Analysis of the Foreign Trade in Germany Based on the Assumptions of the Gravity Model of Trade – a Federal and Federal State Level Perspective

Natalia Wilczewski

LAZARSKI UNIVERSITY
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Natalia Wilczewski (Lazarski University, ORCID 0000-0002-5714-1213)

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Introduction

"For the only way in which a durable peace can be created is by world-wide restoration of economic activity and international trade". These words were once said by Forrestal (1892–1949), an American economist whose words especially gained their relevancy after World War II when the world's economy lay in ruins. Since then, the importance of globalisation and internationalisation has been growing. Companies stopped being national entities and transformed into multinational corporations with branches in more than just one country (Juneja, 2021).

This development became most notable in 2020, starting with the COVID-19 outbreak in March: Supply chains all over the world were disrupted because of production stoppages in China which struggled with the virus initially (Seric et al., 2021). Subsequently, the World Health Organization (2021) declared the virus outbreak a pandemic. As a result, companies were advised to re-consider their supply chain model and transfer at least parts of their production processes more locally, becoming less dependent on one area which up to then was China (Shih, 2020).

It is not a secret that China and the United States of America are the leading industrial nations with significant influence on the world trade, as is Germany (World Trade Organization, 2020, p. 80). The topic of trade has been the research focus for many economists. One of the outcomes is the gravity model of trade which will be the focal point of this monograph. The aim of this monograph is to examine Germany's trade structure and whether the assumptions of the gravity model can be applied. As a further research objective, the monograph will examine whether there are any local differences and peculiarities in trade for the federal states and how they relate to the results obtained on the federal level. Germany will have high trade volumes with China and the USA due to their positions in the overall world trade (Statistisches Bundesamt (Destatis), 2022). Furthermore, it will have a significant trade exchange with its neighbours: the Netherlands (Deutsch-Niederländische Handelskammer, 2022) and Poland (Wilczewski & Bryk, 2020, p. 40) as the traded goods can be quickly transported back and forth. Going down to the federal state level, the relative trade significance compared to the results on the federal level will change. Based on the research conducted by Bremer (2018), it can be deduced that the relative trade significance of foreign countries will increase if the federal state is adjacent to them and decrease when they do not share a common border. Since Tinbergen (1962) discovered that the setup of the Commonwealth is a trade promoter (p. 266), so

might be the setup of occupied zones in Germany after the Second World War in relation to the respective Allies. Another research objective is to find out how trade with China and the USA will be reflected on the federal state level.

Providing a short overview on what is gathered in the following monograph, the first chapter deals with the topic of trade, its progress in history and its evolution from an economic perspective. Within this chapter, different attitudes – from the far protectionist to the far libertarian – will be presented. It will also outline the first models of trade which were created. In the second chapter, the aforementioned gravity model of trade will be discussed, focusing on its basic assumptions and how it has been refined. The chapter will also give first insights which factors may influence trade and to what extent. As an introduction to the second part of this monograph, the last part of chapter two will discuss the applicability of the gravity model of trade based on a literature review and two conducted studies which examine this model for two German federal states.

The second part of the monograph is dedicated to Germany. Chapter three provides an outline of events which led to Germany's current economic and political situation. It aims to give its readers the opportunity to fully understand the reasons behind Germany starting two world wars and why, despite having lost them, is a leading world trader 60 years later. The answer to this question can be found in the 19th century when the foundations were laid down which enabled Germany to recover quickly after a series of events in the 1950s and 1960s had taken place. Chapter three will also focus on the German federalism – why Germany is divided into federal states nowadays, what impact it has had on its politics and economics, especially on trade, and what kind of responsibilities are derived from this setup for both the federal and federal states' government. The fourth and last chapter examines the actual research objective. First of all, a rough overview will be given on Germany's current position in the world trade. Afterwards, the trade structures will be examined and analysed, first on the federal level and in the next step on the federal state level. The analysis covers the last five years available, which are 2016 to 2020. Both sections include a brief introduction of essential economic characteristics. In the last part of this chapter, the identified results will be interpreted.

In order to obtain the relevant theoretical background knowledge, the literature used is mainly composed of books and articles/papers published in journals or magazines. Since trade is affected by current political and economic events, sources of governing authorities and/or institutions formed by official reports and their online presences have been added to this selection. The dataset analysed is provided by the German Federal Statistical Office and supplemented with datasets published by the Federal Statistical Office and the Land Statistical Offices

and the World Bank. For the analysis itself, a model created by the author has been applied, which will assess the correctness and reliability of the discussed gravity model of trade in relation to Germany's ten most important trading partners, both on the federal level and on the federal state level. This model is based on a point system. Trade relations have been allocated points each time they met a criterion that was previously identified as influencing trade between two countries. The higher the criteria a trade relation met, the greater the number of points it received. The total number of points allocated equate to these trade relations being comparable in order to draw relevant conclusions.

The motivation for this topic results from particular interest in international trade and previous research dedicated to the subject of export and import relations and trade structures. It will thus be treated as an enrichment of already existing knowledge and research with a new emphasis[1].

[1] In the course of her studies, the author has already written two papers regarding foreign trade and trade structures of which one can be found in: Wilczewski & Bryk, 2020, pp. 35–54.

1. Introduction to trade

This chapter aims to provide an overview of what trade is and how it has been developing in history. Cambridge Dictionary (2020) defines "trade" as "the activity of buying and selling, or exchanging, goods and/or services between people or countries". One may ask why people or countries have been trading then and now. According to Krugman et al. (2018), both trading parties benefit from such a transaction as each of them may specialise in one area and hence achieve economies of scale. Furthermore, such parties may achieve additional benefits due to migrations and international loans (pp. 30f.). Zhang (2008) states that it is not only economies of scale which motivate countries to undertake international trade but also differences in technology or factor endowments (p. 9). Foreign trade has gained even more importance after World War II when it was supposed to lead to economic well-being and peace (Krugman et al., 2018, p. 32). Nowadays, international trade as a result of the ongoing globalisation has increased competition between companies which are forced to put a stronger focus on profits and efficiency if they want to survive. Increased competition has also led to more available products, both in terms of quantity and variety. Furthermore, international trade speeds up the introduction of new and better technologies and promotes intra-industry trade. Intra-industry trade, in turn, allows countries which are poor in certain factor endowments, e.g., in raw materials, to still play a role in global supply chains by acting as a sub-contractor if they can reduce production costs due to cheaper labour rates (McDonald, 2021, p. 49). One example for such a country is Poland which imports machinery, equipment and raw materials among others from Germany. These are used to produce machinery, equipment, food and industrial goods which are then sold to the European Union, with Germany as one of the recipients (Wilczewski & Bryk, 2020, p. 49).

1.1. Origins of trade

It is not that easy to answer when trade put down its roots as people have always seemed to be trading. With regard to foreign trade, even though countries as we know them today did not exist at the time, tribes or nations exchanged goods in transactions which can definitely be classified as foreign trade.

What is known is that in the past everyday goods and goods with a short shelf life were traded locally, whereas goods which travelled long distances needed to

be of a particular value and resistant as transport was time-consuming and risky. Such goods included spices, rich textiles and precious metals such as gold or silver (Gascoigne, 2021).

The most famous trade route is the Silk Road which is also considered to be "the world's oldest and longest trade route" (Khanduri, 2018). It has a rich history since it has not been created in one go. The first part of the silk road goes back to the Jade Road around 5,000 BC. Further stages included the Tin Road (2,700 BC) and the Persian Royal Road (550 to 486 BC). Its first opening is connected to Alexander the Great in 330 BC, but the "Father of the Silk Road" is considered to be Qian. Qian, a Chinese diplomat at that time, was sent several times to the West, among other things to establish an association with Central Asia which was the purpose of his first journey (Ceceri, 2011).

The Silk Road was not a simple path but a huge network connecting the East with the West in the end spanning 11,300 km. It received its name from its main traded commodity of Chinese origin – which was silk. This era is also associated with the origins of trade between the Chinese Empire and the Roman Empire. It is worth pointing out here that this trade did not happen directly but through the Parthian Empire (Persia) and the Kushan Empire (Central Asia) which linked these two empires. Due to this fact, the Parthian Empire and the Kushan Empire benefited from this trade relation as well by withholding taxes they imposed on passing traders (Ceceri, 2011).

1.2. Pre-doctrinal ideas of trade

Some sources claim that the period of mercantilism (16th to 18th century) was the decisive turning point for foreign trade (Ajami & Goddard, 2006, p. 48; Juneja, 2021), whereas others go back even further, namely to the era of the Ancient Greek (Dorobăț, 2015, p. 109) around 400–300 BC. According to Dorobăț (2015), to be able to fully understand the evolution of foreign trade, one needs to understand the pre-doctrinal ideas of trade formed by the (1) Ancient Greek, (2) Scholastic and Christian thought, (3) Mercantilism and (4) Physiocracy (p. 107).

During the era of Ancient Greek, the most influencing personalities were Plato (380 BC), Xenophon (340 BC), and Aristotle (350 BC). Plato stated that it is impossible for a state to rely on its own outputs and a division of labour is advisable to achieve a higher productivity (Plato, 1930, as cited in Dorobăț, 2015, p. 107). Xenophon supported Plato in his opinion, highlighting the additional benefits for traders and merchants due to price arbitrages and

international markets (Xenophon, 1918, as cited in Dorobăț, 2015, p. 107). Aristotle's attitude was contrary to the aforementioned statements as, in his opinion, the decision about importing and exporting goods ought to be balanced. His main concern was the inequity in trade with other cities resulting from the lack of commercial treaties (Aristotle, 1932, as cited in Dorobăț, 2015, p. 108).

The Scholastic and Christian thought, derived in the 13th to 15th century, is based on the assumptions made by Aristotle. Thus, the representatives of this era faced a certain dilemma. On the one hand, they were aware that the goods provided by nature were not sufficient for the society to survive, on the other hand, international trade was ambivalent with regard to the principles of moral philosophy which appreciated generosity, fairness and justice. Aquinas, one of the representatives of this era, indicated that foreigners might destroy local communities (Dorobăț, 2015, p. 108; Aquinas, 1947, as cited in Dorobăt, 2015, p. 108).

After the era of scepticism, the natural law philosophy in the 17th century entirely approbated commercial freedom stating that "free commercial exchanges are an unalienable right of every individual, and of every nation" (Suarez, 1934, as cited in Dorobăț, 2015, p. 108) clearly expressing that international openness would not cause any cultural or economic damage (Dorobăț, 2015, p. 109).

Contradicting the natural law philosophy of free trade, the movement of mercantilism in the 16th to 18th century focused on promoting exports while putting barriers for imports in place, including but not limited to price controls, tariffs and quotas on imports. The general aim of these practices was to achieve a positive balance of trade.

At the same time, mercantilists intended to increase their own wealth by decreasing the wealth of others (Dorobăț, 2015, p. 109; Ajami & Goddard, 2006, p. 48). The scope of these duties was assigned to the government itself whose responsibility it was to become involved in the trade between relevant nations. Aiming to maximise the balance of trade, powerful countries acquired territories with a rich supply of raw materials and precious metals, turning them into their colonies. The advantage of this transaction was firstly to get hold of resources in a low cost, profitable way and, secondly, force the colonies to buy goods from the colonising countries (Ajami & Goddard, 2006, p. 48). Ajami and Goddard (2006) point out that there were three false assumptions made by the Mercantilists:

1) Gold and precious metals have an intrinsic value when not used for production and consumption.
2) Wealth is related to power rather than specialisation which facilitates production efficiency.

3) The approach of merely increasing one's exports does not stimulate trade if everyone follows the same strategy (p. 48).

With the decline of the Mercantilists' influence, another wave of liberalism surged in the 18th century – Physiocracy. Although this philosophy did not contribute to the general progress of the international trade theory, it did have a decisive influence on the British Classical School, especially on Adam Smith who was in touch with the relevant representatives.

For this reason, the idea of Physiocracy will be briefly discussed. Physiocracy etymologically derives from the "rule of nature" and is a French movement accompanying the doctrine of *laissez-faire*. Its main assumption is the liberalisation of domestic and foreign trade on the one hand; on the other hand, it treats agriculture as the only means of production. Another aspect worth mentioning is the attitude that although foreign trade was treated as useful in terms of substituting shortages in production, a surplus of exports was not the required aim. Furthermore, an extensive volume of foreign trade was regarded to be destructive (Maneschi, 1998, pp. 38f.).

1.3. British Classical School

The 19th century was among other things dominated by the development of the British Classical School (Dorobăț, 2015, p. 110). It is assumed that the British Classical School was founded by Smith who is known for his work *The Wealth of the Nations* in 1776.

Smith argues that nations will only trade with each other when both will benefit from this transaction. This mutual benefit can merely be achieved under the condition of absolute advantage. Absolute advantage, in turn, is the result of each nation specialising in the production of one particular commodity. Moreover, Smith was a supporter of the *laissez-faire* philosophy as, according to him, free trade would encourage nations to use their resources as efficiently as possible and hence increase their production output with a positive impact on the nation's welfare (Zhang, 2008, p. 24).

Ricardo went a step further. Based on Smith's concept of absolute advantage, he came to the conclusion that both nations when exchanging two commodities with each other may also achieve advantage even though only one of them achieves absolute advantage for both commodities. This concept is referred to as "comparative advantage" which states that the specialisation in the production of one commodity is still beneficial if the production costs, i.e., labour hours, are relatively lower in comparison to those of the other nation (Dorobăț,

2015, p. 110; Panic, 2015, p. 121)[2]. To illustrate this theory, Ricardo assumed that there are only two countries (England and Portugal), two commodities (wine and linen), and one factor of production (labour) in the world. There are also no changes in technologies and fixed unit costs to produce each commodity. Assuming that it takes England four hours to produce one unit of linen and eight hours for the production of one unit of wine, and Portugal – six and ten hours respectively, the conclusion can be drawn that there is no advantage for England to trade with Portugal as both goods can be produced cheaper in England. However, taking comparative costs, calculated as the ratio between unit costs of both commodities, into consideration, the opinion may change. In the given example, the comparative costs are 4/8 = 0.5 for England and 6/10 = 0.6 for Portugal. This leads to the conclusion that it is more advantageous for England to produce linen than wine. For the trade to be beneficial for both countries, the given ratio must equal a number between 0.5 and 0.6. Therefore, it can be assumed that under these circumstances only England will benefit from this trade (Zhang, 2008, p. 26).

Amongst Smith and Ricardo, Dorobăț (2015) additionally classifies Mill as an influencing economist of the British Classical School, whereas Zhang (2008) discusses Mill's work in the chapter relating to the Neoclassical Trade Theory (p. 53). Mill introduced the equation of international demand which solved the trade equilibrium problem. According to this equation, the terms of trade are established through the value of exports and the value of imports which need to equal each other. Mill assumed in his model that there is only one factor of production, production is subject to constant returns to scale and requires on the demand side a proportional adaption in line with the changes in production costs regardless of its extent (Zhang, 2008, p. 53). His theory of reciprocal demand is classified as the international version of the general equilibrium theory (Negishi, 2014, p. 155). As stated by Dorobăț (2015), Mill was aware that certain factors such as the intensity of trade or protective trade barriers may influence the countries' gains from trade and make one of them more profitable (p. 111).

Along with the British Classical School, a parallel stream known as the French Liberal School developed. Its origin is linked to Say's publication of *Traité d'économie politique* in 1803. It was mainly active in Paris; hence researchers also call it the "Paris group" when referring to this school (Salerno, 1978, p. 65). Schumpeter (1954), on the contrary, only considers the *laissez-faire ultras* as the Paris group. Compared to the supporters of the British Classical School, the French

[2] An illustrative example how to correctly understand the "comparative advantage" can be found in: Zhang, 2008, p. 26.

representatives were much more extreme. They were "*anti-étatistes*" as described by Schumpeter (1954) meaning that socialism and any kind of state interference were treated as evil. They propagated "unconditional free trade and *laissez-faire*" instead (p. 808). It should not be of any surprise that this formation was not particularly popular with the ruling authorities (Schumpeter, 1954, p. 808). Its era came to an end with the death of Molinari in 1912 (Salerno, 1978, p. 65).

1.4. Extensions of Ricardian comparative advantage

During the following years and decades, the concepts introduced have been expanded, criticised and adapted according to the contributors' needs and ideologies. Taking Ricardo's model of comparative advantage as an example, it had been used as a basis by both Pareto (1895) and Haberler (1936).

Pareto (1895) enriched Ricardo's concept by creating a mathematical model which reflected marginal utility as production costs and illustrated this principle of trade between two countries and two commodities (Dorobăț, 2015, p. 113). He concluded if countries vary in size, it might be impossible for these countries to completely specialise. However, gains from trade could still be achieved if a part specialisation were to be allowed for the larger country (Negishi, 2014, p. 161). In turn, Haberler (1936) modified Ricardo's assumption taking opportunity costs as production costs instead of labour costs. Both approaches contributed towards the creation of an even more advanced mathematical model which covered the trade relationship of more than two commodities and two countries. (Dorobăț, 2015, p. 113).

In the 20th century, Ohlin played a dominant role in the creation of international trade theories (Zhang, 2008, p. 5). In his opinion, the assumptions made by Ricardo were incorrect: It cannot be assumed that production costs only refer to production hours, but it is essential to consider that trade is also reflected by available resources and therefore the analysis of trade should not be merely based on work but as well on capital and raw resources. Krugman et al. (2018) provide the example of Canada and the USA and their relation of trade regarding timber. Canada not only exports timber to the USA because there are more efficient lumberjacks in Canada but mainly because it is less densely populated in comparison with the USA and hence has a richer supply of timber per inhabitant (p. 145).

Dorobăț (2015) and Zhang (2008) describe the assumptions of this model more generally, assuming that there are two factors of production – labour and capital. Based on this, countries which are rich in capital should shift their

production towards capital-intensive products and therefore export them, whereas countries rich in labour should focus on the production of labour-intensive goods (Dorobăț, 2015, p. 114; Zhang, 2008, pp. 51f.). Ohlin has worked this concept out together with his student Heckscher. The outcome of this work is referred to as the Heckscher-Ohlin theorem and its validity is still highlighted by various scholars, especially when they make projections for trade structures between developed and developing countries (Maneschi, 1998, p. 1; Krugman et al., 2018, p. 180).

More generally described, the Heckscher-Ohlin theorem assumes that all countries have the same access to technology, there is no difference in taste between consumers, and the focus between two countries lies in the differences between their factor endowments and commodities which are an outcome of the use of the aforementioned factors such as labour or capital. These two factors are mobile between sectors and the reason for two countries trading with each other is justified in their differences of relative factor endowments. In other words, "this theory examines the impact of trade on factor use and factor rewards" (Zhang, 2008, p. 4). It should not surprise anyone that countries would produce and sell these commodities which need a factor for production they are well-endowed with (Zhang, 2008, pp. 4f., 47; Negishi, 2014, p. 75).

As mentioned by Zhang (2008), all trade models developed before the 1960s, which include the Heckscher-Ohlin theorem, are static and do not consider a change in availability of production factors or that technology may change over the course of time. There were several attempts to extend the model introduced by Heckscher and Ohlin and make it more accurate. Since it is not the scope of this monograph to elaborate the history of the development of trade models, interested readers shall be referred to Zhang (2008). Despite all the attempts at modelling trade as accurately as possible, Zhang (2008) notices that most models still do not consider increasing returns to scale due to the reason that it would be difficult to build it.

Another influencing personality in the 20th century was Mises, a liberalism advocate and opponent of protectionism (Mises, 1985, p. 130). While describing the economic situation of the second half of the 19th century, Mises (1985) pointed out that there had not been a time in history yet when people enjoyed such marvellous living standards as they did at that moment in time and, even in comparison with the previous years, aristocracy faced worse conditions than the working class at the time. This kind of prosperity was the result of liberal spirit and principles adopted, such as granting every citizen the same rights (pp. 1f.). Overall, one could get the impression that this would be the "age of eternal peace" (Mises, 1985, p. 2).

However, moods changed and again a movement of protectionism took control over the political and economic situation, eventually leading to the outbreak of World War I (Mises, 1985, p. 1). Mises's (1985) main reason for disagreeing with the principles of protectionism was the decrease in productivity of labour. This resulted from the fact that, firstly, capital and labour had been blocked from moving freely to these areas that were the most advantageous for them and, secondly, the international division of labour had been hindered (p. 131).

Generally, Mises (1985) argued that people would be richer if production was not controlled by tariffs (p. 131). In his considerations, he also refers to the basic assumptions made by Ricardo. The 19th century was characterised by an increased mobility of capital and labour, including cross-border movement. Since capital was not kept locally anymore, the distinction between free domestic and foreign trade had become inappropriate (p. 133).

1.5. Trade in the 20th century

The 20th century was marked by an outstanding number of events which had a direct effect on the political and economic situation worldwide. The rise of protectionism at the end of the 19th century eventually led to the outbreak of World War I, also called the Great War, which left the world broken into pieces. To re-establish the world order, a peace conference was convened and its outcome was the Treaty of Versailles signed in 1919. At the same time, Wilson proposed his "Fourteen Points" which among other things aimed to set up equal trading conditions, and the "League of Nations" changing the countries more into nation-states to prevent a repetition of the past events (Encyclopædia Britannica, 2021a).

On the other side of the globe, to provide support for the American farmers who were suffering from the decreased demand with the ongoing recovery of Europe and the European agriculture, the Congress put the Emergency Tariff Act in force in 1921, which a year later was replaced by the Fordney-McCumber Tariff Act. Making use of these acts, tariffs were raised to such an extent that they exceeded the levels agreed in 1913. Furthermore, the president was given authority to manipulate tariffs by 50% each way to adapt according to upcoming needs. As a consequence, European nations struggled with exports to the United States, which made it even more difficult to pay off their war debts (Office of the Historian, 2021).

The implemented tariffs did not bring the intended effect though, as along with the increased supply by European farmers, agriculture faced the effect of overproduction followed by decreased prices for these goods. Subsequently,

what had started with the campaign for the 1928/29 elections supporting farmers, ended in requests for the same kind of support by various sectors and industries.

The United States government introduced the Smoot-Hawley tariff expanding protectionism, which had already been set up by the Fordney-McCumber tariff, even further. At the turn of the 1920s and 1930s, world trade declined by 66% (Office of the Historian, 2021). Some scholars even claim that this act evoked the Great Depression in 1929 to 1933 (Krugman et al., 2018, p. 400).

At the beginning of the 1930s, the US government decided to lower tariffs again. As a first step, the United States started with bilateral agreements, meaning that they started discussions with those countries who had a decisive impact on the US imports. This discussion was simply based on an agreement that the United States would lower their tariffs for a certain commodity which they imported from this particular country under the condition that the other country would do the same for a commodity which the United States exported to them. In 1934, the Reciprocal Trade Agreements Act was signed to encourage foreign trade by tariff reductions, trade liberalisation and by supporting cooperation with other countries. There are economists who believe that this Act deepened the Great Depression and allowed for another national movement to become successful, especially the rise of Hitler's power leading to him starting the Second World War in 1939 (Encyclopædia Britannica, 2021c).

After the end of World War II, thanks to their bilateral agreements, the United States reduced their import tariffs compared to 1932 from 59% to 25%. However, bilateral agreements are characterised by an agreement which is limited to two parties and, therefore, they did not liberalise the entire world trade. As a consequence, the representatives of the victorious allied countries started to enter into multilateral agreements. At first, they thought that these negotiations would be supervised by an institution they proposed, which was the International Trade Organization (Krugman et al., 2018, p. 401). Since a certain group of countries did not want to wait until the formal establishment of the International Trade Organization, which in fact has never happened, at least in its original version, they started their negotiations which were audited by a temporary agreement – the General Agreement on Tariffs and Trade (GATT).

1.6. World Trade Organization

The General Agreement on Tariffs and Trade has never been an organisation but a treaty, whose participants were not members but sides. Its secretariat was based in Geneva and it supervised the world trade until the formal foundation of the World Trade Organization (WTO) in 1995.

With the creation of the World Trade Organization, the following GATT principles have remained valid:

1) elimination of the use of non-tariff means except for binding tariffs;
2) prohibited use of export subsidies except for agricultural goods;
3) prohibited import quotas except for already existing ones (the aim was to eliminate these and replace them by tariffs) and for temporary solutions to counteract "market disturbances" (Krugman et al., 2018, pp. 401f.).

The main differences between the GATT and WTO are that the WTO is a fully-fledged international organisation, whereas the GATT was only a temporary solution. With the establishment of the WTO, the original GATT text has been updated and implemented in the WTO principles. Furthermore, two further agreements have been added as they had not been covered previously – the General Agreement on Trade in Services (GATS) and the Agreement on Trade-Related Aspects of Intellectual Property (TRIPS). In addition, the resolution of disputes has been optimised as the procedure nowadays is more formalised and more effective. Before that, it had taken years to resolve issues, whereas today all cases are being resolved within a year (Krugman et al., 2018, pp. 405f.).

One characteristic of the GATT-WTO construct are the trade rounds aiming to "establish a strong and prosperous multilateral trading system" (WTO, 2021c). Table 1 presents all the trade rounds including their years, places (names), subjects covered, and numbers of participating countries.

Table 1. GATT/WTO trade rounds

No.	Year	Place (name)	Subjects covered	Countries
1.	1947	Geneva	Tariffs	23
2.	1949	Annecy	Tariffs	13
3.	1951	Torquay	Tariffs	38
4.	1956	Geneva	Tariffs	26
5.	1960–1961	Geneva Dillon Round	Tariffs	26
6.	1964–1967	Geneva Kennedy Round	Tariffs and anti-dumping measures	62
7.	1973–1979	Geneva Tokyo Round	Tariffs, non-tariff measures, "framework" agreements	102
8.	1986–1994	Geneva Uruguay Round	Tariffs, non-tariff measures, rules, services, intellectual property, dispute settlement, textiles, agriculture, creation of WTO, etc.	123

No.	Year	Place (name)	Subjects covered	Countries
9.	2001–?	Doha Round	Tariffs, developing countries, agriculture, non-agricultural market access, services, trade facilitation, rules, the environment, geographical indications: multilateral register for wines and spirits, other intellectual property issues, dispute settlement	157

Source: WTO (2021b). *The Doha Round*. https://www.wto.org/english/tratop_e/dda_e/dda_e.htm (accessed 7.01.2021) and author's own elaboration based on: WTO (2021a). *Doha Round: what are they negotiating?* https://www.wto.org/english/tratop_e/dda_e/update_e.htm (accessed 31.05.2021).

The first round took place in Geneva in 1947 with 23 countries participating, covering the topic of tariffs. The following four rounds were held in a similar way with a changing number of participants and in different places, focusing on bilateral agreements where each country was separately negotiating its trading conditions with the other (Krugman et al., 2018, p. 402). It is worth mentioning that the first five rounds were finalised within one year (WTO, 2021c).

The sixth round, the Geneva Kennedy Round, already considered multilateral agreements and achieved an overall average tariff reduction (WTO, 2021c; Krugman et al., 2018, pp. 402f.). In the opinion of Krugman et al. (2018), the recovering economic situation at that time contributed to the success of the negotiations (p. 402).

The seventh round, the Geneva Tokyo Round (1973–1979), covered the topics of tariffs, non-tariff measures, and "framework" agreements (WTO, 2021c). The use of "framework" agreements was needed since even more countries were practicing non-tariff measures such as voluntary export restrictions and agreements on the market order (Krugman et al., 2018, p. 403).

In the mid-1980s, the Geneva Uruguay Round, the eighth and last round under the GATT umbrella, started. One of its achievements was the creation of the World Trade Organization starting its activity in 1995. Despite this big achievement, it faced a lot of challenges since the negotiations were not finalised and signed until 1994 (WTO, 2021c; Krugman et al., 2018, p. 403). The achieved decline in the average tariff level had not brought the expected increase of the world trade volume. What was more important though, was the ongoing trade liberalisation in the agricultural and textile market. The agricultural market was especially suffering from the trade policy instruments used, such as Japan that had been applying import restrictions. The textile market was regulated by the Agreement on Textiles and Clothing (ATC) which eliminated existing import

quotas on textiles. In turn, the textile market was flooded with Chinese clothing. Consequently, falling market prices caused that smaller organisations generally could not keep up with the big players. This round also covered new regulations on public orders made by government agencies since the World Trade Organization required its members to jointly agree on its principles (Krugman et al., 2018, pp. 404ff.). According to Krugman et al. (2018), the round was successfully closed in the end as the participants feared a relapse, bearing in mind that protectionist tendencies were resurfacing again in 1993 (p. 408).

The first official round within the World Trade Organization, the ninth in total, is the Doha Round launched in 2001. It is also called the "Doha Development Agenda" as the negotiations focused on how to improve trading conditions for developing countries and the revision of existing trade barriers and rules.

So far, 20 years later, the World Trade Organization has still not announced its official conclusion and signing. Additionally, it gives its readers the impression that the negotiations are still ongoing, not letting them know the progress (WTO, 2021b). On the contrary, Krugman et al. (2018) assess the Doha Round as failed due to missing agreements between developing and developed countries (p. 411). Furthermore, Krugman et al. (2018) point out that any benefits from further trade liberalisation would be limited due to the successes previously achieved (p. 410). All in all, Krugman et al. (2018) describe the world trade system as a leverage combination: International trade negotiations push trade liberalisation while the elimination of barrier practices prevents from a fallback (p. 409).

1.7. Contemporary trade agreements and unions

Simultaneously to the general progress of trade liberalisation in the world, countries have also founded either free trade agreements or customs unions with each other, which will be briefly discussed next.

One example is the North American Free Trade Agreement (NAFTA) which was established by Canada, Mexico and the United States and came into effect in 1994. It was set up to encourage free trade within these three countries. The entire elimination of tariffs and quotas did not happen until 2008 though. An important aspect is that free trade only refers to goods produced by one of the NAFTA parties. This means that any commodity produced in Mexico may be exported to both Canada and the United States without any tariffs or quotas. The situation is different when this commodity has previously been imported into Mexico from somewhere else, e.g., Europe, and is then shipped to Canada or the United States. Free trade under NAFTA does not apply in this case.

Having these rules in force, each shipped commodity must be checked whether it meets the "rules of origin" (International Trade Administration, U.S. Department of Commerce, 2021). This might be simple to assess if that commodity has been produced in one country from the beginning to the end. However, nowadays, the majority of goods shipped are composed of many elements, and each component might derive from a different part of the world.

The North American Free Trade Agreement has been replaced by the United States-Mexico-Canada Agreement (USMCA) stating it would provide better opportunities to American workers and responding to upcoming market changes such as "Digital Trade" and the "21st Century economy" (Office of the United States Trade Representative, 2021).

Another example, with a much longer history, is the European Union which will be presented as an example for a customs union. The benefit of a customs union is that tariffs only apply for a certain commodity at the time when they cross the borders of the territory of the customs union. Unlike with free trade agreements which have been explained by the example of NAFTA, in a customs union, imported goods can be shipped to another country of the customs union without further tariffs since they have already been settled at the time the goods passed the borders of the union.

The European Union is the successor of the European Economic Community (EEC) founded in the 1950s. The motivation behind creating such a community was to restore long-lasting peace between European countries after the world once again was shattered into pieces as a consequence of the Second World War (1939 to 1945). This ought to be achieved by encouraging cooperation between these countries through common trade. The assumption was simple: countries that trade with each other were less likely to start fighting each other. Therefore, even now, one of the goals of the European Union is to "promote peace" without "internal borders".

In the 1990s, the European Economic Community was renamed to the European Union. Having started as an economic union, the European Union nowadays is much more than that, allowing not only the provision of goods and services throughout its territory without imposing any tariffs on them, but also enabling its citizens to move, live, study and work in any European Union Member State of their choice. The freedom of movement is reflected by the European Union's value of non-discrimination. Furthermore, a common currency has been introduced which has also simplified the exchange of goods and services since the value of exports and imports within the euro area is not impacted by exchange rate risks anymore.

With regard to foreign trade, the European Union operates on two levels – supporting its interests following the idea of a "single market" on the one hand, and on the other hand, cooperating with the World Trade Organization. As a representative of each European Union member country, it negotiates agreements for every country, making use of its size and power and therefore achieving better results than countries would gain if they were negotiating just for themselves. Nonetheless, the European Union states that it endeavours to work out beneficial agreements, such as fair trade conditions for both sides, including countries which are not part of it. This is carried out by granting its Member States access to new markets while also opening its own market to foreign countries[3].

Reviewing the development of trade volume, the European Union global trade in goods and services accounted for EUR 3,335.5 billion in 2009, whereas ten years later, in 2019, the value of trade reached EUR 5,984.1 billion[4] (European Commission, 2020). Ignoring inflation rates, this shows an increase by almost 80% (own calculation). As a member of the World Trade Organization, the European Union declares its support for the World Trade Organization in achieving global trade rules and encouraging free trade between its members (European Union, 2021d). To visualise the progress for the same period worldwide, the world's trade volume totalled EUR 18,422.0 billion in 2009, and EUR 36,404.7 billion in 2019 (European Commission, 2019). This shows an increase of 97.6% (own calculation).

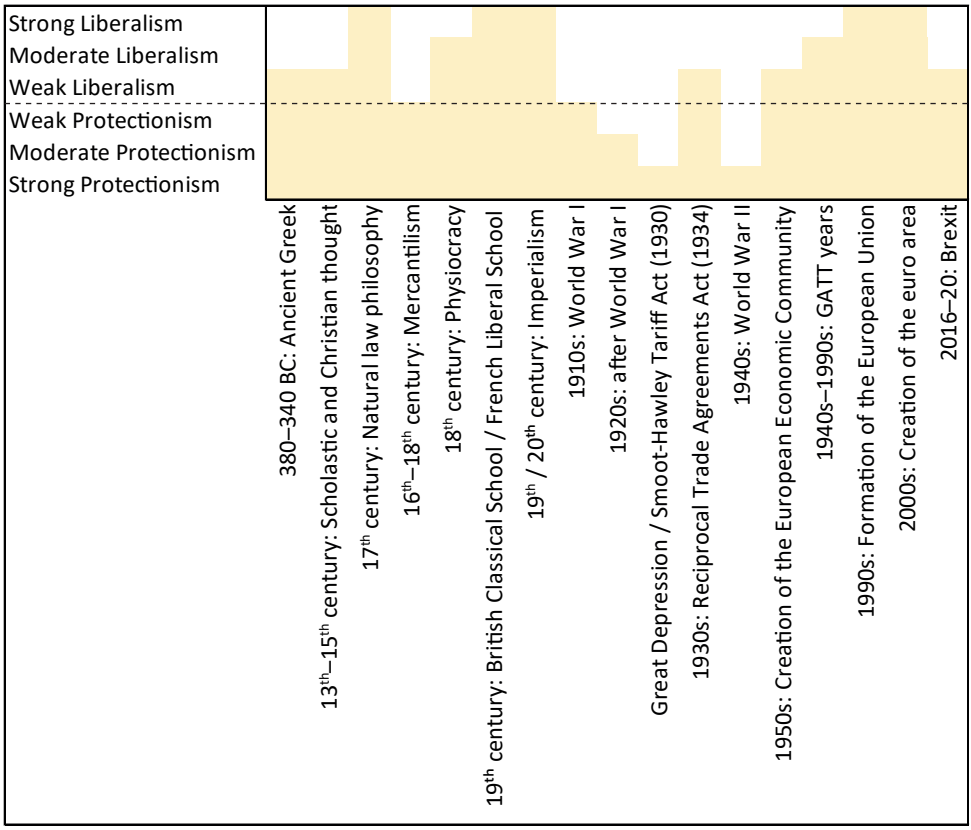
Along with all its achievements, the European Union also had to suffer a loss through the departure of the United Kingdom. In 2017, the United Kingdom declared its will to leave the European Union following a referendum in 2016. The whole process is widely known as "Brexit". The United Kingdom officially left the European Union on 31 January 2020 (EUR-Lex, 2021). The withdrawal of the United Kingdom meant that the up-to-then applicable agreements ceased to be binding. Consequently, new agreements between the United Kingdom and the European Union had to be negotiated. The result of the negotiations is reflected by the following agreements: "Trade and Cooperation Agreement", "Agreement on Nuclear Cooperation" and "Agreement on Security Procedures for Exchanging and Protecting Classified Information" (GOV.UK, 2020). From an overall perspective, Brexit can be seen as a step back in terms of liberalisation.

A summarising timeline outlining the respective tendencies towards protectionism and liberalism and the development of the attitudes in history which have previously been discussed is shown in Figure 1.

[3] The way of working between the European Union and the World Trade Organization described in a more detailed way can be found in: European Commission, 2019.

[4] The presented values for both years reflect the trade volume of EU-27.

Figure 1. Overview of various trade attitudes in history



Source: Author's own elaboration based on (in alphabetical order): Ajami, R. A., Goddard, G. J. (2006). *International business: Theory and practice,* 2nd ed., New York: ME Sharpe; Dorobăț, C. E. (2015). *A brief history of international trade thought: From pre-doctrinal contributions to the 21st century heterodox international economics. Journal of Philosophical Economics,* 8(2), pp.106–137; Encyclopædia Britannica (2021a). *European society and culture since 1914*. https://www.britannica.com/topic/history-of-Europe/The-Great-War-and-its-aftermath (accessed 6.01.2021); Encyclopædia Britannica (2021c). *Smoot-Hawley Tariff Act*. https://www.britannica.com/topic/Smoot-Hawley-Tariff-Act (accessed 6.01.2021); Krugman, P. R., Obstfeld, M., & Melitz, M. J. (2018). *Ekonomia międzynarodowa. Teoria i polityka,* 4th ed., Warsaw: Wydawnictwo Naukowe PWN; Maneschi, A. (1998). *Comparative advantage in international trade: A historical perspective*. Cheltenham / Northhampton, MA: Edward Elgar Publishing; Office of the Historian (2021). *Protectionism in the Interwar Period*. https://history.state.gov/milestones/1921–1936/protectionism (accessed 6.01.2021); Salerno, J. T. (1978). *Comment on the French liberal school. Journal of Libertarian Studies,* 2(1), pp. 65–68; Schumpeter, J. A. (1954). *History of Economic Analysis*. New York: Oxford University Press; WTO (2021c). *The GATT years: from Havana to Marrakesh*. https://www.wto.org/english/thewto_e/whatis_e/tif_e/fact4_e.htm (accessed 6.01.2021).

1.8. Summary

Trade can be generally understood as a swap of goods/services between people or countries where money as a means of payment may be involved. Trade is usually beneficial for both trading parties since each of them might be endowed in different raw materials, have a different access to technology and hence specialise in the chosen production to be effective. The stronger focus on profits and efficiency is a result of the ongoing globalisation. Furthermore, globalisation led to increased competition with more available products but also challenging smaller producers to keep up with the big players.

Originally, due to the existing circumstances, people mainly traded locally and only goods which were robust enough for travel were traded outside the local area. The world's oldest and longest trade route is the Silk Road deriving its name from its main traded commodity – silk. The Silk Road was a network connecting the East with the West and not just a simple route.

Deliberations concerning trade go back to the Ancient Greek era with Plato, Xenophon and Aristotle as its main representatives. Plato noticed that it is impossible for a state to produce everything on its own. To achieve a higher productivity, responsibility of production needed to be divided between nations. Plato supported this approach, highlighting that price arbitrages and international markets would benefit traders and merchants. Aristotle, as opposed to Plato and Xenophon, was worried about the inequity nations could face due to missing commercial treaties.

Aristotle's concern was shared by the representatives of the Scholastic and Christian thought who focused on moral philosophy, generosity, fairness and justice. However, they all were aware that a society was not able to survive based on the goods provided by nature.

The natural law philosophy justified commercial exchanges as a fundamental right for everyone and every nation. Mercantilism contradicted this attitude, focusing on achieving a positive balance of trade. Therefore, powerful countries acquired territories with a rich supply of raw materials, exploited them and contributed to what nowadays is referred to as colonialism.

Physiocracy freed domestic and foreign trade but treated agriculture as the only means of production. It did not require more to be exported than to be imported since extensive foreign trade was harmful.

The British Classical School was founded by Adam Smith, representing the concept of absolute advantage as the reason for parties to trade. Ricardo disagreed and introduced the concept of comparative advantage – trade will still take place even if only one of the parties achieves absolute advantage. Mill introduced

the theory of reciprocal demand which states that trade is defined by the equal value of production and the corresponding demand. On the contrary, the French liberal school proclaimed free and unconditional trade.

Ricardo's concept was picked up by Pareto and Haberler who developed this theory further. According to Pareto, it was difficult for countries to specialise if they varied in size, but bigger countries were still able to benefit if they partly specialised. Haberler used opportunity costs as production costs instead of labour costs. The Heckscher-Ohlin theorem is based on the assumptions of two production factors, equal access to technology and equal consumer taste. It examines how trade impacts the use of factors and factor rewards as the only difference between countries is their factor endowment.

Mises, assessing the second half of the 19th century as one of the wealthiest in history, was an advocate of liberal trade, indicating that protectionism decreased the productivity of labour and hindered people in getting richer.

The protectionist attitude of the 19th century led to the outbreak of World War I. Wilson's "Fourteen Points" aimed to set up equal trading conditions, but European countries were not able to export to the United States due to tariffs implemented there. Since the expected effects were missing, tariffs were decreased, bilateral agreements with the United States introduced, followed by general trade liberalisation.

However, the Great Depression in 1929/30 led to another wave of protectionism and the outbreak of World War II. This time, after the war ended, the United States reduced their import tariffs quicker and victorious allied countries took over the liberalisation of the world trade by setting up multilateral agreements.

Following this, many countries aimed for an International Trade Organization. They set up the General Agreement on Tariffs and Trade (GATT) to manage tariffs, export subsidies and import quotas, starting with bilateral and moving on to multilateral agreements which were concluded during rounds. All in all, there were eight rounds under the GATT concept before the establishment of the World Trade Organization (WTO) was announced. The WTO started its activity in 1995 and since then has not yet achieved a successful ending of its first official round.

Nowadays, trade agreements and customs unions are set up by various countries. The North American Free Trade Agreement (NAFTA) is a trade agreement by the United States, Canada and Mexico, allowing free trade between these countries when a commodity has been produced within their territory. Import quotas apply if the commodity has been produced elsewhere. The NAFTA has been replaced by the United States–Mexico–Canada Agreement.

The European Union (EU) is a customs union where tariffs only apply when a commodity crosses the borders of the EU territory. No tariffs apply within the EU irrespective of the origins of the commodity. The EU is a long-term initiative with roots after the Second World War, set up in order to prevent further wars. The EU follows the idea of a single market where freedom to trade, move, live and work is guaranteed. At the same time, it uses its size to put forward its ideas when co-operating with the World Trade Organization or during other negotiations. To ease trade within the union, most countries introduced a common currency, the euro. However, the EU has also recently been coping with the negative sides of it, which was the United Kingdom leaving the union – its departure commonly referred to as “Brexit”.

2. The gravity model of trade

While the history of trade was progressing, this topic was explored by researchers. Consequently, to establish a more scientific background, economists have created different trade models of which one is the gravity model of trade which will be discussed in this chapter.

2.1. Basic assumptions

In the outline of the introduction to trade, traditional trade theories have been mentioned and briefly discussed. However, their disadvantage is that they can only be used in a limited way to explain and forecast foreign trade since their assumptions are quite theoretical and do not correspond to the real-world circumstances. Among these assumptions, Mathur et al. (2017) mention "perfect competition; constant return to scale; no externalities; and the fully flexible market of factors of production (such as capital and labor) that ensure full employment" (p. 11). For this reason, new trade theories have constantly been developed which would consider:

1) "economies of scale;
2) product differentiation and
3) the existence of imperfect competition in the markets" (Mathur et al., 2017, p. 11)

as the main reasons why countries trade with one another. The range of concepts of new trade theories vary from the introduction of terms such as "intra-industry trade" to the assumption that it is the firms that are trading and not countries or industries (Mathur et al., 2017, pp. 11ff.).

Tinbergen (1962) was among researchers who were trying to build a correspondent model in order to be able to predict the trade volume between two countries. Tinbergen (1962), holder of a PhD in Physics, was asked "to determine the normal standard pattern of international trade that would prevail in the absence of discriminating trade impediments" (p. 262). This exercise was carried out for a report funded by a New York-based philanthropic foundation (De Benedictis & Salvatici, 2011, p. 55).

Tinbergen (1962), inspired by Newton's model which reflects the law of gravity, made use of this model and replaced the variables representing the masses of both objects by the gross national product (GNP) of each country (p. 264;

Head, 2003, p. 2). In the chapter entitled *An Analysis of World Trade Flows* (Tinbergen, 1962, p. 264), he noted down the following equation:

$$E_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3}$$

where:
E_{ij} – exports of country *i* to country *j*,
Y_i – GNP of country *i*,
Y_j – GNP of country *j*,
D_{ij} – distance between country i and country *j*.

Tinbergen (1962) justifies the choice of these variables and their dependencies the following way: The value of exports of country *i*, the exporting country, depends on its gross national product since this is a figure showing how much this country is able to produce. Each supply needs a corresponding demand, represented in this formula by the value of the gross national product of country *j* which is an indicator for its market and its ability to import. Among the gross national products of both countries, distance also plays a significant role with regard to their trade volume (p. 263). Tinbergen (1962) mentions that the distance factor may be used to show "transportation costs" or used as an "index of information about export markets" (p. 263).

Furthermore, he points out that the exponents α_1, α_2 and α_3 have been used to indicate that the proportionality between the variables on the right-hand side of the equation, i.e., Y_i, Y_j, D_{ij}, also called explanatory variables, and the one on the left-hand side of the equation E_{ij}, called variable to be explained, may vary. The factor α_0 is a constant.

In order to understand the equation correctly, Tinbergen (1962) highlights that the gross national product of both countries influences the export volume of country *i* to country *j* in a positive way, i.e., the GNP increases the export volume, whereas factors represented by distance will have a negative impact and will reduce it (p. 263).

Over the years, Tinbergen's formula has been slightly modified to enhance its correct understanding. For this reason, the equation representing the gravity model of trade can be nowadays found as:

$$T_{ij} = A \times Y_i^a \times Y_j^b / D_{ij}^c$$

where:
T_{ij} – trade volume between country *i* and country *j*,
A – constant,

Y_i – GDP of country *i*,
Y_j – GDP of country *j*,
D_{ij} – distance between country *i* and country *j* (Krugman et al., 2018, p. 46).

Comparing both equations, it is noteworthy that some variables have been amended: The variable to be explained does not represent the export value from country *i* to country *j* but the total trade volume between these countries. Additionally, the gross national product has been replaced by the gross domestic product (GDP). Assessing this change, it can be summed up that Tinbergen's original equation has been generalised. Given the situation that all exponents were set to 1, the equation would be analogous to Newton's (Krugman et al., 2018, p. 46).

Many economists have picked up Tinbergen's model and added their own explanations (Mathur et al., 2017, p. 16). Krugman et al. (2018) refer to the gross domestic product rather than the gross national product, stating: The higher the gross domestic product of the importing country is, the more this country is able to spend, meaning to import. At the same time, imports are associated with the ability to export, since countries producing goods have partners to whom they can sell these goods. The bigger the distance between two countries is, the more difficult it is to maintain a good relationship between them which also is a beneficiary factor for their cooperation (Krugman et al., 2018, pp. 46, 48).

Head (2003) adds that the positive dependency between the countries' gross domestic products and their trade volume can be explained by two reasons: Firstly, it seems to be natural that bigger countries trade more in absolute terms. Secondly, the calculation of the gross domestic product is based on both the export and the import value (p. 5).

With regard to distance, Head (2003) has a split opinion. Distances are usually measured with the help of the great circle formula. However, this method is not fully accurate (p. 5). Head's (2003) criticism is that for air travel this formula does not consider the circumstance that most flights avoid the North Pole and therefore the calculated distance might be much shorter than in reality. In relation to shipments by sea, routes might be influenced by land and ice barriers. Additionally, there are certain fixed costs which are independent of the actual distance. These costs include freight costs set by international shipping cartels, costs of packaging, loading and unloading (p. 5). On the other hand, Head (2003) does not underestimate the importance of distance. In his opinion, "distance" can be used as a summary for six influencing factors:

1) transport costs;
2) shipment time;
3) synchronisation costs;

4) communication costs;
5) transaction costs;
6) "cultural distance" (pp. 6ff.).

The correlation[5] between transport costs and distance should be obvious. The longer the distance, the longer the shipping travel and hence costs increase. With regard to shipment time, this factor may have a significant impact for perishable goods. Those goods may lose their quality due to changing weather conditions or rot as a result of organic processes.

Time may also influence the payment process in a negative way since the buyer might lose their interest in this commodity or become insolvent. The problem of synchronisation costs appears particularly in just-in-time production processes. As keeping goods in stock is quite expensive and might be risky for reasons such as fashion changes or technology obsolescence, manufacturers whose location is closer to the factory might be considered as preferred trading partners.

Direct communication always makes it easier to network and to transfer one's relationship into a less formal sphere. As a consequence, it is much easier to negotiate and make a deal. Hence, this is the reason why distance influences communication costs. When searching for a reliable and trustworthy trading partner, distance is again correlated with additional costs because this is an iterative and time-consuming process. The further countries are apart from each other, the more likely it is that they differ in terms of culture and habits. Knowing each other's cultures helps to avoid misunderstandings and a clash of cultures which might cause unnecessary additional costs (pp. 6ff.).

When reviewing Head's explanations on the gravity equation, it is worth highlighting that Head (2003) replaces the above-mentioned constant A by the term R_j which he calls "remoteness" (p. 8). The importance of this term can be reflected if the trade volume between

1) Australia and New Zealand;
2) Austria and Portugal

is compared. The distance between Canberra and Auckland is nearly the same as between Vienna and Lisbon. However, for some reason, the trade volume between Australia and New Zealand was higher in 1993 in comparison to the trade volume between Austria and Portugal.

Head (2003) argues that apart from the gross domestic products and the distance, the existence of alternative suppliers has an influential impact. If a country can choose from a wide range of supplying countries, the term R_j will be lower

[5] Correlation in this context does not refer to the statistical meaning of correlation but is used as a synonym for interdependence.

and so the total trade volume with the other country will decrease (p. 8). The same assumption is made by Helliwell (1998): Remoteness is a variable which "is supposed to represent the trading opportunities available to [country] *j* with countries other than *i*" (p. 11). It can be presented by the following equation:

$$REM_{jit} = \sum_{n,\ n \neq i} \left(DIST_{ij} / GDP_{it} \right)$$

where:
REM_{jit} – remoteness measure for country *j* to trade with country *i* in year *t*,
n – country,
$DIST_{ij}$ – distance between country *i* and country *j*
GDP_{it} – gross domestic product of country *i* in year *t* (Helliwell, 1998, p. 11).

The possibility of different approaches of the basic model already shows that the topic is quite complex and although Tinbergen (1962) provided a solid foundation, he already noticed within his own research that there were further factors needed to be considered which will increase the accuracy and reliability of predicted trade volumes, called "additional explanatory variables" (pp. 265ff.). These factors shall be discussed in the following section.

2.2. Advanced model

In his research, Tinbergen (1962) examines three series of countries. For each series, he uses three basic explanatory variables, i.e., the gross national products of both countries and the distance between them. Afterwards, he modifies the equation by including dummy variables representing neighbouring countries and trade agreements and/or the Gini coefficient of concentration. The Gini coefficient of concentration[6] serves as an assessment for the concentration of goods in exports. A value of 100 means that this country only exports one commodity (pp. 263ff.).

Table 2 summarises the different individual series, showing which variables have been used and highlights the differences between the studies conducted. Unless stated otherwise, the value for the gross national product has been taken from the export statistics of the country and has been converted to US dollars. In one case (A2), Tinbergen (1962) takes the export volume of the exporting

[6] Tinbergen (1962) refers to Michaely, 1958, pp. 722–736.

country from the import statistic of the importing country (p. 265). In series B, the values for gross national products have been split into nominal data – cases B1, B2 and B4 – and real data – cases B3 and B5 (p. 273). With regard to B4, on top, domestic prices for calculating gross national products have been used (p. 268).

Cases A3, B3 and B4 all investigate the importance of trade agreements. The difference between them is that A3 exclusively takes into account Commonwealth and Benelux preferences assuming values "0" for no preference and "1" for the relevant preference (p. 270) whereas B3 and B4 differentiate between no trade agreements (value "0"), semi-preferential trade relations (values "1" or "1.53") and trade either between the United Kingdom and a Commonwealth partner or between a metropolitan country and its (former) colony or colonies (value "2"). Cases B3 and B4 differ from each other in terms of their values for semi-preferential trade relations. The cluster of semi-preferential trade relations has been considered by Tinbergen (1962) for countries of the European Economic Community (EEC) or the USA and Cuba, the Philippines, or Venezuela (pp. 267f.).

It needs to be accentuated that series A includes developed countries with a mainly high gross national product, whereas the following series B and C also include developing countries with a lower gross national product. Furthermore, as a consequence, series B and C consist of countries which are more remote from each other than those in series A. Hence, the distance factor should be more reliable in series B and C than in A (p. 288).

Reviewing the results of his research, Tinbergen (1962) comes to the following conclusions: On average, each model created by Tinbergen (1962) explains more or less 64% of the export volume which he judges as "not very high […] but certainly not unsatisfactory" (p. 269). After adding the dummy variables for the Commonwealth and Benelux preferences to series A and comparing them with each other, Tinbergen (1962) finds out that only the Commonwealth preference has "made a statistically significant contribution" (p. 266). This observation solidifies his opinion that the basic variables, i.e., the gross national products of both countries and the distance between them, are the leading ones to explain the export volume of the exporting country.

Generalising the effect of all preferential treatments, as conducted in series B, Tinbergen (1962) has observed a positive impact on the export volume by up to 12% (p. 288). In connection with semi-preferential trade relations, the additional export volume increases to 5%. Tinbergen (1962) has been able to show that the neighbouring element additionally expands trade. Depending on the case, the export volume has grown by 5% for case A3 and up to 75% in cases B2 to B5 (p. 288).

Table 2. Tinbergen's series for examining the gravity model

Series A: 18 countries *Developed countries with high GNP*		**Series B: 42 countries** *Mixed countries with mixed GNP*		**Series C: 28 countries from Series B** *Mixed countries with mixed GNP*	
A1	• Export • GNP • Distance	B1	• Export • GNP *GNP in nominal data* • Distance	C1	• Export • GNP • Distance
A2	• Export • GNP *GNP taken from the import statistics of the importing country* • Distance	B2	• Export • GNP *GNP in nominal data* • Distance — • Neighbouring country *Used values* *0 if condition not met* *1 if condition met*	C2	• Export • GNP • Distance — • Gini coefficient
A3	• Export • GNP • Distance — • Neighbouring country • Commonwealth preference • Benelux preference *Used values* *0 if condition not met* *1 if condition met*	B3	• Export • GNP *GNP in domestic prices* *GNP in real data* • Distance — • Neighbouring country *Used values* *0 if condition not met* *1 if condition met*		
		B4	• Export • GNP *GNP in domestic prices* *GNP in nominal data* • Distance		

Series A: 18 countries *Developed countries with high GNP*		**Series B: 42 countries** *Mixed countries with mixed GNP*		**Series C: 28 countries from Series B** *Mixed countries with mixed GNP*	
		B4	— • Neighbouring country *Used values* *0 if condition not met* *1 if condition met* • Preferential trade agreement *Used values* *0 if no trade agreement* *1 if semi-preferential trade relation* *2 if trade with (former) colony or between the United Kingdom and a Commonwealth partner*		
		B5	• Export • GNP *GNP in real data* • Distance — • Neighbouring country *Used values* *0 if condition not met* *1 if condition met* • Preferential trade agreement *Used values* *0 if no trade agreement* *1.53 if semi-preferential trade relation* *2 if trade with (former) colony or between the United Kingdom and a Commonwealth partner*		

Source: Tinbergen, J. (1962). *Shaping the World Economy; Suggestions for an International Economic Policy. Books (Jan Tinbergen)*. New York: Twentieth Century Fund.

Having a closer look at the calculated factors α_1 and α_2 which adjust the proportionality of the gross national product for both countries in relation to the export volume of the exporting country, Tinbergen (1962) sums up that both of them equal about 1. This result indicates that an increase in the gross national product of one country by one unit (e.g., US dollars) will lead to an increase in the export volume by the factor resulting from the product of the other variables. When comparing the calculated values for α_1 and α_2, it is worth highlighting that α_2 usually is smaller than α_1 which might be interpreted in such a way that the gross national product of the exporting country has a slightly higher influence on the export volume.

Furthermore, another indication is that the higher the gross national product of a country is, the less a country imports due to an adequately sufficient choice of domestic production. As a consequence, this may imply a disproportion in trade since the export of large countries to smaller countries will be higher than their imports from them (p. 289). The investigation of the Gini coefficient has shown that the more diversified a country's production is, the higher its exports are (Tinbergen, 1962, p. 290).

Tinbergen is not the only researcher who has analysed trade relations with the help of the advanced gravity model. The adjustments of the basic model are broadly discussed in literature. Head (2003), for instance, discusses six variables as such:

1) Income per capita – which is taken into account in addition to aggregated income. The reason for this is that countries with a high income generally trade more and use lower tariffs.
2) Adjacency – as a dummy variable. Head (2003) refers to studies which have observed a 65% increase of trade if countries share a common border. However, in his opinion this factor ought to be considered in the distance variable.
3) Common Language and Colonial Links – Head (2003) states that countries speaking the same language trade two to three times more than countries with different languages. This should not surprise anyone since communication issues are treated as a transaction cost hindering trade in general.
4) Border Effects – The effect of borders may not be disregarded. A study on Canadian trade has shown that its provinces trade twenty times more with each other than with US states even though those provinces and states do not differ in terms of size and distance. Border effects have been observed in Europe as well. The question why borders have such a great impact can be answered in two ways: The first approach would be to critically examine the way of calculation. The other one is to accept it and justify this behaviour with trade promotion by national institutions.

5) Free Trade Agreements – Depending on the source, free trade agreements may enlarge trade up to two to three times.
6) Monetary Agreements – Countries using the same currency may trade three times more. This result needs to be treated with consideration though. It may apply to trade between the USA and Panama but not in the euro area (pp. 9ff.).

Mathur et al. (2017) base their gravity analysis on assumptions made by Anderson and Wincoop (2003) who not only consider trade barriers on a bilateral level but extend their views by also considering multilateral trade barriers, calling them "multilateral resistance term". This multilateral resistance is exercised by countries which are not directly affected in the trade of two countries but may still influence it. The challenge to identify this factor lies in the nature of observation which is directly not possible. For this reason, advanced estimation techniques are required.

Mathur et al. (2017) suggest to simply use a fixed effect estimation (p. 24). Including the multilateral resistance term in the gravity equation is not appreciated by everyone though. De Benedictis et al. (2011) warn that this element may guide the researcher to false assumptions and hence considerable attention needs to be paid to it (p. 64). Another challenge which is highlighted by Mathur et al. (2017) is the quantification of trade barriers. In their opinion, it is worth splitting those barriers into two groups – direct and indirect ones.

Direct barriers are associated with tariffs which the importers pay on foreign goods. On the opposite side are indirect barriers, generally known as trade transaction costs, which among other things delay the shipment from the exporting country i to the importing country j. These costs reflect the price difference between the production price in country i and the final price in the importing country j. This price difference can be subdivided into three stages:

1) before;
2) at;
3) after crossing the border.

To calculate trade costs, Mathur et al. (2017) suggest finding out the tariff rate valid for a certain product classification and in the next step to determine the level of protection index in order to not underestimate the influence of trade restrictions (pp. 25f.).

When referring to the gravity model, at the very beginning, De Benedictis et al. (2011) have a remark on the constant which can be found in most of the gravitation equations. In their opinion, "the gravitational constant […] is not constant" (p. 59) since this factor will always be subject to trade partners, changes over time and policy variables (p. 59). A further point of their dissatisfaction with

Tinbergen's model is the lack of consideration of demand, supply and prices (De Benedictis et al., 2011, p. 63).

De Benedictis et al. (2011) state that models facing these kinds of issues were not created until the 1980s. Only then, a demand function with Constant Elasticity of Substitution (CES), consumer preferences or firm heterogeneity have been included in gravity models. However, they also point out that special attention needs to be paid to firm heterogeneity especially when dealing with companies operating abroad as they may only do business in certain parts of the world and not worldwide (p. 64).

According to De Benedictis et al. (2011), a "well-specified gravity equation" (p. 73) ought to include the following elements:

1) Fixed Effects Specifications – are the most convenient solution in terms of verifying the reliability of the modelled gravity equation. However, it may not be forgotten that certain effects are time-related (p. 74).
2) Attractors – have a positive impact on trade because they simplify trade transactions due to an element which both countries share. This might be a common language, history, ethnicity/nationality as a result of migration, technology, etc. Attractors are not affected by time and therefore should be considered with caution when they are included in fixed effects specifications (pp. 74f.).
3) Trade Frictions – which are reflected by distance do not pose a challenge in terms of the best way of calculating it but rather in their interpretation. It may happen that the calculated gravity equation will show a linear dependency between distance and trade volume. However, trade costs are not merely influenced by the distance a certain commodity is shipped. Hence, this correlation might be applicable for variable costs only. There is no unique understanding of what is mapped behind the distance variable. It might be a proxy for transport costs, for others it might be a variable to show economic distance such as the above-mentioned border effects (pp. 75ff.).
4) Trade Policy – as an influencing trade factor is usually treated as a dummy variable. De Benedictis et al. (2011) highly recommend changing this approach and use a quantification instead by assessing the trade agreement in terms of a margin (p. 80).
5) Dynamics – is a factor which considers the development of trade over time. This circumstance has not been considered by Tinbergen at all. However, it is important to include dynamics in the gravity equation because the way how trade is developing may be a result of what has happened before (p. 85).

6) Interdependence and Networks – treats the topic of expanding a bilateral trade into a more multilateral point of view. This has many reasons: Two countries trading with each other will never be independent. Furthermore, a third country might interfere in the current relationship between those two countries and replace certain existing trade structures by offering an equivalent commodity (p. 86).

2.3. Applicability of the model

The assumptions of the gravity model and the different approaches to improvement have been briefly discussed. As shown by the different perspectives, it is worth stressing that there is no right or wrong when doing the mathematical modelling. The amount of work spent on trying to find out the best working model has brought the topic forward (Mathur et al., 2017, p. 30). This is the reason why the gravity model is still a topic discussed in contemporary literature. Since the aim of this monograph is for own analysis based on the assumptions of the gravity model to be carried out later, it is worth reviewing already existing research covering this topic.

Complex research, the results of which have been collated, has been conducted by Umiński (2016). Umiński (2016) points out that for a long time the gravitational theory was not considered in textbooks for international economy due to missing profound theoretical basics (Anderson, 2011, as cited in: Umiński, 2016, p. 97). Umiński (2016) summarises this occurrence as "facts without theory"[7] referring to Deardorff (1998) who points out that Tinbergen did not even try to make the effort to technically justify it but was rather led by intuition as this model might be useful and achieve its aim (p. 97). Helpman (1987) is of the opinion that the gravity model is a good addition to the Heckscher-Ohlin theorem which does not take trade volumes into account (as cited in: Umiński, 2016, p. 97). Anderson (2011), taking a position on critics of the gravity model, commented that the gravity model in its advanced version is able to predict 80–90% on the change of trade volume correctly (as cited in: Umiński, 2016, p. 97). There is no consent between authors whether borders should be treated as a trade barrier or a neutral factor. Ohmae (1990) insists that the importance of borders is vanishing and does not affect capital flows or knowledge transfer (p. 193, as cited in: Umiński, 2016, p. 97). On the other hand, McCallum (1995) proved that the border between the United States and Canada has a decisive

[7] Own translation.

meaning for their trade even though these countries are very similar to each other. Referring to this research, the assumption would be that the influence of a border between two adjacent countries which show a high distinction grade is even stronger (as cited in: Umiński, 2016, p. 97). Umiński (2016) did himself a rough analysis to check the model's applicability by examining the dependency of distance on the trade volume of Polish voivodeships[8] with Germany. Although he is aware that this picture is very unprecise, it gives a first impression and does show the negative correlation between distance and trade volume (pp. 94f.).

There are two further studies examining the applicability of the gravity model which might be useful for the aim of this study since each of them focuses on a different German federal state aiming to determine influencing factors for trade volumes. Referring to these studies, it can be noted positively that although different research methods have been applied, the assessment of the validity of the gravity model is the same.

The first study deals with the federal state Baden-Württemberg and was conducted by Bremer (2018), an economist working for the Statistisches Landesamt[9] Baden-Württemberg (p. 26). In his analysis, Bremer (2018) compares the 2016 exports between Germany and Baden-Württemberg. His first conclusion is that when comparing Baden-Württemberg with Germany, it has a higher share of exports with Switzerland which is adjacent to Baden-Württemberg but a lower share with Belgium, Austria, Poland and the Czech Republic which are adjacent to Germany but not to the federal state Baden-Württemberg. However, trade with the US and China plays an important role both on the federal and the federal state level due to their country sizes and despite their distances to Germany (pp. 27f.).

In the first step, Bremer (2018) examines the correlation between the gross domestic product of the trading partner with the exported volume from Baden-Württemberg illustrating it with a regression line. His remark is that countries which are closely located to Baden-Württemberg import more volume from it than the regression line would predict based on the gross domestic product. When export volume and distance are examined, the respective correlation is negative. Furthermore, the correlation is less intense and accurate than between the gross domestic product and the export volume. Bremer (2018) justifies this occurrence with the influence of China and the United States (pp. 27f.).

The overall conclusion is that the variables gross domestic product and distance must not be regarded separately when forecasting expected trade volumes

[8] Polish voivodeships are comparable to German federal states, yet they have less autonomy.

[9] Statistisches Landesamt is the Statistical Office on the federal state level.

but in combination and further factors need to be included. Bremer (2018) has used four approaches to model the export volume of Baden-Württemberg with its trading partners. As discussed above, the first one only considers the gross domestic product, the second one distance. The third model takes gross domestic product and distance into consideration, reflecting the traditional gravity model, whereas the fourth model is an extension of the third one where additionally population size, EU membership and WTO membership of the country have been added. Even though the coefficient of determination for the basic model is 0.906, it rises to 0.927 for Bremer's (2018) advanced model. Generally said, the higher the coefficient of determination is, the higher the accuracy of a model is. Based on these results, Bremer (2018) concludes that the gravity model of trade is applicable (pp. 28ff.).

The second study deals with Rhineland-Palatinate and whether the gravity model can be used to predict its export volumes to their trading partners. Within this research, a cross-sectional analysis and panel data analysis have been conducted. König and Schulze (2006) also highlight that there is no "theoretical foundation" for this model, yet its results are substantial (p. 2).

The first approach which is the cross-sectional analysis aims to compare various models. It does not take any time effects into consideration but focuses on exactly one year, i.e., 2003. The basis are 50 countries which are a set of such countries which are important for Rhineland-Palatinate's exports, but also countries from all over the world. In total, three models have been compared. Model A takes into consideration the GDP per capita of the trading partner, the distance between the trading partner and Rhineland-Palatinate, and the population size of the trading partner. Model B additionally considers whether the trading partner is a member of the EU, OECD or WTO (as three independent variables), whether this is a German-speaking country, and the last variable represents a rating of the economic order regarding liberality of this country[10]. Model C is a mix of A and B and considers the GDP per capita, the population size, the distance and the rating of the economic orders.

The outcome of the calculation is generally not surprising. GDP per capita, population size, institution membership, German-speaking ability and a liberal economic order promote trade, whereas distance distracts from it. One exemption can be found in model B. According to the calculated results there, a WTO membership does not promote trade but hinders it. Looking at the reliability of the model, it turns out that the calculated coefficients of determination are as follows – Model A: 0.84, Model B: 0.86, Model C: 0.86. Further, model B indicates

[10] The assessment of the economic order is based on the status index of the Bertelsmann Stiftung.

that all the variables which can be either true or false (e.g., EU membership) do not have the expected influence of trade. Finally, König and Schulze (2006) conclude that based on the indicators, coefficient of determination, mean square error, Akaike and Schwarz information criteria, model C turns out to be the best model.

The overall conclusion is that all models have a high precision, however, the advanced model shall be preferred to the basic one. The authors are aware that the results are based on a static data set and changes over time such as price competitiveness are neglected (pp. 9ff.).

The panel data analysis has been applied in the second approach. Therefore, the data set used considers ten countries from 1972 to 2003. It is worth stressing that within this data set eight countries are European and the remaining two are Japan and the United States. It is therefore important to be aware that these countries are very similar and certain factors such as memberships in the above-mentioned institutions will not be a distinguishing criterion.

Based on the results from the cross-sectional analysis, the authors have not paid any further attention to the basic model but continued their analysis directly with the advanced model (König & Schulze, 2006, p. 14). In comparison with the cross-sectional analysis, the panel data analysis considers individual and time effects. Individual effects are effects relating to a particular individual, in this case the trading partner, whereas time effects affect each of the regarded trading partners, e.g., effects due to globalisation (König & Schulze, 2006, p. 3). In order to examine whether individual or time effects are prevailing, the authors have conducted a pooled regression.

In the first experiment, the criteria: GDP per capita, population size, distance, EU membership and German-speaking country have been taken into account. The influence of these criteria on trade is comparable to the results achieved in the cross-sectional analysis. In a further step, König and Schulze (2006) added the variables: political order[11], GDP growth rate and the development of the price competitiveness of the German economy towards its trading partners[12] to the model. The authors have identified both individual and time effects. Furthermore, the population size does not have a significant influence on the export volume of Rhineland-Palatinate. The authors assume that this is due to the homogeneity of the countries in question. Distance and the German-speaking

[11] The assessment of the political order is based on the indicator of the Polity IV Project which rates countries based on their level of democracy or autocracy.

[12] The price competitiveness is based on an indicator provided by the Deutsche Bundesbank, the central bank of Germany.

factor as further variables do not show an important influence, either. In this case, König and Schulze (2006) justify it with the fact that these variables do not change over time and the considered sample only consists of ten countries. Therefore, during further calculations, the authors ignore the existence of these variables (König & Schulze, 2006, pp. 14f.).

Since the aim of the pooled regression analysis is the discovery of possible individual or time effects, in the next section the authors present the variance analysis results which confirm the existence of these effects. Hence, they reject this modelling approach. Instead, they present the estimation results of two panel models, one with fixed effects, the second one with random effects. These two models differentiate in that the second one additionally considers individual and time effects (König & Schulze, 2006, p. 16).

The calculations of the fixed effect model show that only the EU membership does not impact the exports of Rhineland-Palatinate in a significant way. The model shows a coefficient of determination of 0.97 which is much higher than the models of the cross-sectional analysis. Regarding the random effects model, the results can be summarised as follows: All variables have a significant impact on the export volume, the coefficient of determination is 0.97. Both models show that all variables prove to be trade promoters or distractors as expected (König & Schulze, 2006, pp. 16f.).

Despite the high coefficient of determination, the authors are concerned about the lacking means to check the assumptions of the models. Hence, the appearance of heteroscedasticity and autocorrelation is very probable. There is also no means to consider the variable distance on its own (applicable for the fixed-effects model) or it turns out that its influence might be neglected (applicable for the random effects model) which conflicts with the basic assumptions of the gravity model. The missing impact on export volume also applies in both models for the variable population size. All in all, the conclusion can be drawn that after the elimination of the unsignificant variables, the panel models stop having anything in common with the original gravity model of trade. Another considerable remark is that the weight of impact for each variable might change depending on the constructed model (fixed/random effect) and over time or based on individual effects (König & Schulze, 2006, pp. 18f.).

Therefore, König and Schulze (2006) conclude that advanced models are preferred to the basic one; regarding panel data analysis, the model with fixed individual and time effects is preferred, however taking into account that the panel data analysis shows that the basic variables of the gravity model do not seem to be important, the cross-sectional analysis is preferred. All in all, the

gravity model can be considered as a useful approach to predicting trade volumes with the cross-sectional analysis (König & Schulze, 2006, pp. 19f.).

Overall, empirics have shown that the model created may confirm the circumstances for one set of countries but be completely unreliable for a different one (Mathur et al., 2017, p. 30). Quoting Leamer and Levinsohn (1994), the appearing dilemma can be summarised the following way: "These estimates of gravity models have been both singularly successful and singularly unsuccessful. They have produced some of the clearest and most robust empirical findings in economics" (p. 44).

2.4. Summary

Over the course of time, various economists tried to create or improve existing trade theories to be able to predict trade volumes for a given set of conditions. Models generally face the problem that their assumptions do not reflect real-world circumstances. Recent trade theories have been trying to include economies of scale, product differentiation and imperfect competition in the markets into their calculations.

Tinbergen, one of many, built one of these models – the gravity model of trade – being inspired by Newton's law of gravity. He found out that the export volume of one country is positively influenced the higher the gross national products of the country itself and its trading partner are. The contrary applies with increasing distance between the two of them. The equation also considers a constant which is proportional to the export volume. This assumption has been more generalised replacing the export volume with the total volume and the gross national product with the gross domestic product.

Tinbergen's assumptions have been picked up by other economists. They treat the gross domestic product as an indicator of a country's ability to import which is beneficial to exporting countries as well. The negative impact of distance on trade can be explained with various reasons. Distance causes additional transport costs, increases time-related risks (e.g., shelf-life of products, payment settlements), and complicates maintaining good relationships due to bigger communication efforts and possible varying cultural differences. However, the distance variable may create sources of error: Certain transport costs are fixed and independent from its distance; the calculated distance may be inaccurate compared to the real one. Additionally to distance, remoteness as a complementary factor ought to be considered as shown above.

Tinbergen extended his basic model by examining the influence of adjacency, trade agreements and the Gini coefficient of concentration, and by playing with different values for trade agreements. He concluded that each model explained about 64% of the export volume which he was satisfied with. The Commonwealth preference had a higher statistical significance than the Benelux one, but each kind of trade relations promotes the country's export. The same applies if countries are neighbours, the higher their gross national products are, and the more diversified the exporting country's production is.

Research has shown that the following variables should not be neglected in the calculations as well: Income per capita, common language and history, such as colonial links, border effects, free trade agreements, monetary agreements, trade barriers, both on a bilateral and multilateral level, and the development of trade over time. The problem with trade barriers is their quantification. They can be direct or indirect. Different tariff rates may apply for different products so that the correct evaluation of a country's protection index is challenging.

Critics appear, referring to the constant in the equation which is not a constant but depends on the trade partners and will change over time and based on policy variables. Furthermore, the gravity model trade does not take demand, supply and prices into account.

There is consent among researchers about missing theoretical basics for the gravity model. However, the gravity model remained due to its ability to predict trade volume correctly. Two studies have been discussed which confirmed its applicability. In both of them, the basic model has been examined and extended with criteria the relevant researchers thought to be important. The first study included population size, EU membership and WTO membership. In the second study, GDP per capita instead of GDP was used and EU membership, OECD membership, WTO membership, German-speaking country, rating of the economic order regarding liberty of this country were taken into consideration. In both cases, the coefficient of determination was higher for the advanced model than for the basic one. Therefore, the advanced one is to be preferred.

However, literature review indicates that the predictability of this model is strongly based on the data set and may be correct for one set of countries, but incorrect for a different one.

3. German economics and politics

Having outlined the history of trade and its theoretical assumptions, the following chapter will be focusing on the development of German politics and economics. As pointed out by Kaltefleiter (1968), politics and economics have to be regarded as a unity since they overlap in many aspects (p. 14).

According to the Oxford Learner's Dictionary (2021a), *economics* is defined as "the study of how a society organizes its money, trade and industry", whereas *politics* describes "the activities involved in getting and using power in public life and being able to influence decisions that affect a country or a society" (Oxford Learner's Dictionary, 2021b). Kaltefleiter (1968) refers both terms to behaviours of certain groups – enterprises, consumers, investors and savers for economics; electors and elects for politics (pp. 13f.).

Bearing in mind that history is an ongoing process and previous events always influence the ones to come, it is still worthwhile getting a broader view on the German history. For this reason, although the conducted analysis in the next chapter will refer to recent years, the outline will not only focus on the 20th and 21st century but also include elements from the 19th century.

3.1. The creation of the German state

In the 19th century, no German state as such existed but the region was split into territorial states and free cities. Each area operated in its own currency then and no freedom of movement or settlement was guaranteed. In order to improve trade between these areas, the German Customs Union (*Deutscher Zollverein*), a formal union of 33 German territorial states and four free cities was created (Wurm, 1975, p. 35; Hilt, 2020; Generalzolldirektion, 2022).

Generally, there was no common attitude towards the future economic constitution. The majority of Germans wanted the economy to be bound but the thought of an overall liberal market economy caused their discomfort. In the end, the German states agreed on a common Customs Policy and the expansion of the rail industry which promoted trade liberalisation (Scriba, 2014).

An important event was the liberation of peasants in the 1850s which integrated the agricultural sector into the liberal economic system which the manufacturing industry followed soon. As a consequence, crafts businesses were in oversupply causing wage and price dumping, which then led to an impoverishment

of the working people. Liberalisation of the economic system would not solve the problem but a change of the production process was needed to improve quality and output (Wurm, 1975, p. 38ff.).

Although agriculture played an important role nearly throughout the 19th century, a shift towards manufacturing could already been observed at the end of it (Mahlerwein, 2020). Additionally, this era was marked with the establishment of factories replacing traditional jobs. Even though this time was marked with uncertainty, the level of liberalism achieved within this economic system was comparable to the one established within the European Economic Community after the Second World War. The political borders were respected but, nonetheless, there were several agreements in place which made an exchange of goods, services, currencies, and even people across the borders of the German Federation possible (Wurm, 1975, pp. 54ff.).

At that time, Germany was already intensely trading with Britain and the United States. Its production progress caused an even bigger dependency on its trading partners who provided the required raw materials. Hence, the international gold crisis of 1857–1859 also affected the German economy (Boerse.de, 2022).

In the meantime, Germany extended its heavy industry and rail network, which positively influenced the coal industry (Hilt, 2020). In order to reduce imports of British coal, the delivery of which to certain German areas (especially those located in the north) was still much cheaper than the delivery of German coal, special carriage tariffs were applied (Brüggemeier, 2018; Wurm, 1975, pp. 56ff.). Apart from that, the improvement of the transport network contributed to the redistribution of mismatched goods by transferring them from areas with oversupply to those which were lacking the particular goods (Wurm, 1975, p. 70).

Overall, German products suitable for exports were wheat, outputs of the textile industry, and above all coal, iron and ironware. With regard to the latter, the more Germany improved its quality, the more its exports grew. As a result, the income from coal was the main means of payments to settle all claims from imported goods (Wurm, 1975, p. 59).

Another pillar for Germany's economic development was its dominating position in the chemical industry, especially in the area of paints and pharmaceuticals. From the 1860s, Germany was considered a leader in paint manufacturing, covering 85% of the world's demand for paints, keeping this position until World War II (Wurm, 1975, p. 68).

What still impeded the efficient exchange of goods within the German Customs Union was the existence of different currency areas. Since other countries

such as Britain started using the gold currency, the government decided to follow suit, which however did not happen until 1873 (Wurm, 1975, pp. 73ff.; Wirtschaftslexikon24.com, 2017).

After its victory in the Franco-Prussian War (1870/71), the German Empire (*Deutsches Kaiserreich*) was founded leading to the unity of the German states. Having lost the war, France had to transfer Alsace-Lorraine and pay off war reparations to Germany (Pfeil, 2021). As a consequence, Germany turned into a world monopoly of potash. The ongoing production of coal and iron was another pillar for Germany's success becoming one of the leading industrial nations on the European continent (Wurm, 1975, p. 84).

At this time, the foundation for civil law and economic law, as we know them today, was laid. People made use of their freedom of movement and transport, which resulted in a lot of migration affecting Germany as well. The general population grew, which had a massive influence on the economic development (Wurm, 1975, pp. 85ff.).

Within 30 years between 1870 and 1900, the German economic output grew so much that Germany overtook France and the United Kingdom, becoming second worldwide. This progress was caused by its dominating position in production on domestic and foreign markets (Wurm, 1975, p. 102).

This period of wealth made businessmen look for investment means which eventually happened to be companies with capital stock. This time is primarily called as the years of the rapid industrial expansion (*Gründerzeit*). With the change of the stock exchange law in 1870, joint-stock companies were not overseen by the state anymore, leading to speculations. The first speculation bubble burst in the United States, leading to the stock market crash on the German market in 1873/74. However, this crisis did not last for long as Germany's exports had been growing again since 1887 (Wurm, 1975, pp. 102f.; Draheim, 2005).

Due to the growing population, Germany was not self-sufficient anymore despite improvements in its own harvest outputs. As a consequence, it became more and more dependent on food imports from Russia and Austria-Hungary (Wurm, 1975, pp. 111f.).

The turn of the 19th and 20th centuries is characterised by the era of colonialism, also referred to as imperialism. The leading industrial European countries, which Germany belonged to, focused on the delivery of manufactured goods, semi-finished products, services (such as overseas transport of raw materials) and capital to all continents using their outputs as a means of payments. In order to ensure the supply of raw materials, colonies, mainly in Africa, were acquired. The change in behaviour could also be observed in the German trade structure. In 1873, 38% of the goods exported by Germany were manufactured goods,

whereas 40 years later, in 1913, the share increased to 61%. Additionally, imports grew unproportionally compared to exports, causing a negative trade balance. At first, Germany was able to fill the gap, but the real consequences were yet to come (Wurm, 1975, pp. 112ff.; Laak, 2005).

With the outbreak of World War I, the demand for money increased. The only solution was to print money, which consequently caused inflation. Although many countries were affected by currency devaluation, Germany was one of the most affected ones. (Kaltefleiter, 1968, p. 74; Wurm, 1975, pp. 117ff.).

Aiming to be superior and ahead of the enemy, the German government employed the concept of planned economy and started centralising workforce, arms, munitions, and supplies. Raw materials, semi-finished products and machines were centrally confiscated and fixed prices were imposed. The centralised management also applied to food due to its growing demand and the inability to import it from abroad. In the end, ration cards were introduced in 1915 (Wurm, 1975, p. 181; Bruendel, 2004, pp. 39f.). Generally, the First World War is considered the first of the four periods of German economic instability in the 20th century (Leaman, 1988, p. 9)[13].

The final agreements on the war outcome were specified in the Treaty of Versailles which was signed in 1919. Germany was found guilty and had to give away strategically important regions such as the Saar area, Alsace-Lorraine, Upper Silesia and East Prussia. Their loss meant a deterioration of its influential position in the world economy and reduced its capabilities to produce goods for export. Along with the land and production loss, the huge amount of reparation bills had an extended impact on its economy (2021, Germany, p. 475; Wurm, 1975, pp. 189f.).

In addition to the Treaty of Versailles, Woodrow Wilson proposed in his Fourteen Points the setting up of the *League of Nations* which was "the first attempt to create an international organization that could bring countries together to discuss solutions to mutual problems" (Nyegray, 2021, p. 3). However, this approach did not last for long. According to Wurm (1975), the era after the First World War was characterised by the "economic egoism of the individual countries" combined with methods of "nationalist economic policy"[14] (p. 186).

[13] Leaman (1988, p. 9.) classifies the following periods in Germany as economical instable – 1914–1918: First World War, 1919–1923: beginning of Weimar Republic, 1929–1934: Great Depression and 1940–1945: Second World War.

[14] Own translation.

3.2. The Weimar Republic and the Third Reich

The defeat in the First World War marks the end of both the German Empire and the gold currency, and also the start of the Weimar Republic proclaimed by Scheidemann in 1918 (Cope, 2020, p. 1043; Kaltefleiter, 1968, p. 24). However, the transition from the German Empire to the Weimar Republic caused a lot of social conflicts. Economic impoverishment and inflation have already been discussed. Another important issue was the rise and success of radical parties, such as the National Socialist German Workers' Party (NSDAP[15]) and the Communist Party of Germany (KPD[16]) fighting with the existing democratic system (Kaltefleiter, 1968, pp. 23ff.).

Generally, there was a big discrepancy in people's attitudes since a vast majority lost trust in the existing government (Kaltefleiter, 1968, p. 29). Accompanied by mental and physical exhaustion, the hopelessness was worsened by the harsh conditions imposed by the Allied powers whose claims exceeded by far what Germany was capable to pay off based on its economic performance. Wurm (1975) names this state a "paralysis" (p. 191) which did not come to an end until 1923. Supporters of the right-wing parties hoped they would improve the dramatic situation of Germany at that time (Wurm, 1975, p. 191).

The era following the post-war inflation is called the "Golden Twenties", reflecting the short period of prosperity in the Weimar Republic before the Great Depression hit the world economy (Kaltefleiter, 1968, p. 22). The recovery of the German economy was possible due to the introduction of the Dawes Plan and a new currency, the Rentenmark. The Dawes Plan re-negotiated the conditions of repayments by Germany and ensured financial aid to Germany by the United States. The change of the currency re-gained people's trust in the stability of its value and is often referred to as the "wonder of the Rentenmark". Having the finances under control, the German economy could again flourish, reaching its 1913 level of income in 1928 (Wurm, 1975, pp. 195ff.; Gruber, 2000, p. 134; 2021, Germany, p. 475).

The years of wealth were disturbed by the Great Depression from 1929 to 1934. Falling stock prices at the New York Stock Exchange caused a worldwide crisis which was deepened by decreased demand and production capabilities. Germany faced another problem: Certain banks were granting loans without

[15] The abbreviation originates from its German name *Nationalsozialistische Deutsche Arbeiterpartei* (own annotation).

[16] The abbreviation originates from its German name *Kommunistische Partei Deutschland* (own annotation).

sufficient security. When investors from abroad started to withdraw their money, these banks became illiquid and relied on the support of the state (Gruber, 2000, pp. 134ff.).

According to Kaltefleiter (1968), the situation which emerged after the Great Depression is comparable to the one in 1923 after the fall of the German Empire, with a significant difference though: While the inflation of 1923 was overcome by the introduction of a democratic system which also ensured economic stability, a decade later the upcoming inflation had an opposite effect destroying all democratic achievements so far (p. 80).

With the financial support of leading business representatives and being generally supported by the middle class and right-wing traditionalists, Hitler finally managed to win the elections becoming Chancellor of the Reich in 1933. A year later, after the Reichstag had burned down, he announced the Third Reich and himself as its Chancellor (2021, Germany, p. 475). A further explanation for Hitler's rise to power is provided by Leaman (1988), which is the result of the "process of desperate experimentation managed through the President, Von Hindenburg"[17] (p. 15).

Before seizing power, Hitler promised the German people "work and bread". Looking at the course of the following years, unemployment significantly decreased starting at 6.13 million in January 1933 and reaching 200,000 in 1938, which can be equated with full employment. This was achieved with the introduction of Hitler's first four-year plan which created various areas where people found employment. Officially, this plan was to secure the well-being of the German people but, in reality, Hitler aimed to create a German state which was unconquerable in case another war broke out.

A further step was the transition of all spheres of life under the process of *Gleichschaltung*[18]. Translated into English, this term means consolidation. This process aimed to re-organise existing associations or unions including the agricultural sector to make them perform in line with the goals set by the NSDAP (Schneider & Toyka-Seid, 2021). Everything from cultivation to delivery contingents to price settings was centrally managed but despite good harvest outputs Germany remained dependent on food imports (Wurm, 1975, pp. 247f.).

In 1936, Hitler announced his second four-year plan declaring that within these four years Germany would need to become completely self-sufficient in

[17] Paul von Hindenburg was the first President of the Weimar Republic and then of the Third Reich until 1934.

[18] In English-speaking sources, the term *Gleichschaltung* is often referred to as "co-operation" (BBC, 2021).

terms of any essential goods. Taking 1928, one year before the Great Depression, as a base year, Germany re-achieved its performance in 1933 (Wurm, 1975, pp. 249f.).

Focusing on foreign trade at that time, all transactions outside Germany, be it purchase or sale, were totally controlled and subject to the state's authorities. They checked whether sufficient foreign currency was available and whether this commodity matched the provided priority scale set top-down. Consequently, no real freedom of trade was granted anymore. (Wurm, 1975, pp. 250f.).

The attitude of the state can be summed up with the terms "import quota system" and "export promotions". On the one hand, to reduce the use of required foreign currencies, goods were exchanged for others. On the other hand, to build up foreign cash reserves, Germany started selling its products far below the applicable market price, in some cases even below production costs so that it was able to pay for the required goods from imports. But despite the effort undertaken, the success was limited in time. Overall, Germany as a pioneer led to the end of worldwide free trade and competition being followed by the rest of the world (Wurm, 1975, pp. 251f.).

Getting back to Germany's economic situation at that time, on the outside though, by 1936, Germany achieved the conditions of the economic "magic square" which is composed of economic growth, low inflation, high employment and a healthy balance of payments reflecting "the image of economic equilibrium" (Leaman, 1988, p. 15). But, as stated by Leaman (1988), this "state form became rapidly dysfunctional" (p. 16).

Two years later, in 1938, the situation dramatically changed, leaving a huge debt in the country's balance sheet. By then, nearly one fourth of the production volume was utilised in the armaments sector. The only way to maintain the high living standards of the people, which directly translated to the party's popularity and its overall support, and to prevent any further indebtedness was annexation and war (Leaman, 1988, p. 15; Wurm, 1975, pp. 252, 261).

Countries were annexed which provided profits in terms of gold and foreign currency inventories or food such as grain, meat and fat. (2021, Germany, p. 475; Wurm, 1975, p. 261). Although the first two years went well for Hitler, which also indicates how well he was prepared, his success at that time came little by little to its end. First of all, more and more money was needed to finance the war costs. In order to overcome this problem, money – which was in short supply but was needed – was printed. This action was only approved since Hitler was convinced that he would win the war and be able to impose the costs incurred upon the subjugated countries afterwards.

The final breakthrough of Germany's losing position was the attack on the Soviet Union and the United States in 1941. In 1945, accompanied by Hitler's suicide, the Second World War ended and thereby the era of the Third Reich (2021, Germany, p. 475; Wurm, 1975, pp. 262f.) with no German state left behind (Leaman, 1988, p. 17).

3.3. Post-War Germany

With Germany's surrender, the Berlin Declaration of 1945 constituted which parts of the former Third Reich, later named as zones of occupation, would be allocated to which Allied power. These Allied powers were represented by the United States, the United Kingdom, France and the Soviet Union. Further agreements on the land distribution were made during the Potsdam Conference in 1945 (2021, Germany, p. 475).

With Germany having been divided among them, each of these four powers was responsible for the whole administration within its own zone, which also included, among other things, trade and industrial production. Generally, the aim of the Allied powers was "to destroy the political and economic potential of the German state to wage war" (Leaman, 1988, p. 18).

During the first four years under occupation, there was a low level of investments, which indicates that a capital market as such did not exist and there was still much uncertainty what to expect from the future (Leaman, 1988, p. 26). Focusing on the production of goods, the figures of 1947 show a level of less than one third in comparison with what it used to be in 1938, one year before the outbreak of the war. These huge deficiencies can be explained with the lack of raw materials, the damaged transport system, and the division of Germany into four occupation zones.

During this time, especially the regions in the West suffered from enormous food shortages since, as a result of Germany losing the war, 30% of the former agricultural land had been taken away and another 40% of the production output was under the Soviet control. As a consequence, food was traded on the black market or purchased directly from farmers (Gruber, 2000, pp. 183f.). People living in the areas controlled by the United States and the United Kingdom were so much malnourished that both powers had to provide food from their own supplies (Leaman, 1988, p. 23). The winter of 1946/47, during which the living standards of the people deteriorated further, can be seen even more as the turning point when the first steps were taken to help Germany's recovery (Gruber, 2000, p. 184).

Furthermore, the United States being hardly affected by the war realised that punishing Germany would no longer be in their interest assuming the reduction in the world trade economy would harm them more (Leaman, 1988, p. 23). Additionally, Europe's recovery would not be wise without the simultaneous recovery of Germany (Lange, 1990, p. 268).

As a result, the United States and the United Kingdom formed the Bizone in 1947, which a year later was joined by France. Some sources claim that the creation of the Bizone was "a formal step […] against the USSR" (Leaman, 1988, p. 35). Others emphasise that it was the Soviet Union which separated from the rest following its own way, not only withdrawing from the Allied Control Council but also blocking West Berlin which was part of the Western Allies (2021, Germany, p. 475). A division between West and East could no longer be prevented, which was officially confirmed with the creation of two German states in 1949 – the Federal Republic of Germany and the German Democratic Republic (GDR).

Before the creation of the West German state, which came into effect with the introduction of the Basic Law in May 1949, the United States feared a too strong, independent and unified Germany. On that occasion, they addressed the urgency of establishment of a West European federation which West Germany would be part of in order to prevent a historic recurrence (Leaman, 1988, p. 35).

Another significant event was the currency reform in 1948. Due to the extensive monetary circulation, which was a consequence of the currency devaluation caused by the actions undertaken by the Third Reich government, the currency then in force finally lost its exchange function being replaced by barter economy. However, currency stability is a precondition for a state to function properly not only for international trade but also to create people's trust.

From today's perspective, this reform is mainly considered as one of the significant factors for the economic upturn, also referred to as the "economic miracle" (Gruber, 2000, p. 185; Wurm, 1975, p. 282; Lange, 1990, pp. 268f.). Leaman (1988), however, points out that the currency reform would not have been as successful if it had not coincided with a general cyclical upturn and the general availability of products which had previously been rationed (p. 34).

Another influencing factor which contributed to the economic miracle was the support of the United States organised through various aid programmes such as the Marshall Plan or the GARIOA (short for "Government Aid and Relief in Occupied Areas") programme. Overall, they provided Germany with needed raw materials, food and foreign currency aiming to defeat the misery after the war as quickly as possible and enable the German economy to accelerate (Gruber, 2000, p. 186).

Although, according to Leaman (1988), it is not possible to examine the causation between the introduction of the social market economy and Germany's

upturn (p. 35), the introduction of this new economic system must not be forgotten at this point. This shift aimed to get away from the measures which had been applied as a leftover from the war period, such as price controls and rationing. Instead, the changing was heading towards a world with competition again (Gruber, 2000, p. 186). The social market economy is based on the principle "freedom on the market" combined with social factors, i.e., humanity which implies individual freedom on the one hand, but on the other hand demands solidarity and helpfulness reflected by social justice and security (Lange, 1990, p. 270). This means that in contrast to a traditional free market economy, the state is still allowed to intervene into economic life (Thalheim, 1978, p. 13).

There is no homogeneous consensus as to how to divide the post-war economic development of West Germany into phases.

Gruber (2000) groups the years 1948–1966/67 into one cluster, calling it the "phase of ordoliberalism" whose primary aim was to rebuild the West German economy so that every citizen would be able to benefit from it by analogy to Erhard's[19] slogan "Prosperity for all". However, this economic boom was terminated by the 1967 recession which marked a turning point at that time (p. 188).

Langer (1990) has chosen a different classification and divides this period into three:

1) 1948–1958: economic recovery and implementation of the social market economy concept;
2) 1959–1973: full employment;
3) 1974–1990: structural transformation, split into
   a) 1974–1983: downturn – due to the oil crisis, high unemployment;
   b) 1984–1990: upturn – with high economic growth and export surplus but still high unemployment (pp. 271f.).

In the 1950s and 1960s, West Germany joined several organisations and was one of the founding members for some of them, which in turn strengthened the West German importance on the international market. These organisations are as follows and shall be partly discussed later:

1) North Atlantic Treaty Organization – NATO;
2) European Economic Community – EEC;
3) Organization for European Economic Co-operation – OEEC;
4) International Bank for Reconstruction and Development – IBRD / World Bank;
5) International Money Fund – IMF;
6) General Agreement on Tariffs and Trade – GATT;
7) European Coal and Steel Community – ECSC;

[19] Ludwig Erhard – Chancellor of West Germany.

8) European Payments Union – EPU (Leaman, 1988, p. 82; Gruber, 2000, p. 189).

With the occupation of Germany in 1945, one of the main Allies' aims was to demilitarise the German state. Ten years later, after Germany joined the NATO, plans changed. Triggered by the events of the development of Russia's nuclear bomb, the Chinese Revolution and the outbreak of the Korean War, fear of the East, in particular communism, emerged. The Western Allies became more worried about the "Soviet imperialism" than about the "German militarism" (Leaman, 1988, p. 83).

On top of that, the German heavy industry being well-developed in the past appeared to be of "strategic importance to any West European Defence effort" (Leaman, 1988, p. 84). Furthermore, it was too expensive to maintain an army of occupation along with a standing army. Finally, there was also a psychological factor involved, which assumed that engaging West Germany in the plans of the Western alliance would be more beneficial than excluding it and risking a potential hostility towards the alliance.

Being a member of the NATO, West Germany was released from the occupation, gaining its status of a nation state (Leaman, 1988, p. 84). In 1974, Germany became the second country in terms of exports (Thalheim, 1978, p. 94), which only proves how quickly its economy had developed, bearing in mind that 25 years earlier it started from zero.

In parallel with the development of West Germany, the eastern part of Germany was kept under the Soviet control. Unlike in the West, the economic system in the German Democratic Republic remained a planned economy, or more precisely: "socialistic planned economy" as stated in its constitution. The Soviet Union introduced a two-year plan, first for the period of 1949/50, and afterwards a five-year plan for the period of 1951 to 1955 (Thalheim, 1978, pp. 9f.). In 1954, the Soviet Union renounced their reparation demands towards East Germany and granted its sovereignty (2021, Germany, p. 475).

The difference between the ruling systems of the Western Allies and the Soviet Union was that the Soviet Union acted to serve its own purposes and was less interested in the recovery of the East German economy: Most of the German industrial plants had to be dismantled. The production output of the remaining plants was taken for granted by the Soviet Union.

In other words, the German Democratic Republic was obliged to provide deliveries to the Soviet Union without receiving any compensation. Additionally, the Soviet Union acquired many industrial companies, which meant that they were then owned by the Soviet Union. Even the German workforce could not escape these moves and were transferred, having to serve where they were needed.

Thalheim (1978) uses the term "sovietisation" (p. 10) to describe the entire process. In this context, he also mentions the "socialistic property of production means" and the "central planning and controlling of economy" which had their immediate effect on the development of East Germany (Thalheim, 1978, pp. 9f.).

Having a look at the East German foreign trade, it is worth pointing out that the German Democratic Republic used to be the most important provider for the Soviet Union at that time, especially in the area of capital goods. This reflected the assumptions of the Council for Mutual Economic Assistance which stated that most of the foreign trade was supposed to be transacted with the Soviet Union bloc. The German Democratic Republic being a member of this council from 1952 was not excluded from this approach.

On the other hand, the GDR also relied much on imports which exceeded its export capabilities, causing an imbalance of trade and finally leading to an ongoing indebtedness especially in relation to Western countries. In the Eastern bloc, the GDR was the second biggest exporter and the third biggest importer, in both cases after the Soviet Union itself (Thalheim, 1978, pp. 94ff.). It should not be to anyone's surprise that the bad economic situation had a tangible impact on the quality of life, causing revolts against food shortages and collectivism in the 1950s (2021, Germany, p. 476).

3.4. Divided Germany

With the creation of two separate German states, the question arises how the relationship was maintained between these two regions which previously used to be one. The answer to this question needs to include various spheres which can be split into people migration, trade, and policy, but at the same time need to be considered as an interaction.

In 1949, Konrad Adenauer was appointed Chancellor of the Federal Republic of Germany. Wanting to reunify Germany, he did not recognise the German Democratic Republic as a separate state. It was not until 1972 that a mutual agreement was eventually signed, recognising the existence of two separate states and expressing their will to co-operate with each other. On the other hand, in 1952, the Soviet Union put up a fence along the border between the two German states and another one around West Berlin in 1961, commonly known as the Berlin Wall. Within the first years of separation, from 1945 until 1961, the Federal Republic of Germany experienced a huge migration move from the German Democratic Republic (2021, Germany, p. 476).

Considering the actual exchange of goods, trade between these two regions, after they had been divided into separate states, never achieved its pre-Second World War level. First of all, the split demanded that both of them needed to build factories which had not been needed earlier since the goods manufactured used to be shipped from one area to another. A second, quite important factor was the attitude of the Soviet Union that trade within the bloc had the highest priority. As a consequence, most of the output produced by the German Democratic Republic was used by the Soviet Union itself and there was not much left for the East German state to export outside its group.

Both German states still relied on imports as they used to before. However, since the German Democratic Republic did not have many opportunities to earn on exports, this caused a certain imbalance of trade relations and in the next step – difficulties in payment settlements. By the end of the 1960s, the Federal Republic of Germany delivered more to the German Democratic Republic than it received from it. Apart from that, quality played an important role as well. For some reason, during the years of occupation, the German Democratic Republic ended up with quality standards lagging behind those of the West (Thalheim, 1978, pp. 101ff.).

It is worth mentioning the different treatment of the internal German trade by each country. The payment was handled by the relevant central banks of both states. This means that no cash payments were used in trade. In order to facilitate a transaction, a specific accounting unit ("Swing") was created which equalled one Deutsche Mark, the currency in force in the Federal Republic. Additionally, an interest-free overdraft was introduced between these two countries, which in the end was mainly used by the German Democratic Republic.

The European Economic Community agreed that internal German trade would be custom-free and not considered foreign trade by the West German state. However, this rule only applied unilaterally. The trade statistics of the East German state presented the internal German trade separately (Thalheim, 1978, pp. 101ff.). According to Thalheim (1978), this also served propagandistic purposes (p. 103).

By the end of the 1980s, there were movements towards the unification of the two German states, which finally happened in 1990. The German Democratic Republic accepted the currency of the Federal Republic to be its official currency and also agreed to inherit the economic, monetary and social legislation (2021, Germany, p. 476). The unification caused challenges for the East German producers: They were not used to a market economic system, their production processes were outdated and at the same time they lost their permanent trading partners, the countries belonging to the Soviet bloc (Gruber, 2000, pp. 233f.).

3.5. Federalism

The official name of the re-united Germany was taken over from the then West German state which was Federal Republic of Germany, translated from the German Bundesrepublik Deutschland. Germany is known for its federal structure. The main questions now are: What does federalism mean? What was the motivation for the creation of federal states? When did this happen? To what extent do they differ from the federal (country) level? What are their duties, responsibilities, but also what freedom of choice do they enjoy?

According to Encyclopædia Britannica (2021b), federalism is a "mode of political organization that unites separate states or other polities within an overarching political system in a way that allows each to maintain its own integrity".

Germany has always been formed out of various ethnicities and thus, despite being and feeling German, its population additionally had a local affinity, i.e., they considered themselves e.g., as Bavarians, Saxons or Thuringians (Münch & Laufer, 1998, pp. 98f.). The post-war occupation and the split into zones was one of the milestones for the current federalism. Within their zones, the Allied Powers allowed for the creation of federal states, in German called *Länder*, which happened in 1945 to 1947. Table 3 shows as an overview which states were formed and which occupation zone they belonged to. Since Berlin was sliced into four occupation zones, it received a special status (Sturm, 2001, p. 22).

It is worth mentioning at this opportunity that the border demarcations set not always considered historical, cultural or economic background and therefore were perceived as "arbitrary" or even "original" whereas "original" in this context does not mean based on pre-existing circumstances but rather "inventive" or "novel" (Münch & Laufer, 1998, p. 79; Sturm, 2001, p. 22).

Table 3. Federal states in occupation zones

Occupation zone	**Federal states**
Soviet Union	Saxony, Thuringia, Mecklenburg, Brandenburg, Saxony-Anhalt
French	Baden, Württemberg-Hohenzollern, Rhineland-Palatinate
British	North Rhine-Westphalia, Lower Saxony, Schleswig-Holstein, Hamburg
United States	Bavaria, Hesse, Württemberg-Baden, Bremen

Source: Author's own elaboration based on: Sturm, R. (2001). *Föderalismus in Deutschland*. Opladen: Leske+ Budrich, p. 22.

The Office of Military Government, United States (OMGUS) started as the first institution with the creation of three states: Bavaria, Württemberg-Baden

and Hesse. A further reason for the establishment of federal states was the fact that decisions on a global level, i.e., relating to the entire German state, required a lot more effort. Since Germany was occupied by four powers and to avoid problems with communication, it was easier to make decisions according to local needs and requirements (Leaman, 1988, pp. 33f.).

It needs to be emphasised that although there was consensus between the Allied powers about the creation of federal states, yet the biggest disagreement concerned the future system of the German state. The Soviet Union opted for a strict centralised state. The United Kingdom preferred a system similar to the Soviets but with decentralised and federal elements. The United States aimed to enlarge the federal concept creating an absolute federal state. France, contrary to the rest, wished to introduce a loose State Union (Sturm, 2001, pp. 22f.).

Each of the Allies had its own motivation for a particular system. Looking at the existing political systems at that time, it does not take much effort to conclude that all of them, apart from France, preferred a German state system which was similar to their own. The Americans additionally wanted to prevent a dominant socialist change and tried to encourage self-interest, both private and public. France, however, was afraid of a too strong Germany and therefore supported a solution where relations between the federal states would not get too intense (Leaman, 1988, p. 37). Finally, in 1947, the attempt to achieve a common agreement between the four powers failed. The Soviet Union decided to follow its own goals, separating from the others and later dissolving the federal states under its occupation in 1952 (Sturm, 2001, pp. 23ff.).

The United Kingdom, the United States and France remained together and entrusted the definition of the federal system to the West German politicians. The leading question was the distribution of power between the federal level and the federal state level (Sturm, 2001, p. 24), and more precisely – whether to introduce a more centralised structure or a federal-based one with a strong focus on fiscal control. Since the relevant representatives of the parties were not able to come to an understanding, they sought a decision from the Allies who decided to establish a "highly decentralised government with a weak central state" (Leaman, 1988, p. 38).

The initial set up of the federal states slightly changed over the following years. This might constitute important information for later analysis. In 1952, the states Baden, Württemberg-Hohenzollern (both under French occupation) and Württemberg-Baden (under US occupation) merged into one state – Baden-Württemberg. Saarland joined Germany in 1957 since, according to the Saarland constitution, it was connected to France, at least from an economic perspective, politically there was no clear decision on its affiliation. A referendum decided on

the re-integration of this area into Germany. In the course of the introduction of democracy in the German Democratic Republic, the *Ländereinführungsgesetz* (state introduction law) re-introduced the federal states dissolved by the Soviet Union (Sturm, 2001, pp. 27f.). Table 4 shows an overview of the current federal states, its original occupation zone, and also when these states became part of the Federal Republic.

Table 4. Current federal states, occupation zone and year of entry

Name	Year of entry	Occupation zone
Baden-Württemberg	1949 (1952)	French / United States
Bavaria	1949	United States
Berlin	1949 (1990)	French / United States / British / Soviet Union
Brandenburg	1990	Soviet Union
Bremen	1949	United States
Hamburg	1949	British
Hesse	1949	United States
Mecklenburg-Vorpommern	1990	Soviet Union
Lower Saxony	1949	British
North Rhine-Westphalia	1949	British
Rhineland-Palatinate	1949	French
Saarland	1957	(French)
Saxony-Anhalt	1990	Soviet Union
Saxony	1990	Soviet Union
Schleswig-Holstein	1949	British
Thuringia	1990	Soviet Union

Source: Author's own elaboration based on: Sturm, R. (2001). *Föderalismus in Deutschland*. Opladen: Leske + Budrich, pp. 22, 28.

The German Unity not only has had an institutional impact on the German federalism but also has influenced the federal structures in a social and economic way. It was questioned whether the application of federalism in East Germany would guarantee a symmetric federalism, i.e., an equal treatment of the "new" federal states, especially since the prosperity gap between the West and the East was much higher than, for comparison, between the richest and the poorest West German federal state. The opinions are divided. Sturm (2001) states that the German federalism transformed into an asymmetric one after the unification (p. 32), whereas Alecke et al. (2010) summarise in their paper that since 1995

no differences between the West and the East have been observed with regard to economic growth (p. 23).

The distribution of powers between the federal and federal state level is regulated in the German *Grundgesetz* (GG, in English: Basic Law). Article 30 GG implies that "Except as otherwise provided or permitted by this Basic Law, the exercise of state powers and the discharge of state functions is a matter for the Länder". Furthermore, article 70(2) GG refers to the relevant competencies: "The division of authority between the Federation and the Länder shall be governed by the provisions of this Basic Law concerning exclusive and concurrent legislative powers".

Articles 71 to 74 GG specify under which circumstances and for which areas exclusive and concurrent legislative power are applicable. With reference to exclusive legislative power, federal states are allowed to amend legislation only when they are authorised to do so by the Basic Law (Art. 71 GG). Exclusive legislation among other things applies to "currency, money and coinage" (Art. 73(1), item 4 GG) as well as "the unity of the customs and trading area, treaties regarding commerce and navigation, the free movement of goods, and the exchange of goods and payments with foreign countries, including customs and border protection" (Art. 73(1), item 5 GG). The concurrent legislative power is applicable for "trades" (Art. 74(1), item 11 GG) if "the Federation has not exercised its legislative power by enacting a law" (Art. 72(1) GG).

What is also of significant importance is the independent budgeting of each state and the Federation (Art. 109(1) GG). However, each party is responsible for ensuring the "economic equilibrium" (Art. 109(2) GG).

Münch and Laufer (1988) summarise these circumstances in such a way that the distribution of powers cannot be assigned to one specific party. Furthermore, in some cases the federal level can make decisions on its own, in other cases cooperation between the federation and the federal states might be required. It does even happen that agreements are made between the federal states themselves, referred to as the "third level". As a consequence, such a system is not very transparent in relation to responsibilities (pp. 140f.). Overall, the federal states are in charge of the law enforcement, which covers administration, rather than legislation (Münch & Laufer, 1988, p. 133).

3.6. Summary

The difference between economics and politics is that economics deals with the organisation of a society whereas politics focuses on activities which affect the society's decisions.

Back in the 19th century, Germany was divided into territorial states and free cities with no common currency and no freedom to move or settle outside the respective territory. The first attempt to remove trade barriers was the creation of the Deutscher Zollverein, a customs union. The ongoing trade liberalisation was regarded with scepticism. At that time, the German economy underwent a complete transformation from agriculture towards the manufacturing industry: traditional jobs were replaced, factories created, and Germany was trading with Britain and the United States. The progress was possible due to the extension of the rail network and heavy industry, which allowed the distribution of coal where it was needed. Coal was the main means of settling payments for imported goods. The economic development was additionally supported by Germany's dominating position in the chemical industry. To make internal German trade easier, the gold currency was introduced in the 1870s as the common currency.

After winning the Franco-Prussian War (1870/71), the German states were united into the German Empire which received strategic regions and payments from France as war reparations. At that time the German Empire had the world monopoly in potash supply, which, along with the production of coal and iron, turned the country into one of the leading industrial nations.

The first stock market crash of 1873/74 in the United States also affected the German Empire but not for long. With its growing population, the German Empire stopped being self-sufficient, battling shortages of food for its own people and increasing its dependency on Russia and Austria-Hungary.

The era of colonialism/imperialism at the turn of the 19th and 20th century increased the German exports but the value of imports grew more quickly, leading to a negative balance of trade. The outbreak of World War I caused an even bigger demand for money, which meant that money press was used to counteract the currency devaluation all over the world.

By the end of World War I, the Treaty of Versailles declared Germany to be guilty and demanded that areas important for the country's economic success were demarcated. Having lost the ability to produce goods for exports and in the face of the obligation to pay reparations for the war damages, the German economy suffered from recession. The end of World War I marks the end of the German Empire and the gold currency and the start of the Weimar Republic.

After the downturn, there was a short period of prosperity, the "Golden Twenties", before the Great Depression occurred in 1929. The German economy could recover due to the introduction of the Dawes Plan and the Rentenmark, the new German currency, which made the people trust in the stability of its value. However, as a result of the Great Depression, foreign money was

withdrawn from German banks which thus became illiquid as they had granted unsecured loans.

During the 1920s, Hitler, supported and financed by leading businessmen, gained more and more influence, finally winning the elections in 1933. In 1934, he announced the Third Reich and himself its Chancellor. After the successful implementation of his first four-year plan as the number of unemployed people decreased, the second one was introduced to achieve a self-sufficient Third Reich. In the meantime, the process of "Gleichschaltung" came into effect. Foreign trade was completely regulated, promoting exports and only importing what was in accordance with set priorities and provided there was sufficient foreign currency available. To increase cash reserves, German products were sold below production costs.

By 1936, the Third Reich achieved the conditions of the economic "magic square" – economic growth, low inflation, high employment and a healthy balance of payments. Two years later, the Reich's balance sheets were negative due to increased spending on armaments. To change this situation and to keep the people's support, strategically interesting countries were annexed. The demand for more money was solved with money press which Hitler approved since he was sure that he would be able to impose these costs on the subdued countries. In 1945, Germany surrendered, and Hitler committed suicide.

The first four years after World War II were characterised by a low level of investments, lack of access to raw materials, a damaged transport system and a Germany split into four occupation zones which were administered by the four Allied powers – the United States, the United Kingdom, France and the USSR. The United States realised that a European recovery only made sense if Germany was not excluded. Following that, they first created the Bizone with the United Kingdom before France joined them in order to form a West German State – the Federal Republic of Germany. The USSR created its own German state – the German Democratic Republic.

Before the creation of the Federal Republic of Germany, the respective Allies carried out a currency reform; the Basic Law which is still valid today and the social market economy were introduced. West Germany enjoyed an "economic miracle" which made it possible for it to compete with the world again. In the 1950s and 1960s, West Germany entered several trade organisations some of which exist until today. West Germany was one of the founders in some of them. It also benefited from the growing fear that the Western powers felt towards the Eastern bloc.

On the contrary, the Eastern part of Germany under the Soviets control was being integrated into the socialistic planned economy. It was forced to provide

its outputs to the Soviet Union as trade within the bloc had the highest priority. Thus, East Germany did not enjoy any right of self-determination

With the split of the German state, in both areas new factories were needed as there was no access to the ones from the other part. The respective central banks managed to service internal German trade, facilitating transactions with "Swings" and interest-free overdraft. Furthermore, it was agreed that trade between the German states should not be considered as foreign trade and should be custom-free. However, the traded volume never achieved the volume before the split, mainly due to East Germany's obligation towards the USSR. Hence, the interest-free overdraft was generally used by the German Democratic Republic.

After the re-unification, the German Democratic Republic accepted the currency of the Federal Republic of Germany and agreed to adopt the economic, monetary and social legislation. However, East German producers not only struggled to keep up with the West German standards because of outdated production processes but also lost their main trading partner.

The German state is characterised by federalism as indicated in its official name Federal Republic of Germany, which means that separate states are united but are granted autonomy to maintain their own integrity. This mode goes back to the time when Germany was divided into occupation zones. The Western Allied powers agreed on this concept for two reasons. Firstly, it was easier for them to maintain the required administration by making decisions based on local needs and requirement. Secondly, German people have always had a dual sense of belonging as the German state has been formed out of various ethnicities. However, the split was executed in an arbitrary way without considering the historical context.

After the re-integration of East Germany into the Federal Republic of Germany, the question arose whether the East German states were treated equally, especially since the disproportions in wealth between the West and the East were visible.

Switching to the legal context, the distribution of power between the federal and federal state level is regulated in the German *Grundgesetz* (Basic Law). Matters regarding currency, trading areas, trade treaties, free movement of goods, and the exchange of goods including customs belong to the scope of the Federal Republic, however federal states have concurrent legislative power regarding trade. Furthermore, they are responsible for their own budgeting and need to take care of the "economic equilibrium". Generally, the distribution of powers cannot be assigned to one specific party and depends on the case under consideration.

4. Germany's foreign trade structure

When the World Trade Statistical Review published in 2020[20] is analysed, the vast development of world trade becomes significantly visible. The first available figure reflects the year 1948. Putting it into a historical context, this is three years after the end of the Second World War. The volume of imported goods equalled USD 62 billion at that time. 25 years later, in 1973, the volume increased to USD 594 billion – nearly ten times more compared to 1948. However, in 2019, the volume of traded goods corresponded to USD 18,798 billion. With reference to exports, goods exported worldwide accounted for USD 59 billion in 1948, USD 579 billion in 1973, and USD 18,372 billion in 2019. Even if factors such as inflation are corrected for, the increase is enormous (World Trade Organization, 2020, pp. 80f.).

4.1. Germany's trade role in the world economy

Germany is nowadays considered as one of the most influential trade powers. However, this has not always been the case. Back in 1948, its share in world trade was about two per cent (1.4% for exports, 2.2% for imports). Germany reached its peak in 1973, accounting for 9.2% of the world's imports and 11.7% of the world's exports. In 2019, both shares were slightly lower, reaching 6.6% for imports and 8.1% for exports (World Trade Organization, 2020, pp. 80f.). The development of the world's trade in USD billion and Germany's respective share as a percentage for selected years from 1948 until today is presented in Table 5.

The latest World Trade Statistical Review presents Germany as the third largest economy in terms of the value of traded goods and commercial services in 2019, after the United States and China. Therefore, Germany has been classified as a "top trader". According to this report, its "manufacturing-focused economy" can be considered to have a significant effect on this result (World Trade Organization, 2020, p. 15).

Generally, it is worth highlighting that the top five traders, which has included Germany along with China and the USA for several years, have accounted for 38.1% of the world trade. When the next top five traders are included, the

[20] This was the latest report available at the time of writing.

Table 5. Merchandise trade (in billion USD) and Germany's share (in %) from 1948 to 2019

	1948	**1953**	**1963**	**1973**	**1983**	**1993**	**2003**	**2019**
Exports								
World	59	84	157	579	1,838	3,688	7,382	18,372
Germany	1.4	5.3	9.3	11.7	9.2	10.3	10.2	8.1
Imports								
World	62	85	164	594	1,883	3,805	7,599	18,798
Germany	2.2	4.5	8.0	9.2	8.1	9.0	8.0	6.6

Source: Author's own elaboration based on: World Trade Organization (2020). *World Trade Statistical Review 2020*. Geneva: World Trade Organization. https://www.wto.org/english/res_e/statis_e/wts2020_e/wts2020_e.pdf (accessed 26.05.2021), pp. 80f.

share of the world trade extends to 53.3%. The comparison of the 2018 and 2017 results shows that Germany's exports recorded an increase of 8%, totalling USD 1.56 trillion. This growth can be explained by a higher demand for products of the automotive and pharmaceutical industry (World Trade Organization, 2019, p. 48) which persisted as a trend from the year before (World Trade Organization, 2018, p. 69).

In 2019 though, a worldwide decline could be observed, which was the first such decrease since the financial crisis in 2008/09. According to the World Trade Organization (2020), it was caused by several political events such as trade disputes between the United States and China, the government shutdown in the United States, the United Kingdom leaving the European Union and important economies changing their monetary policies (p. 19). 2020 developed to be an even worse year but this time it was due to the outbreak of the COVID-19 pandemic.

Considering commercial services which include "all services categories except government goods and services" (World Trade Organization, 2020, p. 69), the picture is persistent. In 2018, exports of personal, cultural and recreational services suffered a loss but, overall, all other services categories expanded (World Trade Organization, 2019, p. 51).

Having a look at the value of goods imported by Germany from outside the European Union, Germany accounted for one fifth of the total imports in the European Union. At the same time, it was the largest importer within this country group (World Trade Organization, 2017, p. 49). The importance of imports for Germany is also reflected in the imported content of investments which used to be 24% in 1995 but through a steady rise increased to 38% in 2014 (World Trade Organization, 2017, p. 21). It can thus be extrapolated that Germany's import dependency from the first half of the 20th century is nowadays still valid.

Germany is also considered to be a top exporter of renewable-energy goods. In 2019, Germany was second after Denmark, achieving a share of 28% worldwide. For comparison, Denmark generated a share of 42%, whereas both the Netherlands and China accounted for 13% of the world's exports each (World Trade Organization, 2020, p. 41). In total, the figures add up to 96%. This means that the majority of renewable-energy goods must have been imported from either of these four countries. In 2018, Germany was the second largest exporter of electrical energy, with a share of 11.2% of world's exports. Ten years earlier, in 2008, Germany was leading but since then suffered a bigger decline than France and was finally overtaken by its neighbour (World Trade Organization, 2019, p. 32).

Referring to the global trade of plastics, Germany was the second largest exporter of "plastics and related articles" and the fifth largest importer of "plastic waste" in 2019 (World Trade Organization, 2020, pp. 45ff.). Maritime freight transport in Germany fell by two per cent, which reflects a general trend since the world average dropped by three per cent in 2019 (World Trade Organization, 2020, p. 48).

In 2014, Germany was considered to be the only economy that managed to achieve added value to EU exports in the automotive industry, going from 31.2% in 2000 to 34.5% in 2014. Additionally, due to the outsourcing of some of the production processes to Eastern European countries, these countries could also add value to EU exports and benefit from the increase (World Trade Organization, 2018, p. 62). However, in 2019, the automotive industry suffered losses contributing to a 16% decrease in manufacturing services in Germany. At the same time, Germany was an important trading partner to the United Kingdom, importing "computer and electronics" from it (World Trade Organization, 2020, p. 51).

Germany still plays an important role in the chemical industry. Along with Switzerland, it was the largest exporter of final medicinal products in 2019. In order to be able to produce them, Germany received its raw materials, i.e., active pharmaceutical ingredients, from Switzerland (World Trade Organization, 2020, p. 57).

The brief description of Germany's involvement in the world trade already shows its general importance. To a certain extent that importance goes back to the 19th century in such areas as the expertise in the pharmaceutical industry. Another important factor might be the membership of certain institutions which West Germany joined at that time. Since the aim of this monograph is to examine the applicability of the gravity model of trade on Germany's trade structure, it is worth introducing these organisations briefly in order to achieve a common understanding.

1) North Atlantic Treaty Organization (NATO) – An organisation of currently 30 member states aiming "to guarantee the freedom and security of its members through political and military means". This is achieved through democratic values and diplomatic exchange. If the latter fails, military power might be used. The first members joined in 1949, whereas the last one did so in 2020. A list of all members is included in Appendix A (NATO, 2021).
2) European Economic Community (EEC) – An outcome of the Treaty of Rome set up by Belgium, Germany, France, Italy, Luxembourg and the Netherlands "to work towards integration and economic growth, through trade". It applied from 1958 and is considered as the predecessor of the European Union (EUR-Lex, 2017).
3) Organisation for European Economic Co-operation (OEEC) – This organisation derived from the Marshall Plan and the Conference for European Economic Co-operation. It was founded in 1948 by 18 members (see Appendix B) striving for the following achievements: "co-operation between participating countries", "intra-European trade by reducing tariffs", "creating a customs union or free trade area", "multi-lateralisation of payments" and "better utilisation of labour" (OECD, 2021).
4) International Bank for Reconstruction and Development (IBRD) – This bank was established in 1944 in order to contribute to Europe's recovery after the Second World War. Today, it "provides financial products and policy advice to help countries reduce poverty and extend the benefits of sustainable growth". Together with the International Development Association it forms the World Bank (World Bank Group, 2021a).
5) International Monetary Fund (IMF) – The IMF was created in 1944, counting 190 member countries. It aims to "foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world" (International Monetary Fund, 2021).
6) General Agreement on Tariffs and Trade (GATT) – This agreement became effective from 1948, focusing on its members' "relations in the field of trade and economic endeavour […] with a view to raising standards of living, ensuring full employment and a large and steadily growing volume of real income and effective demand, developing the full use of the resources of the world, and expanding the production and exchange of goods" (World Trade Organization, 1986).
7) European Coal and Steel Community (ECSC) – This community operated from 1952 to 2002. It was initiated jointly by Germany, Belgium, France, Italy, Luxembourg and the Netherlands (Vertrag über die Gründung der

Europäischen Gemeinschaft für Kohle und Stahl, 1951, Präambel). Its establishment was motivated by the tensions after the Second World War and it was set up in order "to create interdependence in coal and steel so that one country could no longer mobilise its armed forces without others knowing" (European Union, 2021b).

8) European Payments Union (EPU) – This union originated from the Marshall Plan and was active from 1950 to 1958. It ceased its operation when "current account convertibility was restored by the participating states" (European University Institute, 2021). The European Payments Union was created by the 18 Members of the OEEC (CVCE.eu by uni.lu, 2021).

For general understanding, Germany's position in the world trade ought to be clear. The following part will focus on the analysis of Germany's trade to examine whether the theoretical assumptions outlined in the previous chapters will apply.

4.2. Analysis of Germany's foreign trade

Since public and freely accessible trade data for Germany does not cover the years before 1990, and in relation to federal states – before 2002, the analysis will examine the last five years available, i.e., 2016 to 2020. Furthermore, in order to keep the scope manageable, it will focus on Germany's top ten trading partners in terms of the total trade volume meaning the sum of the respective values of imports and exports.

Germany is a country located in Western and Central Europe with an annual average GDP of EUR 3,306 billion for 2016 to 2020 (Statistische Ämter des Bundes und der Länder, 2021). Translated into USD, the average GDP in Germany for 2016 to 2019[21] was 3,744 billion p.a. (World Bank Group, 2021b)[22]. It accounts for 29% of the GDP in the euro area and 25% of the GDP in the European Union (own calculation). Germany is a country neighbouring Denmark, Poland, the Czech Republic, Austria, Switzerland, France, Belgium, Luxembourg and the Netherlands.

In order to keep the analysis transparent and comparable, the results discussed will be split into three sections. The first section will be the federal level.

[21] At the time of writing, the World Bank has not yet published results for 2020. Results are available from OECD though, but they deviate from the one's published by the World Bank.

[22] Since GDPs for all regarded entities are not available in one currency, the GDP of Germany is presented in both currencies: USD and EUR. This shall later simplify the discussion of the results.

The second one will cover all the federal states which are located externally and therefore have a common border with at least one of Germany's neighbouring countries, whereas the third section will be composed of the remaining federal states. In total, Germany consists of 16 federal states, of which ten form Germany's border and six are located inside the country.

Table 6 reflects the split into the relevant groups. This split can be justified since it would be inappropriate to compare Germany as a whole with its individual states. Furthermore, according to the assumptions of the trade model, adjacent regions are more likely to trade with each other. This suggests that these federal states meeting the criterion of sharing a border with a foreign country have a more advantageous position. Therefore, they will be assessed separately, too.

Table 6. Overview of examined groups

Group 1	Federal level	Germany
Group 2	Federal state level – exterior states	Bavaria, Baden-Württemberg, Brandenburg, Mecklenburg-Vorpommern, Lower Saxony, North Rhine-Westphalia, Rhineland-Palatinate, Saxony, Saarland, Schleswig-Holstein
Group 3	Federal state level – interior states	Berlin, Bremen, Hamburg, Hesse, Saxony-Anhalt, Thuringia

Source: Author's own elaboration.

Note. The verification of the localisation is based on: FW GbR. (2021). *Bundesrepublik Deutschland*. https://www.kinderweltreise.de/fileadmin/_processed_/3/e/csm_deutschland_bundeslaender_096234eaa7.png (accessed 1.06.2021).

4.2.1. Foreign trade on federal level

Generally said, within the last five years, Germany's annual foreign trade volume oscillated around EUR 2.1–2.4 trillion, of which about 58–60% (in absolute numbers: EUR 1.2 to 1.4 trillion) can be linked to the first top ten trading partners. This means that these countries are accountable for more than half of Germany's total foreign trade volume. Narrowing the analysis to the first three countries, it becomes visible that they make up about 23.2% to 25.0%, i.e., one fourth of Germany's total foreign trade volume.

It is remarkable that the group of Germany's top ten trading partners remained stable throughout these years, only changing their order. These countries were:

China, the United States of America, the Netherlands, France, Italy, Poland, the United Kingdom, Switzerland, Austria and the Czech Republic.

What did not change either was Germany's top trading partner, China, defending its first position with a huge advantage over the rest. This especially applied for 2020 when the difference to the second position, held by the Netherlands, was 1.8 pp. The position of the second most important trading partner was shared between France (in 2016), the Netherlands (in 2017, 2018 and 2020) and the United States (in 2019). With the exception of 2019, the United States were Germany's third most important partner. In 2019, the country ranked third was the Netherlands.

When these figures are reviewed, the development of especially two countries attracts attention. These countries are Poland and the United Kingdom. Whereas Poland increased its share of Germany's foreign trade volume from 4.7% in 2016 to 5.5% in 2020 and therefore climbed from the seventh to the fifth position, the United Kingdom went in the opposite direction. In 2016, the United Kingdom was ranked fifth, accounting for 5.6% of Germany's total foreign trade volume and was able to maintain its position in 2017. However, since 2018, its position kept falling one at a time, finishing eighth in 2020. This drop did not only affect the share but also the absolute trade volume. The volume of trade between the UK and Germany used to be EUR 121.6 billion in 2016, dropping year-on-year to finally reach EUR 101.6 billion in 2020. Both figures refer to current prices.

The Czech Republic came last in the top ten, accounting for 3.7% to 3.8% of Germany's foreign trade volume. In a similar way to China which kept its first position, the Czech Republic did not change its position, either.

In the evaluation of the absolute trade figures, a year-on-year increase could be observed. A huge exception was the year 2020 which was marked by the ongoing COVID-19 pandemic. Comparing the outcome of 2020 with 2019 within the group of Germany's ten most important trading partners, nine out of ten countries, apart from China, suffered from lower trade volumes with Germany. After a closer look at China, the reason for its rise can be explained with the development of imports. The volume of Germany's exports to China did slightly decrease but the volume of its imports increased from EUR 206.0 billion in 2019 to EUR 212.7 billion in 2020. Although the reason for this fact is of particular interest, it is not within the scope of this monograph and shall be put aside.

Along with the weakening position of the United Kingdom, which has already been mentioned, a further decrease relating to Italy could be detected. After the constant growth during the period between 2016 and 2018, 2019 was marked by a sudden cut in the Germany–Italy trade relations. When detailed figures are inspected, a drop can be seen in both the volume of exports and imports (Statistisches Bundesamt (Destatis), 2021b).

Table 7 provides a comprehensive overview of the first ten trading partners, including their shares in relation to Germany's total trade for the period between 2016 and 2020. The number in brackets indicates its position in the respective year.

Table 7. Germany's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
China	7.9% (1)	8.1% (1)	8.3% (1)	8.5% (1)	9.5% (1)
USA	7.6% (3)	7.5% (3)	7.4% (3)	7.8% (2)	7.7% (3)
Netherlands	7.5% (4)	7.6% (2)	7.8% (2)	7.8% (3)	7.7% (2)
France	7.7% (2)	7.4% (4)	7.1% (4)	7.1% (4)	6.6% (4)
Italy	5.2% (6)	5.2% (6)	5.4% (5)	5.1% (5)	5.1% (6)
Poland	4.7% (7)	4.7% (7)	4.9% (7)	5.1% (6)	5.5% (5)
United Kingdom	5.6% (5)	5.3% (5)	5.0% (6)	4.8% (7)	4.6% (8)
Switzerland	4.4% (9)	4.3% (9)	4.2% (9)	4.2% (9)	4.6% (7)
Austria	4.6% (8)	4.5% (8)	4.5% (8)	4.5% (8)	4.5% (9)
Czech Republic	3.7% (10)	3.8% (10)	3.8% (10)	3.8% (10)	3.7% (10)
Total share	58.9%	58.4%	58.3%	58.7%	59.6%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021b). *51000–0003 Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0003&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Now that we have the knowledge of how foreign trade is shaped on the federal level, the question comes up whether these results will be reflected on a one-to-one basis when analysing foreign trade on the federal state level or whether there might be local differences dependent on each federal state.

4.2.2. Foreign trade on federal state level – exterior states

Baden-Württemberg is a federal state located in the South-West of Germany sharing a common border with France and Switzerland. It had an average GDP of EUR 502 billion p.a. in 2016 to 2020 and accounts for 15.2% of Germany's total GDP which makes it the third biggest state as measured by GDP (Statistische Ämter des Bundes und der Länder, 2021).

Its most important trading partner were the United States of America which kept their position for the last five years achieving a share of 10% of Baden-Württemberg's total foreign trade volume. The second most important

partner with the exception of 2020 was Switzerland contributing to 8.0–8.4% of trade. Although its share did not change throughout these years, Switzerland was overtaken by China in 2020, gaining 8.7% of the trade volume in the year in question. Reviewing the trade volume between China and Baden-Württemberg, China had never been as important before as it was in 2020. However, this result could have been foreseen looking at its development. In 2016, it was ranked fifth (7.1%), then fourth a year later, and then third in 2018 and 2019 before it became Baden-Württemberg's second most important trading partner.

A quite important role when it comes to trade with Baden-Württemberg was played by France and the Netherlands sharing the third, fourth and fifth position depending on the year. They accounted for 6.8% to 7.5% of Baden-Württemberg's foreign trade volume. Italy kept its position – sixth, as did Austria – seventh in 2017 to 2020 and eighth in 2016, achieving a 6% and 4.4% share, respectively. The diminishing importance of the United Kingdom was also reflected in this case. Starting in the seventh position in 2016, the United Kingdom did manage to remain tenth in 2020 but a constant fall of trade volume could be observed.

Belgium, which usually was outside the top ten, expanded its trade volume with Baden-Württemberg in 2018. As a result, the percentual share increased as well so that in this particular year Belgium was considered as Baden-Württemberg's eighth most important trading partner. An interesting development could be identified with respect to Ireland. Ireland, which used to be at the end of the top twenty scale, doubled its trade volume with Baden-Württemberg comparing 2018 to 2019 and was ranked eighth in 2020.

Poland and the Czech Republic played another constant but less important role. Both countries accounted for 3% to 4% of Baden-Württemberg's trade volume closing the first ten most important trading partners. There is one remaining country left which is Hungary. Hungary was tenth in 2016 and achieved a share of 3.1%. Apart from this year, it was outside this group of countries.

Generally speaking, the first three most important trading partners accounted for one fourth of Baden-Württemberg's trade volume. When the group is extended to the ten most important countries, the share increased to over 60%. Over the period in question, thirteen countries in total were included in the group of Baden-Württemberg's ten most important trading partners (Statistisches Bundesamt (Destatis), 2021a). The above-mentioned findings are summed up in Table 8. The percentage number refers to the share of the total trade volume whereas the number in brackets to the position of a particular country in the respective year.

Table 8. Baden-Württemberg's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
USA	10.1% (1)	9.8% (1)	9.6% (1)	9.8% (1)	9.9% (1)
Switzerland	8.4% (2)	8.4% (2)	8.0% (2)	8.0% (2)	8.4% (3)
China	7.1% (5)	7.3% (4)	7.7% (3)	7.8% (3)	8.7% (2)
Netherlands	7.3% (4)	7.5% (3)	7.5% (4)	6.8% (5)	7.1% (4)
France	7.3% (3)	7.2% (5)	7.0% (5)	7.2% (4)	6.8% (5)
Italy	6.1% (6)	6.1% (6)	6.1% (6)	5.9% (6)	5.7% (6)
Austria	4.4% (8)	4.4% (7)	4.4% (7)	4.4% (7)	4.5% (7)
United Kingdom	4.7% (7)	4.1% (8)	3.6% (9)	3.8% (8)	3.4% (10)
Belgium			4.0% (8)		
Ireland					3.4% (8)
Czech Republic	3.7% (9)	3.7% (9)	3.6% (10)	3.4% (9)	
Poland		3.1% (10)		3.2% (10)	3.4% (9)
Hungary	3.1% (10)				
Total share	62.3%	61.6%	61.5%	60.4%	61.3%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Bavaria is a federal state located next to Baden-Württemberg in the South-East of Germany, sharing a common border with Austria and the Czech Republic. It had an annual average GDP of EUR 609 billion in the years 2016 to 2020. On the federal level, this figure equals a share of 18.5%. It is Germany's second biggest state taking GDP as an indicator (Statistische Ämter des Bundes und der Länder, 2021).

Unlike Baden-Württemberg and Germany, it did not have a constant most important trading partner. The first position was shared between China (in 2018 and 2020) and the USA (in 2016, 2017 and 2019). However, the top ten trading partners did not change over the years. Nor did the country which closed the table of the ten most important trading partners, which was Hungary accounting for 3.4% to 3.9% of Bavaria's trade.

The USA alternated with China as Bavaria's most essential trading partner. They accounted for about 9% of Bavaria's total foreign trade. China, which was third in 2016, within the last four years, i.e., 2017 to 2020, constantly increased its share, overtaking the United States by 1.3 pp in 2020. This was not an effect of an actual growth in trade volumes with China itself since this remained stable comparing 2020 to the year before but was more the result of a drop in trade by other

countries. Austria had been Bavaria's third most significant trading partner after being second in 2016. It contributed to a share of 8.0% to 8.5%. Italy remained in its position of number four, accounting for about 6.5% of Bavaria's total trade.

Positions five to nine were shared between the Czech Republic, France, Poland, the United Kingdom and the Netherlands. Again, the weakening position of the United Kingdom becomes visible: fifth in 2016, seventh in 2017, eighth in 2018 and 2019, and ninth in 2020. On the other hand, the volume in trade between Poland and Bavaria in absolute terms had been rising including 2020 despite the global slowdown which could be noticed that year. The share of trade with the Czech Republic and France remained constant, oscillating around 5.6% to 5.8% and 5.3% to 5.8% accordingly.

Table 9 presents an overview of the outcomes discussed above, showing the share in Bavaria's trade within the respective year and additionally in brackets the country's position in the relevant year: The first three trading partners accounted for 26% of Bavaria's trade, the first ten partners – for 62% (Statistisches Bundesamt (Destatis), 2021a).

Table 9. Bavaria's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
USA	9.2% (1)	9.0% (1)	8.7% (2)	8.9% (1)	8.5% (2)
China	8.4% (3)	8.5% (2)	8.8% (1)	8.9% (2)	9.8% (1)
Austria	8.5% (2)	8.3% (3)	8.3% (3)	8.4% (3)	8.0% (3)
Italy	6.5% (4)	6.6% (4)	6.6% (4)	6.4% (4)	6.4% (4)
Czech Republic	5.6% (6)	5.6% (5)	5.7% (6)	5.6% (5)	5.8% (6)
France	5.5% (7)	5.6% (6)	5.8% (5)	5.6% (6)	5.3% (7)
Poland	4.6% (8)	4.8% (8)	5.2% (7)	5.3% (7)	6.0% (5)
United Kingdom	5.9% (5)	5.4% (7)	4.8% (8)	4.8% (8)	4.5% (9)
Netherlands	4.4% (9)	4.2% (9)	4.3% (9)	4.4% (9)	4.7% (8)
Hungary	3.4% (10)	3.5% (10)	3.6% (10)	3.8% (10)	3.9% (10)
Total share	62.1%	61.4%	61.8%	62.2%	62.8%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Brandenburg is located in the North-Eastern part of Germany. It is a region bordering with Poland. Its average GDP was EUR 71 billion p.a. between 2016 and 2020 (Statistische Ämter des Bundes und der Länder, 2021).

Based on the review of the figures from Table 10, the trading partners and its significance seem to be more stable. The first and second position in the ranking was dominated by Poland and Russia. In 2018, they swapped positions as Russia had a slightly higher trade volume than Poland. Unlike the aforementioned federal states, Poland and Russia together accounted for more than one fourth of Brandenburg's foreign trade volume. The ten most essential trading partners added up to a share of 69%. For the federal states previously mentioned, this share was around 60%. When these figures are compared with Brandenburg, Brandenburg seemed to have an even more concentrated choice of trading partners.

The USA and France took turns vying for the third and fourth position. Both countries experienced proportionally less trade in 2017 and 2018 and more in 2019 and 2020. On the contrary, China, having a share of 3.4% of Brandenburg's total foreign trade volume in 2016, increased its trade volume with Brandenburg by 2.6 pp. Consequently, its position grew from tenth to fifth in 2019 and 2020.

Similarly to Italy, the United Kingdom remained stable with the exception of 2020 when trade decreased relatively by 0.7 pp. Due to this fact, the United Kingdom dropped by two positions from sixth in 2016 to eighth in 2020. Italy changed between coming seventh and eighth in the ranking during the first four years of the period in question and was overtaken by Spain in 2020. The last three countries mentioned in Table 10 are Spain, the Czech Republic, and Austria. All of them were at the end of the scale, contributing between 3.4% to 4.2% to Brandenburg's foreign trade volume (Statistisches Bundesamt (Destatis), 2021a).

Table 10. Brandenburg's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
Poland	16.1% (1)	16.5% (1)	16.1% (2)	16.4% (1)	16.9% (1)
Russia	11.1% (2)	13.4% (2)	16.2% (1)	12.7% (2)	9.5% (2)
USA	9.7% (3)	7.3% (3)	5.1% (4)	6.4% (4)	8.4% (3)
France	7.4% (4)	6.4% (4)	5.8% (3)	6.4% (3)	7.9% (4)
Netherlands	4.9% (5)	4.8% (5)	5.0% (5)	4.9% (6)	4.9% (6)
China	3.4% (10)	3.8% (9)	3.9% (9)	5.0% (5)	6.0% (5)
United Kingdom	4.8% (6)	4.7% (6)	4.6% (6)	4.8% (7)	4.1% (8)
Italy	4.2% (7)	4.2% (8)	4.3% (7)	4.2% (8)	4.0% (9)
Spain			3.6% (10)	4.2% (9)	4.1% (7)
Czech Republic	3.8% (8)	4.2% (7)	4.2% (8)	3.6% (10)	3.5% (10)

	2016	2017	2018	2019	2020
Austria	3.4% (9)	3.5% (10)			
Total share	68.8%	68.9%	68.7%	68.7%	69.2%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Mecklenburg-Vorpommern, a federal state in the North-East of Germany, shares its border with Poland. Its annual average GDP between 2016 and 2020 was EUR 44 billion, which accounted for 1.3% of the total GDP in Germany (Statistische Ämter des Bundes und der Länder, 2021).

Its two most important trading partners were Poland and the Netherlands which kept swapping their positions. Their shares in Mecklenburg-Vorpommern's total foreign trade volume were more than 8.1% each. Between 2016 and 2020, the Netherlands accounted for 10.1% of the total foreign trade within this state. Another important trading partner was Denmark which was, depending on the year, either ranked third or fourth. Trade between Mecklenburg-Vorpommern and Denmark expressed as a percentage was above 6.0% with one exception of 5.8% in 2016.

Generally, this list is characterised by a high involvement of Scandinavian countries which, besides Denmark, were represented by Finland and Sweden. It can be reviewed in Table 11. Both countries oscillated around the middle of the table. One year each of them was ranked third, but also ninth in another.

Within the ten most important trading partners, Russia, France and China could be identified, of which Russia managed to be third in 2017. What is totally different in comparison with the federal states already discussed is the low significance of the United States. In this case, the United States only appeared once, in 2020, with a share of 5.0%.

The United Kingdom and Italy were at the end of the table, each with a share lower than 4.0% of Mecklenburg-Vorpommern's total foreign trade volume, with the exception of the United Kingdom in 2016 when the share was 4.3% (Statistisches Bundesamt (Destatis), 2021a).

Table 11. Mecklenburg-Vorpommern most important trading partners (2016–2020)

	2016	2017	2018	2019	2020
Netherlands	10.1% (1)	8.6% (2)	7.8% (2)	9.5% (1)	10.1% (1)
Poland	8.6% (2)	9.1% (1)	8.3% (1)	8.8% (2)	8.1% (2)

	2016	2017	2018	2019	2020
Denmark	5.8% (3)	6.4% (4)	6.8% (4)	6.3% (4)	6.7% (3)
Finland	5.6% (4)	5.2% (5)	6.5% (5)	6.9% (3)	3.9% (9)
Russia	5.1% (5)	7.6% (3)	5.9% (6)	4.2% (8)	
Sweden	3.6% (9)	5.1% (6)	7.4% (3)	5.2% (6)	5.0% (6)
France	4.1% (7)	4.6% (7)	5.2% (7)	5.3% (5)	5.5% (4)
China	4.0% (8)	4.0% (8)	3.9% (8)	5.1% (7)	5.2% (5)
USA					5.0% (7)
United Kingdom	4.3% (6)	3.7% (9)	3.5% (10)	3.5% (9)	3.9% (8)
Italy	3.5% (10)	3.4% (10)	3.7% (9)	3.5% (10)	3.6% (10)
Total share	54.7%	57.5%	59.1%	58.4%	57.2%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Lower Saxony is a North-Western German federal state. Its average GDP in the years 2016 to 2020 was EUR 293 billion a year, which translates into a share of 8.9% of Germany's total GDP (Statistische Ämter des Bundes und der Länder, 2021). It shares a border with the Netherlands.

Table 12 sums up Lower Saxony's most important trading partners. They accounted for roughly 55% to 57% of the state's entire volume of trade with foreign countries. Table 12 demonstrates clearly that the countries which Lower Saxony trades with remained the same with the exception of 2020 when Belgium appeared instead of Norway.

The most essential partner that Lower Saxony was dealing with were the Netherlands which in the period in question had a share of more than 8.5%. China used to be second in 2016 and 2017 but in 2018 was overtaken by Poland which was only fourth in 2016. This is due to a constant rise in the value of Poland's exports to Lower Saxony.

The United Kingdom, starting from a third position in 2016, kept losing its significance since 2017 due to a constant drop in both exports and imports. On the contrary, trade with France, the USA and Italy remained stable, setting up the middle part of the table. The list of the first ten trading partners was closed by the Czech Republic, Spain and, exceptionally in 2020, by Belgium whose shares of trade did not exceed 3.5% (Statistisches Bundesamt (Destatis), 2021a).

Table 12. Lower Saxony's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
Netherlands	8.8% (1)	8.5% (1)	8.7% (1)	8.5% (1)	9.0% (1)
China	6.3% (2)	6.6% (2)	6.2% (3)	6.0% (3)	7.4% (3)
Poland	5.9% (4)	6.2% (3)	7.0% (2)	7.5% (2)	8.4% (2)
United Kingdom	6.1% (3)	5.7% (5)	5.4% (5)	5.3% (6)	5.7% (5)
France	5.9% (5)	6.0% (4)	5.9% (4)	5.9% (4)	5.8% (4)
USA	5.5% (7)	5.2% (6)	4.8% (7)	5.8% (5)	4.8% (6)
Italy	4.4% (8)	4.5% (7)	5.1% (6)	4.5% (8)	4.8% (7)
Norway	5.6% (6)	4.1% (8)	4.1% (9)	3.5% (10)	
Czech Republic	3.8% (10)	4.1% (9)	4.4% (8)	4.5% (7)	3.9% (9)
Spain	4.3% (9)	3.8% (10)	4.0% (10)	4.0% (9)	4.0% (8)
Belgium					3.5% (10)
Total share	56.7%	54.7%	55.4%	55.6%	57.1%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

North Rhine-Westphalia is the biggest federal state taking its GDP into consideration. It accounts for one fifth of the entire federal GDP with an annual average of EUR 687 billion in the years 2016 to 2020 (Statistische Ämter des Bundes und der Länder, 2021). It is located in the Western part of Germany, sharing its border with the Netherlands and Belgium.

A look at Table 13 which displays North Rhine-Westphalia's ten most important trading partners in 2016 to 2020 guides us to the first aspect worth mentioning, which is that its top three countries did not change within these five years. These were the Netherlands, China and France. Each of them also remained constant at their relative shares. One exception was China which increased its share by 1.3 pp in 2020 for just one year.

The middle of the table, i.e., positions four to eight, were more mixed up but only when referring to the order of the countries. These countries were Belgium, the United Kingdom, the USA, Italy and Poland. North Rhine-Westphalia's fourth most important partner was the United Kingdom in 2016 but it changed in 2017, and from then on it continued to be Belgium. All five countries had a share of between 4.6% to 5.7% each as measured by North Rhine-Westphalia's total foreign trade volume. Austria and Spain with a much lower share (less than 4.0%) were linked to a steady ninth and tenth position, respectively (Statistisches Bundesamt (Destatis), 2021a).

Table 13. North Rhine-Westphalia's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
Netherlands	13.0% (1)	13.5% (1)	14.5% (1)	14.7% (1)	14.1% (1)
China	9.1% (2)	9.2% (2)	9.2% (2)	9.8% (2)	11.1% (2)
France	7.2% (3)	7.1% (3)	7.0% (3)	7.0% (3)	6.6% (3)
Belgium	5.7% (5)	5.7% (4)	5.6% (4)	5.6% (4)	5.4% (4)
United Kingdom	5.7% (4)	5.3% (5)	4.6% (8)	4.6% (8)	4.3% (8)
USA	5.2% (6)	5.2% (6)	5.2% (5)	5.1% (5)	5.3% (5)
Italy	5.0% (7)	4.9% (7)	4.9% (6)	4.9% (6)	4.8% (7)
Poland	4.6% (8)	4.6% (8)	4.7% (7)	4.7% (7)	4.9% (6)
Austria	3.6% (9)	3.6% (9)	3.7% (9)	3.7% (9)	3.8% (9)
Spain	3.5% (10)	3.5% (10)	3.6% (10)	3.6% (10)	3.5% (10)
Total share	62.7%	62.6%	63.0%	63.6%	63.9%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder (dataset).* https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Rhineland-Palatinate is a region adjacent to Belgium, Luxembourg and France. It is thus located in the Western part of Germany, south of North Rhine-Westphalia. Its average GDP in the period from 2016 to 2020 was EUR 141 billion p.a. (Statistische Ämter des Bundes und der Länder, 2021).

Rhineland-Palatinate's most essential trading partner was France, and this did not change since 2016 for the following five years. Its share in the state's foreign trade volume was at least 8.9% but mostly around 9.5%. The countries ranked next were either the USA, the Netherlands or Italy depending on the year. Italy can be treated as an exception in this case since apart from 2018 it was mainly fifth. The third position was shared by the USA and the Netherlands. Each of both countries accounted for at least 7% of Rhineland-Palatinate's total foreign trade volume. In 2018, Ireland happened to be the fifth biggest trading partner in this state since it accounted for 7.2% of the total volume of Rhineland-Palatinate's trade with foreign countries. However, this needs to be treated as an exceptional case as in the remaining years Ireland was outside the list of top ten partners.

Steady trade significance could be noticed for Belgium (fourth in 2016 and 2017, sixth in 2018 to 2020) and Spain (usually seventh or eighth). This was not the case for China and the United Kingdom. As already mentioned in the previous discussion, China's increase of relative significance and the United Kingdom's deterioration proved again to be true. The table of the top ten was closed

by Austria (in 2016, 2017, 2019), Poland (in 2018) and the United Kingdom (in 2020) (Statistisches Bundesamt (Destatis), 2021a). The discussed results are presented in Table 14.

Table 14. Rhineland-Palatinate's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
France	9.5% (1)	9.0% (1)	8.9% (1)	9.6% (1)	9.5% (1)
USA	8.0% (3)	7.8% (3)	7.8% (3)	8.3% (2)	8.6% (2)
Netherlands	8.5% (2)	8.2% (2)	7.5% (4)	7.3% (3)	7.0% (3)
Italy	6.1% (5)	6.2% (5)	7.8% (2)	6.1% (4)	6.0% (5)
Belgium	6.2% (4)	6.2% (4)	5.5% (6)	5.7% (6)	5.5% (6)
China	4.5% (8)	4.8% (8)	4.7% (7)	5.7% (5)	6.9% (4)
Ireland			7.2% (5)		
United Kingdom	5.5% (6)	5.2% (7)	4.7% (9)	4.9% (8)	4.3% (10)
Spain	4.8% (7)	5.5% (6)	4.7% (8)	5.4% (7)	4.6% (8)
Poland	4.2% (9)	4.1% (9)	4.1% (10)	4.6% (9)	4.6% (7)
Austria	3.9% (10)	3.5% (10)		4.0% (10)	4.4% (9)
Total share	61.1%	60.5%	63.0%	61.6%	61.5%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Saarland is a small federal state, mainly surrounded by Rhineland-Palatinate and France, but also having a common border with Luxembourg. Its average GDP between 2016 and 2020 was EUR 35 billion p.a., which was the second smallest in Germany (Statistische Ämter des Bundes und der Länder, 2021).

As displayed in Table 15, Saarland's main trading partner was France which contributed to a share of at least 15.0% of the state's entire traded volume with foreign countries. Depending on the year, the United Kingdom and Spain were second and third if the United Kingdom's decrease in 2020 is disregarded. The percentual share of the traded volume with each of these countries reached between 8.0% and 11.8% in the period in question. Saarland's trade with the USA and Italy seemed to be of particular importance as well. Comparing their trade shares with the ones of the countries beneath, the difference is substantial, i.e., about 2 pp.

Unlike the trade structure of federal states already discussed, China's trade significance did not increase in Saarland but fell. Instead, the Netherlands managed to improve theirs, starting from a share of 3.8% in 2015 up to 4.5%

in 2020. The end of the table is populated by Austria, Belgium and Slovakia each accounting for a share of roughly 3% (Statistisches Bundesamt (Destatis), 2021a).

Table 15. Saarland's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
France	15.3% (1)	15.1% (1)	15.4% (1)	15.0% (1)	15.1% (1)
Spain	9.1% (3)	9.7% (3)	10.5% (2)	11.8% (2)	11.8% (2)
United Kingdom	11.4% (2)	10.3% (2)	8.8% (3)	8.0% (3)	6.4% (5)
USA	7.4% (4)	6.7% (4)	6.6% (5)	7.0% (4)	8.0% (3)
Italy	6.1% (5)	6.5% (5)	6.6% (4)	6.5% (5)	6.7% (4)
Poland	3.9% (7)	4.0% (7)	4.4% (7)	4.5% (6)	4.6% (6)
China	4.8% (6)	5.2% (6)	4.5% (6)	4.3% (7)	4.3% (8)
Netherlands	3.8% (8)	3.7% (8)	3.9% (8)	4.2% (8)	4.5% (7)
Austria	3.1% (9)	3.3% (9)	3.4% (9)	3.2% (9)	3.0% (9)
Belgium	3.0% (10)	3.0% (10)		2.9% (10)	2.8% (10)
Slovakia			3.1% (10)		
Total share	67.8%	67.4%	67.2%	67.4%	67.1%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Saxony is a federal state which is located in the East of Germany. It is adjacent to Poland and the Czech Republic. Its share of GDP in Germany was 3.7%, which in absolute numbers was EUR 123 billion a year on average when considering the years 2016 to 2020 (Statistische Ämter des Bundes und der Länder, 2021).

Table 16 shows Saxony's most important trading partners for the period between 2016 and 2020. As displayed in this table, the four essential countries, China, the Czech Republic, the USA and Poland, remained consistent in terms of their shares and order. The biggest trading partner for Saxony was China, followed by the Czech Republic. Both of them contributed to a share of no less than 10.2%. The USA and Poland, being third and fourth, marked the next threshold which was 6.0%.

France and the United Kingdom as pioneers of the middle part of this listing were the only countries that exceeded a share of 5.0% as measured by Saxony's total foreign trade volume. Along with the remaining countries, i.e.,

the Netherlands, Italy and Austria, their trade significance with Saxony did not change, oscillating around 4.0%.

The listing is closed by Switzerland in 2016 and 2017 and by Spain from 2018 to 2020. Each of them was of rather minor importance since their trade shares were around three per cent (Statistisches Bundesamt (Destatis), 2021a).

Table 16. Saxony's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
China	11.8% (1)	11.5% (1)	12.4% (1)	13.0% (1)	13.8% (1)
Czech Republic	10.4% (2)	10.2% (2)	10.3% (2)	10.5% (2)	10.7% (2)
USA	7.9% (3)	8.7% (3)	7.9% (3)	9.5% (3)	8.8% (3)
Poland	6.4% (4)	6.2% (4)	6.3% (4)	6.4% (4)	6.9% (4)
United Kingdom	4.9% (6)	5.0% (6)	5.1% (6)	4.6% (5)	4.3% (6)
France	5.3% (5)	5.5% (5)	5.2% (5)	4.5% (6)	4.1% (7)
Netherlands	4.0% (9)	4.0% (8)	4.2% (7)	4.2% (7)	4.7% (5)
Italy	4.3% (7)	4.3% (7)	4.2% (8)	4.2% (8)	3.8% (8)
Austria	4.0% (8)	3.9% (9)	4.1% (9)	3.7% (9)	3.6% (9)
Switzerland	3.7% (10)	3.3% (10)			
Spain			3.5% (10)	3.6% (10)	3.0% (10)
Total share	62.6%	62.5%	63.2%	64.2%	63.7%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Schleswig-Holstein is the only federal state which borders with Denmark. It is also the most northerly state. Its average GDP between 2016 and 2020 was EUR 93 billion p.a. (Statistische Ämter des Bundes und der Länder, 2021).

For the discussed period between 2016 and 2020, there was no definite most important trading partner. This position was shared between China and Denmark which, based on the relevant year, were ranked either first or second. In comparison with the rest of Schleswig-Holstein's trading partners, China and Denmark were the only countries which exceeded a share of 8.0%. When 2019 and 2020 are disregarded, the share was higher than 8.0%. The third position remained unchanged for the USA. Their trade proportion with reference to the rest was between 6.5% and 7.7%.

The Netherlands, Poland, Sweden and France maintained their trade importance, although their individual positions still changed. Of the four countries, the

Netherlands were relatively the most essential trading partner with a share of about 6.0%. The shares of Poland, Sweden and France, however, were very close to one another, which caused their continual change of positions.

Within the years considered, trade between Schleswig-Holstein and Italy progressed with a positive effect on the traded volume and Italy's relative trade significance. A contrary effect was achieved by the United Kingdom with 2017 as its turning point. The listing of the ten most important trading partners for Schleswig-Holstein which is visualised in Table 17 is closed by Belgium between 2016 and 2019 and by Ireland in 2020 (Statistisches Bundesamt (Destatis), 2021a).

Table 17. Schleswig-Holstein's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
China	10.3% (1)	9.1% (2)	9.1% (2)	9.5% (1)	10.2% (1)
Denmark	9.6% (2)	9.2% (1)	9.3% (1)	8.9% (2)	8.1% (2)
USA	6.8% (3)	6.9% (3)	6.7% (3)	7.7% (3)	6.5% (3)
Netherlands	5.9% (5)	6.3% (4)	6.5% (4)	6.3% (4)	5.8% (4)
Italy	4.2% (9)	4.2% (9)	6.1% (5)	5.2% (5)	5.3% (5)
United Kingdom	6.0% (4)	5.6% (5)	4.7% (7)	5.0% (6)	4.7% (7)
Poland	4.6% (7)	4.7% (6)	5.1% (6)	4.7% (8)	4.6% (8)
Sweden	4.5% (8)	4.6% (7)	4.5% (9)	4.8% (7)	4.9% (6)
France	4.9% (6)	4.5% (8)	4.6% (8)	4.6% (9)	4.5% (9)
Belgium	4.1% (10)	3.9% (10)	3.8% (10)	4.4% (10)	
Ireland					3.7% (10)
Total share	60.9%	59.1%	60.4%	61.3%	58.5%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

4.2.3. Foreign trade on federal state level – interior states

Berlin is a federal state located inside of Brandenburg, another German federal state, in the North-Eastern part of Germany. Therefore, none of Germany's neighbours shares a border with Berlin. Berlin's annual average GDP in 2016 to 2020 was EUR 145 billion, which was twice as much as Brandenburg's despite

its smaller area (Statistische Ämter des Bundes und der Länder, 2021). Berlin has a particular significance since it is one of Germany's three city states (*Stadtstaat*), which means it is both a municipality and a state. On top of that, it is the capital of Germany.

Table 18 demonstrates Berlin's ten most essential trading partners, their shares in Berlin's total foreign trade volume and their orders each year. Reviewing it, it may appear that there is no real order with regard to the trading partners.

The first position was shared between the USA (in 2016 and 2017) and China (from 2018). The share in total foreign trade usually used to be around 9% except for China for the last two years where its share equalled 10.6% and 12.0%, accordingly. Before 2018, China was third in 2016 and second a year later being accountable for 6.9% to 7.7% of Berlin's foreign trade volume. On the contrary, the USA lost their position gradually starting from 2017 and were ranked fourth in 2020 with a share of 7.1%.

Poland's position changed from second to sixth, to fourth and then back to second. The drop from the second to the sixth position in 2017 resulted from a smaller value of export by Berlin. In the following years, the export value did not change much but the imported value grew instead.

Along with China and the USA, the third position was shared once by Italy in 2017 and twice by the Netherlands in 2018 and 2020. The trade volumes with Berlin for the latter two countries were comparable to each other in absolute terms, achieving around 6.3% to 7.8%. When these countries traded less with Berlin, they were ranked either fourth or fifth.

Switzerland used to have a much higher trading share with Berlin in 2016 and 2017 (5.9% and 7.3%) but this changed since 2018. Its share dropped to 3.4% to 4.0% and consequently the country fell to the eighth position. Trade between Berlin and France, however, slightly increased in comparison to the rest, so that France improved its trade share by 1.0 pp from 2016 to 2020 and moved from the seventh position one up in 2018. The United Kingdom and its trade with Berlin showed a comparable development following France during these years.

The only country whose trade relation with Berlin remained constant in all these years was Austria. Austria was the ninth most important trading partner for Berlin, achieving a share of around 3.3%. Finally, the tenth position was dominated by Spain with a share of about 3.0% of Berlin's foreign trade volume. 2016 is an exceptional year when the Czech Republic traded more with Berlin than Spain did (Statistisches Bundesamt (Destatis), 2021a).

Table 18. Berlin's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
China	6.9% (3)	7.7% (2)	9.1% (1)	10.6% (1)	12.0% (1)
USA	9.9% (1)	9.4% (1)	8.9% (2)	7.8% (3)	7.1% (4)
Poland	8.0% (2)	6.8% (6)	7.8% (4)	8.8% (2)	10.5% (2)
Netherlands	6.3% (5)	7.2% (5)	7.8% (3)	7.1% (4)	7.3% (3)
Italy	6.5% (4)	7.4% (3)	7.7% (5)	6.9% (5)	6.9% (5)
Switzerland	5.9% (6)	7.3% (4)	3.8% (8)	4.0% (8)	3.4% (8)
France	5.8% (7)	6.5% (7)	6.6% (6)	6.4% (6)	6.8% (6)
United Kingdom	4.2% (8)	4.1% (8)	4.3% (7)	4.1% (7)	4.7% (7)
Austria	3.3% (9)	3.2% (9)	3.4% (9)	3.2% (9)	3.2% (9)
Czech Republic	2.8% (10)				
Spain		3.1% (10)	3.0% (10)	2.9% (10)	2.9% (10)
Total share	59.7%	62.7%	62.5%	61.8%	64.8%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Bremen, the same as Berlin, is a city state and is located in Lower Saxony, a North-Western federal state, and therefore has no shared border with any foreign country. Bremen is also the smallest state within Germany as measured by its GDP since it accounts for around 1.0% of Germany's total GDP – in total numbers: EUR 32 billion p.a. (Statistische Ämter des Bundes und der Länder, 2021).

Focusing on Bremen's foreign trade, the countries with the three highest shares accounted for almost 30% of Bremen's total foreign trade volume. The shares of the subsequent countries were more distributed. Consequently, Bremen's top ten countries contributed to less than 60% of its total trade volume.

The USA and France took turns at being the most essential trading partner, with the USA leading in 2016, 2019 and 2020. It is worth pointing out that in 2020 the total volume of trade between France and Bremen halved. This is mainly caused by an immense drop of Bremen's imports from France, which decreased by EUR 1,022 million from EUR 1,340.5 million in 2019. Instead, China continuously increased its importance, becoming Bremen's second most significant trading partner in 2020.

The third and fourth positions were mainly held by the United Kingdom and China which achieved between 7% and 8% of Bremen's total foreign trade. A constant turnover between 3% and 4% was maintained by Belgium, the

Netherlands, Italy, Poland and Spain. In 2017, Belgium achieved a slightly higher trade volume share with Bremen, which was over 5%.

What seems to be unpredictable is Russia's contribution. In 2016 and 2017, it was outside the scale of the first ten, whereas between 2018 and 2020 it was at first tenth, then fifth and finally ninth. The shift from the tenth to the fifth place is due to a general increase in trade with Bremen. The development from 2018 to 2019 brought an increase of 42% (from EUR 1,075 million to EUR 1,527 million) in current prices. The end of the ten most important trading partners accounted for less than 3.1% of Bremen's total foreign trade volume. This applied to Spain – ninth in 2016 to 2018 and tenth in 2020, Austria - tenth in 2016 and 2017, and the Czech Republic – tenth in 2019 (Statistisches Bundesamt (Destatis), 2021a). The discussed results are reflected in Table 19.

Table 19. Bremen's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
USA	12.3% (1)	8.6% (2)	8.9% (2)	11.1% (1)	10.4% (1)
France	9.6% (2)	11.0% (1)	10.9% (1)	10.9% (2)	7.2% (4)
United Kingdom	7.6% (3)	7.0% (4)	8.3% (3)	6.6% (4)	8.2% (3)
China	7.1% (4)	8.0% (3)	7.2% (4)	7.2% (3)	8.7% (2)
Belgium	4.4% (5)	5.4% (5)	4.2% (5)	4.0% (7)	3.4% (8)
Netherlands	3.9% (7)	3.7% (7)	3.6% (7)	4.1% (6)	4.4% (5)
Russia			2.9% (10)	4.2% (5)	3.4% (9)
Italy	4.1% (6)	4.5% (6)	3.8% (6)	3.9% (8)	4.1% (6)
Poland	3.3% (8)	3.5% (8)	3.5% (8)	3.6% (9)	3.6% (7)
Spain	3.0% (9)	3.1% (9)	3.1% (9)		2.9% (10)
Austria	2.5% (10)	2.5% (10)			
Czech Republic				2.8% (10)	
Total share	57.8%	57.3%	56.4%	58.3%	56.3%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Hamburg is the third German city state. It is located between Lower Saxony and Mecklenburg-Vorpommern. Compared to Bremen which also is a city state, Hamburg has a much higher contribution to Germany's GDP, which on average was EUR 117 billion a year between 2016 and 2020. Expressed as a share of Germany's total GDP, this figure stands at 3.6% (Statistische Ämter des Bundes und der Länder, 2021).

From 2016 to 2019, its most important trading partner was France. It is worth noting its share in Hamburg's total foreign trade volume in 2016 which was over 20%. In 2020, France was overtaken by China which up to then was Hamburg's second most essential trading partner. The United States joined the podium constantly ranking third and accounting for between 8.9% and 10.9% of Hamburg's total foreign trade volume each year.

Table 20 sums up Hamburg's most important trading partners. On this list, three countries appear which have not yet been mentioned at all. These countries are the United Arab Emirates, Turkey and India. Whereas Turkey only played a minor role in this selection, it was ranked eighth with a share of 2.9% in 2020; the United Arab Emirates were Hamburg's fourth most significant trading partner in 2016, accounting for almost six per cent of Hamburg's total foreign trade volume. The following year, in 2017, their contribution relatively almost halved and they were ranked sixth. India, however, closes this set of countries in 2018 and 2019 but increases its relative importance in 2020 as a result of its trade volume having grown in absolute terms.

Having a relatively constant trade involvement and with one exception taking turns to share the fourth and fifth position, the Netherlands and the United Kingdom had a share of more than 4.5% but no more than 6.0% of Hamburg's total foreign trade volume each. Within the period of the years considered, Poland managed to strengthen its position and climbed two positions higher in 2020 compared to 2016.

The end of the set is marked by Belgium and Italy with a share of between 2.1% and 2.7%. In 2016, Denmark appeared on the list as last, contributing to 1.9% of Hamburg's total foreign trade volume (Statistisches Bundesamt (Destatis), 2021a).

Table 20. Hamburg's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
France	22.0% (1)	17.4% (1)	12.7% (1)	13.0% (1)	10.4% (2)
China	10.0% (2)	11.0% (2)	10.8% (2)	11.2% (2)	12.9% (1)
USA	8.9% (3)	10.1% (3)	10.3% (3)	10.9% (3)	9.2% (3)
United Arab Emirates	5.9% (4)	3.2% (6)			
Netherlands	5.5% (5)	4.5% (5)	5.1% (5)	5.2% (4)	5.2% (4)
United Kingdom	4.7% (6)	5.5% (4)	6.0% (4)	4.9% (5)	5.2% (5)
Russia	2.9% (7)	3.2% (7)	3.6% (6)	3.1% (6)	
Poland	2.5% (8)	2.8% (8)	3.0% (7)	3.0% (7)	3.5% (6)

	2016	2017	2018	2019	2020
Turkey					2.9% (8)
Belgium		2.3% (10)	2.5% (8)	2.3% (8)	2.7% (10)
Italy	2.1% (9)	2.4% (9)	2.4% (9)	2.2% (9)	2.7% (9)
Denmark	1.9% (10)				
India			1.9% (10)	2.2% (10)	3.1% (7)
Total share	66.3%	62.4%	58.3%	58.2%	57.7%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Hesse is a federal state in the centre of Germany, whose parts stretch towards the West and South-West. It is surrounded by other federal states and hence is not adjacent to any foreign country. In the years 2016 to 2020, its annual average GDP was EUR 283 billion (Statistische Ämter des Bundes und der Länder, 2021).

Table 21 shows Hesse's ten most important trading partners between 2016 and 2020 including its share of Hesse's total foreign trade volume and its position in the relevant year. When we have a look at these figures, the two most essential countries which Hesse traded the most remained constant. One of them were the USA which were first with a steadily rising share of between 10.3% in 2016 and 11.9% in 2020. The second country was China having a fluctuating share between 8.6% and 9.5%.

The third and fourth positions, apart from the fourth position in 2020, were shared between France and the Netherlands. France's contribution to Hesse's trade was above 6.0%. The same is true for the relevant share of trade with the Netherlands in 2016 and 2017, which relatively decreased by 1.6 pp from 2017 to 2020.

2020 was the year when trade between Switzerland and Hesse had a higher significance since Switzerland's share in Hesse's total trade volume exceeded 5.0%. A constant role was played by the United Kingdom which achieved at least 5.0% in the period in question and qualified as the fifth most essential trading partner.

The second half of the table was represented by Italy, Belgium, Russia and Poland achieving not more than 5.0% in total trade volume each. Japan and Austria played a kind of a role of an outsider since each of them only appeared once in the tenth position (Statistisches Bundesamt (Destatis), 2021a).

Table 21. Hesse's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
USA	10.3% (1)	10.4% (1)	11.1% (1)	11.3% (1)	11.9% (1)
China	8.8% (2)	9.5% (2)	8.9% (2)	8.6% (2)	9.3% (2)
France	6.4% (3)	6.4% (4)	6.7% (3)	7.4% (3)	6.4% (3)
Netherlands	6.2% (4)	6.4% (3)	5.7% (4)	5.6% (4)	4.8% (6)
Switzerland	4.6% (8)	4.6% (8)	4.6% (8)	4.5% (7)	5.5% (4)
United Kingdom	5.0% (5)	5.2% (5)	5.6% (5)	5.3% (5)	5.3% (5)
Italy	5.0% (6)	4.8% (6)	4.7% (7)	4.5% (8)	4.3% (8)
Belgium	4.8% (7)	3.9% (10)	3.9% (9)	4.7% (6)	4.5% (7)
Russia	3.6% (10)	4.7% (7)	5.2% (6)	3.9% (9)	
Poland	3.8% (9)	4.0% (9)		3.6% (10)	4.0% (9)
Japan			3.6% (10)		
Austria					3.5% (10)
Total share	58.6%	59.8%	60.0%	59.3%	59.4%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Saxony-Anhalt is one of the three federal states which is not a city state but is located in the centre of Germany with no shared border with Germany's neighbouring countries. Its area extends from the centre to the east. Saxony-Anhalt achieved an average GDP of EUR 61 billion p.a. between 2016 and 2020 (Statistische Ämter des Bundes und der Länder, 2021).

Its biggest trading partners were Russia, Poland and the Netherlands, of which Russia was first, with its trade share with Saxony-Anhalt exceeding those of the rest. Poland and the Netherlands were second and third in all the years apart from 2020 when they swapped their positions. The fourth and fifth ones which were represented by China and France remained stable as regards their order. It might be worth mentioning that France slightly lost its relative importance from 2017 onwards as in 2016 its share in Saxony-Anhalt's total foreign trade volume had been above 6.0%. Balanced development could be observed for Austria, the Czech Republic and Italy. These countries were ranked between sixth and ninth depending on the year.

The United Kingdom lost its relative importance by 1.3 pp when the beginning and the end of the period in question are compared. As regards its position, this means a drop by four places, from the sixth to the tenth. Before the United Kingdom

fell to the bottom of the table, Belgium used to be the one closing the table (Statistisches Bundesamt (Destatis), 2021a). The discussed results are presented in Table 22.

Table 22. Saxony-Anhalt's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
Russia	11.3% (1)	12.0% (1)	14.8% (1)	13.8% (1)	9.6% (1)
Poland	9.4% (2)	9.0% (2)	8.7% (2)	8.3% (2)	9.1% (3)
Netherlands	7.3% (3)	8.2% (3)	8.0% (3)	8.1% (3)	9.3% (2)
China	6.8% (4)	7.1% (4)	6.9% (4)	6.9% (4)	7.2% (4)
France	6.6% (5)	5.8% (5)	5.5% (5)	5.5% (5)	5.8% (5)
Austria	5.2% (7)	4.9% (7)	4.9% (7)	5.0% (7)	5.2% (6)
Czech Republic	4.9% (9)	4.7% (9)	5.0% (6)	5.2% (6)	4.6% (8)
United Kingdom	5.5% (6)	5.5% (6)	4.8% (8)	4.5% (9)	4.2% (10)
Italy	5.0% (8)	4.8% (8)	4.8% (9)	4.8% (8)	5.0% (7)
Belgium	4.2% (10)	4.7% (10)	4.5% (10)	4.1% (10)	4.6% (9)
Total share	66.2%	66.7%	67.8%	66.2%	64.6%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Thuringia is located in the centre of Germany, surrounded by other federal states. It has no shared border with any foreign country. Its contribution to Germany's GDP was about 1.9%, i.e., an average of EUR 61 billion a year taking into consideration the years between 2016 and 2020 (Statistische Ämter des Bundes und der Länder, 2021).

Thuringia's most important trading partners are presented in Table 23. Except for 2019, when this position was held by the United Kingdom, China could be identified as Thuringia's leading trading partner. In 2019, China was second. Apart from that, the second and third most essential trading partners were the United Kingdom and Poland, each of them achieving a share in excess of 6.0% of Thuringia's total foreign trade volume.

The fourth to ninth places were mixed up since the relative trade shares achieved by these countries were very close to one another and a change of 0.1 pp caused a drop by one to two positions. When the 2016 figures are reviewed, the relative trade shares for all these countries were between 5.4% to 5.7% each. The countries in question were the Netherlands, France, Italy, the USA, Austria and the Czech Republic.

The list is closed by Hungary, Switzerland and Spain which, even if they did not qualify to the group of ten most essential trading partners, were very close to it (Statistisches Bundesamt (Destatis), 2021a).

Table 23. Thuringia's most important trading partners (2016–2020)

	2016	**2017**	**2018**	**2019**	**2020**
China	8.1% (1)	7.6% (1)	7.4% (1)	7.2% (2)	9.7% (1)
United Kingdom	7.3% (2)	7.3% (2)	6.7% (3)	8.3% (1)	7.0% (2)
Poland	6.4% (3)	6.7% (3)	7.1% (2)	6.8% (3)	6.1% (3)
Netherlands	5.7% (7)	5.9% (5)	5.9% (5)	5.7% (5)	6.0% (4)
France	6.0% (4)	6.1% (4)	5.8% (6)	5.6% (6)	5.4% (7)
Italy	5.9% (5)	5.9% (6)	5.9% (4)	5.5% (7)	5.1% (8)
USA	5.8% (6)	5.3% (9)	5.2% (9)	5.1% (9)	5.8% (5)
Austria	5.5% (8)	5.5% (7)	5.8% (7)	6.0% (4)	5.7% (6)
Czech Republic	5.4% (9)	5.4% (8)	5.4% (8)	5.2% (8)	4.9% (9)
Hungary	4.8% (10)	4.7% (10)			4.0% (10)
Switzerland			4.6% (10)		
Spain				4.5% (10)	
Total share	61.0%	60.5%	59.8%	60.0%	59.7%

Source: Author's own elaboration based on: Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

A summarising overview which will allow the comparison of the federal state level with the federal level can be found in Appendix C. If a trading partner is listed in brackets, it means that this country was not a top three / ten trading partner for the whole period of the five years analysed.

4.3. Interpretation of results

Now that we have introduced the economic and geographic basics with a particular focus on Germany's and its federal states' foreign trade structures, the next step is to examine whether the assumptions of the gravity model of trade which were made by Tinbergen and his successors can be applied on the discussed trade relations.

The following evaluation is based on a point system which will allow a better comparison of the individual trade relations with each other. The trade relations will be examined according to a particular set of pre-defined criteria. Every time a criterion is met, a point will be awarded.

The basic gravity model of trade implies that a trade relation between two countries is affected by the value of their individual GDP and the distance to each other. In order to assess whether a certain GDP is high/low or whether a distance is far/close and to be able to classify these factors, quartiles have been used. The basis for the GDP were all GDP measures of the relevant countries, excluding the GDP of the individual German federal states since they are a subset of the German GDP and would decrease the median value. However, with reference to distance, the data basis includes all relevant trade relations as, when trade relations of the federal states are taken into account, the localisation to calculate the relevant distance changes from Berlin, the capital of Germany, to the respective capital of the federal state. It needs to be highlighted though that, at least for Germany, this way of measurement may not be one hundred per cent accurate since its capital Berlin is not located centrally but, in the East, very close to its border with Poland. The distances were measured with an online tool. The calculated values are presented in Table 24.

Table 24. Calculated quartiles for the variables GDP and distance

Quartile	GDP (in billion USD)	Distance (in km)
1	396.48	519.39
2	689.88	765.95
3	2,632.43	1,634.77
4	20,061.95	9,353.38

Source: Author's own elaboration.

The data set presented in Table 24 means that the GDP for 25% of the countries which comprise Germany and its trading partners is equal to or less than USD 396.48 billion. 50% of them have a GDP which equals or is lower than USD 689.88 billion. The next threshold is USD 2,632.43 billion. 25% of the countries with the highest GDP have a GDP above USD 2,632.43 billion with a maximum value of USD 20,061.95 billion. As regards distance, 25% of all trade relations do not exceed the distance of 519.39 km, the next 25% have a distance above 519.39 km and up to 765.95 km. The second half of trade relations face distances above 765.95 km. The threshold dividing them equally in terms of quantity is 1,634.77 km. For comparison, the linear distance between places in

the North and in the South of Germany is about 800 km. This means that for half of the trade relations, although they are considered foreign trade, from a German federal state's perspective, the distance to the trading partner is not that much different as if it were trading domestically.

In the next step, these quartiles need to be translated into points. Since the assumptions of the model say the bigger the GDP is, the more likely it is that these countries will trade, the first quartile of the GDP receives 0.25 points, the second 0.5 points, the third – 0.75, and the fourth – 1 point. With reference to distance, the relationship is the other way round and so will be the assigned the number of points in reverse order, i.e., 1 point for the first quartile and 0.25 for the fourth one.

The trade relations were assigned further points for each of the following criteria they met. These criteria were "adjacent region" if both trading partners are adjacent, "EU" if both trading partners are members of the European Union[23], "Monetary union" if both partners operate in the same currency, in our case in euro, and "Former occupation zone" if the trading partner occupied parts of Germany after the Second World War. The last criterion only refers to the USA, the United Kingdom, France and Russia as a representative of the former Soviet Union. It is especially interesting when the individual federal states are examined to check whether the former exercise of power has had a lasting effect on trade relations. All in all, a trade relation can gain a maximum of six points.

The presented criteria are summed up in Table 25 whereas the results of the point system can be reviewed in the Appendix D.

Table 25. Criteria for the assessment of trade relations

Criterion	**Condition**
GDP of base country	Refers to the average GDP of Germany or one of its federal states in 2016–2019 (in USD billion): 1 point if GDP is more than USD 2,632.43 billion, 0.75 points if GDP is no more than USD 2,632.43 billion but more than USD 689.88 billion, 0.5 points if GDP is no more than USD 689.88 billion but more than USD 396.48 billion, 0.25 points if GDP is no more than USD 396.48 billion.

[23] Since the United Kingdom declared its exit from the European Union with a referendum in 2016, with the exit eventually taking place in 2020, it has had an ambivalent position as to whether it should be counted as a member or not. It has been decided that the United Kingdom is to be treated as half of a member of the European Union and thus trade relations with the United Kingdom have been assigned 0.5 points.

Criterion	Condition
GDP of trading partner	Refers to the average GDP of Germany's or one of its federal states' trading partners in 2016–2019 (in USD billion): 1 point if GDP is more than USD 2,632.43 billion, 0.75 points if GDP is no more than USD 2,632.43 billion but more than USD 689.88 billion, 0.5 points if GDP is no more than USD 689.88 billion but more than USD 396.48 billion, 0.25 points if GDP is no more than USD 396.48 billion.
GDP of trade relation	Average between GDP of base country and GDP of trading partner.
Distance	Distance between two trading partners (in km): 1 point if the distance is no more than 519.39 km, 0.75 points if the distance is equal to or less than 765.95 km but more than 519.39 km, 0.5 points if the distance is equal to or less than 1,634.77 km but more than 765.95 km, 0.25 points if the distance is more than 1,634.77 km.
Adjacent region	Both trading partners are adjacent: 1 point if true, 0 points if false.
EU	Both trading partners are members of the European Union: 1 point if true, 0 points if false, 0.5 points if trade with the United Kingdom.
Monetary union	Both trading partners operate in the same currency, i.e., in euro: 1 point if true, 0 points if false.
Former occupation zone	The trading partner was occupied by the other partner after the Second World War – only applicable for the United States, the United Kingdom, France and Russia: 1 point if true, 0 points if false.

Source: Author's own elaboration.

Note. The criteria for the assessment of trade relations were decided by the author based on: Tinbergen, J. (1962). *Shaping the World Economy; Suggestions for an International Economic Policy. Books (Jan Tinbergen).* New York: Twentieth Century Fund.

The number of adjacent countries is six. When reviewing the results regarding the EU membership and monetary union, six countries and the UK as a half meet this criterion, but only four of them also have the euro as their currency. The number of the adjacent regions and the EU members is similar however this

is not the same reference group since Switzerland is a neighbouring country but not part of the EU, whereas Italy is an EU member but not adjacent to Germany. Within the list of these ten trading partners, three of four former Allies were included.

Assessing this list, the country with most of the points is France which achieved five and a half out of six points. It is followed by the Netherlands and Austria with 4.625 and 4.5 points, respectively, despite their relatively lower GDP. However, China and the USA, apart from having an enormous GDP at least compared to the rest, do not meet any of the other criteria, yet they can be considered as Germany's most important trading partners in terms of value.

When we examine the exterior federal states, which comprise ten out of the total sixteen, 110 unique trade relations can be identified. There are 20 individual countries which traded with these federal states, twice as many compared to the federal level. This is a first indication that trade is differentiated across regions.

None of the federal states received more than 0.75 points for its GDP, while seven out of the ten had an average GDP of no more than USD 396.48 billion and thus receiving 0.25 points for their GDP. Regarding the average GDP of the relevant trading partners, the majority (8 out of 12) have a GDP of no more than the overall calculated median is, i.e., no more than USD 689.88 billion.

When we take a look at the distance, it becomes apparent that it does play an important role. A narrow majority of the trade relations in question (51%) fits within the first two quartiles, which means the respective distance is no more than 765.95 km. This might justify that the review covers exterior states which form the external borders of Germany. But it is worth stressing that there are no trade relations where distance equals 0.25 points (the minimum possible points) and GDP points equal less than 0.5 points. Even for distances, which equal 0.5 points, the majority of trade relations have a GDP equalling at least 0.5. However, the more points are granted for distance, the more trade relations with a smaller number of points for GDP appear.

Since distance has been mentioned, a look at adjacency reveals that 14 trade relations meeting this criterion have been identified. This does not look much at first glance but, if we bear in mind that technically this number is limited to 16[24], the view changes. The missing trade relations here refer to Luxembourg which is adjacent to Rhineland-Palatinate and Saarland.

77% of the trade relations examined, including trade with the United Kingdom, meet the "EU" criterion. If the United Kingdom is excluded from the calculation, the share decreases to 68%. Out of the trade relations where both

[24] Compare Appendix E.

partners are full-fledged members of the European Union, 72% also meet the "Monetary Union" criterion. The share of trading relations with countries which are not members of the European Union is 23%.

In this setting, none of the trade relations achieved the maximum of six points, which is due to the fact, that there is no federal state with a GDP exceeding USD 2,632.43 billion but there are three trade relations which achieved more than 5 points. These are Baden-Württemberg with France (5.75 points), Rhineland-Palatine with France (5.625 points) and Saarland with France (5.625 points). The reason for the difference in points can be explained by the fact that the GDP of Rhineland-Palatinate and Saarland falls in a different quartile and hence they were awarded with 0.5 instead of 0.75 points for their GDP. In all cases, France was always listed in the first ten most important trading partners. In the last two cases, France can even be considered as the most important trading partner when the actual trade volume is taken into account. An almost full score could be achieved since France happened to occupy these areas after World War II as well.

With fewer points but still more than four points, ranged between 4.5 and 4.75 points, four additional trade relations could be identified. These are North Rhine-Westphalia with the Netherlands (4.75 points), North Rhine-Westphalia with Belgium (4.625 points), Bavaria with Austria (4.625 points) and Lower Saxony with the Netherlands (4.5 points). In all these cases, the trading partners in the period in question remained in the top ten list. Apart from the relationship between Belgium and North Rhine-Westphalia, all of them were always in the top three as well.

There is also a question of having a look from the opposite direction and examining which of the foreign countries had the most trade relations within the group analysed. This is a list of seven countries which are the Netherlands, the United Kingdom, Poland, China, the USA, France and Italy. For all of them, ten trading relations could be identified, which means that they were quite essential for every federal state considered. Five of them are located within Europe and were members of the European Union at that time and generally did not exceed the distance of 1,400 km, yet again China and the USA break the rule. Although there is nothing apart from their GDP which would speak for trade with these federal states, in half of these cases, these countries were listed in their top three in each of the years looked at. There is only one federal state, Mecklenburg-Vorpommern, where trade with the USA did not seem to be of much importance.

Getting away from the exterior federal states towards the ones which are centrally located, 70 unique trade relations have been identified. There are six relevant federal states and all of them had an annual average GDP of no more

than USD 396.48 billion between 2016 and 2019. Looking at the list of foreign countries which traded with these federal states, 19 different ones could be identified, whereas six of them only appear once in the relations found. These relations, as a reminder, are an excerpt of the ten most valuable trades for each federal state. The aforementioned countries are Turkey, Japan, India, Hungary, Denmark and the United Arab Emirates. Apart from Hungary and Denmark, all of them are further away than 2,000 km.

Contrary to the results relating to the exterior federal states, in this listing the majority (11 out of 19) of the identified countries had a GDP higher than the median, i.e., USD 2,632.43 billion. The majority of trade relations (64%) was assessed with GDP points of at least 0.5, whereas the maximum number was 0.625. Seven out of 70 identified trade relations were given 0.25 GDP points, but this is due to the GDP of both trading partners, i.e., the relevant federal state and its trading partner.

Focusing on the distance factor, 49% of the identified trade relations are ranked within the first two quartiles (765.95 km or less) and 51% above. Bearing in mind that the currently reviewed federal states are inside of Germany, we can assume that their distance to foreign countries might be generally bigger in comparison with the ones located outside. But, again, it becomes visible that there is a relation between distance and GDP. If distance is awarded 0.25 points, all trade relations apart from one have a GDP of at least 0.5 points. The relevancy of GDP diminishes when countries are closer to each other.

When the trade relations are inspected within the context of the EU membership, a majority of trade relations meeting this criterion can be determined. With the United Kingdom taken into consideration, the share accounts for 69% (48 out of 70). After the monetary union is added as a further determinant, the number of trade relations is narrowed to 30 and the leading sub-group within the EU group.

Since adjacency was irrelevant in this case, the maximum number of achievable total points was five. The highest score of 4.125 was achieved by exactly one trade relation which is Berlin with France. Although France always appeared in Berlin's top ten list, it is not Berlin's most valuable trading partner. When the trade relations with the second highest score achieved, which is 3.625 points, are examined, one trade relation can be detected – Hesse with France. This is very closely followed by further five relations with a total sum of 3.5 points. They all have the Netherlands as their trading partner and refer to Bremen, Hamburg, Hesse, Saxony-Anhalt and Thuringia. With the exception of Saxony-Anhalt and the Netherlands, other relations can be classified in the same way as Berlin's with France: they are essential but not the most essential ones.

A look at these countries which traded the most with the interior federal states reveals a list of six. These countries are Italy, the United Kingdom, the Netherlands, China, France and Poland. All of them trade with each of the regarded region. Whereas five of the countries mentioned are within Europe and were also part of the European Union at that time, China can be again considered as an outsider not meeting expectations, especially when additionally, four of the six trade relations with China seem to be of particular importance in terms of value.

The last point shall focus on the aspect of the "Former occupation zone" which refers to the period after World War II. The goal of this analysis is to inspect whether the former Allies still have an economic influence on their former territories. Therefore, no split between interior and exterior states is needed. As a reminder, Saarland was the only federal state which was not occupied since it was considered a French territory at that point of time. For the purpose of this analysis, it will be examined in relation to France. The total number of possible trade relations in this case is 20 since Berlin was split between four and also the area which nowadays is called Baden-Württemberg was shared. Counting the number of existing trade relations, the result received is 17. This means that there are only three out of the 20 possible combinations missing. These refer to trade with Russia in connection to Saxony, Thuringia and Berlin. A closer look at the relations identified shows that, for half of them, the statement is true that a former Ally could be assessed as one of the three most valuable trading partners. When we refer to the top ten list, this statement applies to every trade relation apart from Russia and Mecklenburg-Vorpommern.

Generally speaking, there are aspects which support the gravity model of trade while others speak against it. As seen above for those federal states which are centrally located, the assumptions of the gravity model did have a meaning but only to a certain extent, whereas for the matter of exterior federal states, the assumptions seemed to apply more accurately.

China and the USA are among countries that are located the farthest away from Germany. An analysis of the fourth quartile for distance shows that trade relations with China and the USA make 92% of these. The remaining three which can be found in this quartile as well are trade relations with the United Arab Emirates, Japan and India. However, the latter three countries appear only once each. While the USA is a member of both the NATO and WTO and additionally a former Ally, China only joined the World Trade Organization having nothing else in common with Germany. China's significance in trade with Germany cannot be explained by the means of the gravity model.

On the other hand, there are certain European countries adjacent to Germany which are worth mentioning as they support the model. One of them is Denmark. Denmark is a country with an average GDP of USD 338 billion p.a.

Within the data set considered, it is a country with one of the lowest GDPs. It does not appear in the top ten list on the federal level, but it does when we examine trade conducted by Schleswig-Holstein, the only German federal state neighbouring with Denmark. Although in some years Denmark was overtaken by China, it remained one of Schleswig-Holstein's most valuable trading partners.

A comparable example is Austria. Austria also had a small GDP, but it was higher than Denmark's, which might be one of the reasons why it appeared among Germany's top ten trading partners. However, it is not included on the list of each federal state and usually is ranked at the bottom. A deviation could be detected with regard to trade with Bavaria. Austria was one of Bavaria's top three trading partners between 2016 and 2020.

On the other hand, there is a neighbouring country such as Luxembourg with an average GDP of USD 67 billion (World Bank Group, 2021b). Despite its advantage of proximity, it was unable to overtake its "competitors".

In the review of the federal states' individual trade structures, one country is worth of being highlighted - i.e., Poland. It could be observed that in the five years of the period in question the volume of trade with Poland not only increased in absolute terms but also had a direct impact on its relative significance as a trading partner. This positive development applies on both levels, i.e., the federal one and in connection with the individual federal states. One reason for this expansion might be Poland's general GDP increase. With 2016 as a base year and the achieved value compared with that in 2020, Poland increased its GDP by 26%. In the same period, Germany gained 11% (World Bank Group, 2021b). Bearing in mind that Poland is an adjacent country, which in this case represents the distance factor as well, and a member of the EU, it can be concluded that based on Tinbergen's assumptions its growth in GDP accounts for the increase in the volume traded with Germany.

A further influencing factor with immediate effect on trade was Brexit. In 2016, the EU referendum took place in which the UK citizens expressed their decision to leave the European Union. The official departure took place in January 2020. The resulting uncertainty may explain the reason as to why the UK dropped from the fifth most important partner on the federal level to the eighth within the five years of the period analysed. A comparable development with a more intense effect could also be observed with trade with the federal states. Similar to the case of Poland, the case of the United Kingdom shows the applicability of the gravity model since a change of one factor affected the relevant trade volume.

Analogically to Tinbergen's observation referring to trade with the Commonwealth countries, a similar observation could also be detected for trade between the former occupied areas and their respective Allies.

4.4. Summary

Reviewing Germany's development and its trade role in the world economy from the late 1940s until today, it becomes visible that straight after the end of the Second World War which Germany eventually lost, its significance in the global trade was limited to about 2%. Nowadays, Germany contributes to about 6–8%[25] of the exported and imported global volumes. Its culmination was achieved in 1973 with 9–11%.

Germany is considered these days as the third largest economy in terms of value of traded goods and commercial services, following the United States and China, and is the biggest in the EU and Europe. Overall, the ten biggest economies are responsible for more than a half of the world's trade.

When Germany's imports and exports are inspected, it turns out that Germany imports 20% of the total EU imports. Among other things, it receives raw materials for its medical production, computer and electronics, but also plastic waste. At the same time, it also exports plastics and related articles. Apart from this, Germany delivers renewable-energy goods, electrical energy and final medical products. In 2014, Germany was the only one achieving added value to EU exports in the automotive industry.

Looking at the year 2018, we can see that Germany increased its exports by 8% in comparison with the previous year when it achieved USD 1.56 trillion. This rise is traced back to the growing demand in the automotive and pharmaceutical industry. From 2019 onwards, Germany and the world in general have been suffering from setbacks caused by various events such as trade disputes between the United States and China, the government shutdown in the United States, Brexit and, in 2020, by the outbreak of the COVID-19 pandemic.

Its success in the world economy also goes back to its membership in several trade and economic organisations which overall liberalised and eased global trade. These are: NATO, the European Economic Community (the predecessor of the EU), OEEC, International Bank for Reconstruction and Development, International Money Fund, GATT, European Coal and Steel Community and European Union. Referring to the European Economic Community and European Coal and Steel Community, Germany is one of their founding members.

Germany's total foreign trade volume in 2016–2020 has been analysed in order to verify whether the assumptions of the gravity model of trade are applicable. Therefore, not only figures for the federal level but also for the federal

[25] Figures refer to 2019.

state level were taken into consideration. The data set has been published by the German Federal Statistical Office.

Germany is a Western and Central European country with sixteen federal states, of which ten form Germany's border and six are located inside the country. The exterior states are Baden-Württemberg, Bavaria, Brandenburg, Mecklenburg-Vorpommern, Lower Saxony, North Rhine-Westphalia, Rhineland-Palatinate, Saarland, Saxony and Schleswig-Holstein, whereas Berlin, Bremen, Hamburg, Thuringia, Hesse, Saxony-Anhalt are the interior ones. The average GDP achieved by Germany in 2016 to 2020 was EUR 3,300 billion p.a., which equals 25% of the GDP in the EU and 29% of the GDP in the euro area. Germany shares its border with Denmark, Poland, the Czech Republic, Austria, Switzerland, France, Belgium, Luxembourg and the Netherlands.

The annual volume which Germany traded with foreign countries was about EUR 2.1–2.4 trillion in the years in question. The first ten most important partners in terms of value account for 58–60% of Germany's total foreign trade volume. Looking at the impact of the first three, this share is reduced to 23–25% meaning that one fourth of Germany's foreign trade goes back to three countries. Within the years analysed, the trading partners remained constant, only changing their order among them. These were China, the United States, the Netherlands, France, Italy, Poland, the United Kingdom, Switzerland, Austria and the Czech Republic.

Germany's top trading partner is China, followed by France (in 2016), the Netherlands (in 2017, 2018 and 2020) and the United States (in 2019). The third position was mainly held by the United States apart from 2019 when it was the Netherlands and the United States came second. A 0.8 pp increase in trade with Germany could be observed for Poland, achieving 5.5% of Germany's total foreign trade volume in 2020. A decrease in trade has been true for the United Kingdom since 2018.

Overall, a year-on-year increase of absolute trade figures could be observed for 2016–2019. In 2020, only China from the top ten list managed to expand their exports to Germany, whereas the remaining ones suffered from a lower trade exchange.

Baden-Württemberg shares a common border with France and Switzerland. It had an annual average GDP of EUR 502 million in 2016 to 2020, which makes it the third largest state in Germany in terms of GDP. The United States were the most important trading partner, accounting for 10% of Baden-Württemberg's total foreign trade volume. Switzerland, a neighbouring country, was second, apart from 2020 when it was replaced by China which had been climbing up one position each year since 2016. Further important trading partners were France

and the Netherlands sharing the third to the fifth position depending on the year and achieving around 7.0% of Baden-Württemberg's foreign trade volume. A diminishing importance could be observed for the United Kingdom. Overall, there are thirteen countries qualifying for the group of top ten trading partners, i.e., the United States, Switzerland, China, the Netherlands, France, Italy, Austria, the United Kingdom, Belgium, Ireland, the Czech Republic, Poland and Hungary.

Bavaria, having a common border with Austria and the Czech Republic, had an average GDP of EUR 609 billion p.a. in the years analysed as it was Germany's second biggest federal state in terms of GDP. Its most important trading partners (contributing to 9.0% of the total foreign trade volume) were China and the United States. A very important trading partner was also Austria which was second in 2016 and third in the remaining years. Trade with the United Kingdom again decreased. Generally, the list of the ten most important trading partners remained constant. These countries are the United States, China, Austria, Italy, the Czech Republic, France, Poland, the United Kingdom, the Netherlands and Hungary.

Brandenburg, located next to Poland, achieved an annual average GDP of EUR 71 billion. The first two positions of the most valuable trading partners were shared between Poland and Russia. Both together contributed to more than one fourth of Brandenburg's total foreign trade volume, whereas the top ten achieved a share of 69%. The third and fourth position were held by the United States and France which swapped their places depending on the year. The remaining countries which changed their order were China, the United Kingdom, Italy, Spain, the Czech Republic and Austria.

Another federal state adjacent to Poland is Mecklenburg-Vorpommern with an average GDP of EUR 44 billion p.a. in 2016 to 2020. The two most important trading partners were Poland and the Netherlands which swapped places during the years analysed. Another important partner was Denmark which was either third or fourth. In comparison with most of the federal states, Mecklenburg-Vorpommern had a higher share of trade with Scandinavian countries – Denmark, Finland and Sweden. The other ten most important trading partners which in total accounted for 55–59% of the foreign trade volume were Russia, France, China, the United States, the United Kingdom and Italy.

Lower Saxony located in the West next to the Netherlands achieved an average GDP of EUR 293 billion p.a. in the years analysed. Its most essential trading partner was its neighbour, the Netherlands, accounting for 8.9% of the total foreign trade volume. The second position was shared between China (in 2016 and 2017) and Poland (since 2018). Trade with the United Kingdom which was in the third position in 2016 kept falling in the following years. The remaining

top ten countries that Lower Saxony traded with were the United States, France, Italy, Norway, the Czech Republic, Spain and Belgium.

North Rhine-Westphalia, neighbouring with the Netherlands but also with Belgium, is Germany's biggest federal state based on GDP, with EUR 687 billion p.a. on average. Not only did its top ten trading partners remain constant, but so did the order of the first three countries which were the Netherlands (1), China (2) and France (3), accounting for about 30% of the total foreign trade volume. The remaining countries were Belgium, the United Kingdom, the USA, Italy, Poland, Austria and Spain. All in all, these ten countries contributed to ca. 62% of North Rhine-Westphalia's total foreign trade volume.

Further south, sharing a common border with Belgium, Luxembourg and France, Rhineland-Palatinate is located. Its average GDP was EUR 141 billion per year. France was its most important trading partner, followed by either the United States, the Netherlands or Italy, depending on the year. Constant trade was recorded with Belgium and Spain. Referring to China, its relative increase in trade with a federal state proved again to be true. The contrary, i.e., a lowering influence, was applicable for the United Kingdom. The other, not yet mentioned, countries forming the top ten list were Ireland, Poland and Austria.

Saarland, which shares its borders with France and Luxembourg, is in the same region. In terms of GDP, it is a small federal state since its GDP was EUR 35 billion a year on average. Saarland's most important trading partner was France, with a share of at least 15.0% in the overall foreign trade volume. The United Kingdom and Spain can also be considered essential trading partners on condition that the sudden drop in trade with the United Kingdom in 2020 is disregarded. Contrary to most of the other federal states, the significance of China's trade with Saarland fell within these five years. The remaining countries which, together with those already mentioned, were responsible for 67% of Saarland's foreign trade volume were the United States, Italy, Poland, the Netherlands, Austria, Belgium and Slovakia.

Saxony located next to Poland and the Czech Republic had an average share of EUR 123 billion a year within the five years under consideration. Its four biggest trading partners were China (1st), the Czech Republic (2nd), the United States (3rd) and Poland (4th), of which the first three accounted for about 30% of Saxony's total foreign trade volume. The order of the first four remained constant. France, the Netherlands, Italy, Austria, Switzerland and Spain contributed to the remaining difference of 62–64% of Saxony's foreign trade volume.

Schleswig-Holstein with a GDP of EUR 93 billion on average a year is the northernmost federal state on the border with Denmark. The position of its main trading partner was shared between China and Denmark, followed by the United

States which were third. Schleswig-Holstein recorded constant trade with the Netherlands, Poland, Sweden and France, yet their relevance changed from year to year. A positive tendency could be observed for trade with Italy. The contrary applies to the United Kingdom with its downwards tendency from 2017. Next to the countries mentioned, Schleswig-Holstein's top ten list also included Belgium (2016–2019) and Ireland (in 2020).

One of the interior federal states is Berlin, a city state and at the same time the capital of Germany, with an average GDP of EUR 145 billion p.a. between 2016 and 2020. When the list of Berlin's top ten trading partners has been reviewed, no order could be identified. The most important trading partners were the United States (in 2016 and 2017) and China (since 2018). The other ones were Poland, the Netherlands, Italy, Switzerland, France, the United Kingdom, Austria and the Czech Republic. The ten countries in total accounted for 60–65% of the volume of Berlin's trade with foreign countries.

Bremen, another city state, is the smallest state in Germany based on GDP, achieving ca. EUR 32 billion a year. The first four positions were shared between the United States, France, the United Kingdom and China, with the United States or France leading this list. Further countries were Belgium, the Netherlands, Russia, Italy, Poland, Spain, Austria and the Czech Republic, which all in all accounted for less than 60% of Bremen's foreign trade volume.

Hamburg, the third city state, had an average GDP of EUR 117 billion a year. Its most important trading partner assessed on traded volume was France, with the exception of 2020 when this position was taken over by China which up to then had been second. The third most essential trading partner were the United States. Hamburg is the only federal state which counts the United Arab Emirates, Turkey and India among its top ten trading partners. Apart from the countries mentioned already, this list includes the Netherlands, the United Kingdom, Russia, Poland and Belgium. The relative trade significance of Hamburg's top ten trading partners fell over the years analysed, from 66% in 2016 to 58% in 2020.

Hesse achieved an average GDP of EUR 283 billion a year. The United States and China were Hesse's most important trading partners. A very important part was also played by France and the Netherlands. Contrary to the other federal states, Hesse had Japan as its tenth most essential trading partner in 2018. Other trading partners, not yet mentioned, were Switzerland, the United Kingdom, Italy, Belgium, Russia, Poland and Austria.

Saxony-Anhalt, a federal state further in the East, conducted the most trade with Russia, Poland and the Netherlands. Its GDP was on average EUR 61 billion p.a. Other countries which Saxony-Anhalt traded with were France, Austria, the Czech Republic, the United Kingdom, Italy and Belgium.

Thuringia contributed 1.9% to Germany's GDP (in total numbers: EUR 61 billion a year) for the five years analysed. Generally, China was Thuringia's most important trading partner, apart from 2019 when China was second and the United Kingdom first. The second position was shared between Poland and the United Kingdom with the exception of 2019. The remaining countries among Thuringia's top ten trading partners were the Netherlands, France, Italy, the United States, Austria, the Czech Republic, Hungary, Switzerland and Spain. However, the order of these countries on the list was not maintained.

The interpretation of the given results was based on a point system which evaluated the relevant trade relations based on the following criteria: GDP of base country, GDP of trading country, distance, adjacent region, EU (membership), monetary union and former occupation zone. Due to its exit, the United Kingdom was given half a score in terms of the EU membership.

On the federal level, ten trade relations have been identified. For six of them, the EU membership criterion applied, but only four of them share the euro as their currency. The UK was considered as the seventh country with half a point. The number of adjacent countries is also six, but the identified trade relations are different since Switzerland shares a border with Germany but is not an EU member. On the contrary, Italy is an EU member but not next to Germany. Germany's top ten list includes three of its four former Allies.

Results show that France has achieved five and a half out of six points. It is followed by the Netherlands and Austria with 4.625 and 4.5 points, respectively. However, China and the United States, despite their outstanding GDP in comparison with the others, do not meet any other criteria and yet are countries Germany trades with the most.

As regards the exterior federal states, 110 unique trade relations have been identified. There are 20 individual countries involved and this number is twice that of the federal level. There is a slight trend visible that distance for these trade relations is below the calculated median. A look at adjacency reveals that 14 out of 16 possible trade relations have been identified as meeting this criterion. 68% of the trade relations refer to trade within the EU, of which 72% operate in euro. When the United Kingdom is added, the share of the EU trade rises to 77%.

There are three trade relations which have achieved more than five points: Baden-Württemberg with France (5.75 points), Rhineland-Palatinate with France (5.625 points) and Saarland with France (5.625 points). In these three cases, France has always been listed as one of the top ten most important trading partners, for the latter two trade relations even as the most important one. The number of points indicate that all of the applied criteria have been met. Point deductions result from the GDP. A filter on trade relations with at least 4.5 points

shows four additional ones: North Rhine-Westphalia with the Netherlands (4.75 points), North Rhine-Westphalia with Belgium (4.625 points), Bavaria with Austria (4.625 points) and Lower Saxony with the Netherlands (4.5 points). In all these cases, the trading partners in the period analysed remained on the top ten list. Apart from the relation between Belgium and North Rhine-Westphalia, all of them were also always in the top three.

When these trade relations are looked at from the opposite perspective, i.e., from the perspective of the foreign countries, there are seven which traded with each of the federal states discussed. These countries are the Netherlands, the United Kingdom, Poland, China, the United States, France and Italy. Five of them are located in Europe and were members of the EU at that time. The distance of these trade relations does not exceed 1,400 km. China and the United States as the excluded ones, despite being outside Europe, are still countries exterior federal states traded with the most; for half of them, China and the United States are considered in their top three.

As regards the interior federal states, of which there are six in total, there are 19 countries they trade with, and six of them only appear in a relation with one federal state. These countries are Turkey, Japan, India, Hungary, Denmark and the United Arab Emirates. Altogether, 70 trade relations have been identified. The share of trade with countries within the EU (including the United Kingdom) is 69%, whereas within the monetary union the share drops to 43%. Since these federal states do not have a border with foreign countries, the maximum achievable number for a trade relation is five. The highest score is 4.125 and refers to trade between Berlin and France. Although France always appeared on Berlin's top ten list, it was not its most essential trading partner. The second highest score (3.625 points) is achieved by Hesse and France. Very close to this result, with 3.5 points, are five trade relations which have one thing in common – trade with the Netherlands. The federal states in question are Bremen, Hamburg, Hesse, Saxony-Anhalt and Thuringia.

From the perspective of foreign countries, six countries trading with each of the interior federal states have been identified. These are Italy, the United Kingdom, the Netherlands, China, France and Poland. Again, China is the only country outside Europe and the European Union, however in four cases it was one of the three most important trading partners for a federal state.

The last aspect analysed looked at whether there is a visible impact on trade between the former Allies and their occupied zones. The number of possible trade relations is 20 as Berlin and Baden-Württemberg were allocated to more than one former Ally. For 17 cases this trade relation seems to be quite important. The three remaining ones refer to trade with Russia and affect Saxony, Thuringia

and Berlin. In 16 cases, apart from the relation between Russia and Mecklenburg-Vorpommern, the traded volume was always high enough to be listed in the federal states' top ten.

The gravity model has shown that there are aspects which support its assumptions while other deny it. It can be stated that the model applied better for the exterior federal states than for the interior ones. A factor to be highlighted is the importance of trade with China and the United States despite their locations. While the United States are a member of the NATO and WTO, and a former Ally, there seems to be nothing to connect China with Germany, at least not in terms of the characteristics inspected. There is Luxembourg which does have a small GDP but, despite its proximity to Germany, it is not able to knock through the other countries. On the other hand, there is another country with a smaller GDP, Denmark, which does not appear on Germany's list of top ten trading partners but plays an important role in trade with Schleswig-Holstein which it is its direct neighbour. Austria does appear on Germany's list of top ten trading partners but, depending on the federal state, it increases its importance or it does not appear on the relevant top ten list at all. Poland increased its trade significance while its GDP was growing. On the contrary, the United Kingdom lost its position after it was known that it would no longer be a member of the EU. However, at this moment in time, it is difficult to judge whether the influencing factor is the leaving of the EU or the growing uncertainty. The dependency between Allies and their occupation zone has an influencing factor on trade which is comparable to Tinbergen's observations with regard to trade with Commonwealth countries.

Conclusion

The aim of this monograph was to analyse the foreign trade in Germany, taking into consideration the assumptions of the gravity model of trade originated by Tinbergen. Therefore, literature has been reviewed and analysed to get a theoretical background knowledge and understanding of what trade is, how it has been developing in history and how researchers tried to explain and forecast it by creating corresponding models. The same research method has been used in the second step to outline the economic and political history of Germany, providing the reader with comprehensive understanding on the background of the current position of Germany in the world trade today. Based on the knowledge gained, corresponding criteria have been deduced to be used for the analysis of the data set on foreign trade in Germany provided by the German Federal Statistical Office in order to examine whether the theoretical assumptions can be applied in practice. The key results of this monograph are as follows:

Trade is an exchange of goods and/or services between two trading partners. Ideally, it leads to a mutual benefit which results from the possibility to focus on selected areas rather than being responsible for producing everything on one's own. Trade has a long history going back to the era of Ancient Greeks. The most famous trade route is the Silk Road which connected the Chinese Empire in the East with the West that is nowadays referred to as Europe.

The idea of trade has been discussed in history by various scholars however their attitudes were dependent on the current economic situation at that time. Plato and Xenophon came very early to the conclusion that a state cannot only rely on its own output and foreign trade will positively influence its productivity. However, Aristotle noticed that the lack of trade agreements may cause injustice for one of the trading partners and therefore trade needs to be balanced. Mercantilists, for instance, preferred to only trade in one direction in order to increase their own wealth and maximise their balance of trade. On the contrary, Physiocrats considered trade as a possibility to counteract shortages, but a surplus was not required. It was even regarded as destructive.

Another finding was the development of the understanding what advantage is. Smith focused on the term "absolute advantage" which in his opinion was the only condition for trade to come into effect. However, Ricardo was convinced that trade might also happen if only one of the trading partners benefitted from it according to Smith's understanding. Ricardo's approach is called "comparative advantage" and considers a trading partner would still benefit if the production

by the other one was relatively lower in comparison with their own. Smith and Ricardo are both representatives of the British Classical School. Ricardo's concept had been further developed but not everyone agreed with it, such as Ohlin who created the Heckscher-Ohlin theorem which is still applicable for international trade today. Ohlin assumed that all countries have the same access to technology, there is no difference in taste, and the focus between two countries lies in their differences between factor endowments and commodities. It is thus a theory examining the impact of trade on factor use and factor rewards. Generally, it can be summed up that all trade models which were developed before the 1960s are static and do not consider changing technology or availability of production factors over time.

The 20th century is characterised by multiple upheavals, changing between liberal and protectionist attitudes towards trade especially in its first half. After the Second World War and the destruction of Europe, it was agreed that arrangements would be made in order to prevent anything of this kind occurring again.

One of the biggest achievements regarding foreign trade was the General Agreement on Tariffs and Trade. The GATT was a temporary agreement between certain countries, promoting trade, and it is the predecessor of the World Trade Organization. The first few rounds focused on the reduction of tariffs between several countries. Later, further measures such as anti-dumping or non-tariff ones were the main topic of the discussion. The last GATT round also considered the final creation of the World Trade Organization.

Another positive upheaval is the creation of the European Union and the euro area which was motivated by the desire to have a single market and a powerful partner when dealing with the WTO. However, the EU had to recently suffer a loss when the United Kingdom left. In 2016, the EU referendum expressed the UK citizens' will to leave the EU, and the exit came into effect in January 2020.

One of the many models originally set up to forecast trade between two countries is the gravity model of trade created by Tinbergen in the 1960s. Tinbergen, inspired by Newton's gravity model, found out that the export volume of one country is affected by various factors. His basic model considers the gross national product of both trading partners and their distance to each other. It says the bigger the GNP, the bigger the export volume, and the bigger the distance, the lower the volume. In his more detailed research, Tinbergen measured the influence of various additional factors such as adjacency, unions, with a particular focus on Commonwealth and Benelux, and the Gini coefficient. He also varied the GNP value between nominal and real data. Overall, he concluded that his model was able to explain about 64% of trade. One of his main findings was that existing trade relations such as agreements have an influence on trade volume.

When comparing the Commonwealth to the Benelux preferences, Tinbergen found out that the Commonwealth preference is statistically more important. Furthermore, when countries have semi-preferential trade relations, the export volume increases additionally by 5%. Semi-preferential trade relations were assumed for countries of the European Economic Community or the USA and Cuba, the Philippines or Venezuela. Tinbergen also confirmed that the neighbouring factor expands trade. Another finding was that the actual export volume rises more if the GNP of the exporting country increases compared to the GNP increase of the importing country. The research on the Gini coefficient has shown that the more diversified a country's production is, the higher its exports are.

Tinbergen was not the only one continuing this research based on his model. Other researchers also took their time striving for additional findings. First of all, a few amendments were made to the model itself. The GNP was replaced by the gross domestic product and the export volume was generalised by the overall trade volume of two countries. These researchers extended the model as well and considered factors such as income per capita, common language, free trade agreements, monetary agreements, bilateral and multilateral trade barriers (which can be split into direct, e.g., tariffs, and indirect e.g., trade transaction costs), history, ethnicity/nationality, trade frictions, interdependence and networks to mention the most important ones.

The gravity model of trade was invented by intuition rather than by having profound theoretical basics. It is a good addition to the Heckscher-Ohlin theorem which does not consider trade volumes. Its advanced model can predict 80–90% on the change of trade volume correctly. However, there is no consent as to the influence of borders – whether they should be treated as trade barriers or as a neutral factor.

The applicability of the trade model has been the topic taken up by various researchers. Two studies have been presented which examined foreign trade relations of one chosen German federal state. One of them investigated Baden-Württemberg. The conclusions were that, compared to Germany, Baden-Württemberg had a higher share of exports with its neighbouring country Switzerland but a lower share with Belgium, Austria, Poland and the Czech Republic which do share their borders with Germany but in different regions. An important role in trade can be seen in relation to the United States and China, both on the federal and federal state level, probably due to their above-average GDP and despite their above-average distances to Germany. The studied trade relations were examined by four approaches: 1) GDP of the trading partner and Baden-Württemberg; 2) their distance; 3) GDP of the trading partner and Baden-Württemberg and their distance (reflecting the basic model) and 4) GDP of the trading

partner and Baden-Württemberg and their distance, population size of the trading partner, EU membership and WTO membership (reflecting an advanced model). It turned out that the coefficient of determination for the basic model equals 0.906 and for the advanced one – 0.972. Based on this study, the gravity model of trade fulfils its purpose.

The second study which dealt with Rhineland-Palatinate not only examined the impact of various variables but also compared two different methodologies, the cross-sectional analysis and a panel data analysis whereas the first one should be preferred. When the impact of variables on trade was assessed, three different approaches were examined: 1) GDP per capita, distance, population size of the trading partner, 2) GDP per capita, distance, population size of the trading partner, EU membership, OECD membership, WTO membership, German-speaking country, rating of the economic order regarding liberality of the trading partner, 3) GDP per capita, distance, population size of the trading partner, rating of the economic order regarding liberality of the trading partner. It turned out that distance was a trade distractor, whereas the higher the remaining factors were, the higher they promoted trade. The calculated coefficient of determination was 0.84 for the first model which reflected the basic assumptions, whereas for the other two it was 0.86. Hence, the advanced model will again be preferred to the basic one. Another conclusion of this study is that the gravity model of trade is useful for predicting trade.

Regardless of the outcome of any studies, researchers need to remember that there is no right way when trying to find out dependencies. Furthermore, when a model is created, it might be applicable for a certain set of countries but not work for a different one.

Politics and economics are related to each other and therefore need to be regarded in combination. Germany's history is quite rich. Originating from territorial states and free cities since a German state as such did not exist in the 19th century, the German people were looking for means and opportunities to improve trade between regions. One of their main achievements was the creation of the German Customs Union. Another one was the development of a proper infrastructure which on the mainland was maintained by the railway network. This allowed an efficient transport of goods from A to B.

Despite economic instabilities, Germany was able to step up to one of the leading industrial nations mainly focusing on the export of coal, potash and manufacturing. However, it was never able to produce as much food as required to be self-sufficient but always depended on imports from abroad. The years of prosperity in the meantime were followed by setbacks such as the fall of the German Empire or the Great Depression.

During its history, Germany went through several economic systems. Starting from the desire to have a liberal market in the years of liberalism, and then replacing it with a planned economy in the years of protectionism, and vice versa. After the Second World War, Germany was divided into four occupation zones, of which three formed the Federal Republic of Germany which from then on has been promoting a Social Market Economy. The remaining one which functioned as a separate state, the German Democratic Republic, was governed under the Soviet power as a planned economy in line with the rest of the Soviet bloc.

40 years later, both German states were united. The German Democratic Republic was integrated into the Federal Republic and analogically split into several federal states. The German Basic Law governs the division of authorities between the federal and federal state level, which also includes the topic of trade. Therefore, the German Federal Statistical Office keeps publishing trade statistics not only on the federal level but also for each individual federal state. This in turn allows the examination of the German trade structure and its trading partners on both levels in order to see whether the assumptions of the gravity model of trade can be applied.

Overall, Germany is nowadays again one of the leading industrial nations. Its roots for success can be found in history which laid the foundations for its flourishing manufacturing economy and its expertise in niche areas such as the pharmaceutical industry. Germany is a member of several associations and unions of which the most important ones for trade are the World Trade Organization, the European Union and the euro area.

When Germany's trade statistics are reviewed, the impression is given that the trade situation is very stable. Its top ten trading partners have not changed and there is hardly any fluctuation in terms of their relative shares in the overall trade volume. To better assess the relevancy of the gravity model, a point model has been introduced which evaluates a pre-defined set of conditions which are the "GDP of trade relation" based on "GDP of base country" and "GDP of trading partner", "distance", "adjacent region" (not applicable for interior federal states), "EU (membership)", "monetary union" and "former occupation zone" (applicable for the federal state level). The first conclusion is that there are relevant differences between the federal level and the individual federal states.

Germany's top ten trading partners in 2016–2020 were China, the United States, the Netherlands, France, Italy, Poland, the United Kingdom, Switzerland, Austria and the Czech Republic. While China remained first throughout the years, the USA, the Netherlands and France shared between each other the second, third and fourth position. These four countries accounted for about 30% of Germany's foreign trade volume whereas the remaining six achieved a share of

about 28%, so that in total the share adds up to about 58–60%. From the top ten list, six countries are Germany's neighbours and seven members of the European Union when including the United Kingdom, but only four of them have the euro as their currency in common. According to the point system created, the country most favourable to trade with would be France achieving a full score if Germany's capital Berlin was more centrally located. However, France was only second in 2016 and fourth in the remaining years. When considering the EU countries, a much better position was achieved by the Netherlands (2nd in 2017, 2018 and 2020, 3rd in 2019 and 4th in 2016) despite its lower GDP compared to France.

With reference to China and the United States, their relevancy is surprising when taking the assumptions of the gravity model as a guideline. Both countries are characterised by a much higher GDP compared to the others, but at the same time are the farthest away from Germany and are not associated with any local union. The influence of the USA may still be explained by their political involvement as an Ally after the Second World War and their actions undertaken for a quick European recovery. However, the intense trade relation with China remains inexplicable by the means of the gravity model. Its significance might be deduced as an outcome of history going back to the years when the Silk Road was created but this approach would not be quite pertinent.

On the other hand, adjacent countries with a comparable lower GDP such as Denmark or Luxembourg are not mentioned on the top ten list despite their proximity which in this case proves the accuracy of the trade model discussed. Another example is Poland whose disproportionate growth of GDP has led with immediate effect to its progressive involvement and relevancy in German trade. Being 7th in 2016–2018 and contributing to less than 5.0% of Germany's foreign trade volume, in 2019 and 2020, it surpassed the 5.0% share coming sixth at first and eventually fifth. A contrary effect could be observed with the United Kingdom. After the announcement of its will to leave the European Union, trade relations with Germany have weakened. The United Kingdom, starting from the fifth position with a share of 5.6%, from 2016 onwards has been dropping its position one by one passing the 5.0% mark in 2019 for the first time. However, it is difficult to judge from this point in time whether the diminishing influence is a temporary phenomenon or a long-term effect. Additionally, finding the real causal relation is not very straightforward. The change in trade might have been caused by Brexit itself. It could have also been a side effect resulting from the uncertainties arising in trade regulations which were one of the topics needed to be negotiated but, in the end, not clearly agreed on.

The federal state level shows regional peculiarities and differences. First of all, countries adjacent to Germany that have a smaller GDP are not mentioned on

the federal level, but they are able to break through, joining the group of the federal states' most important trading partners. This is true for Denmark in relation to Mecklenburg-Vorpommern (third or fourth) and Schleswig-Holstein (first or second). Additionally, there are also countries mentioned in the overall German statistics, but with regard to a particular federal state they are strategically more important than on the federal level. An example for this is Austria in relation to Bavaria: in reference to Germany, Austria was eighth (ninth in 2020), whereas in reference to Bavaria it was third (second in 2016). This also applies for Poland (fifth to seventh on the federal level) with regard to trade with Brandenburg (usually first apart from 2018 when it was second) and Mecklenburg-Vorpommern (first in 2017 and 2018 and second the remaining years). Other examples worth mentioning are France and the Netherlands. France was the most important trading partner for Rhineland-Palatinate and Saarland but mostly fourth on the federal level. Looking at the Netherlands, on the federal level they were second to fourth, depending on the year, but first in relation to trade with Lower Saxony and North Rhine-Westphalia.

On the other hand, there are countries which are completely new to the list. It became the most visible for Hamburg and refers to trade with the United Arab Emirates, Turkey and India, but it also applies for Japan with Hesse, Norway with Lower Saxony, Finland with Mecklenburg-Vorpommern and Slovakia with Saarland. Observations have also been made from the opposite perspective in that countries generally are essential but not for a particular federal state. Taking China as Germany's most important trading partner, it is less strategically important for Brandenburg (fifth to tenth), Mecklenburg-Vorpommern (fifth to eighth), Rhineland-Palatinate (fourth to eighth) and Saarland (sixth to eighth). Additionally, on the federal state level, China was only first referring to trade with Berlin (in 2018 and 2019), Hamburg (in 2020), Saxony (in 2016–2020), Schleswig-Holstein (in 2016, 2019 and 2020) and Thuringia (in 2016–2018 and 2020). Also, when we examine the Netherlands which were second in three years out of five on the federal level, the importance of their trade is lower with Bavaria (eighth but mainly ninth), Bremen (fifth to seventh), Saarland (seventh but mainly eighth), Saxony (fifth to ninth) and Thuringia (fourth to seventh). In most of these cases, foreign countries win or lose their significance due to proximity.

Another impressive finding is that former political arrangements as the occupation zones still have a local impact on trade. This is comparable to Tinbergen's conclusion about unions. In the study conducted, this is true for 17 out of 20 trade relations. The remaining ones all refer to trade with Russia and affect Saxony, Thuringia and Berlin. For half of the cases, it turned out that the former Ally can be considered as one of the three most important trading partners

whereas for the rest of trade relations, the trading partners were always on the federal states' list of top ten trading partners. The only exception refers to trade between Mecklenburg-Vorpommern and Russia in 2020.

All in all, the gravity model of trade can be mostly applied when analysing the German trade structure but needs to be treated with caution. It indicates which country Germany or its federal states are predisposed to trade with, but not in all cases do the indicated countries appear to be the most important ones. From a research perspective, the applicability of the trade model has been examined, with a broader view taken on all federal states and comparisons made between them and the situation on the federal level. Additionally, which was new, a historical factor was considered, i.e., the former Allies and their occupation zones and whether this relationship still has impact on trade 60 years later.

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Appendix

Appendix A. NATO member states and date of entry

Albania (2009)
Belgium (1949)
Bulgaria (2004)
Canada (1949)
Croatia (2009)
Czech Republic (1999)
Denmark (1949)
Estonia (2004)
France (1949)
Germany (1955)
Greece (1952)
Hungary (1999)
Iceland (1949)
Italy (1949)
Latvia (2004)
Lithuania (2004)
Luxembourg (1949)
Montenegro (2017)
Netherlands (1949)
North Macedonia (2020)
Norway (1949)
Poland (1999)
Portugal (1949)
Romania (2004)
Slovakia (2004)
Slovenia (2004)
Spain (1982)
Turkey (1952)
The United Kingdom (1949)
The United States (1949)

Source: NATO (2021). *What is NATO? https://www.nato.int/nato-welcome/index.html (accessed 27.05.2021).*

Appendix B. OEEC original member states

Austria
Belgium
Denmark
France
Greece
Iceland
Ireland
Italy
Luxembourg
Netherlands
Norway
Portugal
Sweden
Switzerland
Turkey
United Kingdom, and
Western Germany
(counted as two since it
was represented by 1- the
American and British
occupation zone and
2- the French occupation
zone)

Source: OECD (2021). *Organisation for European Economic Co-operation.* https://www.oecd.org/general/organisationforeuropeaneconomicco-operation.htm (accessed 27.05.2021).

Appendix C. Comparison of results for the federal state level with the federal level (2016–2020)

Region	Average GDP p.a. (in billion EUR)	Share of Germany's GDP	Neighbouring countries	Top 3 trading partners	Share of top 3 trading partners	Top 10 trading partners	Share of top 10 trading partners
FEDERAL LEVEL							
Germany	3,300	100%	Austria, Belgium, Czech Republic, Denmark, France, Luxembourg, Netherlands, Poland, Switzerland	China USA (Netherlands) (France)	23.2% — 25.0%	China, USA, Netherlands, France, Italy, Poland, United Kingdom, Switzerland, Austria, Czech Republic	58.3% — 59.6%
FEDERAL STATE LEVEL – EXTERIOR STATES							
Baden-Württemberg	502	15.2%	France, Switzerland	USA Switzerland (China) (Netherlands) (France)	25.3% — 27.0%	USA, Switzerland, China, Netherlands, France, Italy, Austria, United Kingdom, (Belgium), (Ireland), (Czech Republic), (Poland), (Hungary)	60.4% — 62.3%
Bavaria	609	18.5%	Austria, Czech Republic	USA China Austria	25.7% — 26.3%	USA, China, Austria, Italy, Czech Republic, France, Poland, United Kingdom, Netherlands, Hungary	61.4% — 62.8%
Brandenburg	71	2.2%	Poland	Poland Russia (USA) (France)	34.9% — 38.1%	Poland, Russia, USA, France, Netherlands, China, United Kingdom, Italy, Czech Republic, (Spain), (Austria)	68.7% — 69.2%

Region	Average GDP p.a. (in billion EUR)	Share of Germany's GDP	Neighbouring countries	Top 3 trading partners	Share of top 3 trading partners	Top 10 trading partners	Share of top 10 trading partners
Mecklenburg-Vorpommern	44	1.3%	Poland	Netherlands Poland (Denmark) (Finland) (Russia)	23.6% — 25.2%	Netherlands, Poland, Denmark, Finland, Sweden, France, China, United Kingdom, (Russia), (USA),	54.7% — 59.1%
Lower Saxony	293	8.9%	Netherlands	Netherlands China (Poland) (United Kingdom)	21.2% — 24.7%	Netherlands, China, Poland, United Kingdom, France, USA, Italy, Czech Republic, Spain, (Norway), (Belgium)	54.7% — 57.1%
North Rhine-Westphalia	687	20.8%	Belgium, Netherlands	Netherlands China France	29.4% — 31.7%	Netherlands, China, France, Belgium, United Kingdom, USA, Italy, Poland, Austria, Spain	62.6% — 63.9%
Rhineland-Palatinate	141	4.3%	France, Luxembourg	France USA (Netherlands) (Italy)	24.5% — 25.9%	France, USA, Netherlands, Italy, Belgium, China, United Kingdom, Spain, Poland, (Ireland), (Austria)	60.5% — 63.0%
Saarland	35	1.1%	France, Luxembourg	France Spain (United Kingdom) (USA)	34.7% — 35.8%	France, Spain, United Kingdom, USA, Italy, Poland, China, Netherlands, Austria, (Belgium), (Slovakia)	67.1% — 67.8%

Region	Average GDP p.a. (in billion EUR)	Share of Germany's GDP	Neighbouring countries	Top 3 trading partners	Share of top 3 trading partners	Top 10 trading partners	Share of top 10 trading partners
Saxony	123	3.7%	Czech Republic, Poland	China Czech Republic USA	30.1% — 33.4%	China, Czech Republic, USA, Poland, United Kingdom, France, Netherlands, Italy, Austria, (Switzerland), (Spain)	62.5% — 64.2%
Schleswig-Holstein	93	2.8%	Denmark	China Denmark USA	24.8% — 26.8%	China, Denmark, USA, Netherlands, Italy, United Kingdom, Poland, Sweden, France, (Belgium), (Ireland)	58.5% — 61.3%
FEDERAL STATE LEVEL – INTERIOR STATES							
Berlin	145	4.4%	—	China (USA) (Poland) (Netherlands) (Italy)	24.6% — 29.8%	China, USA, Poland, Netherlands, Italy, Switzerland, France, United Kingdom, Austria, (Czech Republic), (Spain)	59.7% — 64.8%
Bremen	32	1.0%	—	USA (France) (United Kingdom) (China)	27.3% — 29.5%	USA, France, United Kingdom, China, Belgium, Netherlands, Italy, Poland, (Russia), (Spain), (Austria), (Czech Republic)	56.3% — 58.3%
Hamburg	117	3.6%	—	France China USA	32.5% — 40.9%	France, China, USA, Netherlands, United Kingdom, Poland, Italy, (United Arab Emirates), (Russia), (Turkey), (Belgium), (Denmark), (India)	57.7% — 66.3%

Region	Average GDP p.a. (in billion EUR)	Share of Germany's GDP	Neighbouring countries	Top 3 trading partners	Share of top 3 trading partners	Top 10 trading partners	Share of top 10 trading partners
Hesse	283	8.6%	—	USA China (France) (Netherlands)	25.5% — 27.6%	USA, China, France, Netherlands, Switzerland, United Kingdom, Italy, Belgium, (Russia), (Poland), (Japan), (Austria)	58.6% — 60.0%
Saxony-Anhalt	61	1.9%	—	Russia Poland Netherlands	28.0% — 31.6%	Russia, Poland, Netherlands, China, France, Austria, Czech Republic, United Kingdom, Italy, Belgium	64.6% — 67.8%
Thuringia	61	1.9%	—	China United Kingdom Poland	21.2% — 22.7%	China, United Kingdom, Poland, Netherlands, France, Italy, USA, Austria, Czech Republic, (Hungary), (Switzerland), (Spain)	59.7% — 61.0%

Note. If countries are in brackets, it means they were not top three / top ten throughout the entire period under analysis.

Source: Author's own elaboration based on: FW GbR. (2021). *Bundesrepublik Deutschland*. https://www.kinderweltreise.de/fileadmin/_processed_/3/e/csm_deutschland_bundeslaender_096234eaa7.png (accessed 1.06.2021); Statistische Ämter des Bundes und der Länder (2021). *Bruttoinlandsprodukt bis 2020 – in jeweiligen Preisen – nach Bundesländern* (dataset). https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung/bip (accessed 30.03.2021); Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021); Statistisches Bundesamt (Destatis) (2021b). *51000–0003 Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0003&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021).

Appendix D. Overview of results

Federal level

	Trade relation				GDP (billion USD)		GDP points								Points	
No.	Base country	Foreign country	Top 3	Top 10	Base country2	Foreign country3	Base country4	Foreign country5	GDP points	Distance (km)	Distance points	Adjacent region	EU	Monetary union	Former occupation zone	Total	Max
1	Germany	China	1	1	3,744	12,930	1	1	1	7,356.15	0.25	0	0	0	0	**1.25**	6
2	Germany	USA	1	1	3,744	20,062	1	1	1	6,711.37	0.25	0	0	0	1	**2.25**	6
3	Germany	Netherlands	0	1	3,744	860	1	0.75	0.875	577.42	0.75	1	1	1	0	**4.625**	6
4	Germany	France	0	1	3,744	2,642	1	1	1	878.05	0.5	1	1	1	1	**5.5**	6
5	Germany	Italy	0	1	3,744	1,983	1	0.75	0.875	1,184.10	0.5	0	1	1	0	**3.375**	6
6	Germany	Poland	0	1	3,744	546	1	0.5	0.75	516.34	1	1	1	0	0	**3.75**	6
7	Germany	United Kingdom	0	1	3,744	2,763	1	1	1	934.82	0.5	0	0.5	0	1	**3**	6
8	Germany	Switzerland	0	1	3,744	690	1	0.5	0.75	753.12	0.75	1	0	0	0	**2.5**	6
9	Germany	Austria	0	1	3,744	428	1	0.5	0.75	523.63	0.75	1	1	1	0	**4.5**	6
10	Germany	Czech Republic	0	1	3,744	229	1	0.25	0.625	279.74	1	1	1	0	0	**3.625**	6

Exterior federal states

	Trade relation				GDP (billion USD)		GDP points								Points	
No.	Base country	Foreign country	Top 3	Top 10	Base country2	Foreign country3	Base country4	Foreign country5	GDP points	Distance (km)	Distance points	Adjacent region	EU	Monetary union	Former occupation zone	Total	Max
1	Baden-Württemberg	USA	1	1	570	20,062	0.5	1	0.75	6,626.54	0.25	0	0	0	1	**2**	6
2	Baden-Württemberg	Switzerland	1	1	570	690	0.5	0.5	0.5	241.08	1	1	0	0	0	**2.5**	6
3	Baden-Württemberg	China	0	1	570	12,930	0.5	1	0.75	7,845.17	0.25	0	0	0	0	**1**	6
4	Baden-Württemberg	Netherlands	0	1	570	860	0.5	0.75	0.625	501.44	1	0	1	1	0	**3.625**	6
5	Baden-Württemberg	France	0	1	570	2,642	0.5	1	0.75	499.87	1	1	1	1	1	**5.75**	6
6	Baden-Württemberg	Italy	0	1	570	1,983	0.5	0.75	0.625	808.60	0.5	0	1	1	0	**3.125**	6
7	Baden-Württemberg	Austria	0	1	570	428	0.5	0.5	0.5	533.55	0.75	0	1	1	0	**3.25**	6
8	Baden-Württemberg	United Kingdom	0	1	570	2,763	0.5	1	0.75	730.94	0.75	0	0.5	0	0	**2**	6
9	Baden-Württemberg	Belgium	0	0	570	514	0.5	0.5	0.5	416.09	1	0	1	1	0	**3.5**	6
10	Baden-Württemberg	Ireland	0	0	570	352	0.5	0.25	0.375	1,188.15	0.5	0	1	1	0	**2.875**	6
11	Baden-Württemberg	Czech Republic	0	0	570	229	0.5	0.25	0.375	405.88	1	0	1	0	0	**2.375**	6
12	Baden-Württemberg	Poland	0	0	570	546	0.5	0.5	0.5	918.91	0.5	0	1	0	0	**2**	6
13	Baden-Württemberg	Hungary	0	0	570	149	0.5	0.25	0.375	744.81	0.75	0	1	0	0	**2.125**	6
14	Bavaria	USA	1	1	691	20,062	0.75	1	0.875	6,816.38	0.25	0	0	0	1	**2.125**	6
15	Bavaria	China	1	1	691	12,930	0.75	1	0.875	7,750.95	0.25	0	0	0	0	**1.125**	6
16	Bavaria	Austria	1	1	691	428	0.75	0.5	0.625	355.72	1	1	1	1	0	**4.625**	6
17	Bavaria	Italy	0	1	691	1,983	0.75	0.75	0.75	698.34	0.75	0	1	1	0	**3.5**	6
18	Bavaria	Czech Republic	0	1	691	229	0.75	0.25	0.5	299.84	1	1	1	0	0	**3.5**	6
19	Bavaria	France	0	1	691	2,642	0.75	1	0.875	683.92	0.75	0	1	1	0	**3.625**	6
20	Bavaria	Poland	0	1	691	546	0.75	0.5	0.625	810.30	0.5	0	1	0	0	**2.125**	6
21	Bavaria	United Kingdom	0	1	691	2,763	0.75	1	0.875	920.31	0.5	0	0.5	0	0	**1.875**	6
22	Bavaria	Netherlands	0	1	691	860	0.75	0.75	0.75	668.69	0.75	0	1	1	0	**3.5**	6
23	Bavaria	Hungary	0	1	691	149	0.75	0.25	0.5	561.63	0.75	0	1	0	0	**2.25**	6

	Trade relation				GDP (billion USD)		GDP points									Points	
No.	Base country	Foreign country	Top 3	Top 10	Base country2	Foreign country3	Base country4	Foreign country5	GDP points	Distance (km)	Distance points	Adjacent region	EU	Monetary union	Former occupation zone	Total	Max
24	Brandenburg	Poland	1	1	81	546	0.25	0.5	0.375	539.84	0.75	1	1	0	0	**3.125**	6
25	Brandenburg	Russia	1	1	81	1,555	0.25	0.75	0.5	1,635.11	0.25	0	0	0	1	**1.75**	6
26	Brandenburg	USA	1	1	81	20,062	0.25	1	0.625	6,696.52	0.25	0	0	0	0	**0.875**	6
27	Brandenburg	France	0	1	81	2,642	0.25	1	0.625	851.06	0.5	0	1	1	0	**3.125**	6
28	Brandenburg	Netherlands	0	1	81	860	0.25	0.75	0.5	554.58	0.75	0	1	1	0	**3.25**	6
29	Brandenburg	China	0	1	81	12,930	0.25	1	0.625	7,383.27	0.25	0	0	0	0	**0.875**	6
30	Brandenburg	United Kingdom	0	1	81	2,763	0.25	1	0.625	911.08	0.5	0	0.5	0	0	**1.625**	6
31	Brandenburg	Italy	0	1	81	1,983	0.25	0.75	0.5	1,169.06	0.5	0	1	1	0	**3**	6
32	Brandenburg	Spain	0	0	81	1,340	0.25	0.75	0.5	1,842.83	0.25	0	1	1	0	**2.75**	6
33	Brandenburg	Czech Republic	0	1	81	229	0.25	0.25	0.25	273.71	1	0	1	0	0	**2.25**	6
34	Brandenburg	Austria	0	0	81	428	0.25	0.5	0.375	521.64	0.75	0	1	1	0	**3.125**	6
35	Mecklenburg-Vorpommern	Netherlands	1	1	50	860	0.25	0.75	0.5	458.19	1	0	1	1	0	**3.5**	6
36	Mecklenburg-Vorpommern	Poland	1	1	50	546	0.25	0.5	0.375	660.85	0.75	1	1	0	0	**3.125**	6
37	Mecklenburg-Vorpommern	Denmark	0	1	50	338	0.25	0.25	0.25	239.35	1	0	1	0	0	**2.25**	6
38	Mecklenburg-Vorpommern	Finland	0	1	50	260	0.25	0.25	0.25	1,093.15	0.5	0	1	1	0	**2.75**	6
39	Mecklenburg-Vorpommern	Russia	0	0	50	1,555	0.25	0.75	0.5	1,690.00	0.25	0	0	0	1	**1.75**	6
40	Mecklenburg-Vorpommern	Sweden	0	1	50	536	0.25	0.5	0.375	753.51	0.75	0	1	0	0	**2.125**	6
41	Mecklenburg-Vorpommern	France	0	1	50	2,642	0.25	1	0.625	823.30	0.5	0	1	1	0	**3.125**	6
42	Mecklenburg-Vorpommern	China	0	1	50	12,930	0.25	1	0.625	7,392.93	0.25	0	0	0	0	**0.875**	6
43	Mecklenburg-Vorpommern	USA	0	0	50	20,062	0.25	1	0.625	6,538.08	0.25	0	0	0	0	**0.875**	6
44	Mecklenburg-Vorpommern	United Kingdom	0	1	50	2,763	0.25	1	0.625	816.75	0.5	0	0.5	0	0	**1.625**	6
45	Mecklenburg-Vorpommern	Italy	0	1	50	1,983	0.25	0.75	0.5	1,307.61	0.5	0	1	1	0	**3**	6
46	Lower Saxony	Netherlands	1	1	332	860	0.25	0.75	0.5	329.10	1	1	1	1	0	**4.5**	6
47	Lower Saxony	China	1	1	332	12,930	0.25	1	0.625	7,566.32	0.25	0	0	0	0	**0.875**	6
48	Lower Saxony	Poland	0	1	332	546	0.25	0.5	0.375	765.56	0.75	0	1	0	0	**2.125**	6
49	Lower Saxony	United Kingdom	0	1	332	2,763	0.25	1	0.625	685.42	0.75	0	0.5	0	1	**2.875**	6
50	Lower Saxony	France	0	1	332	2,642	0.25	1	0.625	651.13	0.75	0	1	1	0	**3.375**	6
51	Lower Saxony	USA	0	1	332	20,062	0.25	1	0.625	6,493.41	0.25	0	0	0	0	**0.875**	6
52	Lower Saxony	Italy	0	1	332	1,983	0.25	0.75	0.5	1,184.09	0.5	0	1	1	0	**3**	6
53	Lower Saxony	Norway	0	0	332	401	0.25	0.5	0.375	840.51	0.5	0	0	0	0	**0.875**	6
54	Lower Saxony	Czech Republic	0	1	332	229	0.25	0.25	0.25	413.29	1	0	1	0	0	**2.25**	6
55	Lower Saxony	Spain	0	1	332	1,340	0.25	0.75	0.5	1,676.73	0.25	0	1	1	0	**2.75**	6
56	Lower Saxony	Belgium	0	0	332	514	0.25	0.5	0.375	408.79	1	0	1	1	0	**3.375**	6
57	North Rhine-Westphalia	Netherlands	1	1	780	860	0.75	0.75	0.75	182.04	1	1	1	1	0	**4.75**	6
58	North Rhine-Westphalia	China	1	1	780	12,930	0.75	1	0.875	7,805.14	0.25	0	0	0	0	**1.125**	6
59	North Rhine-Westphalia	France	1	1	780	2,642	0.75	1	0.875	411.25	1	0	1	1	0	**3.875**	6
60	North Rhine-Westphalia	Belgium	0	1	780	514	0.75	0.5	0.625	174.77	1	1	1	1	0	**4.625**	6
61	North Rhine-Westphalia	United Kingdom	0	1	780	2,763	0.75	1	0.875	482.83	1	0	0.5	0	1	**3.375**	6
62	North Rhine-Westphalia	USA	0	1	780	20,062	0.75	1	0.875	6,357.76	0.25	0	0	0	0	**1.125**	6
63	North Rhine-Westphalia	Italy	0	1	780	1,983	0.75	0.75	0.75	1,125.81	0.5	0	1	1	0	**3.25**	6
64	North Rhine-Westphalia	Poland	0	1	780	546	0.75	0.5	0.625	984.84	0.5	0	1	0	0	**2.125**	6
65	North Rhine-Westphalia	Austria	0	1	780	428	0.75	0.5	0.625	766.33	0.5	0	1	1	0	**3.125**	6
66	North Rhine-Westphalia	Spain	0	1	780	1,340	0.75	0.75	0.75	1,447.37	0.5	0	1	1	0	**3.25**	6
67	Rhineland-Palatinate	France	1	1	160	2,642	0.25	1	0.625	446.45	1	1	1	1	1	**5.625**	6
68	Rhineland-Palatinate	USA	1	1	160	20,062	0.25	1	0.625	6,509.20	0.25	0	0	0	0	**0.875**	6
69	Rhineland-Palatinate	Netherlands	0	1	160	860	0.25	0.75	0.5	353.79	1	0	1	1	0	**3.5**	6
70	Rhineland-Palatinate	Italy	0	1	160	1,983	0.25	0.75	0.5	958.93	0.5	0	1	1	0	**3**	6
71	Rhineland-Palatinate	Belgium	0	1	160	514	0.25	0.5	0.375	293.46	1	0	1	1	0	**3.375**	6
72	Rhineland-Palatinate	China	0	1	160	12,930	0.25	1	0.625	7,810.51	0.25	0	0	0	0	**0.875**	6
73	Rhineland-Palatinate	Ireland	0	0	160	352	0.25	0.25	0.25	1,065.47	0.5	0	1	1	0	**2.75**	6
74	Rhineland-Palatinate	United Kingdom	0	1	160	2,763	0.25	1	0.625	616.21	0.75	0	0.5	0	0	**1.875**	6
75	Rhineland-Palatinate	Spain	0	1	160	1,340	0.25	0.75	0.5	1,416.20	0.5	0	1	1	0	**3**	6
76	Rhineland-Palatinate	Poland	0	1	160	546	0.25	0.5	0.375	921.60	0.5	0	1	0	0	**1.875**	6
77	Rhineland-Palatinate	Austria	0	0	160	428	0.25	0.5	0.375	622.09	0.75	0	1	1	0	**3.125**	6

	Trade relation				GDP (billion USD)		GDP points									Points	
No.	Base country	Foreign country	Top 3	Top 10	Base country2	Foreign country3	Base country4	Foreign country5	GDP points	Distance (km)	Distance points	Adjacent region	EU	Monetary union	Former occupation zone	Total	Max
78	Saarland	France	1	1	40	2,642	0.25	1	0.625	342.03	1	1	1	1	1	**5.625**	6
79	Saarland	Spain	1	1	40	1,340	0.25	0.75	0.5	1,291.61	0.5	0	1	1	0	**3**	6
80	Saarland	United Kingdom	0	1	40	2,763	0.25	1	0.625	567.70	0.75	0	0.5	0	0	**1.875**	6
81	Saarland	USA	0	1	40	20,062	0.25	1	0.625	6,461.74	0.25	0	0	0	0	**0.875**	6
82	Saarland	Italy	0	1	40	1,983	0.25	0.75	0.5	921.19	0.5	0	1	1	0	**3**	6
83	Saarland	Poland	0	1	40	546	0.25	0.5	0.375	1,038.05	0.5	0	1	0	0	**1.875**	6
84	Saarland	China	0	1	40	12,930	0.25	1	0.625	7,934.92	0.25	0	0	0	0	**0.875**	6
85	Saarland	Netherlands	0	1	40	860	0.25	0.75	0.5	379.71	1	0	1	1	0	**3.5**	6
86	Saarland	Austria	0	1	40	428	0.25	0.5	0.375	695.71	0.75	0	1	1	0	**3.125**	6
87	Saarland	Belgium	0	0	40	514	0.25	0.5	0.375	261.65	1	0	1	1	0	**3.375**	6
88	Saarland	Slovakia	0	0	40	99	0.25	0.25	0.25	750.30	0.75	0	1	1	0	**3**	6
89	Saxony	China	1	1	140	12,930	0.25	1	0.625	7,432.55	0.25	0	0	0	0	**0.875**	6
90	Saxony	Czech Republic	1	1	140	229	0.25	0.25	0.25	117.41	1	1	1	0	0	**3.25**	6
91	Saxony	USA	1	1	140	20,062	0.25	1	0.625	6,805.51	0.25	0	0	0	0	**0.875**	6
92	Saxony	Poland	0	1	140	546	0.25	0.5	0.375	518.22	1	1	1	0	0	**3.375**	6
93	Saxony	United Kingdom	0	1	140	2,763	0.25	1	0.625	967.08	0.5	0	0.5	0	0	**1.625**	6
94	Saxony	France	0	1	140	2,642	0.25	1	0.625	849.40	0.5	0	1	1	0	**3.125**	6
95	Saxony	Netherlands	0	1	140	860	0.25	0.75	0.5	626.71	0.75	0	1	1	0	**3.25**	6
96	Saxony	Italy	0	1	140	1,983	0.25	0.75	0.5	1,022.72	0.5	0	1	1	0	**3**	6
97	Saxony	Austria	0	1	140	428	0.25	0.5	0.375	368.56	1	0	1	1	0	**3.375**	6
98	Saxony	Switzerland	0	0	140	690	0.25	0.5	0.375	646.66	0.75	0	0	0	0	**1.125**	6
99	Saxony	Spain	0	0	140	1,340	0.25	0.75	0.5	1,789.31	0.25	0	1	1	0	**2.75**	6
100	Schleswig-Holstein	China	1	1	106	12,930	0.25	1	0.625	7,414.49	0.25	0	0	0	0	**0.875**	6
101	Schleswig-Holstein	Denmark	1	1	106	338	0.25	0.25	0.25	216.00	1	1	1	0	0	**3.25**	6
102	Schleswig-Holstein	USA	1	1	106	20,062	0.25	1	0.625	6,430.46	0.25	0	0	0	0	**0.875**	6
103	Schleswig-Holstein	Netherlands	0	1	106	860	0.25	0.75	0.5	410.00	1	0	1	1	0	**3.5**	6
104	Schleswig-Holstein	Italy	0	1	106	1,983	0.25	0.75	0.5	1,393.11	0.5	0	1	1	0	**3**	6
105	Schleswig-Holstein	United Kingdom	0	1	106	2,763	0.25	1	0.625	757.91	0.75	0	0.5	0	1	**2.875**	6
106	Schleswig-Holstein	Poland	0	1	106	546	0.25	0.5	0.375	758.24	0.75	0	1	0	0	**2.125**	6
107	Schleswig-Holstein	Sweden	0	1	106	536	0.25	0.5	0.375	735.98	0.75	0	1	0	0	**2.125**	6
108	Schleswig-Holstein	France	0	1	106	2,642	0.25	1	0.625	810.59	0.5	0	1	1	0	**3.125**	6
109	Schleswig-Holstein	Belgium	0	0	106	514	0.25	0.5	0.375	549.13	0.75	0	1	1	0	**3.125**	6
110	Schleswig-Holstein	Ireland	0	0	106	352	0.25	0.25	0.25	1,078.55	0.5	0	1	1	0	**2.75**	6

Interior federal states

	Trade relation				GDP (billion USD)		GDP points									Points	
No.	Base country	Foreign country	Top 3	Top 10	Base country2	Foreign country3	Base country4	Foreign country5	GDP points	Distance (km)	Distance points	Adjacent region	EU	Monetary union	Former occupation zone	Total	Max
1	Berlin	China	1	1	164	12,930	0.25	1	0.625	7356.15	0.25	0	0	0	0	**0.875**	5
2	Berlin	USA	0	1	164	20,062	0.25	1	0.625	6711.37	0.25	0	0	0	1	**1.875**	5
3	Berlin	Poland	0	1	164	546	0.25	0.5	0.375	516.34	1	0	1	0	0	**2.375**	5
4	Berlin	Netherlands	0	1	164	860	0.25	0.75	0.5	577.42	0.75	0	1	1	0	**3.25**	5
5	Berlin	Italy	0	1	164	1,983	0.25	0.75	0.5	1184.1	0.5	0	1	1	0	**3**	5
6	Berlin	Switzerland	0	1	164	690	0.25	0.5	0.375	753.12	0.75	0	0	0	0	**1.125**	5
7	Berlin	France	0	1	164	2,642	0.25	1	0.625	878.05	0.5	0	1	1	1	**4.125**	5
8	Berlin	United Kingdom	0	1	164	2,763	0.25	1	0.625	934.82	0.5	0	0.5	0	1	**2.625**	5
9	Berlin	Austria	0	1	164	428	0.25	0.5	0.375	523.63	0.75	0	1	1	0	**3.125**	5
10	Berlin	Czech Republic	0	0	164	229	0.25	0.25	0.25	279.74	1	0	1	0	0	**2.25**	5
11	Berlin	Spain	0	0	164	1,340	0.25	0.75	0.5	1869.72	0.25	0	1	1	0	**2.75**	5

	Trade relation				GDP (billion USD)		GDP points									Points	
No.	Base country	Foreign country	Top 3	Top 10	Base country2	Foreign country3	Base country4	Foreign country5	GDP points	Distance (km)	Distance points	Adjacent region	EU	Monetary union	Former occupation zone	Total	Max
12	Bremen	USA	1	1	37	20,062	0.25	1	0.625	6404.73	0.25	0	0	0	1	**1.875**	5
13	Bremen	France	0	1	37	2,642	0.25	1	0.625	651.01	0.75	0	1	1	0	**3.375**	5
14	Bremen	United Kingdom	0	1	37	2,763	0.25	1	0.625	634.57	0.75	0	0.5	0	0	**1.875**	5
15	Bremen	China	0	1	37	12,930	0.25	1	0.625	7568.12	0.25	0	0	0	0	**0.875**	5
16	Bremen	Belgium	0	1	37	514	0.25	0.5	0.375	392.98	1	0	1	1	0	**3.375**	5
17	Bremen	Netherlands	0	1	37	860	0.25	0.75	0.5	275.1	1	0	1	1	0	**3.5**	5
18	Bremen	Russia	0	0	37	1,555	0.25	0.75	0.5	1873.65	0.25	0	0	0	0	**0.75**	5
19	Bremen	Italy	0	1	37	1,983	0.25	0.75	0.5	1273.84	0.5	0	1	1	0	**3**	5
20	Bremen	Poland	0	1	37	546	0.25	0.5	0.375	827.18	0.5	0	1	0	0	**1.875**	5
21	Bremen	Spain	0	0	37	1,340	0.25	0.75	0.5	1694.64	0.25	0	1	1	0	**2.75**	5
22	Bremen	Austria	0	0	37	428	0.25	0.5	0.375	759.07	0.75	0	1	1	0	**3.125**	5
23	Bremen	Czech Republic	0	0	37	229	0.25	0.25	0.25	510.37	1	0	1	0	0	**2.25**	5
24	Hamburg	France	1	1	133	2,642	0.25	1	0.625	744.96	0.75	0	1	1	0	**3.375**	5
25	Hamburg	China	1	1	133	12,930	0.25	1	0.625	7473.33	0.25	0	0	0	0	**0.875**	5
26	Hamburg	USA	1	1	133	20,062	0.25	1	0.625	6455.81	0.25	0	0	0	0	**0.875**	5
27	Hamburg	United Arab Emirate	0	0	133	396	0.25	0.25	0.25	4889.64	0.25	0	0	0	0	**0.5**	5
28	Hamburg	Netherlands	0	1	133	860	0.25	0.75	0.5	365.94	1	0	1	1	0	**3.5**	5
29	Hamburg	United Kingdom	0	1	133	2,763	0.25	1	0.625	723.43	0.75	0	0.5	0	1	**2.875**	5
30	Hamburg	Russia	0	0	133	1,555	0.25	0.75	0.5	1781.58	0.25	0	0	0	0	**0.75**	5
31	Hamburg	Poland	0	1	133	546	0.25	0.5	0.375	752.57	0.75	0	1	0	0	**2.125**	5
32	Hamburg	Turkey	0	0	133	817	0.25	0.75	0.5	2291.14	0.25	0	0	0	0	**0.75**	5
33	Hamburg	Belgium	0	0	133	514	0.25	0.5	0.375	487.86	1	0	1	1	0	**3.375**	5
34	Hamburg	Italy	0	1	133	1,983	0.25	0.75	0.5	1310.1	0.5	0	1	1	0	**3**	5
35	Hamburg	Denmark	0	0	133	338	0.25	0.25	0.25	288.33	1	0	1	0	0	**2.25**	5
36	Hamburg	India	0	0	133	2,632	0.25	0.75	0.5	6008.44	0.25	0	0	0	0	**0.75**	5
37	Hesse	USA	1	1	321	20,062	0.25	1	0.625	6503.98	0.25	0	0	0	1	**1.875**	5
38	Hesse	China	1	1	321	12,930	0.25	1	0.625	7805.9	0.25	0	0	0	0	**0.875**	5
39	Hesse	France	0	1	321	2,642	0.25	1	0.625	447.31	1	0	1	1	0	**3.625**	5
40	Hesse	Netherlands	0	1	321	860	0.25	0.75	0.5	345.83	1	0	1	1	0	**3.5**	5
41	Hesse	Switzerland	0	1	321	690	0.25	0.5	0.375	353.5	1	0	0	0	0	**1.375**	5
42	Hesse	United Kingdom	0	1	321	2,763	0.25	1	0.625	611.82	0.75	0	0.5	0	0	**1.875**	5
43	Hesse	Italy	0	1	321	1,983	0.25	0.75	0.5	968.04	0.5	0	1	1	0	**3**	5
44	Hesse	Belgium	0	1	321	514	0.25	0.5	0.375	288.94	1	0	1	1	0	**3.375**	5
45	Hesse	Russia	0	0	321	1,555	0.25	0.75	0.5	2049.44	0.25	0	0	0	0	**0.75**	5
46	Hesse	Poland	0	0	321	546	0.25	0.5	0.375	919.88	0.5	0	1	0	0	**1.875**	5
47	Hesse	Japan	0	0	321	4,957	0.25	1	0.625	9353.38	0.25	0	0	0	0	**0.875**	5
48	Hesse	Austria	0	0	321	428	0.25	0.5	0.375	626.11	0.75	0	1	1	0	**3.125**	5
49	Saxony-Anhalt	Russia	1	1	70	1,555	0.25	0.75	0.5	1735.98	0.25	0	0	0	1	**1.75**	5
50	Saxony-Anhalt	Poland	1	1	70	546	0.25	0.5	0.375	638.28	0.75	0	1	0	0	**2.125**	5
51	Saxony-Anhalt	Netherlands	1	1	70	860	0.25	0.75	0.5	460.12	1	0	1	1	0	**3.5**	5
52	Saxony-Anhalt	China	0	1	70	12,930	0.25	1	0.625	7479.25	0.25	0	0	0	0	**0.875**	5
53	Saxony-Anhalt	France	0	1	70	2,642	0.25	1	0.625	750.41	0.75	0	1	1	0	**3.375**	5
54	Saxony-Anhalt	Austria	0	1	70	428	0.25	0.5	0.375	551.01	0.75	0	1	1	0	**3.125**	5
55	Saxony-Anhalt	Czech Republic	0	1	70	229	0.25	0.25	0.25	298.82	1	0	1	0	0	**2.25**	5
56	Saxony-Anhalt	United Kingdom	0	1	70	2,763	0.25	1	0.625	813.71	0.5	0	0.5	0	0	**1.625**	5
57	Saxony-Anhalt	Italy	0	1	70	1,983	0.25	0.75	0.5	1140.49	0.5	0	1	1	0	**3**	5
58	Saxony-Anhalt	Belgium	0	1	70	514	0.25	0.5	0.375	524.26	0.75	0	1	1	0	**3.125**	5
59	Thuringia	China	1	1	70	12,930	0.25	1	0.625	7589.99	0.25	0	0	0	0	**0.875**	5
60	Thuringia	United Kingdom	1	1	70	2,763	0.25	1	0.625	780.78	0.5	0	0.5	0	0	**1.625**	5
61	Thuringia	Poland	1	1	70	546	0.25	0.5	0.375	702.46	0.75	0	1	0	0	**2.125**	5
62	Thuringia	Netherlands	0	1	70	860	0.25	0.75	0.5	450.7	1	0	1	1	0	**3.5**	5
63	Thuringia	France	0	1	70	2,642	0.25	1	0.625	664.04	0.75	0	1	1	0	**3.375**	5
64	Thuringia	Italy	0	1	70	1,983	0.25	0.75	0.5	1016.61	0.5	0	1	1	0	**3**	5
65	Thuringia	USA	0	1	70	20,062	0.25	1	0.625	6639.59	0.25	0	0	0	0	**0.875**	5
66	Thuringia	Austria	0	1	70	428	0.25	0.5	0.375	492.89	1	0	1	1	0	**3.375**	5
67	Thuringia	Czech Republic	0	1	70	229	0.25	0.25	0.25	259.33	1	0	1	0	0	**2.25**	5
68	Thuringia	Hungary	0	0	70	149	0.25	0.25	0.25	697.97	0.75	0	1	0	0	**2**	5
69	Thuringia	Switzerland	0	0	70	690	0.25	0.5	0.375	518.64	1	0	0	0	0	**1.375**	5
70	Thuringia	Spain	0	0	70	1,340	0.25	0.75	0.5	1633.74	0.5	0	1	1	0	**3**	5

Source: Author's own elaboration based on: FW GbR. (2021). *Bundesrepublik Deutschland*. https://www.kinderweltreise.de/fileadmin/_processed_/3/e/csm_deutschland_bundeslaender_096234eaa7.png (accessed 1.06.2021); Statistische Ämter des Bundes und der Länder (2021). *Bruttoinlandsprodukt bis 2020 – in jeweiligen Preisen – nach Bundesländern* (dataset). https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung/bip (accessed 30.03.2021); Statistisches Bundesamt (Destatis) (2021a). *51000–0032 Aus- und Einfuhr (Außenhandel): Bundesländer, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0032&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021); Statistisches Bundesamt (Destatis) (2021b). *51000–0003 Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Länder* (dataset). https://www-genesis.destatis.de/genesis//online?operation=table&code=51000–0003&bypass=true&levelindex=0&levelid=1622975418608#abreadcrumb (accessed 31.05.2021); World Bank Group (2021b). *World Development Indicators. GDP (current US$)* (dataset). https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.MKTP.CD&country=#advancedDownloadOptions (accessed 29.05.2021).

Appendix E. Germany's federal states and their neighbouring countries

Federal state	**Neighbouring country**
Baden-Württemberg	Switzerland, France
Bavaria	Czech Republic, Austria
Brandenburg	Poland
Lower Saxony	Netherlands
Mecklenburg-Vorpommern	Poland
North Rhine-Westphalia	Belgium, Netherlands
Rhineland-Palatinate	France, Luxembourg
Saarland	France, Luxembourg
Saxony	Poland, Czech Republic
Schleswig-Holstein	Denmark

Source: Author's own elaboration based on: *FW GbR. (2021). Bundesrepublik Deutschland*. https://www.kinderweltreise.de/fileadmin/_processed_/3/e/csm_deutschland_bundeslaender_096234eaa7.png (accessed 1.06.2021).

The monograph concentrates on an interesting topic of foreign trade, analyzing it through the prism of German experiences and examining whether the assumptions of the gravity model can be applied. As foreign trade is an integral part of the total developmental effort contributing to international competitiveness of the economy, an important research problem was undertaken, both from the point of view of theory and practice.

Dr hab. Arkadiusz Michał Kowalski, prof. SGH

The monograph is interesting and explores an interesting research topic.

Dr Tomasz M. Napiórkowski

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