production of this technology and a technical line of lithium-ion batteries in Poland, that could validate the technologies produced in laboratories on a wider scale (Electromobility Development Plan in Poland "Energy for the Future", 2016). As such, concentrating research and development investments on this industry could help producers of Polish electric vehicles address this issue to limit their dependency on imports in the future. This would allow Polish entities to play the role of technology vendors, not recipients. In turn, this could translate into GDP growth and new employment opportunities (Kurtyka, 2017).

Secondly, building an advanced network of infrastructure is of critical importance to boost the electromobility sector. In line with New Structural Economics, the government is responsible for facilitating such infrastructure to enable the industry's growth (Lin, 2010). That is because an underdeveloped infrastructure discourages consumers from purchasing such vehicles. In the case of electric vehicles, infrastructure includes mostly charging stations. However, such infrastructure must be built in Poland from scratch, while it should be widely accessible to electric vehicle owners. In order to boost demand, it is essential to improve the electric car charging system to the degree that would give customers trust that an electric vehicle is as functional as an internal combustion vehicle. An average car in Poland covers 8,500 km per year, which is 23 km per day (Electromobility Development Plan in Poland "Energy for the Future," 2016). Although with such capacity charging a car around twice a week would be sufficient, the fact that the emergency top-up is not possible significantly shrinks market development. Additionally, due to the lack of fast charging infrastructure, it is challenging or even impossible to traverse longer intercity routes with an electric vehicle, which further discourages customers from purchasing an electric car (Kurtyka, 2017).

The third obstacle is related to vehicles' costs. Due to the limited size of their distribution, vehicle parts used in an electric car are far more costly than combustion technologies (Kurtyka, 2017). Pertinently, the downward trend in individual component prices is evident. By 2024, electric vehicles would be as economical to produce as their conventional counterparts due to decreasing battery prices (Jolly, 2020). Its increasing popularity would be an additional factor affecting the costs drop, as the expense of creating and introducing more technologies would extend to a rising number of customers. Before the prices of electric cars decrease significantly to a level allowing them to compete with conventional cars, however, the state administration should launch incentives and mechanisms to promote electric vehicles (Kurtyka, 2017).

Finally, electric vehicle development can only be effective if it is a part of a more significant socio-economic environment that combines joint efforts of academia, business, and industry. The inadequate degree of existing social capital in Poland obstructs intersectoral cooperation, even though all the parties concerned have a shared interest in such collaboration (Kurtyka, 2017). That is because Poland's practices of a partnership between science and industry are much shorter than those of Western Europe and the United States, resulting in limited interest on both sides and a lack of reliable institutions that support such cooperation (Electromobility Development Plan in Poland "Energy for the Future," 2016). Therefore, adequate support and supervision facilitated by the state are essential.

4.3.4 Active role of the government

One of the most direct references to New Structural Economics in the "Electromobility Development Plan in Poland *Energy for the Future*" is the well-defined, active role of the government in facilitating the sector's development and specific incentives entrepreneurs to invest in this field. Act of January 11, 2018, on Electromobility and Alternative Fuels indicates particular measures to be used by central and local governments to boost the electromobility industry in Poland.

Owing to the size of the initiative and the diffusion of responsibilities, the project's implementation involves both central and local governments. Even before the central government recognized the latent comparative advantage of the electric mobility industry, local governments in Poland already expressed their interest in this field by purchasing electric buses. Their decisions were primarily motivated by a pressing need for improving air quality in cities. Moreover, local governments noticed the potential to reduce the noise level and the need to consistently enhance public transport's service performance by choosing to buy electric buses or proposing car-sharing schemes based on electric vehicles. However, due to limited budget and little accessibility of charging systems, the local governments cannot revolutionize the electronic vehicles industry. Therefore, a comprehensive approach that involves active central government is necessary.

The central government could popularize electromobility by co-participating in the infrastructure development and the procurement of electric cars for its purposes. As such, it would introduce good habits in the process and support the market development. The public's incremental shift away from petrol cars to smaller electric motors would make the government's efforts appear credible to the public and boost demand structurally vital for the further market. Public central authorities must share at least 10% of electric vehicles in their fleets from January 2020, 20% from January 2023, and 50% from January 2025 (Kurtyka, 2017). Moreover, local authorities of voivodships and powiats with a population of more than 50,000 are obliged to ensure the share of electric vehicles in the fleet serving a given office at fixed levels, 10% from January 2020, and 30% from January 2025 (Sejm, 2018). The lack of a sufficient charging infrastructure would not hinder electric vehicles' usability because of the specificity of the fleet's work in public service, where circulation is conducted mainly on preconfigured routes between offices (Electromobility Development Plan in Poland "Energy for the Future", 2016).

4.4.5 Incentives for Polish citizens to purchase electric vehicles

Specific incentives aimed at supporting entrepreneurs and boosting the industry include a favorable depreciation rate, excise duty exemption, free parking, the ability to move in low-emission zones, and the ability to use bus lanes (Ministry of Climate and

Environment, 2020). However, the fundamental incentives offered by the government are subsidies for electric car purchases (Kurtyka, 2017).

The subsidies were introduced in June 2020 after the European Commission has made a favorable decision on its compliance with EU regulations in the common market (European Commission, 2020). The Ministry of Climate and Environment has initiated three incentive schemes for purchasing electric vehicles in Poland in cooperation with the National Fund for Environmental Protection and Water Management. The first one, Green Vehicle Program, is dedicated to private persons interested in purchasing an electric car. The second one, eVAN Program, subsidizes entrepreneurs with the purchase of an electric delivery vehicle. Finally, the Hummingbird Program was arranged for taxi drivers (Szymaczek, 2020). The system includes subsidies up to PLN 18,750 ($5 045) for electric vehicle purchase that does not exceed 15% of the vehicle's price. Thus, vehicle price can be up to PLN 125,000 ($33 634). Besides that, a car owner commits to cover 10 000 km per year and purchase car insurance. It is strictly prohibited to resale the car within two years and to register it beyond Poland. Additionally, a car owner who received a subsidy is obliged to place a sticker on the vehicle, informing that the vehicle was bought with a government grant. Overall, the budget provides subsidies for no more than 2 000 applicants (Ministry of Climate and Environment, 2020).

In terms of favorable depreciation rate, for electric vehicles, there is a larger limit of depreciation write-offs that can be counted as tax-deductible expenses. In conventional cars, depreciation charges were exempt from the costs regarding the portion decided from the value of the vehicle exceeding PLN 150,000 ($40 361). For electric passenger vehicles, obligations that are due were removed from the expenses for the portion determined by the value of the car above PLN 225 000 ($60 542). Moreover, electric vehicles have been exempted from excise duty.

Besides that, clean transport zones have been established in Polish cities of over 100,000 inhabitants. These zones do not allow vehicles powered by traditional fuels, but only vehicles powered by hydrogen and natural gas, and electric vehicles. The deprivation of the possibility to move within the zone does not apply to its residents with light vehicles,

i.e. up to 3.5 tons. Entering the clean transport zone, contrary to the regulations, is associated with a fine of PLN 500 ($135). Besides, since February 2018, only electric vehicles have been permitted to travel on bus lanes previously reserved for public transport only. Simultaneously, the Polish-wide exemption from parking charges in paid parking zones is another privilege for drivers of electric vehicles. In some municipalities, additional parking spaces intended for electric cars only are set as well.

4.4.6 Scaling-up self-discoveries Polish electric car brand

The Polish government's primary goal in promoting electric vehicles is to build the own electric car brand that could compete internationally. Poland is the largest European country without its own automotive brand (Electromobility Poland, 2020). Although Poland does not have a national car brand, it has several car and bus factories, including Fiat, General Motors Manufacturing Poland, Volkswagen, Volvo, MAN Truck & Bus AG, Solaris Bus & Coach S.A. Moreover, Poland has well-developed car parts manufacturing line, with 5,7% of Polish export being vehicle parts (The Observatory of Economic Complexity, 2018).

In 2050 the European Union is to become the first climate-neutral continent (European Commission, 2020). Following increasingly tight measures on carbon dioxide emission limits in the European Union set in April 2019 along with Regulation (EU) 2019/631, launching a conventional car line would be short-sighted. That is because the European Union Members States are obliged to a reduction of the average carbon dioxide emissions from new cars by 15% in 2025 and by 37.5% in 2030, while a 15% decrease for 2025 and a 31% drop for 2030 are the current targets for light-commercial vehicles (European Parliament, 2019). As Europe's obligation for its vehicle fleet heads toward the carbon dioxide emissions drop, electrification is a prevailing trend in the European automotive sector.

Izera is a new Polish automotive brand that will produce electric cars in Silesia in southern Poland (Ministry of Climate and Environment, 2020). Its name refers to Izera Mountains and the Izera River located in Poland and Czechia, which portrays the national

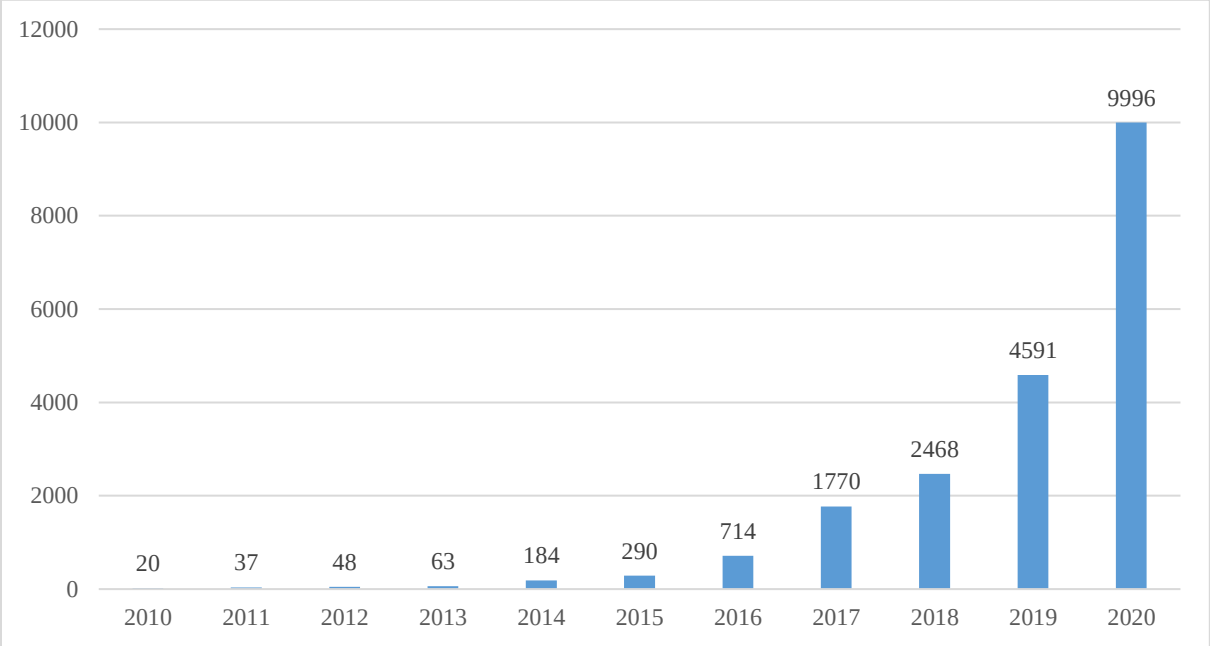
character of the brand. The car factory will be built in 2021 in Jaworzno and will constitute a part of a special economic zone. The first cars will be manufactured in 2024 (Electromobility Poland, 2020). The producers guarantee the vehicles could travel up to 400 km on a single charge. ElectroMobility Poland, a company founded by four Polish state-owned companies that produce, distribute and sell energy, is the owner of Izera. It is not known how much the Izera will cost in the production version. However, one of the most critical assumptions of the project was introducing a convenient installment sales system to keep the total cost of car ownership at a level more attractive than combustion cars of a comparable class. Izera is to produce 100 000 vehicles per year (Electromobility Poland, 2020). In terms of the investment costs, the factory's construction in Jaworzno alone is about two billion Polish zlotys ($535 654 000), and the total cost of the investment in the Polish electric car has been estimated at five billion zlotys ($1 341 401 500) (Electromobility Poland, 2020).

4.4.7 Initial outcomes of the electric vehicles promotion campaign in Poland

Although it is still too early to comprehensively summarize the effectiveness and rightness of selecting the electromobility sector as a future driver of the Polish economy, some successes and challenges can already be identified.

Firstly, an increasing number of Poles who declare their interest in purchasing an electric car can be considered a success. Already 29.4% of Poles think of buying an electric vehicle. Since 2017, when the government initiated a campaign promoting electric cars, the number of stakeholders has risen from 12% to 17% in 2018. Finally, it hit 28% in 2019 (New Mobility Barometer, 2020). Moreover, 18,2% of Poles state that they have used an electric vehicle at least once, in comparison to merely 6% in 2017 (New Mobility Barometer, 2020). High price – the main obstacle to the rapid increase in the number of electric cars in Poland – is also gradually adjusted to customers' requirements. While in 2017, Poles declared the price must be lowered by 44%, in 2020, 26% was the average value by which vehicles should be cheaper for consumers to express willingness to purchase them (New Mobility Barometer, 2020). The increase in interest translates into more registered electric cars in Poland. While in 2016, when the promotion campaign of

electric vehicles in Poland just started, the number of electric passenger cars (PHEV and BEV) was merely 714. It jumped to 9 996 by 2020 (see figure 4.1).



Source: Statista data: https://www.statista.com/statistics/1081299/poland-number-of-electric-passenger-vehicles/

Figure 4.1 Number of electric (PHEV/BEV) passenger cars in Poland from 2010 to 2020

Despite the increasing interest in electric vehicles, a small number of applications for the electric car incentive scheme prove the need to change its terms. The number of applications demonstrates that the subsidies offered do not match customer expectations. Only 262 applications for the amount of PLN 4 586 138 ($1 226 276) were transferred to the Green Vehicle Program, focused on co-financing the purchase of an electric passenger car (New Mobility Barometer, 2020). The eVAN Program dedicated to co-financing an electric delivery vehicle's purchase received merely 81 applications for the amount of PLN 6 614 296 ($ 1 768 580). Similarly, for the pilot Hummingbird Program arranged for taxis, only one application was submitted for a grant of PLN 25 000 PLN ($ 6684) (New Mobility Barometer, 2020. Thus, only 12.2% of the total budget reserved for the Green Car Program could be used. Similarly, in the eVan Program, 9,4% of the assumed budget was implemented, and for the Hummingbird Program, only 0,1%. As a result, out of 2 000 applications that the budget initially expected, only 344 were submitted (Business Insider,

2020). According to the Polish Alternative Fuels Association, the first reason why such a small number of applications occurred was the COVID-19 pandemic that negatively affected the entire automotive industry and significantly shrank customers' interest in purchasing new vehicles (Mazur, 2020). However, the first round of subsidies program itself proved ineffective, mostly due to its mismatch with customer expectations. Firstly, it is necessary to raise the maximum price of vehicles covered by the support, including the current limit of PLN 125 000 ($33 400) in the Green Vehicle Program. In practice, there are only six electric car models that fit within the limit of subsidies (New Mobility Barometer, 2020). Secondly, the subsidy of maximal amount of PLN 18 750 ($5 010) is not enough to encourage customers. Thirdly, a vehicle purchased with subsidy under the Green Vehicle Program and the Hummingbird Program is obliged to travel 10 000 km and 48 000 km per year, respectively. Since electric cars are mostly urban vehicles with limited charging capacity, long-range travels might be challenging. Thus, such a high requirement is challenging to meet. Finally, simplification of procedures related to subsidies application is vital, including operating leasing as a form of purchasing a subsidized vehicle (Business Insider, 2020).

Besides incentive programs that ought to be revised to match customers' expectations, the Polish government's initial targets' implementation deserves attention. In 2016 the Ministry of Climate and Environment announced that by 2025 one million electric cars would be present on Polish roads (Electromobility Development Plan in Poland "Energy for the Future," 2016). However, in the "Polish Energy Policy until 2040" adopted by the Council of Ministers in 2021, this number dropped to 600 000 electric and hybrid cars by 2030). The government's updated "Strategy" predicts a lower number of electric vehicles in the long run while considering both electric and hybrid vehicles. Similarly, according to a report commissioned by the Ministry of Entrepreneurship and Technology – "Analysis of the state of development and current development trends in the field of electromobility in Poland" – merely 300 000 electric cars will appear in Poland by 2025. These dynamics portrays that initial targets might be unachievable in the given period. Secondly, by January 2020, Poland's central and local governments were obliged that at least 10 % of their fleets would be electric vehicles. Nonetheless, the administration did not meet the set deadline (Ministry of Climate and Environment, 2020). Tenders for the purchase, leasing, or rental

of electric cars were launched in a sporadic number. As a result, the government decided to postpone this date. According to the draft amendment to the act on electromobility, the 10% target in the state administration's fleets would be delayed to January 2022. The next two thresholds are to remain unchanged, 20% by January 2023 and 50% by January 2025. A similar target, 10 % of electric cars in the fleet by January 2020, was also imposed on local government bodies' vehicles unchanged (Ministry of Climate and Environment, 2020). It was also postponed by two years. However, the target level of 30% of electric vehicles in local authorities' fleets by 2025 remains unchanged (Ministry of Climate and Environment, 2020). To revise and improve the comprehensive plan of electromobility development in Poland, Warsaw should learn from current leaders' successes and challenges.

Chapter 5: Electric vehicles in Germany and China – lessons for Poland

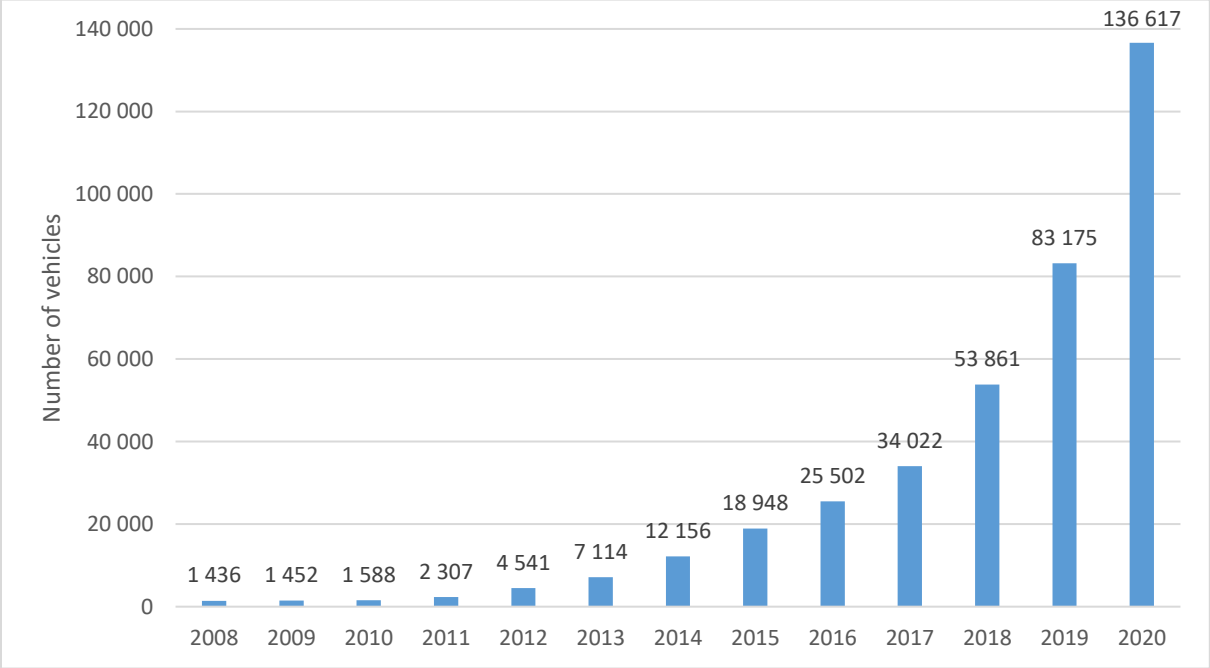
This chapter provides an overview of the Chinese and German approaches to the electric vehicle sector. Due to the complexity of this sector, the author focuses on specific issues only, such as public interest in electric cars, incentives for purchasing electric vehicles, infrastructure, and government's role.

5.1 Overview of electric car sector in Germany

Germany's electromobility technology has a rich and long history. Ferdinand Porsche and Ludwik Lohner proposed an electric vehicle prototype in 1900 called the "Lohner-Porsche System". This consisted of two battery-powered electric engines (Komarnicki, 2017). Due to technological limitations and the greater range of the internal combustion engine, the electric vehicle did not dominate the market at that time. However, along with increasing environmental damage and depleting natural resources, electric cars have become a variable alternative once again.

The introduction of electric cars has become an essential point in Berlin's agenda at the end of the 20th century since energetic transformation was already widely discussed in

Germany by then. The publication of the Institute of Applied Ecology in Germany in 1980 is a symbolic date for the start of Germany's energy transition process, called "Energiewende" (Morris & Pehnt, 2014). The document declared that economic development does not have to be followed by a rise in energy usage, and that renewable sources and energy conservation should be prioritized. Taking measures to promote the electromobility sector has been a natural outcome of the focus on energy transition in Germany. In this way, the number of registered electric vehicles in Germany has gradually risen over the years. While in 2008, the total number of battery-electric cars was 1 436, by 2020, it hit 136 617 (see figure 5.1).

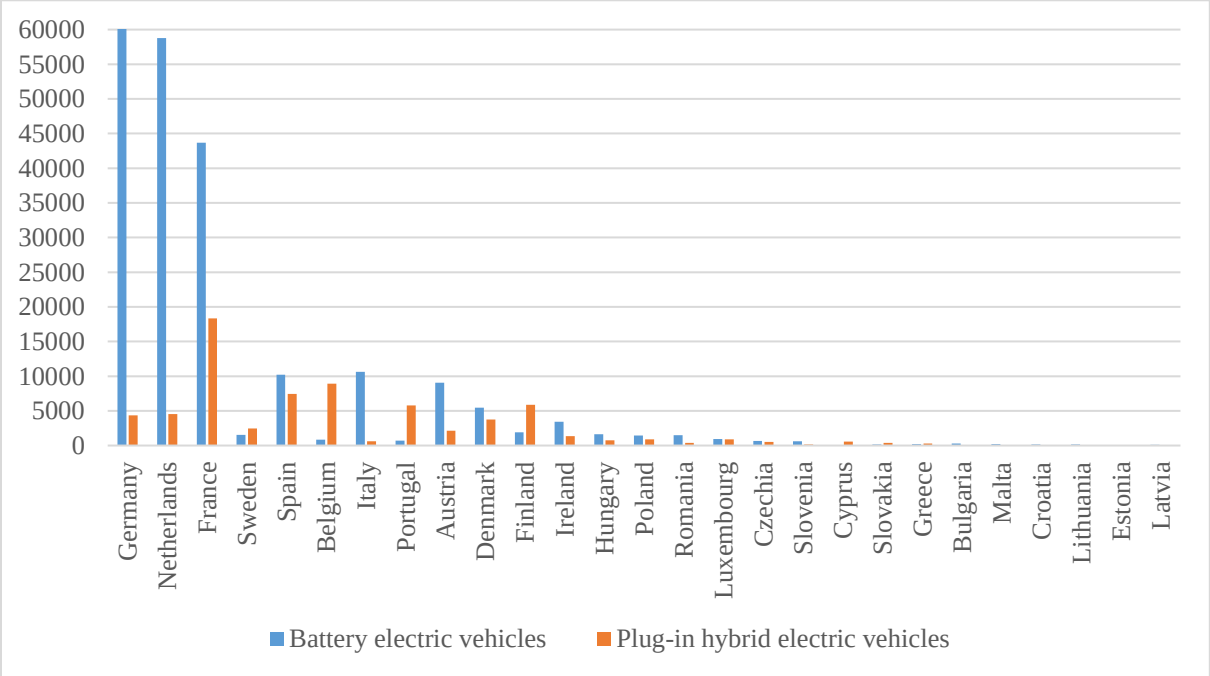


Source: Statista https://www.statista.com/statistics/646075/total-number-electric-cars-germany/

Figure 5.1 Total number of battery-electric- cars registered in Germany from 2008 to 2020

As such, Germany has the highest absolute number of registered electric cars in the European Union (Statista, 2020). Out of 27 European Union Member States, Germany ranks first with its 60 192 battery electric vehicles and 4 337 plug-in hybrid electric vehicles registered in 2020. Germany is followed by the Netherlands (58 767 battery electric vehicles and 4 561 plug-in hybrid electric vehicles registered in 2020) and France (43 678 battery electric vehicles and 18 359 plug-in hybrid electric vehicles registered in 2020).

Poland is ranked in the middle of the chart, on the 14th out of 27th, with its 1 443 battery electric vehicles and 891 plug-in hybrid electric vehicles recorded in 2020 (see figure 5.2).



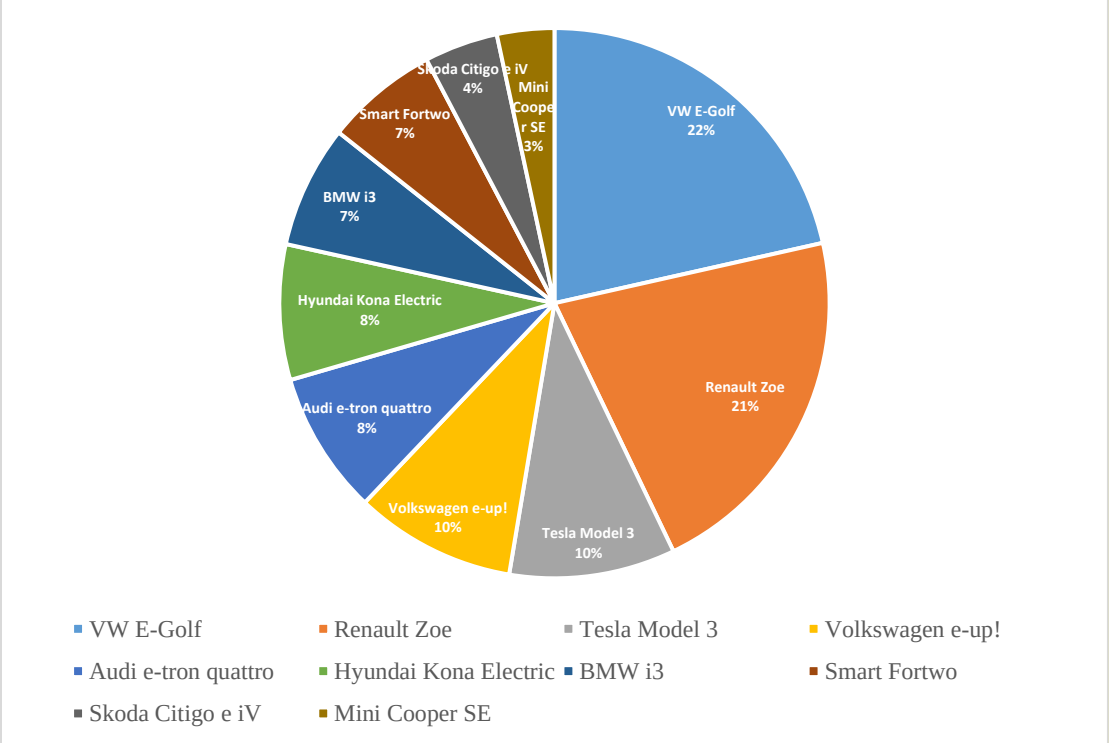
Source: European Environment Agency: https://www.eea.europa.eu/data-and-maps/indicators/proportion-of-vehicle-fleet-meeting-5/assessment

Figure 5.2 Newly registered electric cars in the EU Member States in 2020, in absolute numbers

Such a high increase in the number of electric cars in Germany is related to the European Union's limitation of carbon dioxide emissions. Like the rest of the EU Member States, Germany set an objective of becoming greenhouse neutral by 2050 (European Commission, 2015). To achieve this, Berlin has set a tentative goal of reducing emissions by at least 55 % from 1990 levels by 2030. To achieve this goals in the transportation market, Germany may need 7 million to 10 million electric vehicles on the road by 2030 (Deutschland braucht für seine Klima-Ziele 10 Millionen Elektroautos bis 2030, 2019).

German electromobility should not be analyzed in isolation from the conventional automotive industry. Car production has been the source of Germany's remarkable economic success. In 2018, German car exports valued 156 billion dollars and accounted for 10,3% of its total export (The Observatory of Economic Complexity, 2018). In 2019, 75% of cars produced in Germany were targeted for foreign markets (Hui, 2020). Similarly,

vehicle parts composed 4,5% of the German export, while their value was estimated at 68,1 billion dollars (The Observatory of Economic Complexity, 2018). Therefore, the energetic transformation followed by the increasing popularity of electric cars threatens the core German industry (Ewing, 2019). As such, private business in Germany from the automotive industry concentrates its efforts on building new electric car models to gain comparative advantage in the new market. Thus, currently, electric cars are available from all German automakers. Well-established conventional car brands are gaining popularity in the electromobility sector as well. Importantly, there is significant domestic and international demand for German electric car brands. For instance, in Germany, five of the top ten best-selling electric vehicles are produced domestically (Hunt, 2020). All of them are brands with a well-recognized domestic and international market share in the conventional car industry, such as Volkswagen, Audi, BMW, and Smart (see figure 5.3).

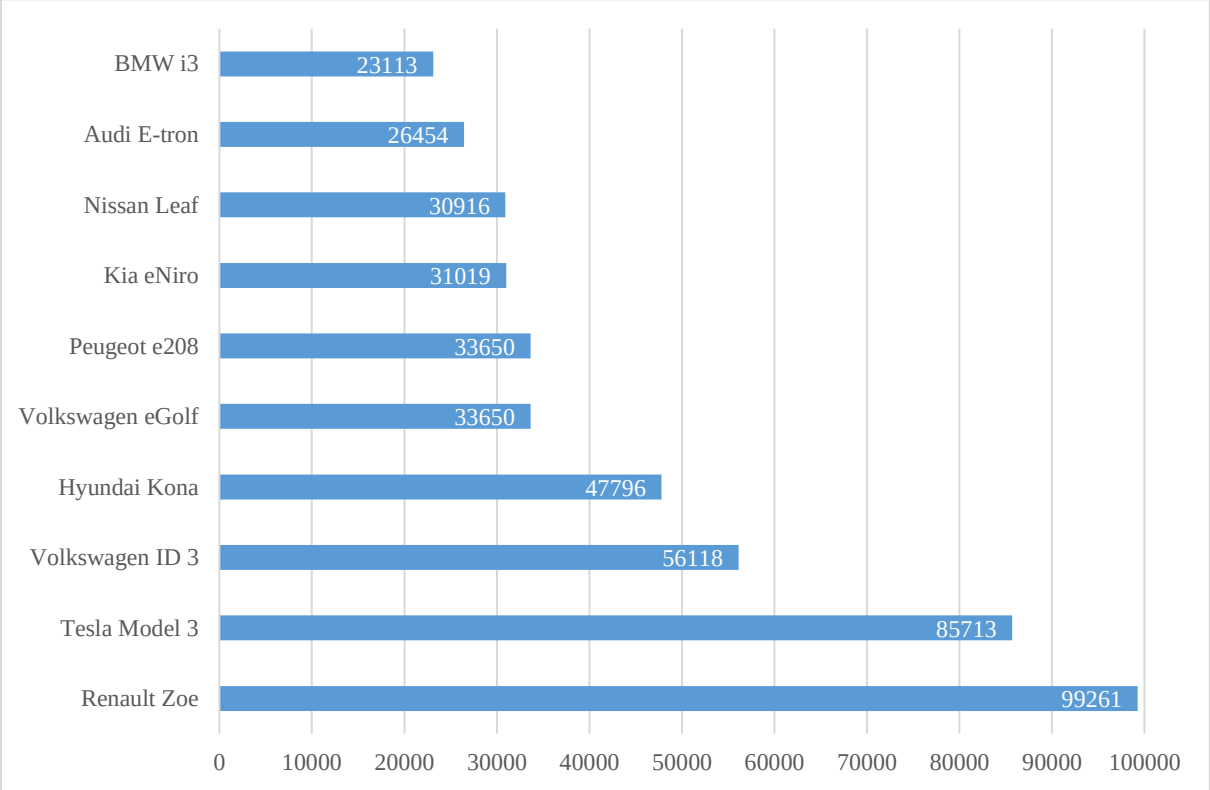


Source: A. Hunt, *Ten best-selling electric cars in 2020 in Germany,* Wheelsjoint.com: https://www.wheelsjoint.com/ten-best-selling-electric-cars-in-2020-in-germany/

Figure 5.3 Top ten best-selling electric cars in Germany, 2020

Domestic demand for German electric cars is supported by the international market as well. All over the world, Germany has a strong brand of a high-quality vehicle producer.

Therefore, electric vehicles are gaining interest, too (Hui, 2020). According to sales figures for electric vehicles in Europe, four out of the twenty most commonly sold models in 2020 were manufactured by German companies, including BMW, Audi, and Volkswagen (see figure 5.4).



Source: JATO Press Release 2020: https://www.jato.com/wp-content/uploads/2020/10/JATO-European-Volumes-Press-Release-September-2020-Final.pdf

Figure 5.4 Best-selling battery electric vehicles in Europe, 2020

5.1.1 Active role of the government

From the beginning of Germany's energy transformation, state officials' active involvement and enforcement were essential to facilitating electric car development in Germany. German Federal Government's National Electromobility Development Plan issued in 2009 proposed research initiatives aimed at the development of electromobility and an environmental incentive for new vehicles (German Federal Government's National Electromobility Development Plan, 2009). Its key target was to introduce one million electric cars to Germany by 2020 (Moulson, 2009).

The following year, the Joint Agency for Electric Mobility (Ger. *Gemeinsame Geschäftsstelle Elektromobilität*; *GGEMO*) was established as a coordinator of all government and private initiatives focused on electromobility in Germany. Along with the Agency, the National Platform for Electromobility (Ger. *Nationale Plattform Elektromobilität*) was founded to prepare the activities aimed at implementing the National Electromobility Development Plan. The Platform was the first German institutional forum for cross-sectoral consultation on electric mobility composed of 147 high-level stakeholder members. Among them, seven working groups were created to work on a diverse electromobility-related field, such as drive train technologies, battery technologies, standardization and certification, materials and recycling, education and qualification, and framework regulations. Bringing together and networking all related players from business, academics, politics, trade unions, and civil society groups aimed to get 1 million electric cars on German roads by 2020 and achieve sustainable mobility through the use of renewable energy (Fernholz, 2013). Along with Platform, the Bundestag adopted a new Electric Mobility Act in 2014. All these endeavors' overriding goal was to make Germany a world leader in the electromobility industry by building its position as a leading market and a key supplier (Federal Ministry for Economic Affairs and Energy, 2020). The German government recognizes that electric cars' increasing popularity threatens conventional vehicles – the core pillar of the German economy, and strives to gain a comparative advantage in the electromobility sector.

Nonetheless, several obstacles significantly constraint the rapid development of the electric car industry in Germany. The German government defined the country's dependency on battery import as a significant impediment to market development (Electromobility in Germany: Vision 2020 and Beyond, 2016). Therefore, the government aims to reach a battery energy density of 280 to 300 Wh/l15 by 2025. While lowering battery costs is critical for market entry and consumer adoption, it is estimated that the cost of the battery cell device is to drop to EUR 200 ($240,80) per kWh. Work on battery technology is currently carried out under the assistance instrument "Batterie 2020," overseen by the Federal Ministry of Education and Research (Ger. *Bundesministerium für Bildung und Forschung*; *BMBF*). However, the German industry remains dependent on electric car batteries import from China, the US, South Korea, and Japan. To address this

issue, several research and development projects were co-financed from German public and private sources. Amongst them, "Lithium-Ion Battery 2015 - BMBF Innovation Alliance," a research project initiated by the German Ministry of Development, is the most prominent. The initiative is focused on modern lithium-ion cells production and involves Volkswagen, BASF, Bosch, Evonik and LiTec. Similarly, the "Elektropower II" program (Ger. *Elektromobilität, Positionierungentlang der Wertschöpfungskette*) focused mainly on the research development of flexible and scalable production technologies, integration of e-vehicles in the power grid, and high-performance wireless charging of e-vehicles. Finally, ATEM Program (Ger. *Antriebstechnologien für die Elektromobilität*) was dedicated to developing drive systems for electric and hybrid cars and the Electromobility Showcase Program (Ger. *Schaufenster Elektromobilität*) to promote modern electromobility solutions, such as shared mobility or car-pooling.

The number and variety of research and development projects dedicated to electromobility demonstrate a synergy between the German public and private sectors. On average, around EUR 80 billion ($96 billion) is spent on R&D, which constitutes around 3% of German GDP (Hui, 2020). The automobile and electronics sectors account for over 55% of annual in-house R&D expenditures, which indicates Germany's immense research and development capacity. 9 out of 10 German top patent filing companies represent the automotive industry (Hui, 2020). German business circles, combined with governmental support, focus on boosting the domestic electric car sectors and facilitating innovations to gain supremacy in the international electromobility industry.

5.1.2 Incentives for German citizens to purchase electric vehicles

Germany's industry incentive package focuses on three financial-impacting measures: temporary buying incentives, charging capacity growth, and public-sector procurement of electric cars.

Germany launched its electric cars subsidy program in 2016, relatively late compared to other EU Member States (Kottasova, 2016). At that time, German authorities offer "eco benefit" – a grant for new vehicles of EUR 4 000 ($4 828) for non-hybrid electric cars and

EUR 3 000 ($3 621) for plug-in hybrids. The grant was provided regarding the procurement of vehicles with a list price of up to EUR 60 000 ($72 432). The overall sum of capital available for this objective was EUR 1.2 billion ($ 1 448 650 800) (Federal Ministry for Economic Affairs and Energy, 2020). Half of the budget was covered by the federal government and half by the automotive industry (Federal Ministry for Economic Affairs and Energy, 2020). Initially, the subsidy program was planned to expire at the end of 2021. However, the government decided to extend it to 2025 (Europe, 2020).

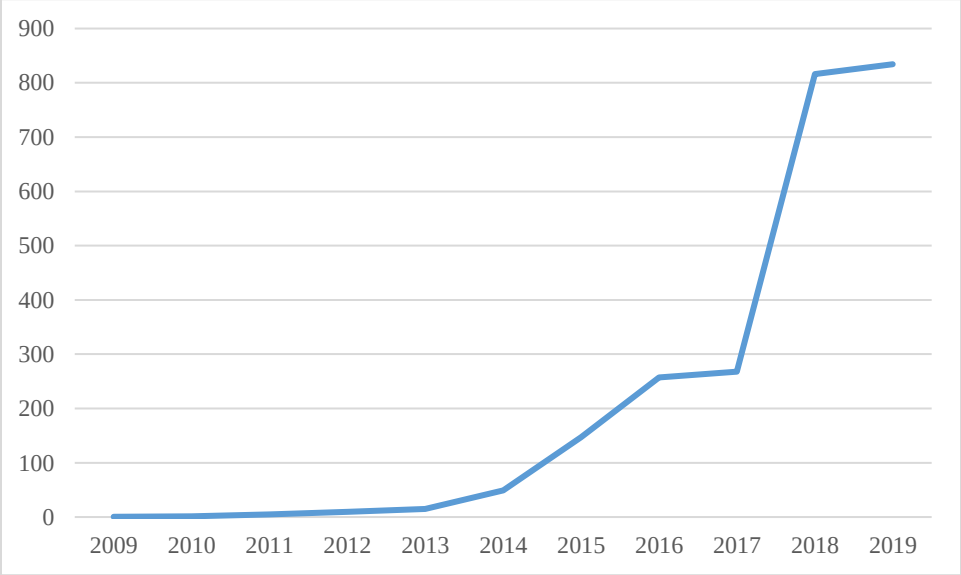
However, incentives can boost the electric car market only temporarily. Among the decisive factors that influence consumers' decisions on a car purchase, the availability of charging infrastructure is one of the main concerns, along with the price (Wang, Tang & Pan, 2019). One of the reasons for the German supremacy in electric car sectors in the European Union is its massive charging infrastructure investments. In the case of charging capacity growth, the German government reserved EUR 300 million ($362 162 700), including EUR 200 million for fast charging equipment and EUR 100 million ($120 554 000) for regular charging appliances, to enhance charging infrastructure development industry (Federal Ministry for Economic Affairs and Energy, 2020). This rapid development might be problematic in the long run, though, since currently, Germany's charging infrastructure already outstrips demand from e-car owners (Wehrmann, 2020).

In addition to financial incentives and the development of infrastructure for charging electric cars, these vehicles can enjoy many privileges in road traffic, such as exceptions to entry and driving bans, the possibility of using bus lanes, special parking spaces for electric vehicles, exemptions from parking fees (Balzer, 2020).

5.2 Overview of electric car sector in China

The automotive industry in China has been the biggest in the world since 2009. As a consequence, in 2007 China overtook the US as the worlds' biggest carbon dioxide emitter. A rapid expansion of personal cars, gasoline-powered private vehicles, and public buses constituted a vital part of the increased emissions (The Guardian, 2007).

Given the pressing environmental issues posed by conventional vehicles, Wang Gan (万钢), the PRC's Minister of Science and Technology between 2007-2018 and a former Audi executive, aimed to transform China into an electric car industry leader (Wang, 2013). Whereas China was unable to compete internationally with well-establish global conventional car brands, the electric car industry was an opportunity to install early in the up-and-coming market to gain the first-mover advantage in the field. Besides the environmental dimension, developing the domestic electric car industry could help China solve the long-term goal of foreign oil dependence and facilitate China's quest for more energy security (Wang, 2013). This motivations translated into tangible effects. Together with a national campaign promoting battery-electric cars, the number of these vehicles increased from 480 across China in 2009, to 834 200 in 2019 (Statista, 2020) (see figure 5.5).

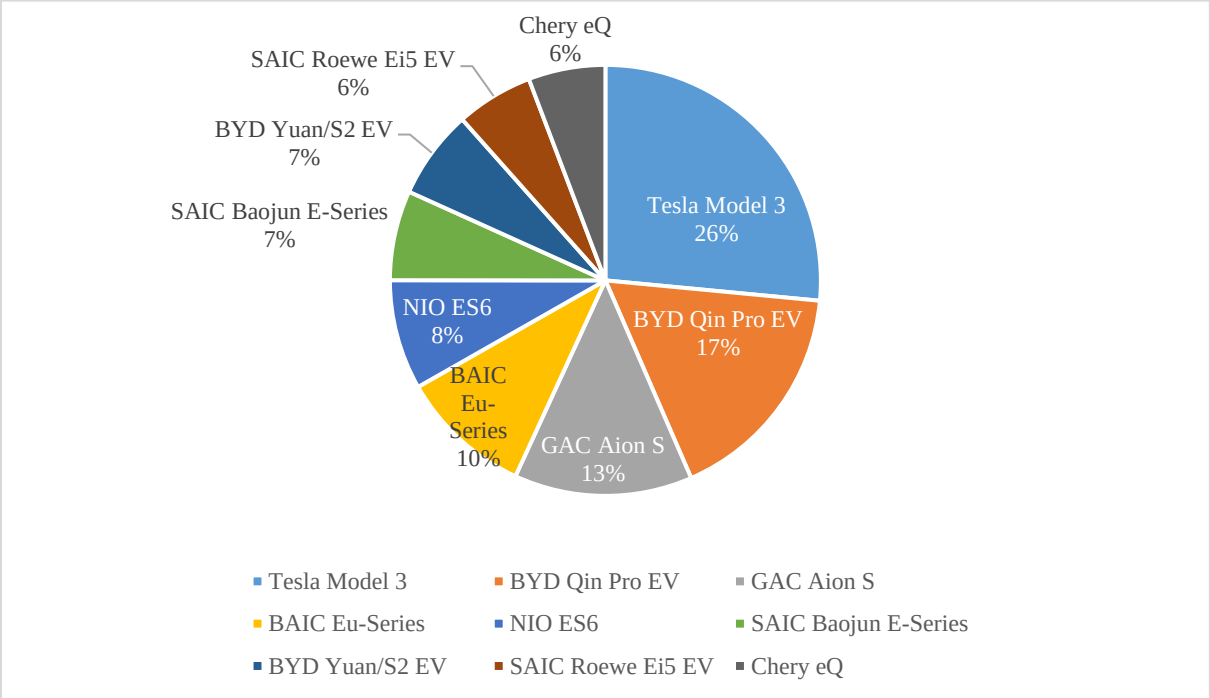


Source: own study based on Statista's data.

Figure 5.5 Total number of battery-electric cars registered in China from 2008 to 2020 (in 1 000 units)

Such a rapid development of the electric cars sector was not based on electric car imports. Chinese authorities proactively promoted the creation of Chinese electric car brands. Simultaneously, along with government policies, private businesses, such as Byd, BAIC, SAIC, Geely, Wuling, Aiways, Nio, Li Auto, and Xpeng, strived to dominate the market. Currently, China demonstrates a capacity of producing nearly 140 electric vehicle

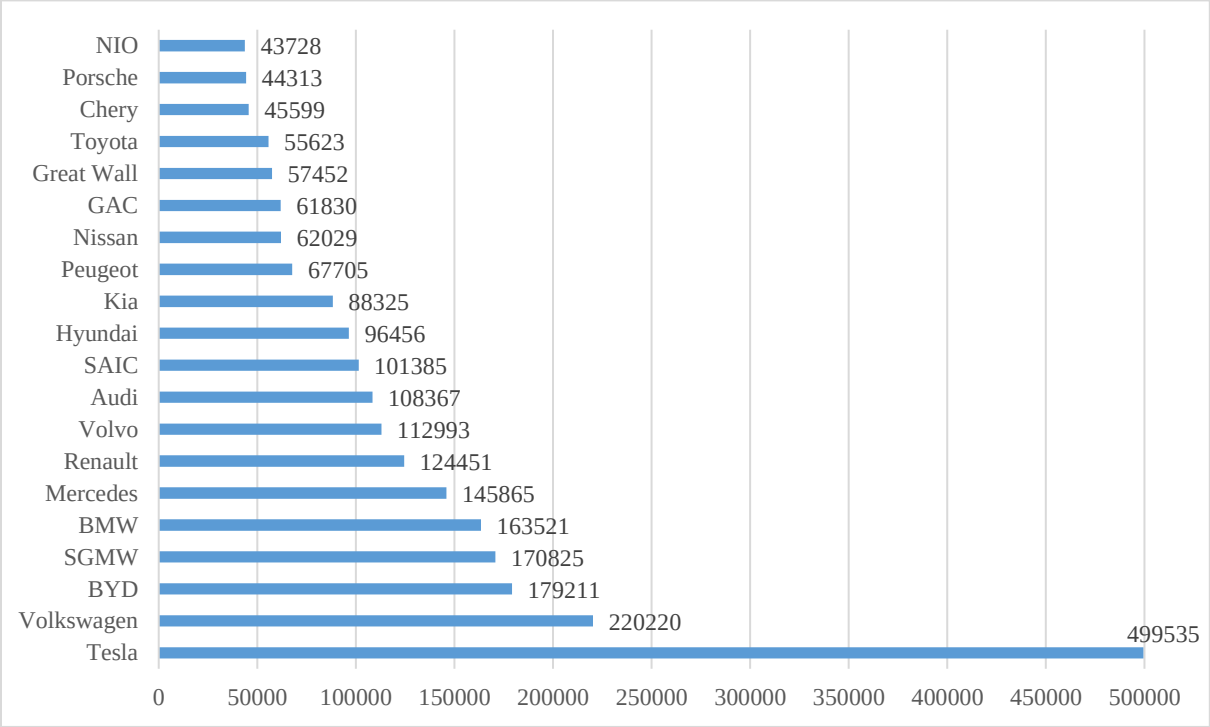
models (Munoz, 2020). While Tesla still has a dominant role in the Chinese market by occupying 26%, it faces rising competitiveness from local rivals. The remaining nine out of ten places are all taken by domestically produced Chinese electric car brands. BYD Qin Pro ranks second with a 17% market share, followed by GAC Aion S as the third most widely-selling electric car in China with a 13% market share (see figure 5.6). Moreover, after the company received permission for its Shanghai plant in 2018, Tesla's electric vehicles are also produced in China, making it the first international automaker to run a wholly-owned plant in China (BBC, 2020).



Source: own study based on Statista's data.

Figure 5.6 Top ten best-selling electric cars in China, 2020

The majority of Chinese electric car brands have not entered the international market, but they plan to do so shortly (Cheng, 2020). Despite not becoming globally-recognized brands yet, Chinese electric automakers already occupy top ranks in world vehicle sales. The domestic market's demand is sufficiently big to place them to rank highly in the international rankings. Therefore, eight out of twenty top automakers of plug-in hybrid cars in the world are produced in China (including Tesla), while seven are purely Chinese brands (see figure 5.7).



Source: data from CleanTecnica dataset https://cleantechnica.com/2021/02/04/global-electric-vehicle-top-20-ev-sales-report /.

Figure 5.7 Top 20 automakers of plug-in hybrid cars in the world (by sales)

5.2.1 Active role of the government

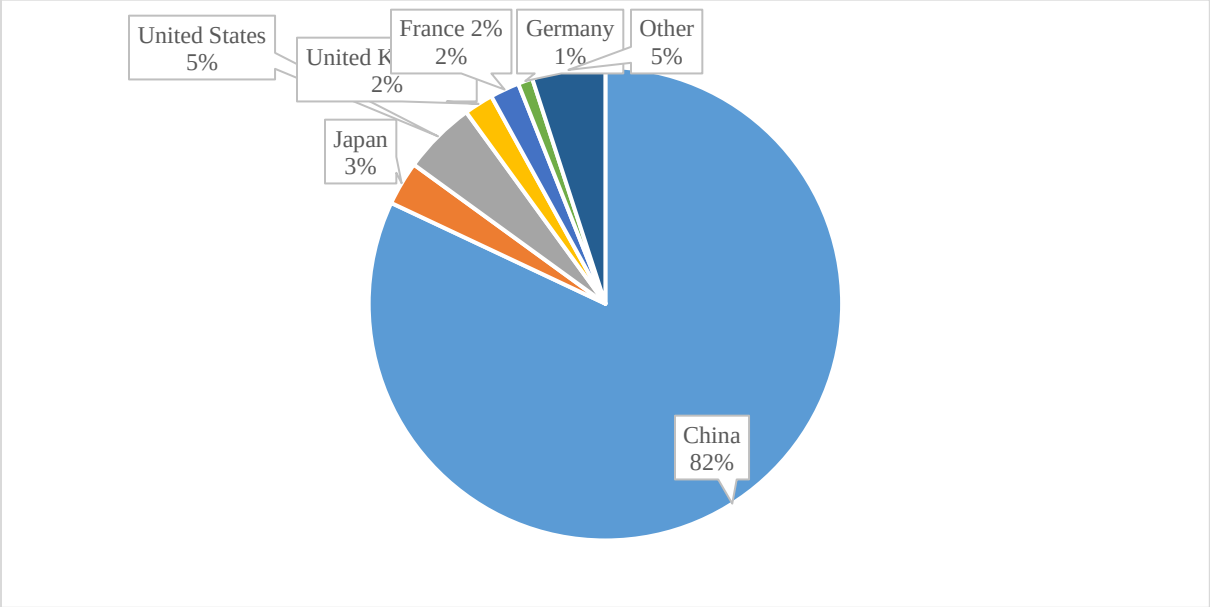
Addressing the pollution issue has become a priority in Beijing's political agenda, with the 12th 5-Year Plan (for years 2011-2015) being a case in point (Fan & He, 2011). In the Plan, China set three key development targets of rebalancing its economy, reducing socioeconomic inequity, and protecting the environment. Specifically, in terms of protecting the environment, the main tasks included promoting new energy, cleaning up the environment and saving energy. Seven strategic emerging industries were recognized, such as new energy cars, next-generation information technology, high-end equipment manufacturing, new materials, energy-saving, environmental protection, alternativeenergy, and biotechnology (Kasoff, 2011). RMB 10-14 trillion ($1 526 018 600 000-$2 136 426 040 000) were dedicated to developing these industries. At the same time, targets for electric cars were set at 500,000 pure electric and hybrid electric vehicles by 2015 and 5 million by 2020 levels (Marquis, Zhang, & Zhou, 2013).

Intensive works focused on the electric vehicle sector started in 2009. At that time, the "Ten Cities, Thousand Vehicles Program" ("十城千辆"工程) was launched (Marquis, Zhang & Zhou, 2013). At first, the initiative sought to establish ten pilot cities, each of which would promote 1 000 electric vehicles into service within three years. The number of pilot cities had grown to 25 by 2011 (Marquis, Zhang & Zhou, 2013). Every pilot city implemented a different policy to reach the 1 000 vehicles objective. Beijing based its approach on tax exemptions and offering waivers from the license plate lottery. Shanghai incorporated a rental scheme inspired by solutions initiated in the German city of Bremen. With state-owned companies Potevio New Energy and China Southern Power Grid, the Shenzhen government has cultivated a financial leasing model. Chongqing underscored infrastructure development and introduced fast-charging stations across the city (Marquis, Zhang & Zhou, 2013). Despite the wide range of implemented techniques and policies, most cities failed to meet the initial targets, mostly due to the private sector's stagnation and insufficiently developed technology and infrastructure (Wang, 2013).

The initial results did not discourage Chinese authorities from further investments in the electric cars sector. To boost domestic market and promote Chinese auto manufacturers, a generous subsidies program was launched. However, it only included China-produced vehicles, while imported electric cars were subject to tariffs (Marquis, Zhang & Zhou, 2013). This way, Chinese authorities comprehensively backed indigenous EV start-ups and parts manufacturing to charging infrastructure network. The implemented policy's overall goal was to nurture high-quality domestic producers and create a domestic supply chain ecosystem (Munoz, 2020). Chinese automakers quickly took advantage of the governments' preferential treatments and produced various electric car models. Currently, there are 138 electric vehicle models available in China, compared to 60 models accessible across Europe and merely 17 in the United States (Munoz, 2020).

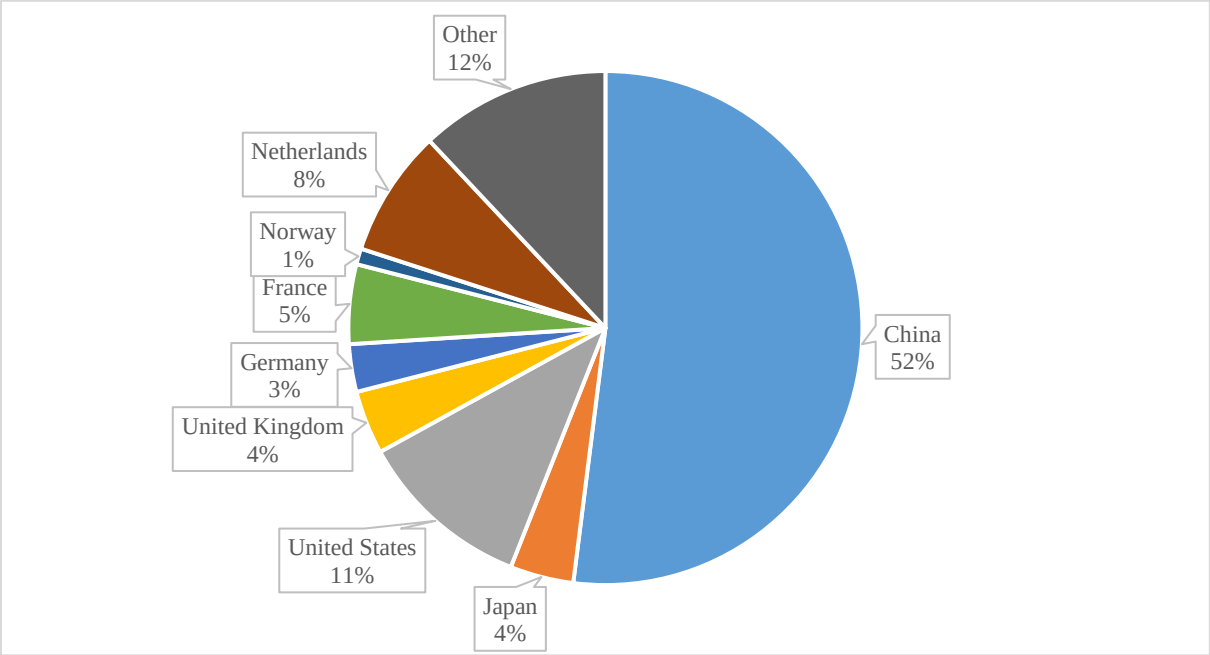
However, the governments' role went beyond subsidies, imposing import tariffs, and preferential treatment of the domestic manufacturers. Well-developed charging points infrastructure is even more critical to effective electric vehicle transition than temporary government subsidies (Adhikari, Ghimire, Kim, Aryal & Sundar, 2020). The Chinese government built its strategy upon providing tangible charging infrastructure across

Chinese cities as well. In 2019, China had 301 238 out of 598 000 public slow chargers accessible worldwide, which composed a 52% share globally. Moreover, China established an unprecedented number of public fast chargers for electric vehicles – 214 670 out of 264 000, which constituted 82% of all such chargers globally. By 2019, the United stated built merely 64 265 slow charging stations and 13 093 fast-charging stations, which constitutes 11% and 5% of the global share, respectively. Similarly, Germany accounts for only 3% with its 19 716 slow charging stations globally and 1% with its 2 315 fast-charging stations. Due to a very small number of charging points, Poland was not measured separately in the dataset. It was included in the "other countries" category, that had 71 178 slow-charging stations (12% globally) and 13 649 fast-charging stations (5% globally) (see figure 5.8 and 5.9).



Source: International Energy Agency, Global EV Outlook, Paris 2020.

Figure 5.8. Publicly accessible electric vehicle slow chargers by country, 2019



Source: International Energy Agency, Global EV Outlook, Paris 2020.

Figure 5.9. Publicly accessible electric vehicle fast chargers by country, 2019

5.2.2 Incentives for Chinese citizens to purchase electric vehicles

There are plenty of solutions that the Chinese central and local authorities implemented to encourage Chinese citizens to buy electric cars. One policy that is very specific to China is an exemption from a registration plate lottery. Taking Beijing as an example, the registration plate lottery was introduced in 2011 to limit private vehicles (Marquis, Zhang & Zhou, 2013). Besides the market price, buyers must win a lottery to register a new internal combustion engine vehicle in Beijing. Under the scheme, prospective car owners compete in a lottery organized every two months. In the last round of 2020's lottery, one in every 3 000 people in Beijing's conventional car license plate lottery was picked, which portrays how competitive the process is (Li, 2021). On the other hand, electric vehicle certificates are awarded by a queueing system rather than a lottery. The plates for new energy vehicles are issued on a first-come, first-served basis, which significantly improves their availability. To help discern and classify new energy vehicle, China started issuing special green license plates (绿色车牌) in 2016 (Li, 2021). Similarly, in 2021, Beijing is to distribute 100,000 license plates. 60% are provided for green license plates – electric and plug-in hybrid vehicles, while 40% for conventional cars. The system also includes

applicants' background since families have a greater chance of receiving an electric vehicle purchase license than individuals (Li, 2021). Whereas the capital's approach is strict, other Chinese metropolises offer even more preferential treatment for new energy vehicles. Shanghai presents a different approach than Beijing and so far, grants no limit for new energy vehicles purchase in the city (Argus, 2021). Moreover, non-local plate car owners are prohibited from taking certain routes within specific timeframes, encouraging more citizens based in Shanghai to buy an electric vehicle with Shanghai green plates specifically for in-city commuting.

Another incentive for Chinese citizens to buy electric vehicles is a generous subsidies program. Initially, the Chinese government launched the scheme in 2013 and planned to abandon it by the end of 2020, since relying on subsidies harms the market in the long-term (Wang, Tang & Pan, 2019). However, due to a profoundly weakening influence of the COVID-19 pandemic on the automotive market across the world, China's Ministry of Finance, Ministry of Industry and Information Technology, Ministry of Science and Technology, and National Development and Reform Commission announced that the subsidies program for electric vehicles was prolonged (Ministry of Finance of the People's Republic of China, 2020). Along with the extended policy, the minimum electric range limit for battery electric passenger cars was tightened from 250 kilometers to 300 kilometers. Electric energy consumption thresholds are significantly higher for all forms of BEVs and longer-range plug-in hybrid passenger vehicles, with an electric range of at least 80 kilometers. 2020 also introduces a new requirement – maximum CNY300,000 ($43 000) gross pre-subsidy vehicle price with tax included for passenger vehicles (Ministry of Finance of the People's Republic of China, 2020). However, battery-swapping cars are not included in this limit since the government promotes the technology *(China announced 2020–2022 subsidies for new energy vehicles*, 2020). According to the full program, the support would be cut by 20% in 2021 and 30% in 2022. After the subsidies program terminates by 2023, Chinese customers' willingness to purchase electric cars is expected to outgrow conventional vehicles (Ministry of Finance of the People's Republic of China, 2020).

5.3 Lessons for Poland

The two case studies presented above provide essential information for Poland's current stance and future development of its electric cars sector. Both Germany and China set ambitious goals on their pathway to electromobility and consistently pursue them. Therefore, it is worth it for Poland to learn from these two countries' successes and challenges.

5.3.1. Lessons to learn from Germany

Germany – a benchmark country for Poland according to GIFF – is a prominent example of a country that bases its successes in the electric cars sector on the interplay between public and private cooperation in research and development. Due to high expenditures invested in this area both by public and private actors, Germany boosted its innovativeness and technological advancement. This trend is particularly noticeable in the high number of patents concerning electromobility. Considering Germany's case, Poland should strive to engage more private companies in its research and development projects focused on electromobility. A compelling interplay between private and public sectors guarantees innovative solutions and helps new products meet customers' requirements.

When analyzing Germany's electric cars sector, one should underscore an essential role of its well-developed conventional combustion cars sector. With its leading position in this field, Germany positions well to compete with other brands internationally, including competition in the electric cars sector. Traditionally, customers worldwide recognize German cars as high-quality products, empowering German companies in the electric car sector too. This should be an essential lesson for Poland – a country that has not created its car brand despite having well-developed vehicle part production lines. In domestic and international markets, consumers tend to choose recognizable car brands associated with high quality. Therefore, not having a single traditional car brand can be a significant challenge for Poland when launching its electric car. Besides establishing its first car brand, Poland would have to strengthen its national brand's recognizability.

Finally, despite ranking top high in global innovativeness indexes and having a leading position in the automotive industry worldwide, Germany still struggles to build its own electric car battery. Berlin invests heavily in research and development projects focused on electromobility, yet it remains dependent on importing electric car batteries. This trend significantly limits the market growth for German electric car brands. As such, Poland should consider enhancing research projects focused on electric battery production to mitigate the long-term risk of import dependence in the electromobility sector.

5.3.2 Lessons to learn from China

China – a global leader in the electric car sector – is an illustrative example of a country that, despite not having globally competitive conventional combustion engine car brands, succeeded in promoting electric cars domestically. In the first decade of the 21st century, Beijing focused its research and development capacities and production potential on electric vehicles. This move aimed at mitigating environmental damages related to a vast number of classic cars. Due to the increasing role of electromobility, China significantly limited car-made pollution, mainly across big cities. This success should be a vital example for Poland, which also strives to protect its environment by introducing more electric cars. However, the timing of the actions taken by Poland and China is worth mentioning too. While China took action to promote electromobility around 2009, Poland's launched its first initiatives in this area around a decade later.

Like many other countries, to encourage its citizens to purchase an electric car, China decided to launch generous subsidy programs. However, another tool used by Beijing in its path to electromobility was limiting subsidies only to domestic producers while putting import tariffs on foreign electric car brands. This preferential treatment of domestic manufacturers proved effective and helped China build a comprehensive domestic supply chain ecosystem for electromobility. However, as the European Union's Member State, Poland could not implement a similar solution to facilitate its national electric car brand growth. European single market guarantees the free flow of goods, people, capital, and services. In practice, it means that from the very beginning, Izera will have to compete with other electric car brands not only on international but also on its domestic market.

China's leading position in charging infrastructure for electric cars (including fast-charging stations) paved its way to a rapid increase in electric vehicles across Chinese cities. Currently, China ranks first in the world in terms of accessibility of charging infrastructure. This enables Chinese customers to use their electric cars efficiently both for in-city and long-distance travel. Poland should recognize the importance of building charging infrastructure across the country to encourage customers to transfer from traditional to electric cars. Only with a sufficient charging infrastructure can an electric car brand compete both domestically and internationally.

Chapter 6: Conclusions

Implementing a leading Chinese economic theory in developing African and Asian countries is widely described in English and Chinese literature. However, the Polish government's interest in New Structural Economics and a direct reference to Professor Lin's framework in a strategic development document issued by Prime Minister Morawiecki in 2016 has opened a new room for research. This thesis is one of the first pieces in English on New Structural Economics implementation in a developed, European country. As such, this thesis aimed to shed light on three research questions:

1. How has NSE framework adapted to European economic, political, and legal circumstances?
2. Was the electric vehicles sector – having the latent comparative advantage according to the Polish government – chosen in line GIFF methodology?
3. What are the main opportunities and challenges in NSE implementation in Poland?

Interviews with leading Polish and Chinese New Structural Economics specialists, data analysis of Poland's economic and political growth path, and analysis of the "Strategy for Responsible Development for the timeframe up to 2020 (including the perspective up to 2030)" were used to examine the first query. The research revealed that the Polish government's interest in Professor Lin's legacy brought a positive trend. So far, Polish development strategies were primarily established in line with the Washington consensus. However, none of them transitioned Poland from its semi-peripheral, innovative imitator status to a leading, innovative economy. The adoption of New Structural Economics

framework marked a novel attempt in this direction (Interviewee 3, 2020). By contesting the Washington consensus and looking for new development possibilities for less advanced countries, the theory constituted an essential guide for the Polish government when projecting future drivers for its economic growth. As such, New Structural Economics opened new doors in economic and political thinking about Poland's potential.

However, considering economic, political, and legal obligations that Poland must meet due to its European Union's Member State status and NATO membership, Warsaw cannot merely copy the Chinese development path (Interviewee 2, 2020). Poland's accession to NATO in 1997 and the European Union in 2004 are significant successes. However, these developments also provided the country with an institutional cage within which it must operate. Therefore, it is impossible for Poland to reject the Washington consensus entirely. Moreover, an inquiry into Poland's political circumstances also reveals challenges to a comprehensive implementation of New Structural Economics. Professor Lin interprets the government's role as defining latent comparative advantages and facilitating business environments to uncover their latent potential (Lin, 2012). To ensure this vision's fulfillment, a government needs to take a long-term approach to its goals. However, for Poland – a multi-party, democratic country with short governance circles of around four years – it is difficult to think in such categories (Interviewee 3, 2020). Offering long-term solutions is risky since the government might be changed in elections if its actions do not bring tangible effects in the short term.

Growth Indication and Facilitation Framework was used to address the second research question on whether the Polish government selected benchmark countries and sectors with a latent comparative advantage in line with New Structural Economics. Based on GIFF, Germany is the most suitable benchmark country for Poland. That is because the automotive industry has been the German economy's driving force for more than two decades, while Poland has a well-developed car part manufacturing industry. Following the "flying geese model," the automotive sector could provide Poland with new development opportunities. However, considering the European Union's policy to achieve climate neutrality by 2050, investing heavily in conventional cars would not benefit the European Member states in the long term. Therefore, the Polish government indicated the

electric cars sector as having a latent comparative advantage. To this end, the Polish strategy rightly recognized Germany as its benchmark country, which is consistent with GIFF. However, focusing on electric cars does not fully conform to GIFF's methodology.

Yet, it is worth underscoring that the electric car sector is only one out of ten economic branches marked by the Polish government as having a latent comparative advantage ("Polish Strategy," 2016). Although not all sectors meet GIFF requirements, some of them, such as the electronic industry's development, prove to be in line with Professor Lin's approach. These dynamics portray that while Poland did not implement New Structural Economics across its entire economy, sectoral analysis displays the critical influence of this theory on Poland's development.

Finally, to address the third research problem, the author undertakes a case analysis on electric vehicle uptake in Germany and China. This study looked at how New Structural Economics paradigm was applied in the natural environment. Such an approach enabled the author to recognize opportunities and challenges in the theory's implementation in Poland. The investigation demonstrated numerous opportunities that Poland got due to its interest in New Structural Economics. Firstly, focusing on Professor Lin's theory was a positive phenomenon that translated into a well-thought-out vision for the country's future. Thanks to NSE, the government prepared a comprehensive plan of getting away with its peripheral status to boost its economy with innovative rather than imitative technology. Simultaneously, investing in a promising sector that is expected to overtake conventional cars in the future proves that it is a long-term strategy rather than a short-visioned political action.

However, case studies on Germany – a benchmark country for Poland according to GIFF, and China – a global leader in the electric vehicles sector, revealed some challenges that Poland might face when promoting its electric car brand. Insufficiently developed charging infrastructure in Poland, combined with increasing European and Chinese electric vehicles' competitiveness, may significantly threaten the Polish electric car brand's development. The project also requires gradual but decisive withdrawal from coal in the economy, which in Polish conditions is a huge political risk due to the strong lobby of

miners. While New Structural Economics warns countries against setting excessively ambitious goals on their development path, promoting Poland's own electric car brand is inconsistent with GIFF and thus, proves challenging.

The thesis concludes by arguing that although Poland did not implement New Structural Economics across all its economic sectors, the present findings confirm that NSE sectoral implementation in Poland was successful. Broadly translated, the results indicate that countries with very different economic and political circumstances from China can benefit from New Structural Economics as well. In the case of Poland, the theory brought vibrant, novel ideas to economic and political debate. It also contributed to the Polish government's new development directions in the "Polish Strategy" and boosted friendly bilateral relationships between the two states. Future studies could further explore this issue by investigating New Structural Economics implementation in other European countries.

6.1 Limitations

The analysis of New Structural Economics implementation in Poland is not without its limitations. The disruption of the COVID-19 pandemic in Poland has been significant to date. It forced the Polish government to concentrate its efforts on combating the health crises and facilitating economic stability. This translated into fewer resources devoted to innovative projects focused on the country's industrial upgrading. The electric car industry is a case in point. Although it would be premature now to summarize the pandemic's damage, some trends are already noticeable. To that end, future studies exploring the role of COVID-19 on New Structural Economics implementation are a promising research area.

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