

Germany's economic structure in times of multiple shocks

By Michael Grömling

Germany's economic structure in times of multiple shocks

By Michael Grömling

Prof. Dr. Michael Grömling works with the Cologne Institute for Economic Research (Institut der deutschen Wirtschaft) since 1996, where he is head of the cooperation cluster macroeconomics and business cycle analysis. Since 2006 he has been a professor for economics at the International University (IU), now at the Campus Köln/Germany. His research focuses on business cycle analysis, long-term economic development and structural change, national accounting. Michael Grömling studied economics at the Julius-Maximilians-University in Würzburg/Germany. After graduating, he worked in the economics department at the University of Würzburg, where he received his doctorate in 1996.



Abstract

The German economy is experiencing its longest period of stagnation since the Second World War. Since 2019, there has been no dynamism in the economy as a whole. This is the result of multiple shocks and the associated adjustment burdens caused by the pandemic. These have been weighing on the supply and demand side of the German economy for several years. The burdens of the Russian invasion of Ukraine and geopolitical uncertainties have been impacting the economy since the beginning of 2022. In addition to the high cost of materials, energy costs have also risen sharply. The associated inflation is curbing overall economic demand. Geoeconomic uncertainties and trade distortions as well as high inflation rates are curbing the propensity to invest and consume worldwide. The German economy is generally struggling in such a weak global environment. Due to its strong focus on global markets and therefore its high export ratio, it suffers more than average from geoeconomic shocks and a weakening global economy. The general drivers of the structure of an economy – changing preferences, internationalization, technological changes – are influenced on the one hand by the pandemic and the geopolitical disruptions in the wake of the war in Ukraine and the repositioning of major emerging markets. On the other hand, major megatrends – demographic change, climate change and scarcity of resources – are also having an impact on the economic structure in Germany.

Key words: German economy, structural change, geopolitics, global trends

Disclaimer: The opinions expressed in this report represent those of the author and do not represent the opinion of the Centrum Balticum Foundation, and thus, the Centrum Balticum Foundation does not bear any responsibility for the opinions expressed in the report.

Table of contents

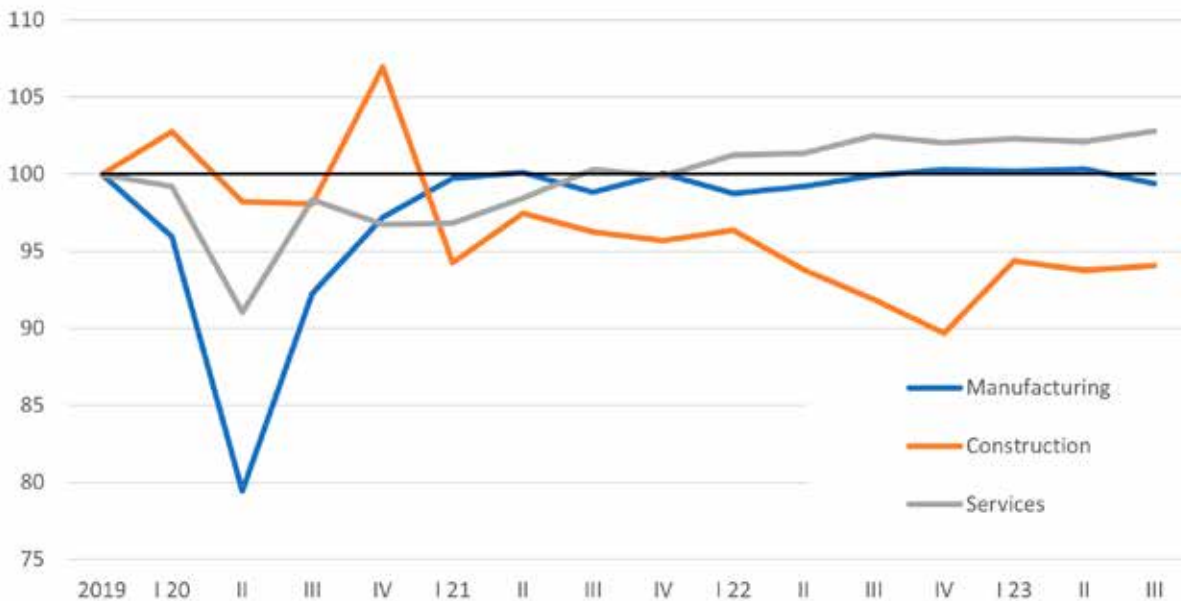
1. Long-term standstill on a broad basis	4
2. Multiple shocks burden the German economy	4
3. Germany – a manufacturing-based economy	7
4. Drivers of structural changes	8
5. Structural effects of megatrends	9
6. Demand opportunities and supply potential	12
References	13

1. Long-term standstill on a broad basis

The German economy has come to a standstill since 2018. Although the sharp decline in real gross domestic product (GDP) caused by the outbreak of the coronavirus pandemic in spring 2020 was made up for by the first quarter of 2022, economic activity in Germany has stagnated since then. The sharp rise in energy prices in the wake of the Russian invasion of Ukraine, the associated general increase in prices, geopolitical uncertainties and the significant slowdown in the global economy can explain the economic standstill in Germany. Figure 1 illustrates how the major economic sectors are shaping this macroeconomic development:

Figure 1: Sectoral dynamics in Germany

Price and seasonal adjusted value added, index annual average 2019 = 100



Sources: Federal Office of Statistics; own calculations

- After recovering from the coronavirus slump, **manufacturing** has been stagnating for three years now. While material bottlenecks caused by the pandemic-related production and logistics disruptions initially impacted industrial production, the war-related energy shock caused problems in energy-intensive industries, such as the chemical industry and paper production, from the beginning of 2022. Weak foreign demand is weighing on manufacturing as a whole. In 2023 real gross value added in the manufacturing sector was at the same level as in 2019.
- The **service economy** as a whole was less severely affected by the pandemic, but took longer than manufacturing to return to business level seen at the end of 2019 due to the repeated interruptions caused by the multiple waves of the pandemic. After that, however, there was hardly any upturn in the service sector either. This was primarily due to the cost effects of the energy price shocks and the loss of purchasing power as a result of inflation.
- As a result of the pandemic, the **construction industry** was initially affected by increased staff shortages, followed by material shortages in 2021. The associated cost increases and the decline in demand for construction due to higher financing costs (interest rates) led to the industry producing on average around 6 ½ % below the 2019 level in 2022 and 2023.

2. Multiple shocks burden the German economy

As mentioned above, two major shocks have led to new adjustment burdens and challenges for private households and companies not only in Germany but also in many other countries. Firstly, from spring 2020, the **coronavirus pandemic** was a combination of shocks with a wide range of consequences (Grömling, 2021a):

- Within a very short period of time, economies around the world were hit by the coronavirus. In contrast to other recessions, there was no global economic counterbalance. Corona hit all countries almost simultaneously, triggering a genuine **global economic crisis** and a global investment slump.
- In contrast to previous economic crises, which were usually triggered by a specific shock (e.g. oil price shock or financial market crisis), the coronavirus crisis quickly unfolded as a **combination of multiple supply and demand shocks**. The illnesses and the restrictions impaired production processes. Employees were absent, supply of intermediate goods was interrupted due to production and transport problems and, as a result, just-in-time networks were disrupted until 2023. In the service sector, the closures brought production, sales and revenues to a complete standstill in some cases. The lockdown measures also partially paralyzed the demand side. As a result of the lockdowns, some consumer opportunities simply failed to materialize. This was exacerbated by employment and income concerns. In addition, investment in equipment, which is important for the modernization of the economy, fell sharply.
- At least as far as Germany is concerned, previous economic crises were generally crises in the manufacturing sector. The pandemic and the measures taken to contain it affected both the **manufacturing industry and large parts of the service sector**. While the latter had usually stabilized the economy in previous crises, this time it was primarily the personal service companies themselves that came under severe pressure.
- The **uncertainty** about the course of the pandemic and the search for vaccines and therapies initially also led to economic uncertainties – for example with regard to further waves of the disease and renewed lockdown measures. Politicians and population were repeatedly surprised by the multiple and growing waves of infection. The global economic slump, the diverse transmission channels, the broad sectoral impact in highly interconnected economies and the lack of experience with the effectiveness of economic policy measures also created multiple uncertainties. Last but not least, it was not clear how people would behave in such a crisis and to what extent this would make a return to a previous normality more difficult.

The past few years have clearly shown that the pandemic, with its many side effects, stood in the way of a rapid return to normality. The recovery in consumption was repeatedly interrupted by multiple waves of infection and the associated restrictions. As vaccination progressed, consumption returned to normal. However, the global supply networks were still not running smoothly in the course of 2021 and at the beginning of 2022. Since February 2022, the burdens and uncertainties associated with the Russian invasion of Ukraine have been impacting economies, some of which are not operating in normal mode. The **war** is having an impact primarily via three transmission channels (Grömling, 2022):

- In addition to the pandemic-related **supply and production problems**, there has been considerable uncertainty regarding the quantitative energy supply in a number of European countries since spring 2022. The level of strain depends on the respective national energy mix and their own endowment with resources.
- The supply risks for energy and raw materials, primarily due to the war, have caused unprecedented **cost shocks** in many European economies and created uncertainty and additional transaction costs for companies, which has changed their international competitiveness. Rising labour costs – with the understandable aim of limiting the loss of purchasing power of private households – can further impair the competitiveness of companies. In some cases, it is not possible to pass on these rising costs to customers, so there is a risk of a loss of earnings with a negative impact on investment activity.
- The significantly higher price level at producer and consumer level in many countries is having a direct impact on **demand for consumer and investment goods**. The high inflation rates are eroding the purchasing power of private households. In view of the uncertain economic outlook and rising financing costs, companies are holding back on investments. The global economy is losing momentum again, which is affecting foreign trade in many countries.

Looking ahead, the development of the global economy and inflation will essentially determine the general economic conditions for the German economy in 2024. A key risk for the global economy and the German economy is the **geopolitical situation** and its further development. The global economy is crucial for German exports and the manufacturing sector. In addition to this demand effect, domestic production conditions and consumption opportunities depend on the supply of inputs, energy and imported consumer goods. The pandemic and the Russian invasion of Ukraine have clearly demonstrated these transmission channels (Aiyar et al., 2023). Looking ahead to 2024, the economic outlook is still subject to multiple geoeconomic risks, for which ad hoc assumptions can be made at best.

An end to the war in Ukraine is not in sight at the beginning of 2024. This means that the associated adjustment burdens and geoeconomic uncertainties will remain in place in the medium term. The sanctions introduced remain in place and trade with Russia's partner and "transfer countries" presents additional uncertainties. China's global political stance and the opaque position of a number of emerging economies are jeopardizing access to raw materials and energy as well as the functioning of global supply chains and important sales markets. The systemic conflict between the Western economies (USA and Europe) and China is reinforcing the isolationist mechanisms of national economies via tariff and non-tariff trade barriers. It remains to be seen how the political repositioning of major emerging economies will affect international economic relations and to what extent global trade activities will become more concentrated in geopolitical blocs.

The attack by Hamas terrorists in Israel at the beginning of October 2023 has given additional momentum to geopolitical confrontations. A regional expansion of the existing conflict poses a significant downside risk for the global economy. A number of transmission channels are conceivable:

- A **shortage in global energy supplies** due to production restrictions and disruptions to transport routes could lead to a renewed sharp **rise in energy prices** in the economies directly and indirectly affected (World Bank, 2023). A fifth of the global oil supply and a quarter of the global liquefied natural gas trade is transported through the Strait of Hormuz. Large countries in Asia in particular, such as China and India, obtain oil from the Gulf region. These countries in turn have a major influence on the world economy.
- In addition, war-related **disruptions to global logistics** due to restrictions or threats to important trade routes could have a negative impact on trade as a whole, with a renewed risk of **material bottlenecks** and corresponding price effects.
- An oil price shock is also likely to have an **impact on other commodity markets**, such as the markets for agricultural commodities (World Bank, 2023). The situation here has already been tense since the war in Ukraine.
- Moreover, the conflict in the Middle East increases the **risk of terrorist attacks** worldwide and political unrest in certain countries and regions (e.g. North Africa). The risk of **cyber attacks**, particularly on critical infrastructure, which is already virulent due to the confrontation with Russia, is likely to be even higher. This will also increase transaction costs and inhibit global investments due to potentially higher risk premiums.
- Last but not least, an escalation in the Middle East could **accelerate the formation of geoeconomic blocs** with all the accompanying trade and location effects. In this environment, characterized by numerous conflicts, the military presence of the US and the associated financial ties will increase. Looking ahead to 2024, it should be borne in mind that the outcome of the US election itself could represent a political and economic imponderable – which in turn could be influenced by geopolitical escalations in the aforementioned and other potential hotspots, as well as by terrorism.

These diverse adjustment burdens as a result of the pandemic and all geopolitical conflicts can have long-term implications for the economic structure and growth potential (Grömling, 2021a; 2021b). Over time, the diverse social developments and changes in preferences as well as the very different corporate strategies and technological changes come together in the structure of an economy. In addition, there are the consequences of global political and economic changes as well as national economic policies, which leave their mark.

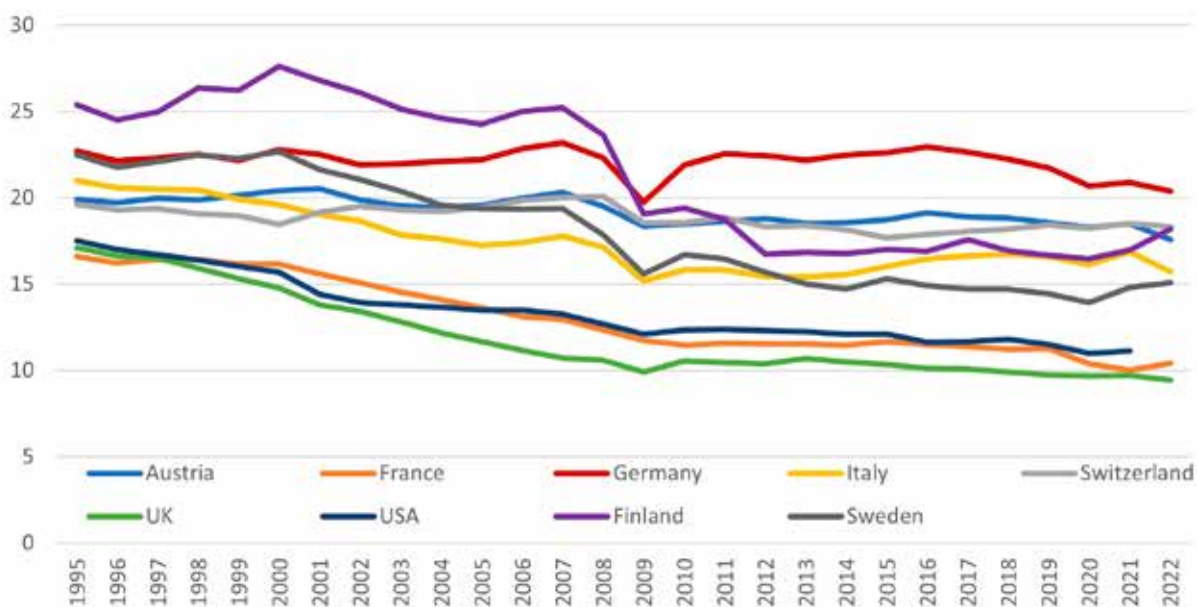
3. Germany – a manufacturing-based economy

Germany as a business location is characterized by a high proportion of manufacturing, although the importance of this sector is significantly higher due to the network effects with specific service sectors. Private research in Germany is essentially research in the manufacturing industry. Due to the high importance of the production of capital goods, Germany is still one of the most important “equipment suppliers” in the world. This also explains the export successes in times of booming global investment (Grömling, 2014; 2017).

Against the background of this brief description, Figure 2 shows the **share of manufacturing** in Germany in an international comparison. Despite the decline in the last five years – as a result of the two crises mentioned above and the protectionism that has already emerged – the manufacturing industry in Germany has an outstanding position in an international comparison. In 2022, manufacturing accounted for a good fifth of total economic output – 24% including energy production. The construction industry accounted for a further 6%. The diverse service sectors account for the lion’s share of the economy at almost 70%. Figure 2 also shows that the share of manufacturing in Germany has remained constant over long periods since the mid-1990s. Until the decline in recent years, there was only an abrupt slump to below 20% in 2009 as a result of the global financial market crisis, but this was largely compensated for in the following year. Due to the global investment slump, the financial market crisis primarily affected manufacturing, whose nominal value added fell by a good 15% in 2009 compared to the previous year. Switzerland and Austria have experienced similar structural developments – at a slightly lower level – since the mid-1990s. In contrast, manufacturing had lost considerable importance in a number of other advanced economies – particularly in the UK, France, the USA and Italy – until the global financial market crisis. The share of manufacturing in the UK, the USA and France was recently around half of the German level. In Finland, the share of manufacturing was well above the German level at over 25% until the global financial market crisis of 2008/2009. This was followed by a sharp drop to just under 17% in 2012, but since then the manufacturing share has stabilized and recently even increased slightly. This also applies to Sweden at a lower level.

Figure 2: Manufacturing in international comparison

Value added of manufacturing as a percentage of total economy



Sources: OECD; own calculations

The German economy is also characterized by its **broad manufacturing base**, which stands behind the high manufacturing share compared to other countries. With a share of 5% of the economy as a whole and 23% of manufacturing value added, the automotive industry held an outstanding position in 2019. However, production of machinery, the electrical industry, the metal industry and the chemical and pharmaceutical industries are also very important for overall economic value added. This broad

manufacturing base is unique in Europe. Particularly striking in an international comparison is the **high importance of the capital goods sector**, which has even increased since the mid-1990s (Grömling, 2017). According to the OECD definition, capital goods production accounted for 14% of total economic value added in Germany before the outbreak of the current crisis. Among the European economies, Austria followed with just under 10% and Sweden and Switzerland with just over 8%. In France and the United Kingdom, the production of capital goods only accounts for 4%, while in the USA it is 5%. This shows that the German economy is highly sensitive to global investment cycles.

The **close interaction between manufacturing and service providers** is also relevant for an assessment of the sectoral structure in Germany. This can be explained by the high cross-sectoral division of labour and the combination of manufacturing goods with a wide range of product-related services. The so-called manufacturing-service network provides an empirical impression of this collaboration. In addition to the direct value added by manufacturing, this also takes into account the reciprocal intermediate input purchases by manufacturing and service providers. According to this, German manufacturing accounts for almost 30% of total economic output – the composite amounts to around 9 percentage points. This is significantly higher than in the other major European economies.

Another characteristic of the German economy is that the vast majority of **private sector research** (85%) is carried out by manufacturing. Only in Japan is the respective share of R&D expenditure in the private sector higher, in all other advanced economies it is considerably lower – in France it is around half, in the United Kingdom just under 40%. This results from the economic structure, but also points to clear differences and starting points in the sectoral research infrastructure.

As far as the **export structure** is concerned, Germany is dominated by exports of goods (80%), which mainly consist of manufactured goods. Only Japan and Italy have comparable figures. German manufacturing exporters focus less on high-tech goods and more on the high-end segment of medium-tech products, which also includes vehicles and machinery. This underlines Germany's great global importance as a developer and supplier of capital goods.

4. Drivers of structural changes

The high and largely constant share of manufacturing in Germany shown in Figure 2 should not be interpreted to mean that there is no structural change in Germany. On the one hand, this is due to the fact that looking at the overall share of manufacturing can obscure the fact that there have been shifts in different directions within the major sectors. On the other hand, there are very different explanations for the structural changes, which can also lead to opposing effects. As already mentioned, the economic structure is a reservoir for very different social, political and economic influences (Grömling, 2019).

Changes in preferences and consumption: As prosperity increases, the demand and production structure of an economy shifts towards services. Private households are increasingly buying (high-quality) services, for example in the areas of leisure, finance or culture. Changing consumer preferences – for example as a result of digitalization or climate change – affect companies and sectors in very different ways. Consumers are also demanding a range of product-related services when purchasing manufactured goods. Above all, the increasing complexity of modern societies is stimulating demand for knowledge-intensive services. Last but not least, demographic trends are likely to drive demand for services from private households. As the average age increases, goods are becoming less important and household-related services, for example in the healthcare and social services sectors, are gaining in importance.

Changes in production: However, it is not only what is produced that is changing, but also the way in which it is produced. Some companies are transforming themselves into so-called hybrid companies that offer manufactured goods and services. Competitive advantages over domestic and foreign competitors are often created precisely through product-related services – such as joint research and development by the customer and manufacturer. Parallel to this expansion of the range of services offered by companies, it can be observed that manufacturing companies have concentrated on their core business at the production level over a longer period of time and have outsourced certain services to specialized companies. The availability of specialized knowledge, quality differences, cost differences and capacity bottlenecks are all factors in favour of this outsourcing. Both trends directly benefit the service sector, but also strengthen the competitiveness of manufacturing.

Changes in internationalization: Changes in production processes and the economic structure also occur when manufactured components that were previously produced domestically are substituted by components sourced from abroad. The opening up of countries and the liberalization of markets have led to a restructuring of production processes over a certain period of time. Specialization and cost advantages can speak for this offshoring, but also access to production factors. National energy policy also has an influence on the location and production decisions of companies (Bardt/Grömling, 2023) – the war makes this more than clear. Here, too, effects are possible in both directions: internationalization substitutes domestic manufacturing production, but at the same time strengthens it via the intermediate input effects within global value chains. At the same time, globalization opens up new markets, which can also have a positive effect on domestic production. The enormous catch-up process of emerging and developing countries in the past decades has led to an enormous global investment boom, from which countries with a stronger focus on the production of capital goods in particular, and thus export have ultimately benefited the most (Grömling, 2014).

Technological changes: Last but not least, product and process innovations lead to structural changes at the goods and production level. International competition in turn creates different incentives for innovation in different sectors. Manufacturing, but to some extent also service companies that are in international competition, experience greater pressure to innovate. This is underpinned by the high proportion of manufacturing in private sector research in Germany. In addition, new general-purpose technologies – such as digitalization – also determine the three drivers of structural change outlined above. Modern information and communication technologies have been widely used in society and the economy for several decades. Nevertheless, the pace of the “digital revolution” appears to be accelerating as a result of advancing innovations and the growing importance of networks. The pandemic is likely to have accelerated the need for, and facilitated the success of, increasing networking and digitalization (Grömling, 2021a). In general, a number of benefits are expected from digitalization: These include efficiency gains and cost savings as a result of digitized production and business processes. These process innovations should strengthen (international) competitiveness, which will also help to open up new markets. New customers are also gained through modern digital goods, i.e. product innovations. Digital platforms enable a new organization and management of (international) value chains as well as completely new digital business models. The locational conditions (e.g. digital infrastructure, e-government, digital legal framework) also determine whether a business location can keep up with global competition. In any case, the digital platforms in the USA and China have played a decisive global role up to now. These initial advantages – above all the large number of users and the associated network effects – pose a challenge for Europe.

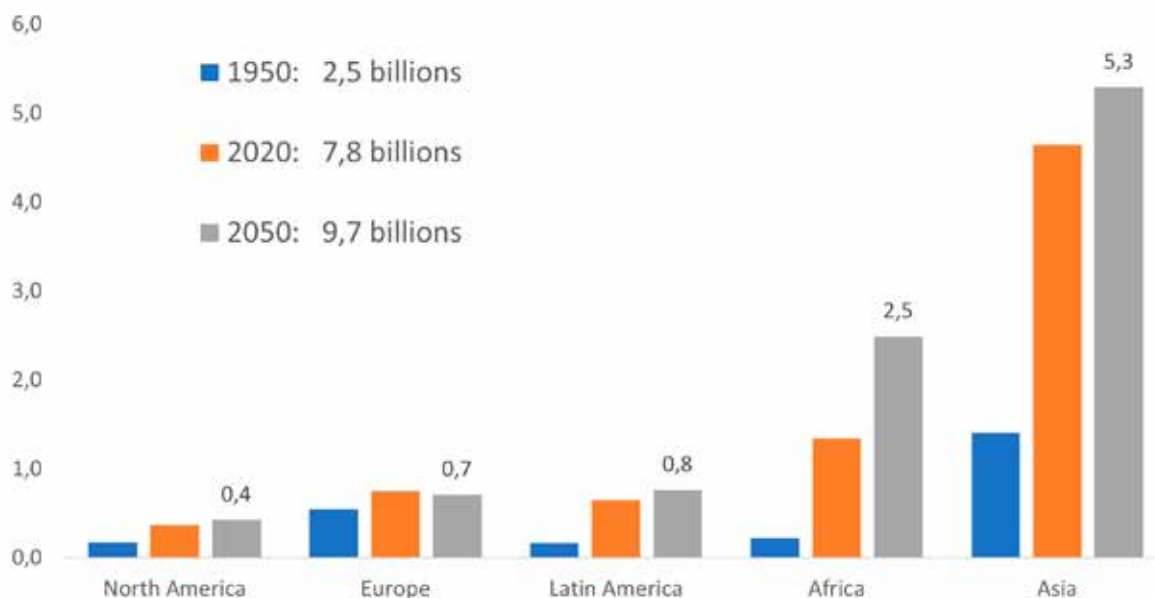
5. Structural effects of megatrends

These general drivers of the structure of an economy are influenced on the one hand by the two major shocks of recent years – the pandemic (see Grömling, 2021a) and the geopolitical breaks in the wake of the war in Ukraine and the repositioning of major emerging markets (Grömling et al., 2023). On the other hand, major megatrends – demographic change, climate change and scarcity of resources – are also having an impact on the economic structure.

Demographic changes: With regard to demographic development, a distinction must be made between two trends: On the one hand, the world’s population will continue to grow. According to the medium variant of the UN forecast (UN, 2022), it will rise from around 8 billion people at present to 9.7 billion by 2050 (Figure 3). The entire increase will be accounted for by today’s developing and emerging countries. In 2050, only a good 11% of the world’s population will live in Europe and North America. In addition to population growth, urbanization will continue. In 1950, 72% of the then 2.5 billion people still lived in rural areas and 28% in cities; in 2008, the proportions were balanced for the first time in human history. By 2050, the number of urban dwellers will have almost doubled from today’s level to 6.7 billion. Two thirds of the world’s population will then live in cities. The manifold infrastructures (public utilities) in mega-cities are already often inadequate, making enormous investments necessary. The pandemic has clearly demonstrated these consequences of urbanization. Capital goods producers that are well positioned internationally should be able to meet vital demand potentials in the face of a growing and densely populated world.

Figure 3: Development of the World Population

Population by region in billions



Sources: UN (UN-Medium Variant – 2019 Revision); own calculations

Contrary to previous expectations, the population in Germany has also risen in recent years, reaching a record high of 84.5 million people in 2023. The number of inhabitants rose by over one million mainly as a result of the war in Ukraine. Since 2010, the population in Germany has increased by over 4 million. The coronavirus pandemic significantly reduced net immigration in 2020 and 2021, before the war and the overall geopolitical situation led to a renewed increase. The initially predicted decline in the population did not materialize due to the high level of immigration. Nevertheless, a far-reaching demographic change will begin in the current decade. As in many other advanced economies, the population structure will shift towards older people and the proportion of the total population in employment will decrease significantly. This is a global phenomenon – even in the emerging economies the population structure is shifting towards older people. In Germany, the population will continue to age, especially until the mid-2030s. This is due to the retirement of the baby boomers of the 1960s from the labour force and the insufficient number of young people entering the workforce. Immigration to Germany is unlikely to fundamentally halt this ageing of society. Based on current population projections, not only will the population structure shift, but the potential workforce (residents aged between 18 and 67) is also estimated to decrease by more than 5 million people, or one tenth, in absolute terms over the next ten years.

The direct consequence of this is that the overall economic output must be provided by a part of the population that is becoming smaller in absolute and relative terms. This alone results in economic adjustment burdens – for example in the financing of the general government budget and social security systems. This creates additional challenges for economic policy – such as the financing of public investment and infrastructure. As demographic change will not occur evenly from a regional perspective, there are also likely to be noticeably different regional economic production and growth effects over the next two decades. The challenges posed by the other megatrends mentioned here – climate change and scarcity of resources – will not diminish as a result of the demographic change that has been predicted. This requires a wide range of innovations and accelerated technological progress. This, in turn, is based on a well-trained workforce. However, it is to be feared that the general demographic change will lead to a pronounced decline in skilled workers and exacerbate the existing shortage of skilled workers in Germany as a business location. Whether or not skilled workforce can be secured will then also have a direct impact on how the country deals with further economic changes and challenges.

Climate change: The Intergovernmental Panel on Climate Change (IPCC) assumes that the Earth's surface temperature will continue to rise (IPCC, 2023). Although the specific extent is still open, serious global burdens are to be expected. The adverse effects of climate change are likely to affect the continents, specific economies and regions in very different ways. Climate changes will have a direct impact on

nature (specifically on continental ice, permafrost, rainforests, ocean currents and vegetation zones). This can result in a variety of social and economic adjustment burdens (Tol, 2009; Batten, 2018; EU, 2023). A concrete example of the latter is infrastructure disruption caused by unusually severe storms and prolonged periods of low water. Physical damage to production facilities and permanent production restrictions – for example in agriculture – must also be considered. This, in combination with high population growth, can trigger migration within and between countries. A number of serious social changes are conceivable.

Table 1: Macroeconomic effects from climate change

Type of shock/impact		Physical risks		Transition risks
		From extreme weather events	From gradual global warming	
Demand	Investment	Uncertainty about climate events		'Crowding out' from climate policies
	Consumption	Increased risk of flooding to residential property		'Crowding out' from climate policies
	Trade	Disruption to import/export flows		Distortions from asymmetric climate policies
Supply	Labour supply	Loss of hours worked due to natural disasters	Loss of hours worked due to extreme heat	
	Energy, food and other inputs	Food and other input shortages		Risks to energy supply
	Capital stock	Damage due to extreme weather	Diversion of resources from productive investment to adaptation capital	Diversion of resources from productive investment to mitigation activities
	Technology	Diversion of resources from innovation to reconstruction and replacement	Diversion of resources from innovation to adaptation capital	Uncertainty about the rate of innovation and adoption of clean energy technologies

Source: Batten (2018, p. 6)

Based on the classification by Batten (2018), the table provides an overview of the various macroeconomic risks and effects of climate change. A distinction is made between two categories of effects:

- **Physical effects:** On the one hand, these are the direct effects of climate change on production processes and on the factor endowments of an economy, i.e. on the supply side. On the other hand, climate risks also have effects on the demand side of the economy, e.g. on public and private investment or on consumption of private households. The physical effects can be further subdivided into gradual and acute effects or risks. The former are concerned with the long-term effects of global warming, primarily on the supply side. This involves, for example, reallocation effects in investment and innovation towards climate adaptation measures. The acute effects include damages to the capital stock caused by extreme weather events and the associated reconstruction measures.

- **Transition effects:** Adaptation effects resulting from political climate protection measures and the corresponding adjustments in production processes, particularly in carbon-intensive sectors. On the demand side, for example, crowding-out effects can be mentioned, which are caused by climate events and the associated adaptation burdens.

All of this will have an impact on the global demand for goods and solutions to problems, on the production possibilities of companies and on the structure of an economic location.

Resource scarcity: A large number of very different raw materials are needed to produce goods and services. The pandemic with its various supply disruptions and material shortages and the war with its impact on the global supply of energy and raw materials have made geopolitical dependencies abruptly clear. This concerns the supply of energy raw materials (e.g. oil and gas), industrial raw materials (e.g. copper, aluminum, rare earths) and agricultural raw materials (e.g. grain, seeds, wood, rubber). Moreover, the development and production of “green technologies” also requires a wide range of natural raw materials. The “green transition” means a shift from a fuel-intensive to a material-intensive energy system (IEA, 2022). Due to the natural and politically induced scarcity of raw materials – which must also be seen in the context of the growing world population – it is necessary to decouple global economic production from the use of raw materials. Absolute decoupling is required by reducing resource intensity in production and final consumption. For manufacturing companies in particular, this means a great need for adaptation, but it also means opportunities for the development of alternatives and technologies to increase resource productivity.

6. Demand opportunities and supply potential

What significance do these key challenges have for Germany as a business location and its economic structure? On the one hand, they mean very different adjustments and restructurings for corporate production processes (Grömling et al., 2023). On the other hand, it is undeniable that many of the problems associated with these major global challenges can only be tackled with the help of manufacturing solutions. The aforementioned close cooperation between manufacturing and the service sector must be taken into account. With its modern industry, Germany has a good chance of continuing to play a part in overcoming the burdens and adjustments associated with these megatrends in the future.

Production of machinery and equipment, the electrical industry and information technology producers, for example, are key drivers in environmental and process technology. The chemical and pharmaceutical industries can also make a major contribution to adapting to climate change and increasing resource efficiency. The prospects for the energy, automotive and food industries have a global dimension. Globally active construction and building materials companies can benefit from the fact that a growing world population entails increasing infrastructure investments and that this can only be achieved efficiently with modern technologies. Last but not least, those sectors that meet the demand of older people also have good opportunities. These include, for example, the pharmaceutical industry, biotechnology, medical technology and industrial suppliers of healthcare services. The repeated reference to the network and interconnection effects for the various company-related service providers is relevant.

However, in order to be able to tap into this future global demand potential, which, in addition to the general drivers of structural change, results primarily from the three megatrends outlined above, it is necessary to permanently develop the supply side of the economy. In broad terms, this includes the workforce and its diverse qualifications (human capital) as well as the supply of physical capital of various kinds, including a broadly understood infrastructure. Natural capital (endowment with energy and raw materials) can also be understood as part of the overall economic capital stock. The technological knowledge of an economy, which in turn results from education and research efforts, is also of fundamental importance for the supply side of an economy.

Whether and in what quality all these production factors will be available in the future depends on the respective investments. This is central to understanding long-term economic development. The foreseeable decline in the workforce alone will require more capital and technological knowledge in order to maintain our standard of living at the current level. Climate change also requires diverse investments in human capital, physical capital, infrastructure, technological knowledge and efficient and resource-conserving forms of using natural capital.

References

- Aiyar, S. et al. (2023) 'Goeconomic Fragmentation and the Future of Multilateralism', International Monetary Fund, Staff Discussion Note, SDN/2023/001 [online]. Available at: <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2023/01/11/Geo-Economic-Fragmentation-and-the-Future-of-Multilateralism-527266> (Accessed: 22 January 2024)
- Bardt, H., Grömling, M. (2023) 'Supply Chains, Costs and Investments in Times of Multiple Crises' in Clausen, U., Dellbrügge, M. (eds.) *Advances in Resilient and Sustainable Transport*. Heidelberg: Springer, Cham, pp. 1-10
- Batten, S. (2018) 'Climate Change and the macro-economy: a critical review', *Bank of England Staff Working Paper*, No. 706 [online]. Available at: <https://www.bankofengland.co.uk/working-paper/2018/climate-change-and-the-macro-economy-a-critical-review> (Accessed: 22 January 2024)
- EU – European Commission (2023) 'European Economic Forecast', Institutional Paper, 258 [online]. Available at: https://economy-finance.ec.europa.eu/publications/european-economic-forecast-autumn-2023_en (Accessed: 22 January 2024)
- Grömling, M. (2014) 'A Supply-Side Explanation for Current Account Imbalances', *Intereconomics*, 49(1), pp. 30–35 [online]. Available at: <https://www.intereconomics.eu/contents/year/2014/number/1/article/a-supply-side-explanation-for-current-account-imbalance.html> (Accessed: 22 January 2024)
- Grömling, M. (2017) 'Economic outlook for Germany: in the big shadow of global uncertainties' in Liuhto, K. (ed.) *The economic state of the Baltic Sea region*, Turku: Centrum Balticum, pp. 55-67 [online]. Available at: https://centrumbalticum.org/files/3899/BSR_Policy_Briefing_IM_F2017_2.5_final.pdf (Accessed: 22 January 2024)
- Grömling, M. (2019) 'Industrieller Strukturwandel im Zeitalter der Digitalisierung', *ifo Schnelldienst*, 72(15), pp. 8–12 [online]. Available at: <https://www.ifo.de/publikationen/2019/zeitschrift-einzelheft/ifo-schnelldienst-152019-global-und-hidden-champions> (Accessed: 22 January 2024)
- Grömling, M. (2021a) 'The German economy and the Corona shock – An acceleration of structural changes?', BSR Policy Briefing series, No. 3 [online]. Available at: https://www.centrumbalticum.org/files/4995/BSR_Policy_Briefing_3_2021.pdf (Accessed: 22 January 2024)
- Grömling, M. (2021b) 'COVID-19 and the Growth Potential', *Intereconomics*, 56(1), pp. 45-49 [online]. Available at: <https://www.intereconomics.eu/contents/year/2021/number/1/article/covid-19-and-the-growth-potential.html> (Accessed: 22 January 2024)
- Grömling, M. (2022) 'Wirtschaftliche Effekte des Krieges in der Ukraine – Ausgangslage und Übertragungswege' IW-Report, No. 14 [online]. Available at: <https://www.iwkoeln.de/studien/michael-groemling-wirtschaftliche-effekte-des-krieges-in-der-ukraine.html> (Accessed: 22 January 2024)
- Grömling, M., Koenen, M., Kunath, G., Obst, T., Parthie, S. (2023) 'Deindustrialisation – A European Assessment', *Intereconomics – Review of European Economic Policy*, 58(4), pp. 209-214 [online]. Available at: <https://www.intereconomics.eu/contents/year/2023/number/4/article/deindustrialisation-a-european-assessment.html> (Accessed: 22 January 2024)
- IEA – International Energy Agency (2022) 'The Role of Critical Minerals in Clean Energy Transitions', *World Energy Outlook Special Report, Revised Version* [online]. Available at: <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions> (Accessed: 22 January 2024)
- IPCC – Intergovernmental Panel on Climate Change (2023) 'Climate Change 2023', Synthesis Report [online]. Available at: <https://www.ipcc.ch/report/sixth-assessment-report-cycle/> (Accessed: 22 January 2024)
- Tol, R. (2009) 'The Economic Effects of Climate Change', *Journal of Economic Perspectives*, 23(2), pp. 29–51 [online]. Available at: <https://www.aeaweb.org/articles?id=10.1257/jep.23.2.29> (Accessed: 22 January 2024)

UN – United Nations (2022) 'World Populations Prospects 2022: Methodology of the United Nations populations estimates and projections', Methodology Report [online]. Available at: https://population.un.org/wpp/Publications/Files/WPP2022_Methodology.pdf (Accessed: 22 January 2024)

World Bank (2023) 'Special Focus – Potential Near-Term Implications in the Middle East for Commodity Markets: A Preliminary Assessment', Commodity Markets Outlook October 2023, pp. 11-19 [online]. Available at: <https://openknowledge.worldbank.org/server/api/core/bitstreams/27189ca2-d947-4ca2-8e3f-a36b3b5bf4ba/content> (Accessed: 22 January 2024)

Earlier publications in the BSR Policy Briefing series by Centrum Balticum Foundation

- [BSR Policy Briefing 1/2024](#): "China's influence in Northern Europe" by Oscar Shao
- [BSR Policy Briefing 8/2023](#): "The wicked problem of eutrophication - next steps in the process towards sustainable agriculture in Finland" by Anna Törnroos-Remes
- [BSR Policy Briefing 7/2023](#): "A literature review on the main environmental challenges in the Baltic Sea region in the 21st century" by Sergei Gladkov and Léo Pignol
- [BSR Policy Briefing 6/2023](#): "Developing the economic competence in Åland: Recommendations and key learning points for policymakers" by Anna Lundgren and Jukka Teräs
- [BSR Policy Briefing 5/2023](#): "The green transformation of the European maritime sector: Six tricks to support sustainable cruise shipbuilding" by Elisa Aro and Eini Haaja
- [BSR Policy Briefing 4/2023](#): "Iron curtain on Belarus' western border: Does the crisis in Minsk's relations with its Baltic neighbors threaten Belarusian independence?" by Kamil Kłysiński
- [BSR Policy Briefing 3/2023](#): "The economic interaction between the USA and the littoral states of the Baltic Sea" by Alari Purju
- [BSR Policy Briefing 2/2023](#): "The Resource Balanced Economy to meet the twin challenges of phasing out fossil fuel energy and self-sufficient supply of raw materials" by Simon P. Michaux
- [BSR Policy Briefing 1/2023](#): "Baltic Sea region security of supply after Russia's invasion on Ukraine: The past is just a prologue" by Anna Mikulska and Luke Min
- [BSR Policy Briefing 11/2022](#): "Sanctions against Russia, their effectiveness and impacts on Finland" by Hanna Mäkinen
- [BSR Policy Briefing 10/2022](#): "The Baltic Sea islands and their impact on the regional security" by Zdzislaw Sliwa, Hans Helseth and Viljar Veebel
- [BSR Policy Briefing 9/2022](#): "Willingness to fight for Ukraine: Lessons to the Baltic States" by Jānis Bērziņš and Victoria Vdovychenko
- [BSR Policy Briefing 8/2022](#): "Chinese investment in the Baltic Sea region: Main characteristics and policy challenges" by Kálmán Kalotay and Ágnes Szunomár
- [BSR Policy Briefing 7/2022](#): "NATO and security in the Baltic Sea region" by Klaus Wittmann
- [BSR Policy Briefing 6/2022](#): "The Ostrovets Nuclear Power Plant: Energy independence on paper – isolation in practice" by Justinas Juozaitis
- [BSR Policy Briefing 5/2022](#): "Aspects of blue economy in the Baltic Sea region" by Riitta Pöntynen
- [BSR Policy Briefing 4/2022](#): "Leveraging bioeconomy development for climate change mitigation and adaptation in the Baltic Sea Region" by Alisher Mirzabaev
- [BSR Policy Briefing 3/2022](#): "Russia's renewable energy sector: Policy recommendations" by Liliana Proskuryakova
- [BSR Policy Briefing 2/2022](#): "The circular economy in St. Petersburg" by Yury Nurulin, Olga Kalchenko and Inga Skvortsova
- [BSR Policy Briefing 1/2022](#): "Energy dimension of green growth in Kaliningrad" by Artur Usanov
- [BSR Policy Briefing 11/2021](#): "Mortality in Russia during the pandemic in 2020 and in the first half of 2021" by Marina Lifshits
- [BSR Policy Briefing 10/2021](#): "Building security in the Baltic Sea region: Military perspective and NATO approach" by Andrzej Fałkowski
- [BSR Policy Briefing 9/2021](#): "The "Swedish model" in the COVID-19 pandemic" by Torbjörn Becker, Jesper Roine, and Svante Strömberg
- [BSR Policy Briefing 8/2021](#): "Lithuania's response to the COVID-19: Two stages, mixed results" by Linas Kojala
- [BSR Policy Briefing 7/2021](#): "The Kaliningrad Region and COVID-19" by Vitaly Petrovich Zhdanov
- [BSR Policy Briefing 6/2021](#): "Polish struggle against COVID-19" by Bartosz Arłukowicz

- [BSR Policy Briefing 5/2021](#): "COVID-19 and Finland: Not good news for fiscal sustainability" by Jouko Vilmunen
- [BSR Policy Briefing 4/2021](#): "Latvia and COVID-19: Preliminary impressions" by Dzintars Mozgis and Normunds Vaivads
- [BSR Policy Briefing 3/2021](#): "The German economy and the Corona shock – An acceleration of structural changes?" by Michael Grömling
- [BSR Policy Briefing 2/2021](#): "Contemporary trends and future scenarios for the Greater St. Petersburg region" by Nikita Lisitsyn
- [BSR Policy Briefing 1/2021](#): "The COVID-19 in Estonia: Governance of the Health Care System, spread of the disease, regulations and impact on economy" by Alari Purju
- [BSR Policy Briefing 6/2020](#): "Leadership in Turbulent Times: Germany and the Future of Europe" by Kimmo Elo
- [BSR Policy Briefing 5/2020](#): "Denmark and COVID-19" by Marin A. Marinov
- [BSR Policy Briefing 4/2020](#): "Lithuania and Belarus: Will Lithuania become Belarus?" "Iceland"?" by Ruslanas Iržiķevičius
- [BSR Policy Briefing 3/2020](#): "The corona pandemic and its impact on the economic development of the Baltic Sea region in 2020" by Kari Liuhto
- [BSR Policy Briefing 2/2020](#): "Increasing Eco-efficiency via Digitalisation in Maritime Industry in The Baltic Sea Region: Policy Support through Carrots or Sticks?" by Milla Harju
- [BSR Policy Briefing 1/2020](#): "The forest industry around the Baltic Sea region: Future challenges and opportunities" edited by Kari Liuhto
- [BSR Policy Briefing 9/2019](#): "The Baltic states and security in the Baltic Sea region: Dark clouds in blue sky" by Kristi Raik
- [BSR Policy Briefing 8/2019](#): "Creation of regional gas market in the Baltic States and Finland: Challenges and opportunities" by Tadas Jakstas
- [BSR Policy Briefing 7/2019](#): "US FDI in the Baltic Sea region: The state of American investment and selected challenges" by Kalman Kalotay
- [BSR Policy Briefing 6/2019](#): "Germany and the Baltic Sea region: political and security interests" by Tobias Etzold
- [BSR Policy Briefing 5/2019](#): "Government support for the Russian shipbuilding industry: Policy priorities and budgetary allocations" by Elena Efimova and Sergei Sutyryn
- [BSR Policy Briefing 4/2019](#): "Finnish tonnage as the implementer for security of seaborne supply in maritime transport" by Bo Österlund
- [BSR Policy Briefing 3/2019](#): "The Estonian-Finnish economic cooperation" by Alari Purju
- [BSR Policy Briefing 2/2019](#): "Bioeconomy Policies in the BSR" by Torfi Jóhannesson
- [BSR Policy Briefing 1/2019](#): "Cooperation between Saint-Petersburg and Finland" by Stanislav Tkachenko
- [BSR Policy Briefing 10/2018](#): "The sanctions against Russia. Are there winners and losers around the Baltic Sea?" by Susanne Oxenstierna
- [BSR Policy Briefing 9/2018](#): "Future of Public Sector Governance and Digitalization" by Meelis Kitsing
- [BSR Policy Briefing 8/2018](#): "American Policy Towards the Baltic States" by Stephen Blank
- [BSR Policy Briefing 7/2018](#): "Russian direct and indirect investment in the Baltic Sea region" by Alexey Kuznetsov
- [BSR Policy Briefing 6/2018](#): "Foreign economic relations of the Kaliningrad region" by Vitaliy Zhdanov, Vladimir Kuzin and Mikhail Pliukhin
- [BSR Policy Briefing 5/2018](#): "Why is Russia seeking to ignite a civil war in the European Union and how to stop it?" by Ruslanas Iržiķevičius
- [BSR Policy Briefing 4/2018](#): "On the paradoxes of foreign expansion: the experience of Polish firms" by Piotr Trąpczyński and Krystian Barłózewski
- [BSR Policy Briefing 3/2018](#): "The bioeconomy in the Baltic Sea region" by Anna Berlina
- [BSR Policy Briefing 2/2018](#): "Russia vis-à-vis Ukraine: On Some Economic Costs" by Sergey Kulik
- [BSR Policy Briefing 1/2018](#): "Chinese Direct Investment in the Baltic Sea Region" by Jean-Marc F. Blanchard
- [BSR Policy Briefing 5/2017](#): "The economic impact of China on the Baltic Sea region" by Jean-Paul Larçon

- [BSR Policy Briefing 4/2017](#): "National innovation and smart specialisation governance in the Baltic Sea region" edited by Zane Šime
- [BSR Policy Briefing 3/2017](#): "The economic state of the Baltic Sea region" edited by Kari Liuhto
- [BSR Policy Briefing 2/2017](#): "Russia's foreign relations and the Baltic Sea region" by Sergey Kulik
- [BSR Policy Briefing 1/2017](#): "Russia and the security in the Baltic Sea region" by Justyna Gotkowska & Piotr Szymański
- [BSR Policy Briefing 2/2016](#): "The EU-Russia relations and their reflections in the Baltic Sea region" Stanislav L. Tkachenko
- [BSR Policy Briefing 1/2016](#): "The maritime cluster in the Baltic Sea region and beyond" edited by Kari Liuhto
- [BSR Policy Briefing 1/2015](#): "Natural gas revolution and the Baltic Sea region" edited by Kari Liuhto
- [BSR Policy Briefing 4/2014](#): "A Russian Sudden Stop or Just a Slippery Oil Slope to Stagnation?" by Torbjörn Becker
- [BSR Policy Briefing 3/2014](#): "Poland and Russia in the Baltic Sea Region: doomed for the confrontation?" by Adam Balcer
- [BSR Policy Briefing 2/2014](#): "Energy security in Kaliningrad and geopolitics" by Artur Usanov and Alexander Kharin
- [BSR Policy Briefing 1/2014](#): "The Baltic Sea region 2014: Ten policy-oriented articles from scholars of the university of Turku" edited by Kari Liuhto
- [BSR Policy Briefing 4/2013](#): "The Kaliningrad nuclear power plant project and its regional ramifications" by Leszek Jesien and Łukasz Tolak
- [BSR Policy Briefing 3/2013](#): "Renewable Energy Sources in Finland and Russia - a review" by Irina Kirpichnikova and Pekka Sulamaa
- [BSR Policy Briefing 2/2013](#): "Russia's accession to the WTO: possible impact on competitiveness of domestic companies" by Sergey Sutyryn and Olga Trofimenko
- [BSR Policy Briefing 1/2013](#): "Mare Nostrum from Mare Clausum via Mare Sovieticum to Mare Liberum - The process of security policy in the Baltic" by Bo Österlund



www.centrumbalticum.org/en