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The economic rise of China – an integrated analysis of China's growth drivers

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Abstract

The economic rise of China has changed the global economy. The authors explore China's transformation from a low-cost manufacturing hub to an increasingly innovation- and service-driven economy. Major growth drivers for the period 2010-2025 are analysed, including the paradigms of "Made in China" and the "Dual Circulation Strategy". The export intensity of China's economy is declining overall, with a tendency towards greater regional diversification and a gradual decoupling from North America and the European Union. At the same time, trade and investment activities are increasingly geared to the Belt and Road Initiative. Furthermore, labour and energy cost advantages for manufacturing operations in China are likely to diminish in the coming years, calling into question China's attractiveness as a global manufacturing hub. In this regard, the further development of regional and industrial clusters is pivotal for China to enhance its global competitiveness and remain an attractive destination for foreign direct investment (FDI) in the medium term. On the other hand, high productivity in science and technology and rich deposits of critical minerals put China in a favourable position in advanced industries. Important challenges include the still wide development gap between rural and urban areas, the structural mismatch in the labour market, with persistently high youth unemployment, and the race to achieve carbon neutrality by 2060.

JEL F01, F14, O1, O53

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The economic rise of China – an integrated analysis of China's growth drivers

1. Introduction

The economic rise of China over the past few decades has changed the global economy, as China has become a major trade and investment partner for many countries. As China's economic importance to the global economy grows, so do its political ambitions. At the same time, tensions persist in China's economic relations: the United States and the European Union claim that unfair competition practices such as dumping, intellectual property rights violations and poor labour and environmental standards have resulted in huge trade deficits in China's favour. A key area of concern is intellectual property related to the design and manufacture of high-performance semiconductors, which are critical to many high-tech applications such as artificial intelligence, electric vehicles, factory automation and defence.

Some observers recommend that other countries reduce their dependence by gradually decoupling or de-risking from China (e.g. Scissors, 2020; Schmucker et al., 2022, Spillner et al., 2023). Others emphasise the economic importance of China and warn against any kind of trade conflict (Black et al., 2021; Federal Republic of Germany, 2023; Felbermayr et al., 2021).

Against this background, a profound understanding of China's growth strategy is important for political and business decisions-makers. There is growing interest both in the academic and policy communities to gain a better understanding of China's economic development. Several research activities focus on the pattern of development (e.g. Cai, 2015; Lin et al., 2020; Lin, 2013; Naugton, 2022; Rogoff et al., 2023; Yang et al., 2023; Zhu, 2012) and the impact of China on the global economy (e.g. Jenkins, 2022; Nuruzzaman, 2016; Pieterse, 2015). In addition, the Belt and Road Initiative (BRI) initiated by China in 2013 is primarily addressed in policy-oriented papers (e.g. Cai, 2017; Ebel, 2023; Johnson, 2016; Lokanathan, 2020; Nedophil, 2023; OECD, 2018; Zou et al., 2021). Research has also been conducted on specific economic questions such as China's development as a cost-efficient manufacturing hub (e.g. Kennedy, 2015; Liu, 2018; Liuyi et al., 2023), the impact of infrastructure investment on economic growth (Ansar et al., 2016) and the Dual Circulation Strategy (e.g. Lin, 2022; Lin et al., 2021). Another question raised by researchers is what Western industrialised economies suffering from comparatively low real growth rates could learn from China (e.g. Ross et al., 2016). Although there are many scientific and practice-oriented papers covering individual aspects of China's economic growth, the authors see a lack of integrated studies that would provide a more complete picture of China's growth development.

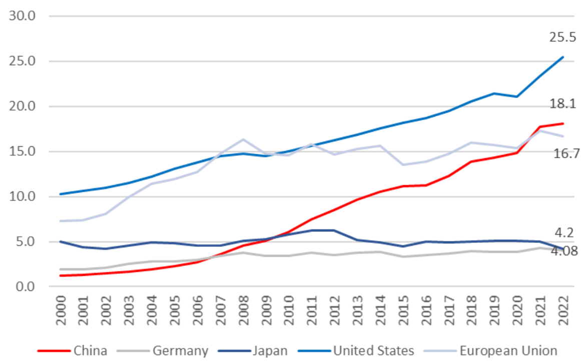
The following article briefly outlines China's economic significance and analyses its growth strategy from an external perspective. The analysis demonstrates that China, over the last twenty years, has gone through several growth phases that leveraged different growth factors. Starting as a primarily export-driven country, the focus shifted to a more domestically-oriented growth strategy based on heavy investment in domestic infrastructure. More recently, China has entered another phase of development aiming to combine domestic growth with international infrastructure and technology investments (Dual Circulation Strategy). China's access to critical natural resources and innovation performance are considered as well. Finally, we discuss the conclusions that can be drawn from our analysis.

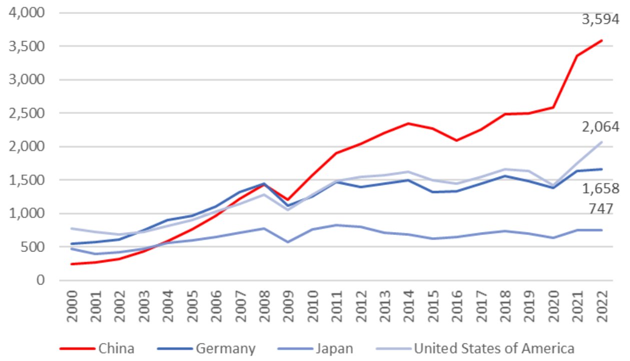
2. China's Economic Development

The economy of the People's Republic of China (PRC) has grown enormously over the last twenty years. With a GDP of USD 18 trillion (2022), it is the second largest economy in the world and has even closed the gap on the United States. In 2007 China surpassed Germany in terms of GDP, then three years later Japan. Since 2021 China's economic output has been higher than that of the European Union in total (Figure 1a). The PRC is the fourth largest country in the world in terms of area (9,596,961 km^2) and the second largest in terms of population (approximately 1.4 bn people). China's persistent current account surpluses have led to foreign exchange reserves of more than USD 3 trillion, by far the highest in the world, followed by Japan with approximately USD 1.3 trillion as of November 2023 (IMF, 2024).

Figure 1a: Growth of selected economies (GDP in trillion USD, current prices)

Figure 1b: Export volumes of selected economies (bn USD, current prices)





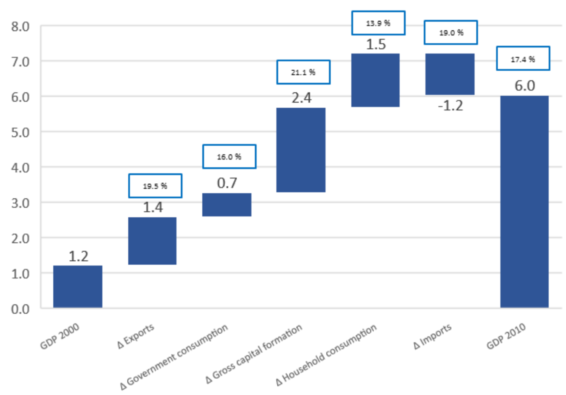
Source: IMF, WEO, Eurostat, own calculations

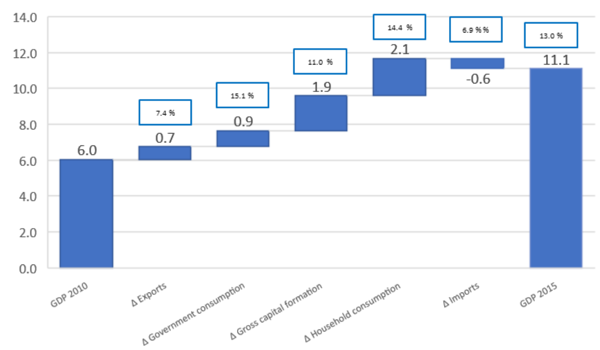
The compound average growth rate (CAGR) for 2000 to 2022 of 13.1% is far higher than the comparable Figures of the United States (4.2%), the European Union (3.85%) or Germany (3.41%). Exports of goods and services have been an important growth driver over the last twenty years, also triggering domestic consumption and capital expenditures. China has become the number one economy in terms of absolute volume of exported goods and services, ahead of the United States and Germany (Figure 1b).

China has evidently undergone different phases of economic development. Figures 2a, 2b, 2c visualise the components that make up China's GDP for the period 2000 to 2020. Looking at the different time periods, we see that the CAGR of GDP has been declining over time. During the period 2000-2010, with a CAGR of 17.4% p.a., China's GDP is mainly driven by exports, followed by government consumption and gross capital formation. Household consumption also increases, but at a lower rate. In the subsequent period 2010-2015, covered by the 12th FYP, the CAGR has flattened to 13% per year. Exports contribute much less to the GDP growth, while household consumption and gross capital formation stand out.

Figure 2a: China's growth 2000-2010 (trillion USD) (CAGR of components)

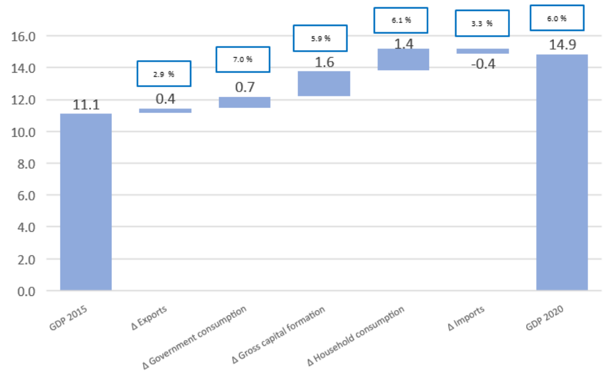
Figure 2b: China's growth 2010-2015 (trillion USD) (CAGR of components)





Source: WEO, Unctad, own calculations

Figure 2c: China’s growth 2015-2020 (trillion USD)
(CAGR of components)



Source: WEO, Unctad, own calculations

This trend is even more accentuated in the 13th FYP, covering the period 2015-2020 (Figure 2c). The current 14th FYP is still ongoing, but so far shows a similar trend at a lower growth rate due to the various geopolitical crises.

In order to understand China’s economic development, one has to look at the most recent FYPs. Their main components are summarised in Table 1. In general, an FYP sets out the economic and social development objectives and priorities for the respective planning cycle. High-level programmes, measures and budgets are established at the national level and then translated into corresponding detailed plans for specific sectors and regions. As such, the FYP is a key instrument for aligning different policy areas to achieve efficient resource allocation and ensure effective coordination of different initiatives, e.g. in industry, environmental protection, science and technology, social security and education. The FYP is initiated by the Central Committee of the Chinese Communist Party (CCP) and finally approved by the National People’s Congress (Chen et al., 2017; Heilmann, 2018).

Every FYP since 2010 has had different focus areas, featuring not only economic objectives and programmes but also political and social development programmes. Examples include the improvement of social security systems, the promotion of underdeveloped rural areas, educational policies and urbanisation. Many of the initiatives spill over from one FYP to another. As we concentrate on the economic aspects, we have identified seven areas of particular interest for economic development purposes, namely the “guiding principles” that we see as underpinning each FYP, the core “industrial strategy” and key initiatives in the areas of “environment”, “energy”, “infrastructure”, “science and technology” and “urbanisation” (Table 1). Although their focus areas change, the FYPs must be considered as part of a continuous development process, building on each other rather than being clearly distinguishable phases.

Up to the 12th FYP (e.g. ADB, 2011; NDRC, 2011; USSC, 2011) China developed primarily as a low-cost country for many manufacturing industries. Foreign investors and local producers benefited from low labour costs, especially for low-skilled workers, due to an abundant labour supply and comparatively low energy costs. There are no independent trade unions in China, and consequently no collective bargaining agreements. Significantly longer working hours and an underdeveloped social security system lowered the cost base of companies in labour-intensive sectors such as agriculture, textiles, toys and other consumer goods (e.g. Eloot et al., 2013; Liu et al., 2014). For many years, the same applied to components and intermediate products for the automotive, chemicals and mechanical equipment industries. Based on these cost advantages, China’s growth continued to be mainly export-driven during the 12th FYP. In addition, heavy investments in domestic infrastructure and in foreign countries were important growth drivers. However, rising labour costs contributed to triggering a trend reversal, as manufacturing was partly reshored to the United States or other regions (Zhai et al., 2016).

The key development theme under the 13th FYP was “Made in China” (e.g. CSET, 2019; USSC, 2017; Wübbecke et al., 2016) in conjunction with the Belt and Road Initiative (BRI) (e.g. NRDC, 2015; OECD, 2018) which was launched during the implementation of the 12th FYP. “Made in China“ aimed to transform China from a low-cost manufacturing hub to an economy driven significantly by innovation and technology. This was reflected in the target to increase the domestic content of high-tech products to 40% by 2020 and 70% by 2025. Reducing dependence on foreign production of certain technical goods, such high-performance semiconductors, also became a strategic objective.

Table 1: The Five Year Plans of China since 2010 – a brief overview

Plannig Cylcle	Guiding principles	Industrial strategy	Environment	Energy	Infrastructure	Science & Technology	Urbanisation
14th FYP 2021-2025	Dual Circulation Strategy, expand domestic consumption, decrease dependency on foreign demand and technology, increased urbanisation, further implementation of BRI, improved social security system, reduced disparities between urban and rural areas, keep urban unemployment rate below 5%, improve access to healthcare and educational system, increase per capita disposable income in line with GDP growth.	Focus on high-tech innovation, keep strength in modern manfucaturing (Robotics, IoT, supply chain integration), enhance agricultural technology and productivity, increased labour productivity by 2.5% p.a., boost innovation rate measured by number of patents per 10.000 people, further increase corporate and governmental R&D expenditure, further develop service sector.	Improve energy efficiency,reduced energy consumption and carbon dioxide emissions per unit of GDP by 13.5% and 18% respectively, carbon neutrality by 2060, promotion of new energy technologies (e.g. car batteries), improved water conservation infrastructure, transformation of automotive sector (50% of vehicles in China electric or fuel-cell powered, 50% hybrid by 2035).	Development of up to 60 gigawatts hydropower capacity on the Yarlung Tsangbo, increased proportion of non-fossil fuel energy use to 20% by 2025, continue to use nuclear energy.	Completion of the "eight Vertical and eight Horizontal" high-speed rail network, expansion of expressway networks (e.g. Beijing-Shanghai, Beijing-Hong Kong-Macau, Changchun-Shenzhen, Shanghai-Kunming), improved civil aviation, including the construction of 30 new airports, modernise digital infrastructure ("Digital China", HighSpeed Internet, Supercomputing, Blockchain etc.).	Promotion of modern information-intensive infrastructure including AI, Big Data, smart factories, semiconductors, biotechnology, new materials, quantum computing, brain science, seed industry, genetic research etc., build national laboratories in Beijing, Shanghai, and the Guangdong-Hong Kong-Macau Greater Bay Area, establish national science centers e.g. in Huairou, Zhangjiang, Greater Bay Area, Hefei	Target urbanisation rate of 65%, development of clusters around large, medium-sized and small cities.
13th FYP 2016-2020	"Made in China", increased domestic content of high tech products to 40% by 2020 and 70% by 2025, foster innovation, pursue agglomeration (i.e. regional and sectoral clusters), promotion of individual talent and excellence.	Transition from "world's factory" (production of low-tech goods facilitated by labour cost advantages) into a technology-intensive manufacturing hub, focus on "strategic emerging industries" i.e. information technology, high-end manufacturing, biotech, green and low-carbon industry, E-vehicles, new materials, the added value of these strategic emerging industries shall account for 15% of GDP by 2020, leverage the BRI, establish integrated value chains.	Further development of renewable energy and environmental technology industry (GreenTech).	Increased target for the use of non-fossil fuel energy sources to 15%, improved feed-in to the grid of wind and solar energy.	Upgrade the digital infrastructure both domestically (high-speed fiber optic network, "Broadband China") and internationally by amending the BRI with a "Digital Silk Road".	Refocus R&D strategy from traditional industries to strategic emerging industries, expansion and establishment of new scientific and industrial clusters, close integration with regional clusters and large cities, foster international cooperations and common development platforms.	Closing the welfare gaps between rural and urban areas, further urbanisation focusing on nineteen city clusters, often referred to as two horizontals and three verticals, clusters include the Beijing-Tianjin-Hebei region, the Yangtze River delta region, and the Greater Bay area.
12th FYP 2010-2015	More emphasis on domestic consumption than investments and export, development of strategic industries and the service industry, improved balance between the urban and rural development; enhanced environmental protection, more equal income and wealth distribution, improved social infrastructure and social security systems, announcement of Belt and Road Initiative (BRI) in 2013., planned CAGR of GDP: 7%, 45 million of additional jobs in urban areas.	Improved competitiveness in core manufacturing industries (equipment manufacturing, automotive, steel, non-ferrous metals, building materials, petrochemicals and textile); development of strategic industries (e.g. energy conservation, environmental protection (Greentech), new generation IT (IoT, AI, mobile networks, cloud), biotech, high end manufacturing (e-mobility, airospace, traffic control, new materials, semiconductors, high temperature alloys, high performance rare earth materials, renewable energy), development of service industry, modernisation of agricuitural sector.	Improved resource conservation and environmental protection targets, farmland reserves, cut of water consumption per unit of value-added industrial output by 30%, non-fossil fuel resources up to 11.4% of primary energy consumption, decreased energy consumption per unit of GDP by 16% and emissions per unit of GDP by 17%, decrease in emissions of major pollutants.	Accelerated construction of coal bases e.g.in Huanglong, Shendong, Shanxi, Yunnan, Guizhouily, and Xinjiang, some large coal fired power plants along these coal bases, creation of 5 large-scale oil and gas producing areas (e.g. the Tarim and Junggar Basins, the Liaosong Basin, the Sichuan Basin), exploration and development of offshore and deep water oil and gas fields, accelerated development of nuclear power; large-scale hydropower stations in key watersheds, onshore and offshore wind parks and solar energy power stations (focus on Tibet, Mongolia, Gansu, Ningxia, Qinghai, Xinjiang), construction of China-Kazakhstan crude oil pipeline, the China-Myanmar oil and gas pipeline, Central Asia natural gas pipeline, West-to-east Gas Transmission Lines.	Railways: Construction of 4 longitudinal and 4 transverse passenger transport lines, express way railway network (c. 45,000 km), covering cities with a population of over 500,0000, urban rail traffic network systems e.g in Beijing, Shanghai, Guangzhou Shenzhen, many other urban rail traffic frameworks e.g. in Tianjin, Chongqing, Wuhan, Xi’an, Highways:a national expressway network (83,000 km), expansion of coal loading ports, large crude oil handling terminals in Dalian, large iron ore handling terminals in Ningbo, Zhoushan and container terminals in Shanghai, Tianjin and other ports, construction of new and expansion of existing airports (e.g. Beijing, Guangzhou, Nanjing).	Promotion of industrial modernisation by scientific excellence, guidance of investments, talents and technology flow to enterprises, fostering strategic union of production and R&D, increase the industrial core competitiveness through corporate and state-supported R&D.	Simultaneous promotion of industrialisation, urbanisation and agricultural modernisation (increase urbanisation rate from 47.5% to 51.5%), optimizing of industry layout and productivity in light of regional capabilities/resources, major domestic products of energy and mineral resources to be located in central and western China, major projects that utilise imported resources mainly to be located in coastal and frontier areas, create advanced manufacturing bases with international competitiveness based on key state projects using industry chains and industrial parks, support the rural economy.

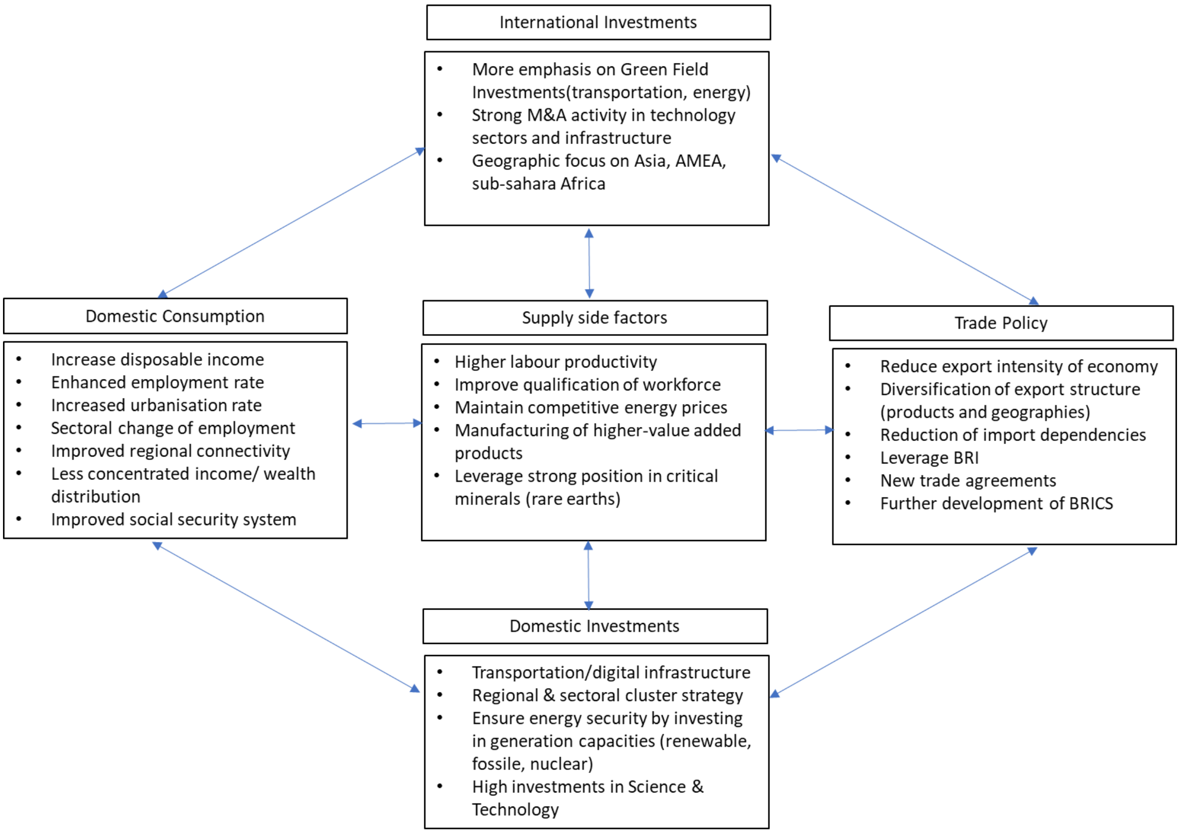
Source: Own selection of parts extracted and grouped from translations by CSET (2021, 2019), British Chamber of Commerce in China (2011).

For the current 14th FYP (2021-2025), the economic purpose can be subsumed under the Dual Circulation Strategy (CSET, 2021; Javed, 2021; Lin et al., 2021; USCC, 2021). Published in 2020, the Dual Circulation Strategy aims to strengthen domestic consumption (“internal circulation”) while reducing dependence on international trade and investment (“external circulation”). As Western industrialised countries become more economically dependent on China, China is pursuing the opposite strategy. The Chinese government is focusing on transforming the country into a modern, technology-based service society with a strong industrial base. Large-scale investments in science and technology, logistics and digital infrastructure continue to play a major role as China embarks on a new growth path. Although China has not signed the Paris Climate Agreement, it has announced its intention to achieve climate neutrality by 2060.

3. Analysis of China’s growth

In the following we provide an external view of China’s economic development in light of the communicated strategy of China’s current and the two previous FYPs and the actual strategic directions that can be derived from investment decisions and foreign investment and trade policies. The five dimensions that form the framework of our analysis are summarised in Figure 3. We will analyse China’s development path along these dimensions, including measures to increase domestic consumption and employment, continued high levels of domestic and international investment, and an adapted and more diversified export strategy. Finally, China's strong base in critical minerals provides a platform to further develop China's emerging position in new technology-driven markets, while low energy costs provide the basis for ensuring cost competitiveness in more mature industries (Figure 3).

Figure 3: Analytical framework



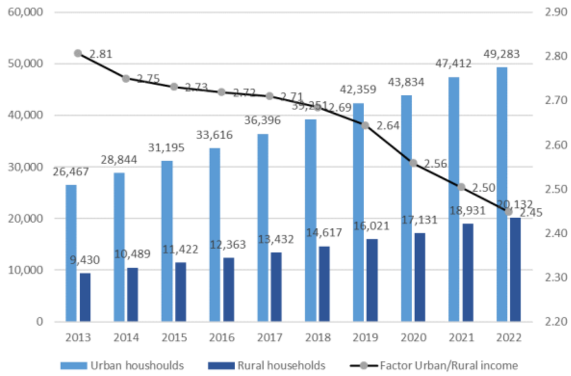
Source: Own analysis

3.1 Domestic consumption

A pivotal element of China's growth strategy is to increase domestic consumption based on a growing disposable income of the Chinese population. Improved living standards for both the urban and rural populations, combined with better education, are prominently mentioned in the 13th and 14th FYPs. Broader participation in China's economic growth is crucial to maintaining economic, social and political stability.

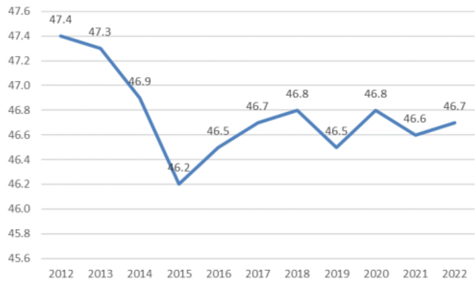
The disposable incomes of both urban and rural households have increased significantly since 2013. Moreover, the gap between these two categories has been narrowing as the ratio between the average urban and rural disposable incomes has declined from 2.81 (2013) to 2.45 (2022) (Figure 4a). The level of inequality in China's income distribution has also declined in terms of the Gini coefficient (Figure 4b).

Figure 4a: Disposable annual income of urban and rural households (in yuan)



Source: Statista and IMF, own calculations

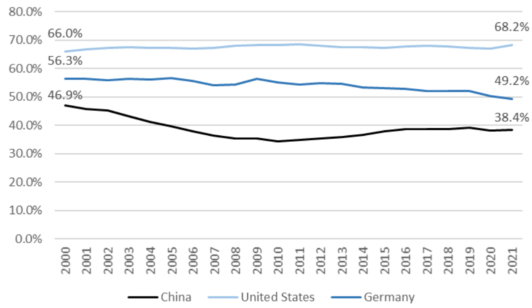
Figure 4b: Gini coefficient China (2012-2022)



Source: Statista 2023

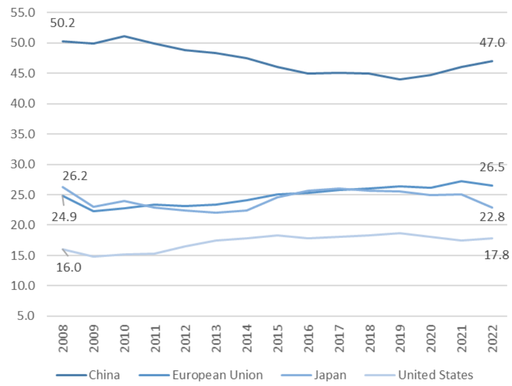
However, although the affluent middle class has expanded rapidly and the propensity to consume tends to rise with income (Lina et al., 2023; Yang et al., 2023), China's household consumption-to-GDP ratio remains low (Figure 5).

Figure 5: Household consumption-to-GDP ratio China, United States and Germany (2000-2021)



Source: Own calculations, UNCTAD

Figure 6: Macroeconomic savings rate (2008- 2022, % of GDP)



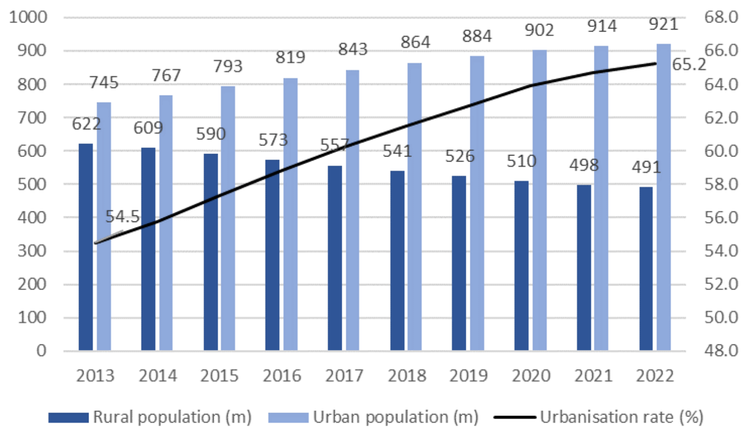
Source: Own calculations, World Bank

The household consumption to GDP ratio actually decreased from 46.9% in 2000 to 38.4% in 2021. The particularly low Figure in 2021 is certainly influenced by the Covid-19 pandemic. Compared with the United States or Germany, the relative importance of domestic consumption is much lower in China. Although the macroeconomic savings rate fell slightly from around 50% in 2008 to 47% in 2022 (Figure 6), it is still much higher than in the European Union, for example (26.5%), suggesting that a large part of the savings is needed for national and international investment activities.

Possible reasons include the still low absolute level of income for large parts of the population, combined with uncertainty about individual social security, as well as high housing and healthcare costs (Lina et al. 2023, Yang et al., 2023). Sustained economic growth and structural reforms of the social security and tax systems are needed to establish domestic consumption as a strong pillar of economic growth in China.

At the same time, the urbanisation rate has increased from 54.5% in 2013 to 65.2% in 2022 (Figure 7). This development is in line with China's strategy to increase the number of people living in urban areas to meet the growing demand for skilled labour in these industrialised and service-intensive areas. This helps to reduce the still wide gap in income opportunities between urban and rural areas and supports domestic consumption.

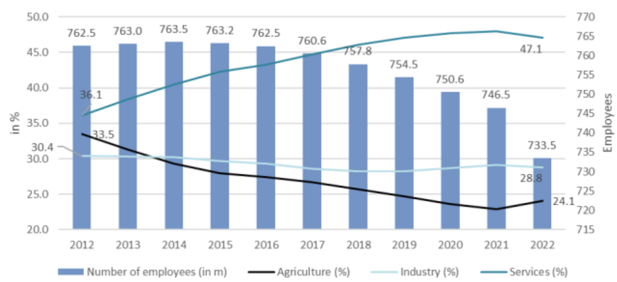
Figure 7: Rural versus urban population development in China (2013 – 2022)



Source: China Statistical yearbook, own calculations

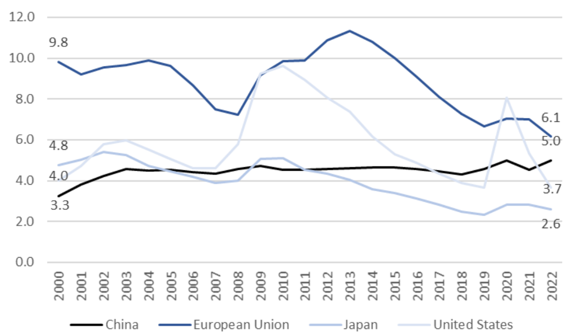
Looking at the size and sectoral distribution of the labour force, it is apparent that the absolute number of employable people is decreasing, mainly due to the one-child policy in place from 1980 to 2015 (e.g. Feng et al., 2016). As a result, the potential labour force has declined from 762 m in 2012 to around 733 m in 2022 (Figure 8a) and is likely to continue falling in the coming decades (O'Hanlon, 2023). Furthermore, we see that employment in the services and industrial sectors is growing, while employment in the agricultural sector is declining. This sectoral shift in employment is caused by the sectoral transformation of the Chinese economy towards higher value-added activities in the industrial and service sectors, while increased productivity in a modernised agricultural sector has reduced labour demand in this sector.

Figure 8a: Sectoral change of employment in China



Source: Statistical bulletin on human resource and social insurance 2022, own calculations

Figure 8b: Unemployment rate in China



Source: World Development Indicators, own calculations

Nevertheless, a slightly increasing unemployment rate can be observed, which suggests a structural mismatch between labour supply and demand (Figure 8b). In this context, the persistently high youth unemployment rate is of particular concern (e.g. ADB, 2023). China's long-standing shortage of skilled workers will become even more challenging in light of the rapidly ageing population.

3.2 Supply side factors

Productivity and labour costs

Due to the ongoing transformation, industrial labour costs have also risen in China (e.g. Coates, 2023; Liu, 2018; Liuyi, 2023, Zhai et al., 2016; Zhou, 2024). Yet China needs to retain its status as a global manufacturing hub for the foreseeable future in order to generate sufficient employment opportunities for its large population. China must therefore continue to improve its labour productivity in order to keep unit labour costs competitive and remain attractive for domestic and international manufacturing companies (e.g. Cai, 2023).

Against this background, we have estimated the average labour productivity (based on GDP per employee) in the manufacturing sector in the United States, Germany and China and compared those with the average wage costs (PPP adjusted) in the respective country (Table 2). The calculations show that, on average, labour productivity is much higher in the United States and Germany than in China, but unit labour costs are still lower on average in China. Over the period 2013-2022, productivity growth in China is much stronger than in the United States and Germany. At the same time, average wages in China have risen faster than in the other countries and also compared to China's productivity growth. Therefore, while labour cost advantages still exist in China, they are diminishing over time.

Table 2: Labour productivity and per-unit labour costs in the United States, Germany and China

Country	GDP/Employee (p.a., 2022, PPP, USD)	CAGR (GDP/Employee) (2013-2022)	Average labor costs (ALC) (p.a. 2022, PPP, USD)	CAGR ALC (2013-2022, PPP, USD)	Labor-Unit-Costs (LUC) (per unit GDP, 2022, PPP, USD)	CAGR (LUC) (2013-2022, PPP, USD)
United States	131,108	0.89%	65,495	2.83%	0.50	1.93%
Germany	106,311	0.67%	66,540	3.03%	0.63	2.34%
China	34,242	5.43%	13,654	7.71%	0.40	2.16%

Source: Own calculations based on ILO data and National Bureau of Statistics

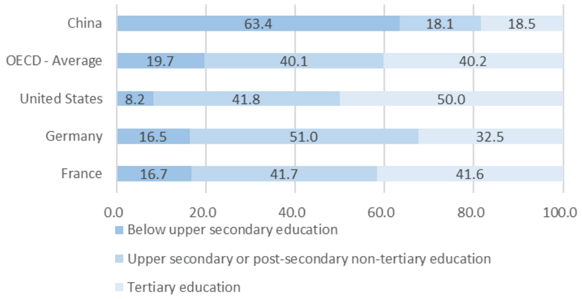
Productivity growth in China has been driven by the huge capital formation, fuelled by both domestic and foreign investment. In many cases, foreign investment (e.g. in the automotive industry) has led to the transfer of technological know-how (e.g. Liu et al., 2020). As Chinese employees moved down the learning curve, product quality improved and manufacturing processes became more efficient. Whether or not the total cost of ownership of a production plant in China is currently still lower than in industrialised countries or other offshoring hubs obviously depends on several other factors such as logistics and energy costs, tariffs and exchange rates. However, it is important to remember that these figures are macroeconomic aggregates. In some sectors, unit labour costs at the factory level may still be much lower in China if labour cost advantages outweigh any productivity disadvantages.

However, a recent study comparing manufacturing labour costs concluded that China should no longer be considered a low-cost country in general. In some sectors, including textiles, other countries such as India, Vietnam, Myanmar and Bangladesh offer even cheaper manufacturing labour at comparable productivity levels (Coates et al., 2023). Nevertheless, it should be noted that a huge number of low-paid migrant workers are moving to larger cities to work as unskilled labourers in construction or factories. Between 2013 and 2023, the number of these migrant workers was between 280 and 290 million (NBS, 2023). The availability of such a large pool of mobile and cheap workers, despite their low skill levels, is a significant economic factor, especially in labour-intensive industries.

Change in the level of education

China has made great efforts to improve its education system and has made substantial progress. This is evidenced, for example, by very good results in the OECD's worldwide PISA study (Programme for International Student Assessment) or international student competitions in natural sciences. Besides, some universities, such as Tsinghua University and Peking University, have reached the top tier of international university rankings. Nevertheless, there is still a considerable proportion of the Chinese population with a relatively low level of education (Figure 9). It is striking that more than 60% of Chinese people aged 25-64 have less than upper secondary education, whereas the corresponding figures for the OECD, France and Germany are below 20%.

Figure 9: Education structure of China versus selected other countries (2022)



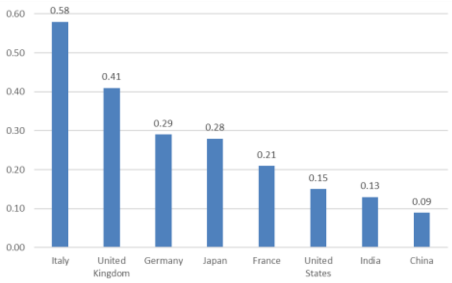
Source: Own calculations, OECD database

In addition, the proportion of people in this age bracket with a tertiary education, at 18.5%, is well below the United States (50.0%) and the OECD average (40.2%). These figures, combined with evidence of excellence in certain educational fields, suggest that the promotion of elites is highly effective. This comes as no surprise, given the rigorous selection of talent and the heavy workload associated with the curricula. On the other hand, there still seems to be huge potential to upgrade the education system in terms of educating broader sections of the population, especially in rural areas of China, and reforming higher education to better meet labour market requirements.

Energy costs

Another important cost driver for many industries is the cost of energy in a country, which is determined by generation and distribution costs, as well as government taxes and levies. Low energy prices have been used by China as a strategic tool to attract foreign investment in specific sectors and regions. Energy prices are highly regulated in China and vary significantly across regions (e.g. Deng, 2023; Zhang, 2019). Therefore, an international comparison of industrial electricity prices based on regional averages can only serve as an indication of relative price differences (Figure 10), especially as primary energy prices are highly volatile and long-term data on China's energy prices are not publicly available. Nevertheless, it is evident that manufacturers in China have benefited, and continue to benefit, not only from lower labour costs, but also in many cases from low energy prices.

Figure 10: Industrial electricity prices USD ct/KWh (June 2023)



Source: GPP Database (2023)

However, it is questionable whether China's energy policy is sustainable, given the country's already huge energy consumption and its steadily increasing dependence on primary energy imports. In 2022, China was by far the highest energy consumer (Table 3), accounting for 26.4% of global energy consumption, ahead of the United States (15.9%) and the European Union (9.6%). Among these top three energy consumers, the share of fossil energy is far higher in China (81.6%) and the United States (81.1%) than in the EU (71.1%). The EU has the highest share of renewable energy sources (including hydropower) at around 20.5%, ahead of China (16.0%) and the United States (11.3%).

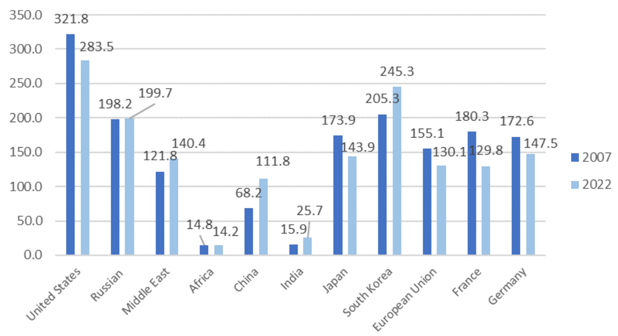
Table 3: Energy consumption, generation mix of selected countries/regions

2022	Total Consumption		Energy Mix					
Country/ Region	Exajoules	% of global	Oil	Natural Gas	Coal	Total Fossile	Nuclear energy	Renew-ables
China	159.39	26.4%	17.7%	8.5%	55.5%	81.6%	2.4%	16.0%
United States	95.91	15.9%	37.7%	33.1%	10.3%	81.1%	7.6%	11.3%
European Union	58.18	9.6%	36.0%	22.5%	12.6%	71.1%	8.4%	20.5%
Middle East	39.13	6.5%	45.9%	51.6%	0.9%	98.4%	0.6%	1.0%
India	36.44	6.0%	27.6%	5.7%	55.1%	88.5%	1.1%	10.4%
Russia	28.89	4.8%	24.4%	50.8%	11.1%	86.3%	7.0%	6.7%
Japan	17.84	3.0%	37.0%	20.3%	27.6%	84.9%	2.6%	12.5%
South Korea	12.71	2.1%	43.0%	17.5%	22.6%	83.2%	12.5%	4.3%

Source: Energy Institute, Statistical Review of World Energy 2023), own calculations and research

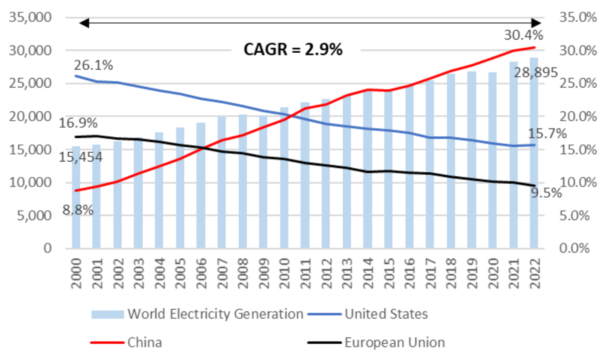
Translating these figures into per capita consumption (Figure 11), it can be noted that the United States, together with South Korea and Russia, have the highest values in 2022. Compared to 2007 we see a declining trend in the US, Japan and the EU, while emerging economies such as China, South Korea and India show remarkable growth rates in per capita consumption, albeit from a comparatively low level.

Figure 11: Primary energy consumption per capita 2007 vs. 2022 (gigajoules)



Source: Statistical Review of World Energy (2023), own calculations

Figure 12: Electricity generation (in terawatt hours and in % of world total)



Source: Statistical Review of World Energy (2023), own calculations

China's growing economic relevance is also reflected in its increasing share of electricity generation. China's global share of electricity generation increased from 8.8% in the year 2000 to 30.4% in 2022, while the respective shares of the US and the EU declined substantially (Figure 12). Global electricity production grew at an annual rate of 2.9% between 2000 and 2022. Electricity demand will continue to grow due to the overall transformation of the global economy and the further industrialisation of emerging economies.

At the same time, relative decarbonisation, as measured by the percentage point reduction in fossil primary energy consumption, was stronger in China (-17.3 pp) than in the US (-11.2 pp) and the EU (-12.6 pp) (Table 4). The share of renewables increased the most in the EU (23.4 pp), while China and the US made somewhat slower progress, with increases of 13.7 pp and 13.0 pp respectively.

Table 4: Electricity generation (in terawatt hours) based on primary energy sources 2000 to 2022

United Sates (Terawatt-hours)				China (Terawatt-hours)				European Union (Terawatt-hours)			
CAGR 2020-2022 (%)	∆ Fossile (pp)	∆ Nuclear (pp)	∆ RE (pp)	CAGR 2020-2022 (%)	∆ Fossile (pp)	∆ Nuclear (pp)	∆ RE (pp)	CAGR 2020-2022 (%)	∆ Fossile (pp)	∆ Nuclear (pp)	∆ RE (pp)
0.53	-11.2	-1.8	13.0	8.87	-17.3	3.5	13.7	0.24	-12.6	-10.8	23.4

Source: Energy Institute, Statistical Review of World Energy 2023, own calculations

China's energy import dependence has increased for all primary energy sources (Figures 13a, b, c). Despite substantial domestic reserves, China has been the largest importer of coal and oil for years. Net imports of gas (especially LNG) have also increased.

Figure 13a: Trade balance coal (exajoules)

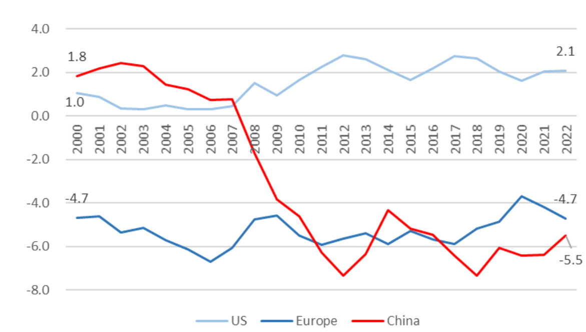
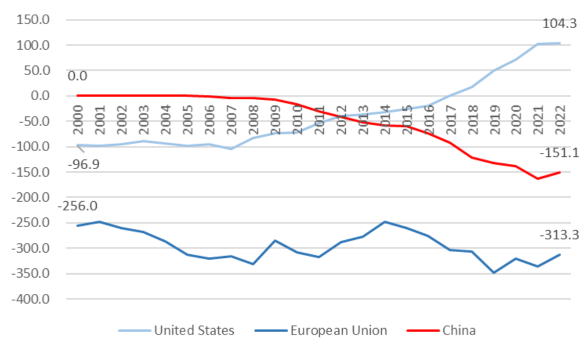
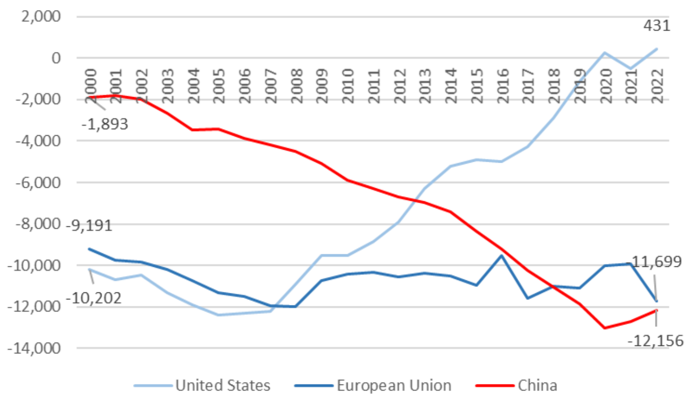


Figure 13b: Trade balance gas (LNG, pipeline, billion cubic metres)



Source: Energy Institute, Statistical Review of World Energy 2023, own calculations

Figure 13c: Trade balance oil (thousand barrels daily)



Source: Energy Institute, Statistical Review of World Energy 2023, own calculations

Energy security is obviously a major challenge for China's economic development. Against this background, China invests heavily in domestic energy generation capacities. Investment in renewables has been scaled up, putting China on track to reach its ambitious 2030 target of 50% of primary energy consumption (1,200 gigawatts) five years ahead of schedule (GEM, 2023). However, due to the enormous energy demand expected in the coming decades, nuclear and fossil fuel power plants will continue to play a major role until at least 2050.

Around 60 new nuclear power plants are under construction worldwide and scheduled for completion by 2030, 27 of which are in China (World Nuclear Organisation, 2024). China also intends to expand the share of natural gas in its total energy consumption to 15% by 2030 (International Trade Administration, 2023). To fill the widening gap between China's domestic natural gas production and demand, both pipeline and liquefied natural gas (LNG) trade have increased. The situation is similar for coal, which is the dominant primary energy source in China with a share of around 55% (2022). Domestic consumption requires large imports of hard coal. At the same time, approvals for new coal power plants quadrupled in 2022-23, compared with the five-year period (2016-2020). Since the beginning of 2022, an estimated 218 GW of new coal power plants have been approved (GEM, 2024). Therefore, it seems questionable whether China's stated target of net zero emissions by 2060 can be achieved.

Although China is investing heavily in its energy infrastructure, new domestic capacity is unlikely to be sufficient to meet energy demand in the coming decades. Therefore, there will be increasing pressure to further reform China's energy system by introducing more market-based pricing and allocation schemes (IMF, 2023). Although China introduced an emissions trading system (ETS) in 2020 (IEA, 2020), the impact on energy prices has so far been very limited due to high allowances, limited scope and low price levels, creating an implicit subsidy compared to other international ETS such as the European ETS (World Energy Outlook, 2023).

The relatively low energy prices in China so far have been a positive factor for foreign investment and local manufacturing, especially in energy-intensive industries such as steel, aluminium, copper and other basic materials. However, the expected growth in China's energy demand will lead to persistently high imports of fossil fuels in the coming decades. Combined with the target of net zero emissions by 2060, a more market-based energy system and the introduction of a more stringent ETS will most likely lead to rising energy prices in China that will be more in line with international levels. Consequently, energy cost advantages of manufacturing operations in China are likely to diminish in the coming years.

Critical minerals

China has abundant natural resources, giving it a considerable strategic advantage in developing vertical value chains around these resources. This applies to important metals such as copper, iron/steel, aluminium, zinc and lead as well as critical minerals. Critical minerals are usually defined as non-fuel minerals, elements or substances that perform critical functions in key technologies and whose shortage could lead to supply chain disruptions (American Geosciences Institute, 2024; US Department of Energy, 2024).

Table 5 illustrates the importance of China for selected critical minerals. China is by far the largest supplier of rare earths and natural graphite, which are irreplaceable in applications such as electric motors, electric car batteries, fuel cells, lasers, weapons systems and many electronic products including cell phones, hard drives and semiconductors (International Energy Agency, 2023b, USGS, 2023; USGS, 2014). China is therefore in a unique position to leverage this resource capacity to expand further down the value chain. China is already a leader in e-mobility, solar and battery technologies.

Table 5: Production, reserves and applications of selected critical minerals

Rank	Rare Earth Metals	Production (thousand Tonnes)			Reserves (thousand Tonnes)			Applications
		2022	% of global	CAGR 2012-22	2022	% of global	R/P ratio	
1	**China**	**210.0**	**70.3%**	**8.4%**	**44,000**	**35.0%**	**210**	e.g. Fuel Cells, E-engines, wind turbines, LED, LCD, permanent magnets, catalysts, batteries, glass/eramics, optical systems
2	United States	43.0	14.4%	30.5%	2,300	1.8%	53	
3	Australia	16.0	5.3%	17.4%	4,200	3.3%	263	
4	India	2.6	0.9%	-	6,900	5.5%	2,654	
5	Russia	2.6	0.9%	2.0%	21,000	16.7%	8,077	

Rank	Natural Graphite	Production (thousand Tonnes)			Reserves (thousand Tonnes)			Applications
		2022	% of global	CAGR 2012-22	2022	% of global	R/P ratio	
1	**China**	**850.0**	**61.1%**	**0.4%**	**52,000**	**14.6%**	**61**	e.g. semi-conductors, electro steel, aluinium electrolysis, solar technology, glass, precious metals products
2	Mozambique	163.0	11.7%	-	25,000	7.0%	153	
3	Brazil	95.0	6.8%	0.8%	74,000	20.8%	779	
4	Madagascar	88.2	6.3%	40.8%	26,000	7.3%	295	
5	India	57.3	4.1%	-8.2%	8,000	2.2%	140	

Rank	Lithium	Production (thousand Tonnes)			Reserves (thousand Tonnes)			Applications
		2022	% of global	CAGR 2012-22	2022	% of global	R/P ratio	
1	Australia	61.0	46.8%	17.0%	6,200	26.9%	102	Mainly batteries (Lithium-Ion), but also in polymers, lubricants, metal powder, ceramics, glass
2	Chile	38.9	29.8%	12.2%	9,300	40.4%	239	
3	**China**	**19.0**	**14.6%**	**15.5%**	**2,000**	**8.7%**	**105**	
4	Argentina	6.4	4.9%	9.0%	2,700	11.7%	423	
5	Brazil	2.2	1.7%	30.8%	250	1.1%	114	

Rank	Cobalt	Production (thousand Tonnes)			Reserves (thousand Tonnes)			Applications
		2022	% of global	CAGR 2012-22	2022	% of global	R/P ratio	
1	Congo	111.3	67.0%	2.6%	4,000	46.9%	36	e.g.batteries (Lithium-Ion), e-mobilty, engines, super alloys, carbides, catalysts, magnets
2	Russia	8.9	5.4%	3.5%	250	2.9%	28	
3	Australia	5.9	3.5%	-	1,500	17.6%	254	
4	Philippines	4.7	2.8%	5.6%	260	3.0%	56	
5	Canada	3.9	2.3%	0.5%	220	2.6%	56	

Source: Statistical Review of World Energy 2023), own calculations

The dependence of Western industrialised countries on China's deposits can lead to (artificial) shortages of these raw materials on the world markets, resulting in significant price increases due to China's export restrictions. Such behaviour has already been observed in the recent past. For example, China has restricted exports of germanium and gallium, important raw materials for chip production and the solar industry since August 1, 2023. As the largest producer of graphite, China has also regulated exports of this important raw material for battery production from December 1, 2023. Other suppliers are unable to make up the shortfall, or can only do so with considerable lead time and at very high cost.

3.3 Domestic investments

Domestic investment and government consumption will remain important growth drivers for the foreseeable future. Detailed data on investment areas are not available from the Chinese authorities. However, according to the respective FYP, improving domestic infrastructure in terms of transport networks, energy supply and distribution, water security and digital infrastructure are priority areas for investment. China is pursuing a sectoral and regional cluster strategy, given its scarce resources and huge size. The potential economic benefits of clusters for regional development have been widely discussed (e.g. Bergman et al., 2020; Liu et al., 2022).

Regional clusters

Improved connectivity is an important condition for developing rural areas, facilitating urbanisation and exploring local market and industrial potential (e.g. Miyamoto, 2018; Wang et al., 2021). China continuously invests in long-distance and local transport networks. Prominent rail projects include the construction of the Beijing-Xiongan-Shangqiu high-speed railway and rail projects in Chongqing, Kunming, Chengdu, Zhengzhou and Xian (GIZ, 2022; GIZ, 2019; Quin, 2016; Yugling et al., 2010). China already has 40,000 km of high-speed rail — more than twice the rest of the world combined. It plans to have 70,000 km of high-speed rail by 2035. China also plans to construct or restore 58,000 km of highways by 2035.

The 13th FYP (covering 2016-2020) prioritised nineteen city clusters to be developed and strengthened. In addition, five major city clusters were identified as larger regions that should provide an additional layer of connectivity between the underlying city clusters, i.e. the Jing-Jin-Ji cluster, the Yangtze River Delta cluster, the Pearl River Delta cluster, the Cheng-Yu cluster and the Yangtze River Middle Reaches cluster (Table 6). These five regions cover just eight percent of China's land area, but contribute over 50 percent of the country's economic output and foreign investment (Xin, 2021).

Regional coordination mechanisms shall ensure efficient resource allocation within and between the clusters, e.g. through collaborative industrial development, sharing infrastructure costs, common administration and joint environmental protection. Infrastructure investments to improve transport and digital capacities are also focused on priority clusters, as well as connectivity between them to deepen the networks around regional clusters.

Alongside transport networks and energy infrastructure, water conservation projects and the development of digital infrastructure are strategic development projects for China's economic development. China's ambitious South-North Water Transfer Project – an underground network of water tunnels that relocates water from the Yangtze River to northern China – is a prominent example (Magee, 2011). Other investment programmes in the past to bolster nationwide connectivity include the construction of 5G networks, high-speed rail, the West-East Electricity Transmission Project and the West-East Gas Pipeline Project, most of which were part of the Western Development Programme adopted in 2000 to bridge the development gap between the western and eastern part of China (e.g. Kong, 2021).

Table 6: Selected regional and industry clusters

Regional Cluster	Cities
Jing-Jin-Ji (North)	Beijing, Tianjin, Shijiazhuang
Yangtze River Delta (East)	Shanghai, Heifei, Nanjing, Hangzhou
Yangste River Middle Reaches (South East)	Wuhan, Changsha, Nanshang
Cheng-Yu (Central)	Chengdu, Chonqing
Pearl River Delta (South)	Guangzhou, Hong Kong, Macao

Industry Cluster	Province (Cities)
Automotive	Shanghai, Jiangsu, Zhejiang, Anhui, Beijing, Liaoning (Shenyang)
Technology	Guandong (Shenzhen, Guangzhou, Dongguan), Beijing, Shanghai Guangxi, Sichuan (Chengdu)
Steel	Shanghai, Shanxi (Taiyuan), Shandong (Jinan), Henan (Zhengzou), Hebei (Shijiazhung), Chongqing
Apparels	Guandong (Shenzhen, Guangzhou), Zhejiang (Hangzhou, Shaoxing)
Toys	Guandong (Shantou/ Chenghai, Shenzhen), Jiangsu (Yangzhou)

Source: Own Analysis, Xin (2021)

"Eastern Data, Western Computing (EDWC)" is a national project through which China intends to reduce regional disparities in the development of computing and data infrastructure throughout the country (Council of Foreign Relations, 2022; Groenewegen-Lau, 2022). The western parts of China shall benefit more from the digital economy by collecting data from the urban centers of eastern China and sending it to the west for processing. Modern digital infrastructure is essential to make inland provinces such as Guizhou and Gansu more attractive to domestic and foreign investors, especially as land and electricity costs are only a fraction of those in the urban centers where the bulk of Chinese tech companies are based.

Industrial clusters

China is known as the "factory of the world" because the Chinese government attaches great importance to building industrial clusters that enable integrated supply chains, joint development and production activities, and shared use of modern infrastructure (e.g. logistical, digital, energy or environmental) provided by industrial parks. The idea is also to attract foreign investors and skilled labour, and to enhance competition among the cluster members. A diversified supplier base allows for more flexible production cycles and reduced time-to-market. In addition, economies of scale and scope in production make investment in modern technologies and equipment more attractive, as capacity utilisation can be achieved more easily than in more dispersed regions. Specialised economic zones and standardised government services should also facilitate cluster activities.

Major clusters are located in different regions (Table 5). The automotive industry has traditionally been a key sector for FDI in China. All major OEMs and automotive suppliers have established manufacturing facilities in China, many of them in the Yangtze River Delta. Electronics manufacturing in China is mainly concentrated in Guangdong, with Shenzhen, Guangzhou, and Dongguan being the major hubs. Guangdong is also home to important apparel clusters and toy clusters. The further development of regional and industrial clusters is a key component of China's domestic development strategy to enhance its global competitiveness and remain an attractive destination for FDI in the medium term, despite further increases in wages and energy costs.

Science and Technology

China's transformation into an innovation-driven economy with a strong service sector is an important part of China's current 14th FYP. China aspires to reach leading positions in high-tech sectors such as artificial intelligence, big data, cloud computing and quantum computing. Furthermore, nanotechnologies, biotechnology, advanced materials and energy technologies are considered to be of strategic importance for China's next development phase (Appelbaum et al., 2018; Fu, 2016; Li et al., 2020) as well as the service industry (e.g. Clemes et al., 2016). Therefore, China has invested heavily in research and development in future-facing industries. In many cases, top Chinese researchers are trained at elite universities abroad and a large proportion of them later return to their home country. The sheer size of the Chinese population and the rigorous selection and promotion process in all fields from childhood onwards creates a huge talent pool, especially in science and information technology. Knowledge transfer through joint ventures also plays an important role (Liu et al., 2023).

The Global Innovation Index (GII) regularly evaluates the research and development productivity of international science and technology (S&T) clusters based on the number of patent applications and the number of scientific publications in the respective field (Wipo, 2023). The world's five largest S&T clusters are all located in East Asia (Table 7).

Tokyo-Yokohama leads as the largest global S&T cluster, followed by Shenzhen-Hong Kong-Guangzhou, Seoul, Beijing and Shanghai-Suzhou. Of the top 100 S&T clusters identified by the Global Innovation Index 2023, 24 clusters are located in China, 21 in the United States, followed by Germany with 9 clusters and Japan, Canada, India and the Republic of Korea with 4 clusters each. With more than 1 million patents per year, China files more patents than any other country in the world and is now among the innovation leaders in some areas.

Table 7: Top 10 S&T clusters according to the Global Innovation Index 2023

Rank	Cluster	Country	PCT applications	Scientific publications	Share total PCT filings (%)	Share total Publications (%)	Total score	Top PCT applicants	Top publishing institutions
1	Tokyo–Yokohama	Japan	127,418	115,020	10.1%	1.5%	11.7	Mitsubishi Electric, Sony, NTT	University of Tokyo, Tokyo Institute of Technology, Keio University
2	Shenzhen–Hong Kong–Guangzhou	Hong Kong, China	113,482	153,180	9.0%	2.1%	11.1	Huawei, Oppo, Zte	Sun Yat Sen University, South China University of Technology, Shenzhen University
3	Seoul	Republic of Korea	63,447	133,604	5.1%	1.8%	6.8	Samsung Electronics, LG Electronics, LG Innotek	Seoul National University , Korea University, Yonsei University
4	Beijing	China	38,067	279,485	3.0%	3.7%	6.8	Boe Technology, Beijing Xiaomi Mobile Software, Beijing Bytedance Network Technology	Tsinghua University, Peking University, University of Chinese Academy of Sciences
5	Shanghai–Suzhou	China	32,924	162,635	2.6%	2.2%	4.8	Aac Acoustic Technology, Zte, Suzhou University	Shanghai Jiao Tong University, Fudan University, Tongji University
6	San Jose–San Francisco, CA	United States	47,269	58,575	3.8%	0.8%	4.6	Google, Apple, Applied Materials	Stanford University, University of California Berkeley
7	Osaka–Kobe–Kyoto	Japan	38,413	51,948	3.1%	0.7%	3.8	Murata Manufacturing, Kyocera , Nitto Denko	Kyoto University, Osaka University, Kobe University
8	Boston–Cambridge, MA	United States	18,184	76,378	1.4%	1.0%	2.5	Massachusetts Institute of Technology , Harvard University, General Hospital	Massachusetts Institute of Technology, Harvard University, Harvard Medical School
9	San Diego, CA	United States	23,261	20,928	1.9%	0.3%	2.1	Qualcomm , Hewlett-Packard , University of California	University of California San Diego, San Diego State University, Scripps Research Institute
10	New York City, NY	United States	13,838	74,849	1.1%	1.0%	2.1	IBM , Regeneron Pharmaceuticals , Honeywell	Columbia University, New York University, Princeton University

Source: Wipo (2023) amended by own analysis

In Table 8 we have collected and analysed the data for China, the United States, Japan, Germany and South Korea for selected technology fields in order to compare the R&D productivity in those research fields that are widely considered to have inherent high growth potential in the coming years, i.e. computer technology; semiconductors; biotechnology; medical technology; environmental technology; optics; machine tools; engines, pumps and turbines; electrical machinery, apparatus and energy; and nanotechnology.

Table 8: Innovation productivity of selected countries (2000-2022)

Technology	China	Germany	Japan	Republic of Korea	United States
Computer Technology					
Patents 2022	258,247	7,603	26,528	25,292	69,781
in % Global (416.556)	62.0%	1.8%	6.4%	6.1%	16.8%
Rank	1	5	3	4	2
Patents 2000-2022	1,335,062	121,071	698,361	318,501	1,130,041
Rank	1	5	3	4	2
Semiconductors					
Patents 2022	34,859	2,861	21,544	17,911	13,097
in % Global (97.165)	35.9%	2.9%	22.2%	18.4%	13.5%
Rank	1	5	2	3	4
Patents 2000-2022	240,712	82,600	640,271	306,625	303,286
Rank	4	5	1	2	3
Biotechnology					
Patents 2022	27,141	3,117	4,614	4,859	24,221
in % Global (80.767)	33.6%	3.9%	5.7%	6.0%	30.0%
Rank	1	5	4	3	2
Patents 2000-2022	241,397	75,907	105,238	53,915	397,204
Rank	2	4	3	5	1
Medical Technology					
Patents 2022	64,403	7,396	14,977	11,936	45,088
in % Global (183.719)	35.1%	4.0%	8.2%	6.5%	24.5%
Rank	1	5	3	4	2
Patents 2000-2022	406,320	155,416	308,751	111,791	802,657
Rank	2	4	3	5	1
Environmenal Technology					
Patents 2022	38,245	1,938	3,953	3,580	4,245
in % Global (183.719)	65.5%	3.3%	6.8%	6.1%	7.3%
Rank	1	5	3	4	2
Patents 2000-2022	359,461	54,955	142,077	61,997	95,820
Rank	1	5	2	4	3

Technology	China	Germany	Japan	Republic of Korea	United States
Optics					
Patents 2022	24,188	2,982	18,586	5,418	9,986
in % Global (68.63	35.2%	4.3%	27.1%	7.9%	14.5%
Rank	1	5	2	4	3
Patents 2000-202	206,921	62,456	746,768	155,934	206,780
Rank	2	5	1	4	3
Machine Tools					
Patents 2022	70,096	5,370	9,256	4,080	5,483
in % Global (102.5	68.3%	5.2%	9.0%	4.0%	5.3%
Rank	1	4	2	5	3
Patents 2000-202	628,179	137,458	258,106	73,155	156,666
Rank	1	4	2	5	3
Engines, pumps, turbines					
Patents 2022	22,514	4,692	7,039	2,985	6,899
in % Global (56.01	40.2%	8.4%	12.6%	5.3%	12.3%
Rank	1	4	2	5	3
Patents 2000-202	196,851	192,291	304,236	70,262	203,550
Rank	3	4	1	5	2
Electrical machinery, apparatus, energy					
Patents 2022	109,920	15,429	39,040	22,547	19,359
in % Global (230.7	47.6%	6.7%	16.9%	9.8%	8.4%
Rank	1	5	2	3	4
Patents 2000-202	885,839	283,005	979,760	315,405	405,635
Rank	2	5	1	4	3
Nanotechnology					
Patents 2022	3,329	334	350	200	645
in % Global (5.812	57.3%	5.7%	6.0%	3.4%	11.1%
Rank	1	4	3	5	2
Patents 2000-202	28,197	6,273	11,982	7,259	15,104
Rank	1	5	3	4	2

Source: Own analysis based on Wipo data (2023)

The aggregated patent applications over the period 2000-2022 and the most recent data available for 2022 reveal that China is already an innovation leader in computer technology, environmental technology, machine tools and nanotechnology. In all other fields China is ranked between two and four and is rapidly catching up with its major competitors, as indicated by its first position in all categories in 2022.

Although there is not necessarily a strong correlation between patent registrations and commercial success in the respective field, the high levels of government and corporate investment have paid off in terms of research excellence. Combined with China's investment in digital infrastructure and its efforts to set industry standards, the improved R&D productivity could establish a platform for further growth in key technologies.

3.4 Trade policy

China's trade surplus with the rest of the world has increased massively, with a trade surplus of around USD 877 bn, while the United States shows increasing deficits, reaching a value of around USD -1.3 trillion in 2022 (Figure 14a).

Figure 14a: Trade balance (in bn USD)

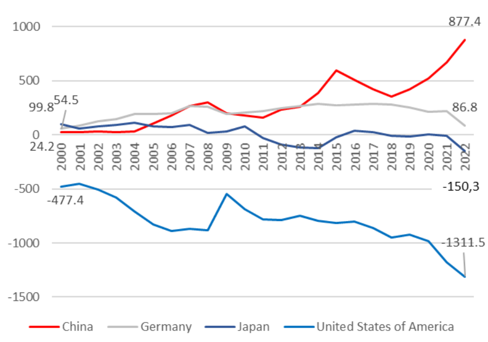
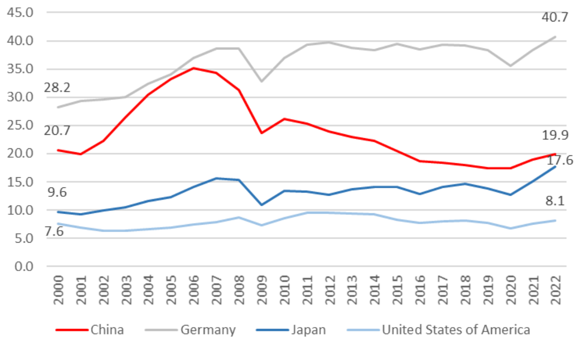


Figure 14b: Export intensity (in % GDP)



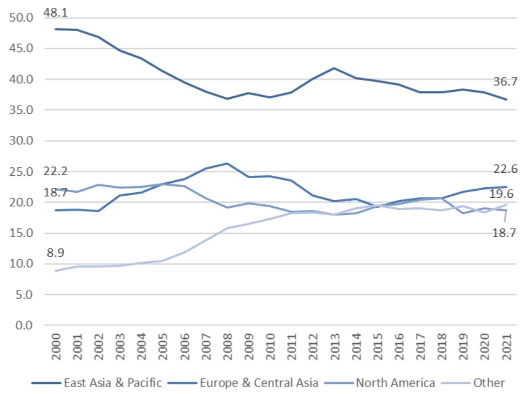
Source: Unctad, own calculations

These persistent imbalances have been the subject of many controversial debates between the countries involved and have led to several legal proceedings at the WTO, including the "US-China trade war" that started in 2018. Although China's economic growth has been mainly export driven over the last twenty years, the dependence of China's economic development on exports is decreasing and is lower than in Germany, for example (Figure 14b), which supports the view that China is seeking to reduce its dependence on major trading partners. While China's export ratio has fallen from its peak of almost 35% of GDP (2005) to around 20% in 2022, the corresponding figure for Germany is around 40% with an upward trend. While the export intensity of the Chinese economy has decreased, the focus of Chinese economic policy has shifted towards more public and private investment and domestic consumption.

Geographic diversification of exports

Over the past 20 years, China has significantly diversified its export structures and thus reduced its dependence on individual trading partners. On an aggregate level, China has managed to reduce its dependence on East Asian and Pacific economies, which accounted for 48% of the total export volume around 2000, to around 37% in 2021.The relative importance of North America has been reduced, while China has significantly improved its trade with "growth markets" (Figure 15). For the purpose of this analysis, "growth markets" from a Chinese perspective include the regions Latin America & Caribbean, Middle East & North Africa, and Sub-Saharan Africa.

Figure 15: Change of regional trade structures of China (2000 – 2021)



Source: Own calculations, Unctad, Wits (basis: 95% most important trading partners)

China has transformed itself from a primarily low-technology, resource-based manufacturing country in the 1990s, when many industrialised countries shifted the manufacturing of labour-intensive and standardised products to China. High- and medium-tech manufactures now account for more than 50% of total exports (Figure 16a).

Another interesting perspective on China's changing export structure is provided by the type of labour involved in manufacturing the respective products (Figure 16b). Since 1995, the share of labour- and resource-intensive products has fallen from 36.7% to 17.4%. The shares of medium- and high-skilled technology-intensive products have significantly increased to 29.4% and 35.1% respectively (Figure 16b).

Figure 16a: Changed product mix of China's exports (2000 to 2022)

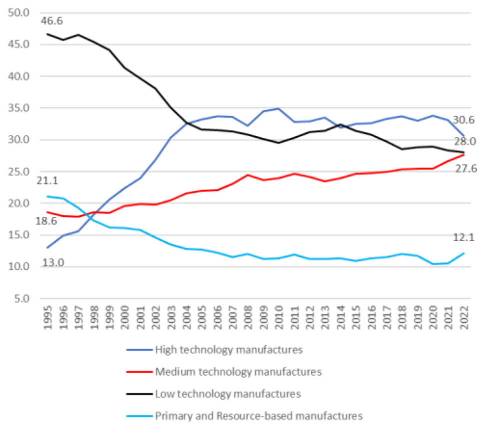
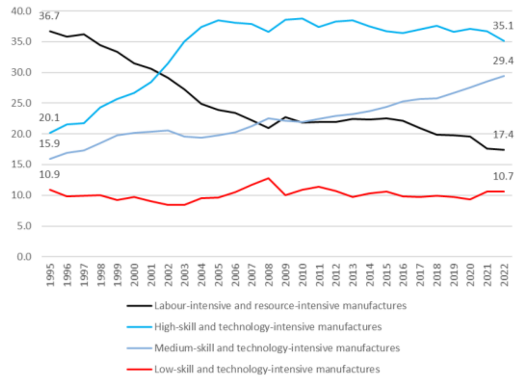


Figure 16b: Changed product structures according to type of labour involved (2000 - 2022)



Source: Own calculations, Unctad, Wits

Trade and investment agreements

The US and EU are still pursuing a number of dumping cases and intellectual property rights cases against China, leading to punitive tariffs or penalties and countermeasures by China. However, China has concluded a number of strategic agreements that have put it in a strong economic and political negotiating position vis-à-vis the US and the EU. These include the Regional Comprehensive Economic Partnership (RCEP), which is an Asia-Pacific free trade agreement with 15 countries. In addition to China, it includes Indonesia, Australia, New Zealand, Japan, South Korea, the Philippines, Singapore, Thailand and Vietnam. With effect from 1 January 2022, it created an economic area comprising around 30% of the world's population and around 30% of global GDP (ADB, 2020). At the same time, the BRICS countries have invited Argentina, Egypt, Ethiopia, Iran and the United Arab Emirates to join the organisation as of January 1, 2024. Although the association of BRICS states does not constitute a common trade or investment area, it could develop into one in the future. Australia, Brunei, Canada, China, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam have joined forces under the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). The agreement is the successor to the Trans-Pacific Partnership (TPP) agreement, from which the US withdrew in 2017. Following Brexit, the UK is now a member of the CPTPP, which should also be viewed in the context of comparable agreements such as the EU-Japan Free Trade Agreement (JEFTA), the EU-Canada Free Trade Agreement (CETA) and the North American Free Trade Agreement (USMCA). In addition to these major trade and investment agreements, China's Belt and Road Initiative (BRI) plays a key role in China's foreign trade and investment policy.

Belt & Road Initiative

In March 2015, China published a global infrastructure initiative aimed at creating better trade and investment opportunities between China and all major economic regions, which is now widely known as the Belt and Road Initiative (BRI) (Cai, 2017; Johnson, et al., 2016; NDRC, 2015; OECD, 2018; The World Bank, 2019; Xi, 2017; Xinhua, 2013). The Chinese government has pointed out that the BRI should also enable more balanced regional growth and help shift the global economy to a more sustainable development path in the future. As such, improving transport and digital infrastructure is at the heart of the BRI. In addition, bilateral and multilateral cooperation agreements are supposed to be established to create new free trade areas. Another important aspect of the BRI is access to natural resources, energy and food. However, economic and political observers also see the BRI as a fundamental component for strengthening China's global political influence (e.g. Beeson, 2018; Cheney, 2019). In particular, the huge investment volumes, often combined with long-term service and supply contracts and funding from Chinese financial institutions, may lead to emerging economies becoming dependent on China.

The modern Belt and Road Initiative includes the Silk Road Economic Belt for the land part and the 21st Century Maritime Silk Road for the maritime part. The BRI originally involved 64 economies, but has since expanded its scope to 151 countries or regions that have at least one BRI-related contract (Nedophil, 2023; OECD, 2018). The economies involved in the BRI represent more than a third of global GDP and over half of the world's population (OECD, 2018; World Bank, 2019).

The BRI initially envisaged six economic corridors integrating highways, railways, waterways, and airways. Xinjiang is to become the core region of the Silk Road Economic Belt and Fujian the core region of the 21st Century Maritime Silk Road.

The Silk Road Economic Belt

- The New Eurasian Land Bridge (NELB): Connecting China and Europe via Kazakhstan, Russia, Belarus, Poland (Lodz), the Netherlands (Rotterdam) and Germany (Duisburg)
- China, Mongolia, Russia Economic Corridor (CMREC)
- The China, Central Asia, West Asia Economic Corridor (CCAWEC): Connecting China and Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Turkmenistan, Iran, and Turkey
- The China Indochina Peninsula Economic Corridor (CICPEC): Connecting southern China with Southeast Asia (Vietnam, Laos, Cambodia, Thailand, Malaysia, Singapore).
- The China, Pakistan Economic Corridor (CPEC)

The Bangladesh, China, India and Myanmar Economic Corridor (BCIM) was a proposed corridor connecting India and China through Myanmar and Bangladesh. However, the project seems to be on hold. Other prominent examples of infrastructure projects undertaken within the Silk

Economic Belt in Africa include the Addis-Ababa-Djibouti Railway and the Mombasa-Nairobi Railway.

The 21st Century Maritime Silk Road

The 21st Century Maritime Silk Road (MSR) will link the Chinese coast (Fuzhou) with Hanoi, Jakarta, Singapore and Kuala Lumpur. The maritime belt also includes Colombo in Sri Lanka, Nairobi in East Africa and Djibouti, connecting to Europe through the Red Sea via the Suez Canal to Istanbul, Athens and Trieste (OECD, 2018; The State Council - the People's Republic of China, 2017; NRDC, 2015). The acquisition of ownership rights in ports or long-term leases are pivotal elements of China's MSR project. These include Gwadar (Pakistan), Kyaukpyu (Myanmar), Kuantan (Malaysia), Djibouti, Hambantota (Sri Lanka) and Muara (Brunei).

In several cases, port investments by Chinese entities go hand in hand with financial commitments to modernise the respective infrastructure and to provide the necessary financing (e.g. The Law Library of Congress, 2021). Depending on the size of the stake and the contractual arrangements, the Chinese counterparties will have a degree of control over the port activities. China can ensure adequate access to storage and container handling capacity, which is essential to provide seamless global supply chain services. However, this could lead to entry barriers for international competitors in times of scarce port capacity if China can exercise strategic influence over port management (Ghiasy et al., 2018). In addition, the Chinese state-owned Cosco Group, one of the world's largest container shipping companies, has acquired significant stakes in foreign ports, including those not directly related to the BRI. These include participations in Piräus (Greece, 100%), Seebrüge (Belgium, 90%), Valencia (Spain, 51%), Bilbao (Spain, 40%), Antwerp (Belgium, 20%), Rotterdam (Netherlands, 17.85% of Euromax terminal), Hamburg (Germany, 24.9% of Tollerort container terminal) (Cosco Shipping Holdings, annual report, 2022)

Digital Silk Road

The Digital Silk Road (DSR) was introduced as the digital complement of the BRI at the second Belt and Road Forum in 2019. The DSR has since become a focus of China's foreign economic policy, for example in terms of digital connectivity cooperation with members of the Association of Southeast Asian Nations (ASEAN) (Cheney, 2019; Chow-Bing, 2021; Gordon et al., 2022). The DSR fits with China's ambitions to become a high-tech leader. The DSR involves large investments in digital technologies such as telecommunications network infrastructure, including 5G, submarine and overland fibre-optic cables, satellite ground tracking stations, data centers, "smart city" concepts, cybersecurity systems and e-commerce investments (Ghiasy et al., 2020).

The Pakistan and East Africa Connecting Europe (PEACE) project is an ambitious element of this plan: a 15,000 km submarine cable network being built to serve countries across the BRI region, with the aim of linking Asia, Africa, and Europe (Chow-Bing, 2021). The same applies to the Guangxi-ASEAN connection. The southern Chinese province of Guangxi plays a strategic role in China's seaport alliances with ports in Southeast Asia (e.g. Kuantan in Malaysia), but has also been selected as the main hub for the China-ASEAN Information Harbor, launched in 2016. Nearly all of China's tech giants and major telecom carriers are now present there. A key component of China's digital strategy is the initiative "China Standards 2035", which intends to establish Chinese norms for modern technologies such as blockchain, AI, cloud computing and IoT as global standards (CSET, 2021b). Therefore, Chinese institutions are becoming more active in major standardisation bodies such as the International Standardization Organization (ISO) or the International Telecommunications Union (ITU).

Financing

Buyouts of foreign companies are mainly financed by the Chinese SOE involved, possibly with supplemental funding from Chinese financial institutions. Large construction projects are mainly financed by one or more Chinese infrastructure funds or multinational financial institutions such as the IMF or the World Bank. Local funding or guarantees from the respective host countries also play a significant role in most cases. Major financiers include the Asian Infrastructure

Investment Bank (AIIB), the Silk Road Fund (equity investments), the China Investment Corporation (CIC), the China Development Bank, the China Exim Bank, the Agricultural Development Bank of China and the Industrial and Commercial Bank of China (OECD, 2018).

However, many of these debt-financed initiatives are proving unsustainable, leaving host countries and firms in financial trouble. Prominent examples include Montenegro's controversial Bar to Boljare highway, which was built by the China Road and Bridge Corporation (CRBC) and financed by the Export-Import Bank of China with a volume of around USD 1 bn. Restructuring of such loans can have unintended consequences for the host country, as demonstrated by Sri Lanka's Hambantota Port with a transaction volume of around USD 1.1 bn. As the port attracted little traffic, the project was unable to pay its debt. The loan obligation was therefore swapped for a 99-year lease contract with Chinese entities. Other examples of African countries' rising external debt to China include investments in Djibouti's Doraleh multi-purpose port and the railway line between Djibouti and Ethiopia (Scissors, 2023; Chen, 2021; Lokanathan, 2020).

When looking at overall transaction volumes within the BRI, it is important to distinguish between investments in corporates and the extensive construction activities by Chinese firms in infrastructure projects that make up the BRI.

BRI - investments and construction

In the following we analyse the overall development of the BRI-related transaction volume, which includes the total volume of Chinese investments and the corresponding construction volume under the BRI initiative. Figure 17b illustrates that cumulative investments (both corporate and greenfield) together with the BRI-related construction has reached more than USD 900 bn in 2022. The data distinguishes "investments", which involve ownership rights of Chinese firms or joint ventures with local partners, from "construction", which is mainly carried out by Chinese firms that serve as general contractors for infrastructure projects abroad. The construction activities along the BRI routes account for as much as 59% of the total transaction volume. Total investments have peaked in the years 2015 and 2018 and have been reduced since 2020 due to the pandemic, with signs of recovery in 2023 (Figure 17a).

Figure 17a: Investments and construction (2013-2022)

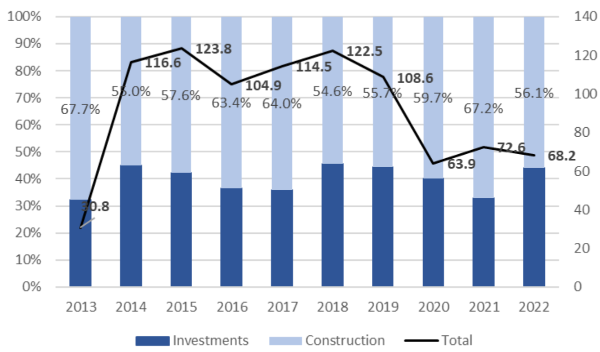
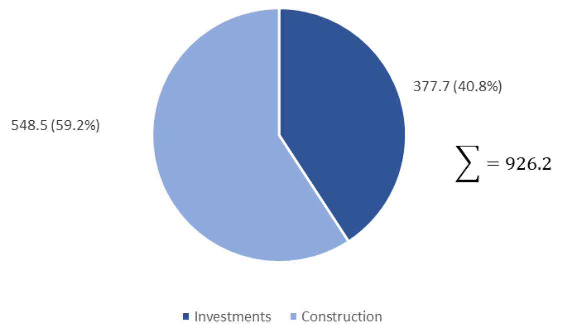


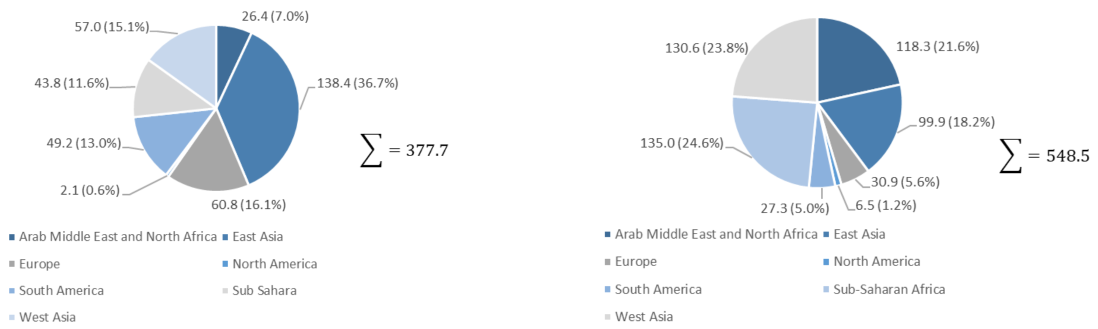
Figure 17b: Cumulative distribution (2013 - 2022)



Source: Own analysis, China Investment Tracker

The regional focuses of direct investments and construction projects differ quite substantially (Figure 18a and 18b). While East Asia (36.7%), Europe (16.1%) and West Asia (15.1%) attract the largest shares of Chinese corporate investment, construction activities are more concentrated in Sub-Saharan Africa (24.6%), West Asia (23.8%) and the Middle East and North Africa (21.6%). The construction activities are mainly focused on port and related railway infrastructure to establish the Maritime Silk Road, whereas investments are more oriented towards the economic land belt.

Figure 18: (a) Regional distribution of investments (b) Regional distribution of construction



Source: Own analysis, China Investment Tracker

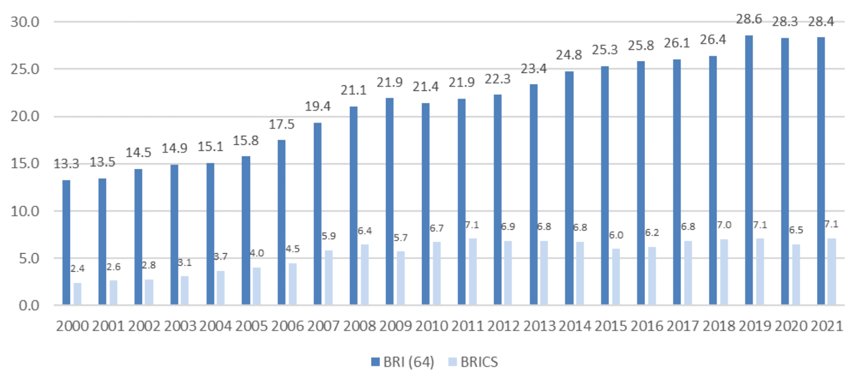
Looking at the sectoral distribution of investments and construction, Energy/Utilities account for the largest share of investments (36.6%) and construction (44.7%), followed by Transport/Logistics (18.6% and 30.8%) (Figures 19a, 19b).

Figure 19: (a) Sectoral distribution of investments (b) Sectoral distribution of construction

Source: Own analysis, China Investment Tracker

The economic relevance of the BRI for China is also reflected in the increasing export shares of the BRI countries (Figure 20). The export share of BRI countries has risen from 22.3% (2012) to 28.4% (2021) and more than doubled since 2000 (13.3%). In the same period, the export relevance of the BRICS countries has almost tripled from 2.4% (2000) to 7.1% (2021). The relative importance of the BRI and the BRICS countries as trade and investment partners is expected to continue growing in the future.

Figure 20: Export shares with BRI und BRICS countries



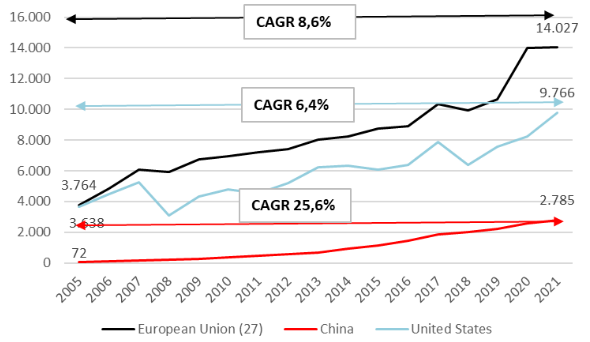
Source: Own Analysis, Wits

3.5. International investments

China's investment strategy

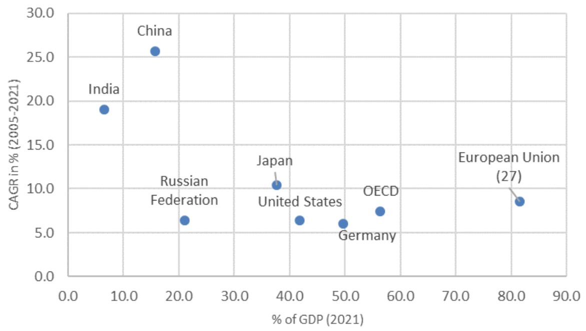
China has dramatically increased its foreign direct investment since 2005 (Figure 21a). The cumulative FDI position amounts to more than USD 2.7 trillion, with a CAGR of more than 25%. However, the absolute level is still relatively low compared to those of the EU or the United States.

Figure 21a: Development of FDI position (cumulative in bn USD, 2005-2021 outbound)



Source: OECD, own analysis

Figure 21b: FDI intensity versus FDI growth (outbound, 2005-2021; 2021)

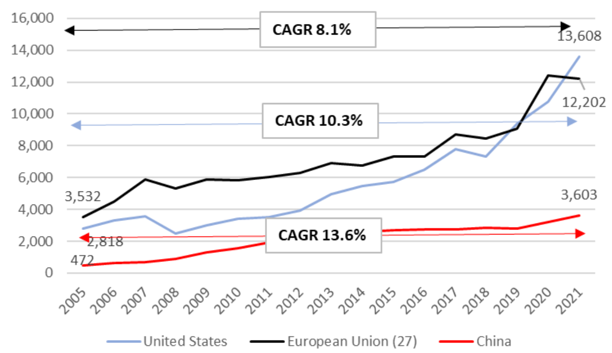


Source: OECD, own analysis

Relating the CAGR of outbound FDI to the FDI intensity (in % of GDP in 2021) shows that China's outbound investment is growing faster than that of industrial economies such as the United States, the EU or Japan, but that outbound investment still plays a minor role relative to the overall size of the economy (Figure 21b).

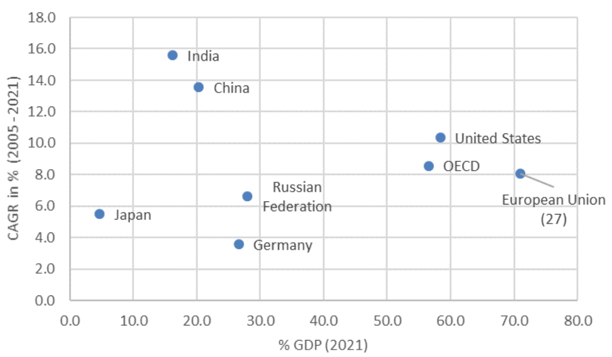
The pattern is somewhat similar for inbound FDI (Figure 22a, 22b), although the cumulative volume of USD 3.6 trillion is higher and the CAGR of 13.6% is lower than the corresponding outbound figures. Overall we see a clear increase of China's FDI in both directions, while the absolute volumes are still at a relatively low level compared to the EU or the United States. Therefore, there seems to be substantial upside potential for the expected medium- to long-term development of China's FDI flows.

Figure 22a: Development of FDI position (cumulative in bn USD, 2005-2021 inbound)



Source: OECD, own analysis

Figure 22b: FDI intensity versus FDI growth (inbound, 2005-2021; 2021)



Source: OECD, own calculations

We will now take a closer look at outbound investment flows by segmenting them along different dimensions. Firstly, we look at the split between corporate and greenfield investments (Figure

23a). In the following, corporate investments are defined as investments associated with ownership rights, e.g. buyouts, acquisitions of minority stakes and the creation of joint ventures. Greenfield investments are defined as investment activities conducted by legal entities or joint ventures, e.g. the construction of new production facilities or real estate investments.

Figure 23a: Greenfield and corporate investment flows of China (outbound 2005 – 2022, in bn USD)

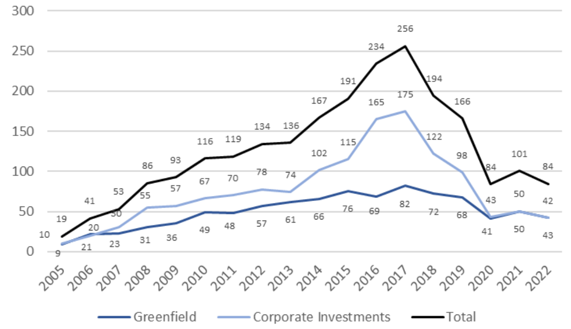
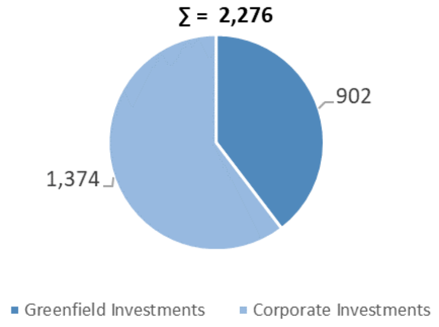


Figure 23b: Greenfield and corporate investments (outbound 2005-2022, cumulative, in bn USD)



Source: Own Analysis, China Investment Tracker

China's investments peaked in 2017 and then declined sharply in the following years, especially during the Covid-19 crisis. A stabilisation of foreign investment was observed in the years 2021 and 2022, albeit at a low level. Furthermore, there was a clear focus on corporate acquisitions for many years to gain access to markets and technologies, especially in Western economies. Due to the Covid pandemic, FDI in companies plummeted in the years 2020-2022, while greenfield activities remained relatively stable even during the crisis. Another reason may be the more restrictive approaches of Western economies to acquisitions by Chinese state-owned enterprises, partly to protect domestic critical infrastructure and technologies. Although investment activity has shifted more towards greenfield investment in relative terms since 2017, the cumulative volume of corporate investment in the period 2005-2022 is still higher than the corresponding value of greenfield investment (Figure 23b).

Sectoral patterns of FDI by China

Interesting insights into China's FDI strategy can be drawn from analysing the change of sectoral compositions both within corporate and greenfield investments. Figure 26 illustrates the sectoral patterns of corporate investments in 2005 compared to 2022. The following definitions of the sectors are applied:

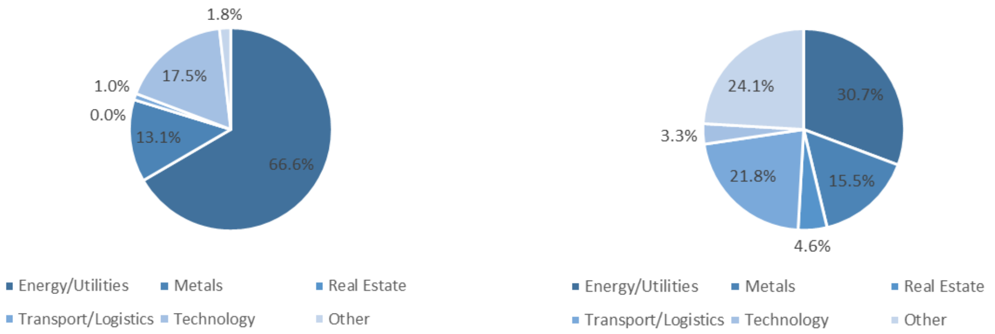
- Energy: generation, refinery and distribution of oil, gas, coal, hydro, renewables
- Metals: iron ore, steel, aluminium, copper and others
- Real estate: property, construction
- Technology: IT, telecommunications (networks and services)
- Transportation: automotive, rail, shipping, aviation
- Other: industrials, textiles, timber, consumer goods, other industries

While China already focused on acquisitions in the energy sector in 2005 (66.7% of total investment), corporate investments in this sector continue to play a major role in the acquisition strategy in 2022 (30.7%) due to China's huge demand for energy. In addition, investments in the metal sector including steel, copper or aluminium remain on a high level (13.1% in 2005, 15.5% in 2022) which is driven by China's role as a global manufacturing hub. The biggest shift can be observed in the transport sector, which rises from 1% in 2005 to 21.8% in 2022. This is primarily due to the Belt & Road Initiative, which was launched in 2015.

Figure 24: Sectoral distribution of China's corporate investments (outbound, 2005 versus 2022)

a) in 2005: ∑ = 9,970 bn USD

b) in 2022: ∑ = 41,880 bn



Source: Own analysis, China Investment Tracker

Investments in technology such as robotics, telecommunications, computer technologies (hardware/software) and semiconductors have experienced a relative decline in importance (from 17.5% in 2005 to 3.3% in 2022), mainly because China's SOE have tightened restrictions in numerous Western countries. Within the segment "others", textiles, consumer goods and industrial products (automotive, mechanical & electrical engineering) stand out.

The energy sector is also the most important sector for greenfield investments in both years (32.7% in 2005 versus 37.1% in 2022), which includes the construction and expansion of existing primary energy production and distribution facilities, including pipeline and refinery capacities (Figure 25). Similarly, the transport and logistics sector has become even more important (24.9% in 2005 versus 35.7% in 2022), also in light of the BRI. Conversely, foreign greenfield investments in metals have decreased as China increasingly explores its own natural resources. A sharp decline in foreign real estate investments, which accounted for more than 20% in 2005, stems from China's strategy of acquiring or building assets with substantial value added. Technology investments play a minor role in greenfield investments asChina prefers to build production facilities on home ground.

Figure 25: Sectoral distribution of China's greenfield investments (outbound 2005 versus 2022)

a) in 2005: ∑ = 9,300 bn USD

b) in 2022: ∑ = 42,590 bn USD

Source: Own analysis, China Investment Tracker

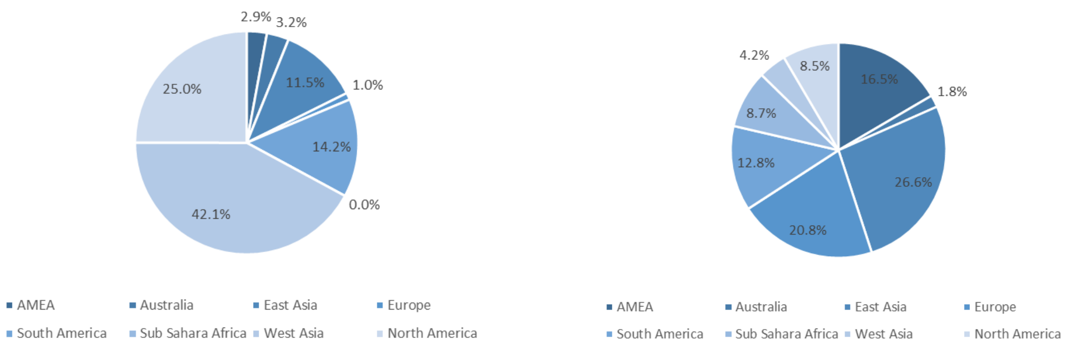
Further insights into China's investment strategy reveal the changing regional patterns of foreign investment. The regional focus of corporate investments has changed quite substantially. Corporate direct investments have clearly shifted from the United States (25.0% in 2005 versus 8.5% in 2022) due to investment restrictions, and from West Asia (42.1% in 2005 versus 4.2% in 2022) to East Asia (11.5% in 2005 versus 26.6% in 2022), Europe (1.0% in 2005 versus 20.8%

in 2022) and the Middle East (2.9% in 2005 versus 16.5% in 2022), also due to the BRI (Figure 26).

Figure 26: Regional distribution of China's corporate investments (outbound 2005 versus 2022)

a) in 2005: ∑ = 9,970 bn USD

b) in 2022: ∑ = 41,880 bn USD



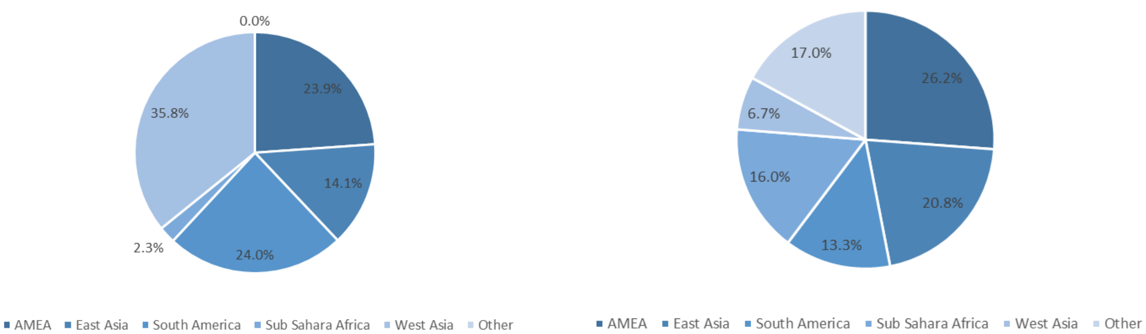
Source: Own analysis, China Investment Tracker, AEI

The regional shift in greenfield investment is slightly different. Although greenfield investment has increased, especially in East Asia (14.1% in 2005 versus 20.8% in 2022) and the Middle East (23.9% in 2005 versus 26.2% in 2022), strong growth can also be observed in Sub-Saharan Africa (2.3% in 2005 versus 16.0% in 2022). Investments in West Asia have clearly been reduced (35.8% in 2005 versus 6.7% in 2022) (Figure 27).

Figure 27: Regional distribution of China's greenfield investments (outbound 2005 versus 2022)

a) in 2005: ∑ = 9,300 bn USD

b) in 2022: ∑ = 42,590 bn USD



Source: Own Analysis, China Investment Tracker, AEI

4. Conclusions

The main purpose of this paper is to gain a better understanding of China's growth development since the year 2000, with a special focus on the FYP from 2010 to 2025. We have found that China's economic development has been driven by a number of economic components. While China's economic growth between 2010 and 2015 was mainly export-driven, international and domestic investment have been the largest contributors to economic growth from 2015 onwards. The dual circulation strategy focuses on increasing domestic consumption, achieving more balanced economic growth and transforming into a more science- and innovation-driven economy.

The export intensity of China's economy has been significantly reduced under the dual circulation strategy. Moreover, Chinese exports have become more diversified in terms of regional trade partners, with a stronger focus on East and Central Asia, Sub-Saharan Africa and North Africa and the Middle East. At the same time, the relative importance of Europe and North America as trade and investment partners has declined. Furthermore, China is gradually improving its production and export mix of products from predominantly low-tech products to higher value-added goods.

In this respect, the BRI plays, and will likely continue to play, a major role in China's development strategy. The investment and – very often neglected, if not overseen – construction activities of Chinese SOEs along both the economic belt and the maritime silk road, will lay the foundation for China's future export business and ensure access to critical natural resources and energy. Building and controlling key transport, pipeline and digital infrastructure improves China's strategic economic and political position. New trade and investment partnerships and regional free trade zones along the BRI will further reduce China's dependence on Western economies.

China's strategic plan to develop domestic consumption as an important growth driver has failed so far. Disposable incomes have risen for broad sections of the population, thanks to rising labour productivity, increasing urbanisation and a slightly lower level of income and wealth concentration. However, there is clearly still huge potential to establish domestic consumption as a strong economic pillar in China.

Therefore, China's GDP growth has been mainly driven by government consumption and gross capital formation. Large investments in physical (transport, energy) and digital infrastructure will remain an important driver of China's growth, especially to improve urban-rural connectivity and to strengthen the regional and sectoral cluster strategy. Improved connectivity within China shall contribute to a further increase in the urbanisation rate while also narrowing the still enormous gap between rural and urban areas in terms of productivity, income and education levels.

Large investments in science and technology have made China one of the most innovative countries in key technologies such as computing, biotechnology, medical and environmental technologies. Over the past few decades, China has moved from being a low-cost manufacturing base for many industries to a leading country in high-technology sectors. Such clusters exist or are emerging in eastern and south-eastern China. However, this does not mean that China is losing ground as a global manufacturing hub, as in the case of textiles, toys, basic materials or mechanical or electrical components. "Made in China" remains an important backbone of the Chinese economy, ensuring low unemployment and a successful transition to a more service- and technology-driven economy. Our analysis confirms that China still has unit labour cost advantages and continues to offer attractive energy prices. In addition, labour-intensive industries could move to less developed regions in western China, where land, labour and energy costs are often lower than in China's modern urban areas.

Looking ahead, China's remarkable achievements in scientific and technological excellence and its abundance of critical mineral resources (e.g. rare earths) put it in a good position to enter a new phase of growth after 2025. Investment is likely to remain the main driver of growth in China in the coming years, with a regional focus on the BRI and a sectoral focus on technology, transport and energy. The improvement in domestic consumption will largely depend on the success of China's structural transformation, i.e. the creation of more and better-paid job opportunities across the country. Once China succeeds in tapping the largely untapped domestic consumer market, the country could see a quantum leap in its economic development.

However, China also faces some serious strategic challenges, including energy security, environmental protection, persistently high youth unemployment and achieving carbon neutrality by 2060. In addition, maintaining cost competitiveness in more standardised products will become a challenge as both labour and energy costs are expected to continue to converge with international levels. In addition, China will need to upgrade its social security system, which is likely to increase labour costs. The energy and labour sectors need to be reformed towards a more market-based system to improve the efficient allocation of resources and avoid structural mismatches between supply and demand for scarce resources.

Our analysis of China's economic development suggests that China's global economic importance will continue to grow in the long term. This could lead to Western economies becoming increasingly dependent on China, while China pursues the opposite strategy. International imbalances could be exacerbated, with consequences for global security, international human rights and environmental protection.

Limitations and further research

It should be noted that the granularity of the data available for China is much lower than, for example, for OECD countries. Therefore, the findings in this article are somewhat preliminary and subject to future research. This is particularly true for the role of sectoral and regional clusters as drivers of economic growth. Moreover, the long-term impact of the BRI remains to be seen. The same applies to the compatibility of China's energy strategy with the goal of becoming carbon neutral by 2060, which may require further analysis.

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