GLOBAL SUPPLY CHAINS AND THE GREEN TRANSITION

A successful transition to a green economy – which will require a rapid roll-out of clean technologies – will depend on the availability of various critical raw materials. Currently, China dominates the production and processing of many of these materials, so manufacturers around the world are trying to diversify their supplier bases. This diversification will take time and require significant investment, but it may benefit several economies in the EBRD regions. There are clear opportunities, for example, when it comes to supplying materials for the solar power and fuel cell sectors.

Introduction

This chapter looks at the reshaping of global supply chains in the context of both the transition to a green economy and rising geopolitical tensions. Limiting global warming in line with the Paris Agreement – keeping global temperature rises well below 2°C (and ideally as low as 1.5°C) relative to pre-industrial levels – will require a rapid and large-scale roll-out of clean technologies in order to fully decarbonise the electricity supply, electrify most final energy use and scale up the use of low-carbon hydrogen.[1] In parallel, digital technologies are becoming increasingly important in many areas of business.

The green and digital transitions both require a range of critical raw materials. Few substitutes (if any) are available for these inputs at present, and their production is heavily concentrated in a handful of countries. China is the dominant player in the mining and processing of many critical raw materials, from germanium to lithium,[2] which amplifies the risk of supply chain disruptions in the transition to a green economy.

Geopolitical tensions have been on the rise. Covid-19 and Russia's war on Ukraine have intensified firms' search for alternatives to offshoring, with "reshoring" (bringing the production of goods back to the firm's home country) and "nearshoring" (shortening supply

[1] See Energy Transitions Commission (2023).
[2] See Overland (2019) and Righetti and Rizos (2023).

chains by sourcing inputs from nearby economies) receiving increased attention. The decoupling of trade and financial links between Russia and Western economies has intensified since the invasion of Ukraine in 2022. Countries that are not politically aligned with the West have started to make greater use of currencies other than the US dollar in their cross-border transactions, while trade patterns have been shifting.

A recent survey conducted by the EBRD shows that more than 80 per cent of investment promotion agencies (IPAs) across the EBRD regions regard this reshaping of global value chains as an opportunity for their country. Moreover, many are actively seeking to attract foreign investors that are looking to diversify their supply chains (particularly companies that are active in green transition sectors).

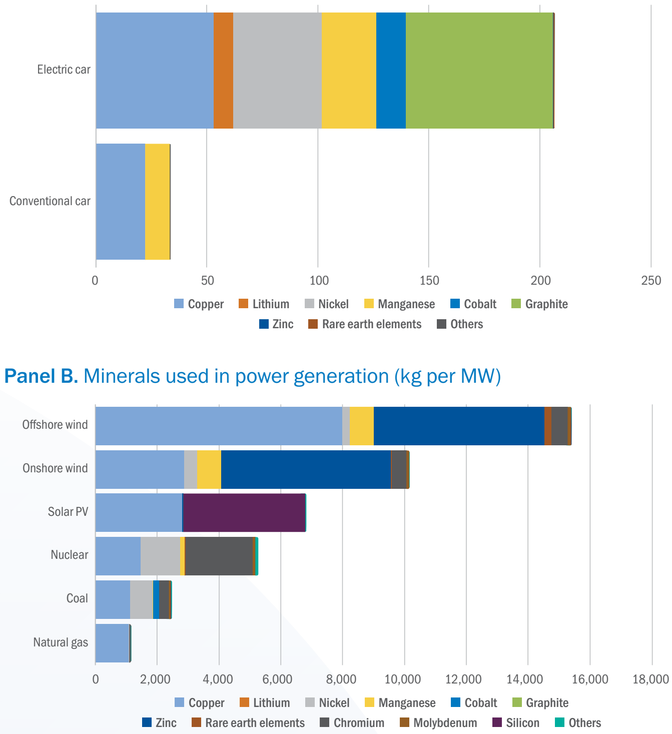
Of the various products that are necessary for the green transition, the products that economies in the EBRD regions are best positioned to produce – given their existing comparative advantages – are those required by the solar power and fuel cell sectors. Opportunities may also follow from the tightening of regulations on supply chain sustainability, which will require companies to report emissions for the whole of their supply chains and seek to reduce those emissions. Commercial information and communications technology (ICT) services are one sector where the EBRD regions would stand to benefit from such tightening of green reporting requirements. In addition, several economies in the EBRD regions boast significant deposits of critical raw materials. However, it takes time and investment to establish new mines and processing facilities.

This chapter examines, in turn, the scramble for key raw materials that are required for the green transition, changes in supply chains and global firms' feelings about reshoring and nearshoring, as well as changes to invoicing currencies in international trade. It considers the implications that these trends have for the EBRD regions, looking at how IPAs view the opportunities arising from the reshaping of global supply chains and identifying the most promising green transition sectors from the perspective of the existing export capabilities of economies in the EBRD regions. The chapter ends with a number of policy recommendations.

MORE THAN
80%
OF ALL IPAs IN THE EBRD REGIONS SEE THE RESHAPING OF GLOBAL VALUE CHAINS AS AN OPPORTUNITY FOR THEIR COUNTRY

CHART 2.1. Clean energy technologies and electric cars use large amounts of minerals

Panel A. Materials used in transport (kg per vehicle)



Source: IEA (2022).

Critical raw materials

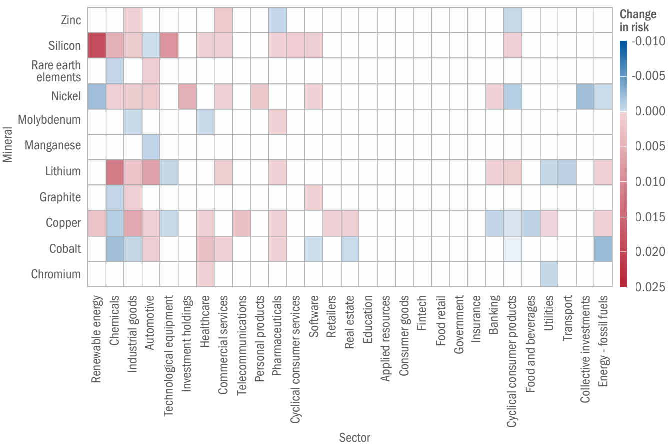
The generation of green energy requires a number of key raw materials, including (i) copper for wiring, (ii) rare earth elements for electric motors, (iii) lithium, nickel and graphite for batteries, and (iv) silicon for solar photovoltaic (PV) panels. The amounts of materials involved are significant (see Chart 2.1).

Supplying these materials in sufficient quantities to keep the green transition moving at pace will require large-scale investment in mining and refining capacity. While there are concerns today about the supply of raw materials, that is nothing new. As far back as 1977, the Council of the European Communities noted the dependence of member countries on raw materials from abroad and called for action. In 2008, the European Commission launched the Raw Materials Initiative – the first integrated strategy aimed at improving access to raw materials. China, India and the United States of America took early action as well.[3]

The specific raw materials that are regarded as critical differ from country to country, reflecting differences in development priorities and industrial needs. Only a handful of countries published such lists prior to 2020; however, the supply chain disruption

[3] See, for example, Righetti and Rizos (2023), IEA (2016) and Gupta et al. (2016).
[4] See IEA (2022).
[5] See IEA (2021), p. 248, and European Commission (2023), Annex II, Section 1, respectively. See also Box 2.1.

CHART 2.2. Risks relating to critical minerals rose in green economy sectors between 2015 and 2023



Source: NL Analytics and authors' calculations.
Note: Data as at 11 July 2023. Sectors are sorted on the basis of the average change in risk across all listed minerals.

caused by the Covid-19 pandemic, the war on Ukraine and recent geopolitical tensions has prompted many others to follow suit.[4] This chapter classifies a raw material as critical if it is on the International Energy Agency (IEA) list or in the EU's proposed Critical Raw Materials Act.[5] Thus far, no EBRD economies outside the EU have published critical raw materials lists of their own.

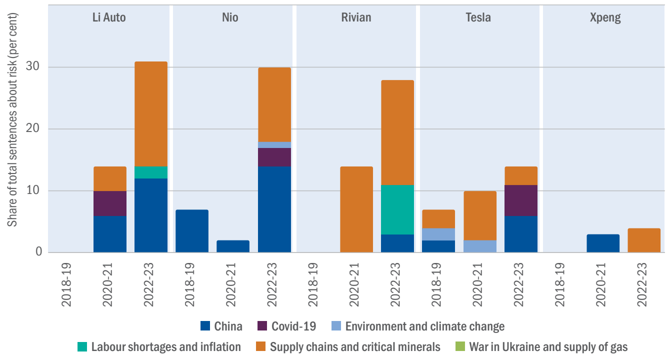
Global firms and critical raw materials

This section looks at trends in terms of references made to critical raw materials in earnings calls – regular calls between managers of listed companies and analysts and potential investors. The analysis is based on NL Analytics' transcripts of almost 220,000 earnings calls between 2013 and the second quarter of 2023. Those transcripts cover 11,445 publicly listed firms, which are headquartered in 85 countries.

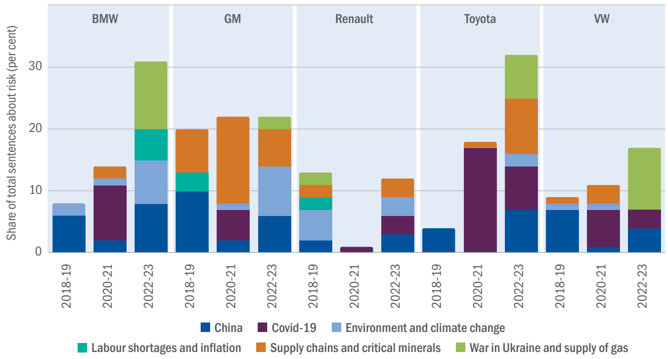
The analysis focuses on firms' concerns about factors that could affect their future revenues. It identifies sentences relating to critical raw materials, supply chains, the environment and climate change, Covid-19, inflation, labour shortages, China's economic outlook, the war on Ukraine and the supply of natural gas by checking for the relevant keywords, which were chosen with the aid of NL Analytics' keyword tool.[6] The analysis also tracks (i) whether the terms "risk", "risky", "uncertainty" or "uncertain" (or any synonyms for those terms) were used in combination with those keywords and (ii) whether the sentiment of the surrounding sentence was positive or negative. For example, someone saying "we are balancing imports with local sourcing to de-risk the company from tariffs and supply chain risks" indicates that supply chains are contributing to uncertainty, while someone talking about "the disruption felt in India, where aggressive shutdown mandates were enacted, impacting market demand and supply chain infrastructure" indicates negative sentiment regarding supply chains.

CHART 2.3. Supply chains and critical raw materials are more of a concern for pure EV companies than for traditional car manufacturers diversifying into EVs

Panel A. Pure EV companies



Panel B. Other automotive companies



Source: NL Analytics and authors' calculations.
Note: Data as at 11 July 2023.

While concerns about the operating environment have fallen overall since the second quarter of 2022, they are still higher than they were prior to 2020. Such concerns are more prevalent where firms operate in sectors that are exposed to risks relating to critical raw materials (such as industrial goods, renewable energy, chemicals, automobiles and automobile parts, and technological equipment), particularly when it comes to supply chain-related risks. The perceived risks relating to critical raw materials increased markedly in key green transition-related sectors between 2015 and the second quarter of 2023 (see Chart 2.2), with the largest increase being seen for risks relating to silicon (which is used in solar panels) in the renewable energy sector.

As expected, supply chains and critical minerals are a major concern for pure electric vehicle (EV) companies such as Li Auto, Rivian Automotive and Tesla (see Chart 2.3). They are also of considerable – albeit lesser – concern for companies that produce both EVs and conventional cars with internal combustion engines, such as Volkswagen (VW), Renault and BMW.

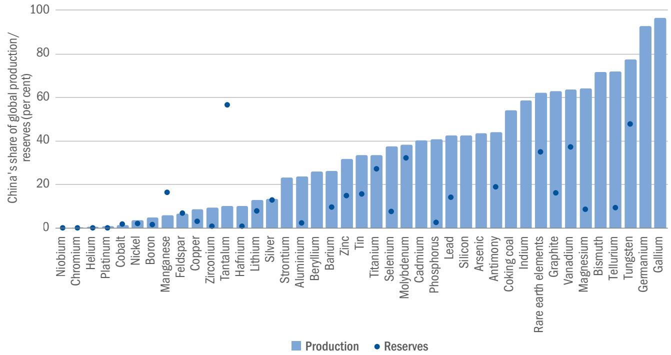
[6] The keywords used for supply chains were "global chain", "logistic chain", "logistical chain", "sub-supplier", "supplier", "supplier chain", "suppliers", "supply chain", "supply logistic", "supply network", "supply technologies" and "value chain". The keywords used for critical raw materials were "critical mineral(s)", "rare mineral(s)" and "rare earth(s)", plus all of those listed in Table 2.1.1; the words "lead" and "Silicon Valley" were excluded from the analysis. The Covid-19 keywords were taken from Hassan et al. (2020). The keywords relating to the invasion of Ukraine were taken from Hassan et al. (2021) and NL Analytics' keyword tool. The keywords relating to climate change and the environment were taken from Sautner et al. (2021) and NL Analytics' keyword tool.

Existing mining capacity is concentrated – reserves less so

The supply risk that is associated with a critical raw material is determined by (i) where it is mined and processed, and (ii) the general availability of reserves (that is to say, known commercially viable deposits in the ground). For example, rare earth elements tend, on average, to be more abundant than silver, gold and platinum (despite what their name suggests); however, few of those deposits are concentrated and economically viable to mine.[7]

The mining of most raw materials is concentrated to some degree. If one looks at standard measures of concentration such as a Herfindahl-Hirschman index (HHI), the minerals with the highest levels of geographical concentration are gallium and germanium (used in chips), followed by niobium (used in steel alloys) and tungsten (used in wear-resistant metals). In contrast, zinc (used to protect steel from corrosion), silver (used in solar cells) and copper are the most diversified geographically.

CHART 2.4. In 2021, China dominated the production of most critical raw materials



Source: Reichl and Schatz (2023), US Geological Survey (2023), Ministry of Natural Resources, PRC (2022) and authors' calculations.
Note: Both here and in subsequent charts, "platinum" refers to the platinum group of metals. Data on reserves are not available for certain minerals.

In 2021 – the most recent year for which detailed country-level production data are available – China dominated the production of most critical raw materials (see Chart 2.4). Other major producers of critical raw materials included Brazil (which supplied more than 90 per cent of all niobium), the United States (which accounted for almost two-thirds of all production of beryllium, an important input in the aerospace and defence industries) and the Democratic Republic of Congo (which supplied almost 70 per cent of all cobalt, which is used in rechargeable batteries).

ALMOST
90%
OF ALL KNOWN RESERVES OF BORON ARE IN TÜRKIYE

Reserves are more diversified geographically. While China has more than half of all known reserves of tantalum (used in electronic components), as well as significant percentages of the world's reserves of tungsten, vanadium (used in batteries and steel) and rare earth elements, almost 90 per cent of all known reserves of niobium and boron (used in fertilisers, EVs, wind turbines and solar panels) are located in Brazil and Türkiye respectively.

The scramble for resources

As the scramble for resources has intensified, major mining companies have sought to explore deposits and buy mines around the world. While companies headquartered in the United States and Canada have the most mines overseas, Chinese companies have been actively buying overseas mines over the past decade. In Africa, which is home to about 30 per cent of all known mineral resources, the number of Chinese-owned mines has doubled since 2013 on the basis of data from Standard & Poors (S&P). From an individual country's perspective, acquiring overseas mines increases the security of supply of critical raw materials.

The analysis that follows combines data on mine ownership with trade data at the six-digit level of the Harmonised System (HS6 – a level of disaggregation that corresponds to product groups such as cobalt ore and concentrates, for instance). Owing to a lack of detailed data, this exercise assumes that production and imports are distributed equally across the mines in a particular country, regardless of whether mines have domestic or foreign owners. The analysis provides a number of insights.

[7] See Van Gosen et al. (2014).

First, global sourcing of critical minerals is more diversified than the sourcing of such materials by individual countries. This indicates that countries could, in principle, further diversify their supply of critical raw materials. Their reluctance to do so may be driven by inertia and geopolitical considerations, or it may be caused by differences in the quality of supplied products that are not visible in trade data.

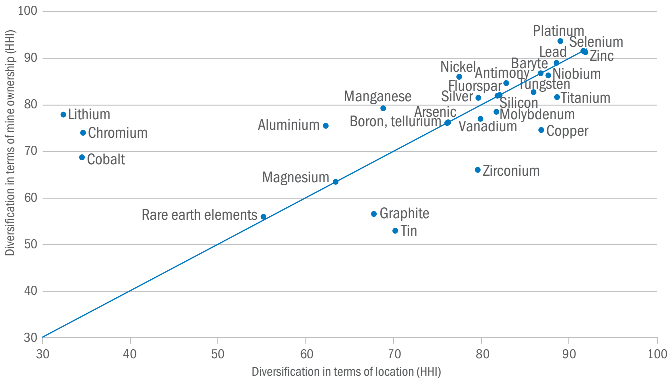
Second, measures of diversification differ depending on whether imports are assigned to source countries on the basis of (i) the location of mines or (ii) ownership of those mines (see Chart 2.5). For example, lithium production is geographically concentrated (with most of it taking place in Australia and Chile), but ownership of lithium mines is fairly diverse, with owners headquartered in countries around the world. Thus, producers who need a stable supply of lithium can reduce their supply risk somewhat by sourcing it from different mining companies, although the risk of export restrictions being imposed by the countries where the mines are located remains unchanged.

Protecting green and digital assets

While demand for critical raw materials has grown in recent years, the percentage of critical products that are subject to export restrictions shot up around 2020. Data on export restrictions taken from the Global Trade Alert can be combined with data on international trade flows to gauge the economic importance of such restrictions.[8] This analysis reveals that around 30 per cent of global exports of critical raw materials by value were subject to restrictions in 2022, up from just 5 per cent in 2019 (see Chart 2.6). An increase was also observed for other products over that period, reflecting broader trends in terms of geopolitical tensions and the fragmentation of global trade, but that increase was limited to 5 percentage points.

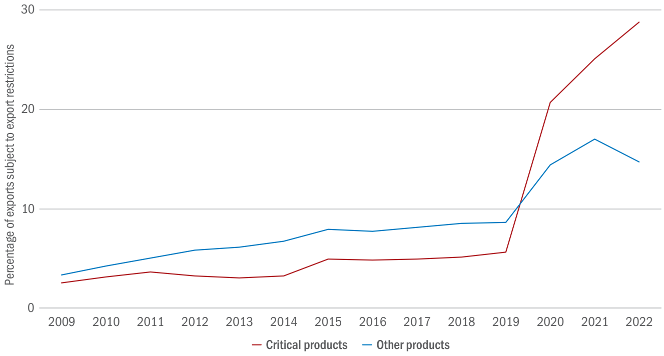
The biggest increases in the percentage of critical materials that are subject to export restrictions have been observed in the United States, Vietnam and China, while economies such as Armenia, Egypt, the Kyrgyz Republic and Uzbekistan have bucked the trend and *reduced* the percentage of critical products that are subject to restrictions. In terms of individual materials, export restrictions have been tightened for feldspar, lithium and rare earth elements, while trade in selenium, baryte and palladium has become less restricted (see Chart 2.7).

CHART 2.5. The sourcing of some critical raw materials is more diverse in terms of mine ownership than it is in terms of location



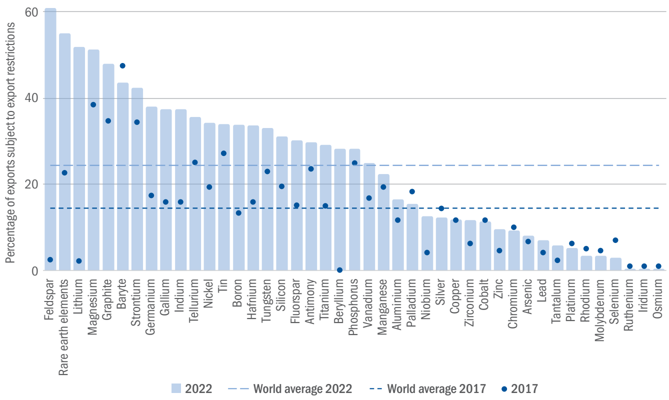
Source: S&P, UN Comtrade annual data and authors' calculations.
Note: Based on international trade in 2022, disaggregated at the HS6 level. When calculating diversification in terms of mine ownership, the owner of a mine is defined as the company that owns the largest equity share. The country of ownership is based on the location of the owner's headquarters.

CHART 2.6. Export restrictions on critical products have surged since 2019



Source: Global Trade Alert, UN Comtrade, US draft list of critical supply chains and authors' calculations.
Note: Global Trade Alert data as at 11 July 2023. Critical materials are defined in Box 2.1.

CHART 2.7. Export restrictions have increased substantially for lithium and rare earth elements



Source: Global Trade Alert, UN Comtrade, US draft list of critical supply chains and authors' calculations.
Note: Global Trade Alert data as at 11 July 2023. Critical materials are defined in Box 2.1.

[8] See Evenett and Fritz (2020) for a discussion of data on export restrictions.

Countries impose export restrictions on critical raw materials in an attempt to capture more of their value by embedding them in other domestically manufactured products, or to make it more costly for others to obtain certain critical materials. For example, when the US CHIPS and Science Act of 2022, which provides subsidies for the construction of semiconductor manufacturing plants, prohibited recipients of such subsidies from expanding semiconductor manufacturing in China or other countries that pose a threat to US national security, China retaliated by imposing restrictions on exports of gallium and germanium. China accounts for more than 90 per cent of all global production of those two key metals, which are used in semiconductors and electric vehicles.

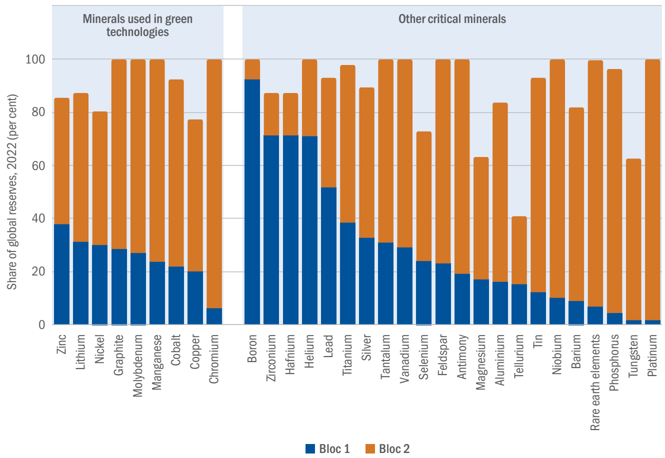
While export restrictions on critical raw materials have been on the rise, import tariffs for those materials – which were already less than half of the average tariff across all products in 2002 – have dropped further, to less than 1 per cent in 2022, compared with an average of 2.4 per cent across all products.

Friends to the rescue?

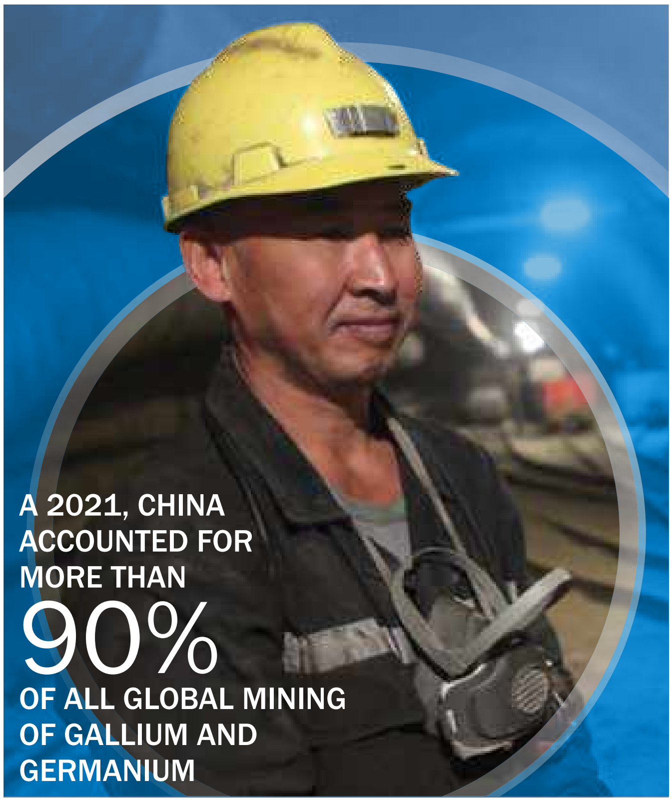
If a country does not have critical raw materials within its territory, firms located in that country may seek to acquire mines overseas or import such materials from trading partners that are regarded as being reliable (for instance, economies that share similar values or are otherwise closely aligned in geopolitical terms). This section looks at the extent to which such similarities in values might affect countries' bilateral trade in critical raw materials. The analysis, which is based on the votes that were cast by each country in the United Nations (UN) General Assembly between 2014 and 2021, uses those votes to divide countries into two blocs:[9] one ("Bloc 1") comprising countries that are more closely aligned with the United States and other Western economies (see the notes accompanying Chart 2.8 for details); and another ("Bloc 2") containing the rest of the world (including China).

Bloc 2 dominates the known reserves of all raw materials critical for the green transition, as well as most other critical raw materials (with the exception of boron, zirconium, hafnium, helium and lead; see Chart 2.8). Box 2.2 presents related analysis for products further up the value chain, identifying areas where Bloc 1 economies could establish or scale up manufacturing of critical supply chain products.

CHART 2.8. Reserves of critical raw materials in countries geopolitically aligned with the West and the rest of the world

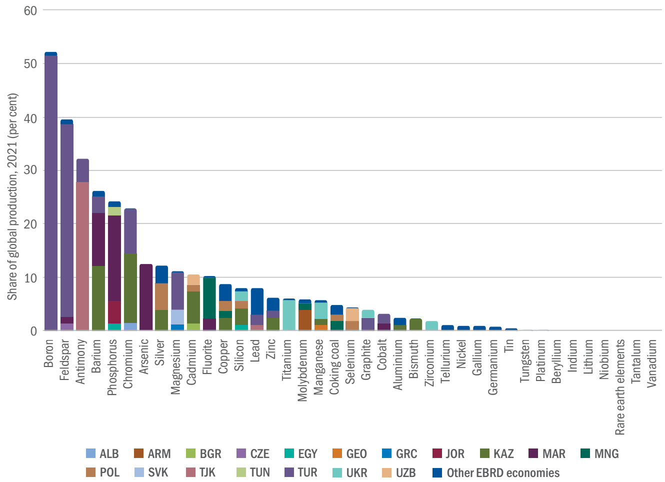


Source: S&P, Voeten (2013) and authors' calculations.
Note: Based on the location of mines. Bloc 1 consists of countries that are more closely aligned with Western economies and comprises Albania, Andorra, Australia, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Marshall Islands, Micronesia, Moldova, Monaco, Montenegro, Nauru, the Netherlands, New Zealand, North Macedonia, Norway, Palau, Poland, Portugal, Romania, San Marino, Serbia, the Slovak Republic, Slovenia, South Korea, Spain, Sweden, Switzerland, Türkiye, Ukraine, the United Kingdom and the United States. Bloc 2 contains all other economies.



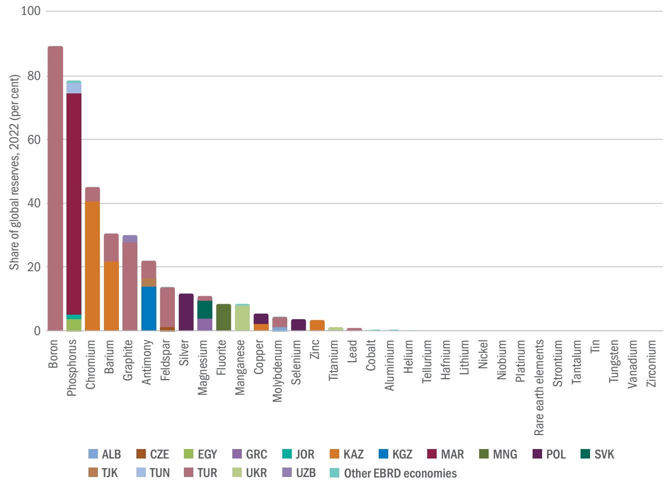
[9] Following in the footsteps of Bailey et al. (2017), countries are divided into blocs on the basis of (i) average ideal points on a unidimensional scale and (ii) the Jenks natural breaks classification method, with two clusters. Of the various countries in Bloc 2, Armenia is the closest to Bloc 1 using this measure.

CHART 2.9. Most economies in the EBRD regions are not major producers of critical raw materials



Source: Reichl and Schatz (2023) and authors' calculations.

CHART 2.10. Some countries in the EBRD regions have substantial reserves of critical raw materials



Source: US Geological Survey (2023) and authors' calculations.

EBRD economies are not generally major producers of critical raw materials – with a few exceptions

Most economies in the EBRD regions are not major producers of critical raw materials – particularly the key materials used in clean technologies at present – but there are a few exceptions (see Chart 2.9). Türkiye, for example, is the world's largest producer of both boron and feldspar (the latter being used in glass and ceramics) and an important producer of chromium (used in stainless steel) and magnesium (used in electronic components). Tajikistan is the world's third-largest producer of antimony (used in batteries and flame retardants), while Morocco is the second-largest producer of phosphates (used in fertilisers) and one of the top three producers of barium (used in the cement and petroleum industries). As battery technologies evolve, new materials might be needed. For example, one possible area of growth is lithium iron phosphate batteries, with Morocco, Tunisia and Jordan all boasting phosphate reserves. Taken as a whole, the EBRD regions' total share in the global production of 19 critical raw materials was higher than their share in global GDP at market exchange rates in 2021 (3.6 per cent).

Moreover, some countries in the EBRD regions are home to relatively large reserves of critical raw materials (see Chart 2.10). In addition to its boron reserves, Türkiye also accounts for 28 per cent of the world's known graphite reserves, while almost 70 per cent of all phosphate rock reserves are located in Morocco. Meanwhile, Kazakhstan has over 40 per cent of the world's known chromium reserves and more than 20 per cent of its barium reserves. European Metals Holdings Ltd (which the EBRD has an equity stake in) has been developing lithium-tin deposits in the Czech Republic with a view to producing battery-grade lithium and by-products such as tin and tungsten. The EBRD also has an equity stake in Euro Manganese Inc., which is looking to extract manganese from waste tailings in the Czech Republic.

In order to fully reap the benefits of those critical minerals, the economies in question need to update, digitise and publicise all relevant information on their geological endowments to help facilitate investment in exploration.[10] For instance, new feasibility studies may be needed to check whether deposits identified by geological surveys decades ago are economically viable. Adopting the Extractive Industries Transparency Initiative (EITI) standards on contracts, revenues and beneficial ownership can help to improve transparency in the industry, in addition to providing greater clarity regarding companies' rights and obligations, as well as fiscal and permit regimes (including fair and competitive licensing). Countries also need to invest in the acquisition and development of skills specific to the geological exploration, mining and refining of critical minerals.

[10] See EBRD (2023) for a discussion.

Expanding production: social, environmental and economic challenges

Once critical minerals have been mined, they need to be refined – turned from ore into concentrate that can be used to manufacture goods such as batteries or wire. However, mined rare earth elements, for instance, have to go through several processing steps before they can be used to produce magnets, and China accounts for around 90 per cent of global production at each of these stages. It is also the world's largest processor of cobalt and lithium, and one of the three largest refiners of copper, and it has a large share in the manufacturing of related goods (such as battery cell components and solar panels).[11]

Meeting demand for the critical raw materials that are required for the green and digital transitions will require significant increases in mining and refining capacity, as well as the establishment of manufacturing facilities for intermediate products such as batteries.[12] Setting up new mines takes time, with various permits needing to be obtained and any legal challenges relating to the social and environmental impact of mining needing to be addressed. For instance, when LKAB, a state-owned mining company in Sweden, announced the discovery of a large deposit of rare earth elements in Kiruna, Sweden, it estimated that it would be at least 10 to 15 years before mining could start.[13] Long investment lags increase the risks associated with such projects, given that demand for certain minerals can change quickly as technology evolves or alternative supplies come on stream. For example, 60 per cent of China's EVs are predicted to use cobalt-free batteries in 2023, up from just 18 per cent in 2020.[14]

Processing facilities can be built faster, but they may face shortages of ore and/or skilled labour. Shortages of skilled engineers and other experts can be acute throughout the supply chain, while interest rate rises can significantly increase the effective cost of exploiting new deposits.

While many critical raw materials reduce pollution at the point of consumption (as in the case of the emissions savings associated with driving an EV), the processes involved in producing the relevant goods may be far from green. Refining rare earth elements, for instance, produces extremely large amounts of pollution, releasing toxic and radioactive waste. Emissions produced by the mining and production of metals account for about 10 per cent of total greenhouse gas (GHG) emissions worldwide, most of them stemming from the production of aluminium and steel.

Moreover, the extraction of mineral ore has knock-on effects on local ecosystems and biodiversity as a result of changes to local land use, the movement of large amounts of rock and the accumulation of left-over materials. Although mining plays a more limited role in deforestation and other forms of biodiversity loss than agriculture, it can affect ecosystems indirectly through the construction of roads and other infrastructure required to establish a mine or a processing facility.[15] Other issues include the degradation of local air, water and land quality, corruption and tax avoidance, as well as inadequate standards in terms of health and safety, human rights abuses and the use of child labour. (See Box 2.3 for a detailed discussion of the impact that air pollution has on health and labour market outcomes.) For these reasons, it is often the case that countries' tariff schedules effectively encourage imports of pollution-intensive inputs by imposing lower import tariffs on those goods relative to other imports.[16]

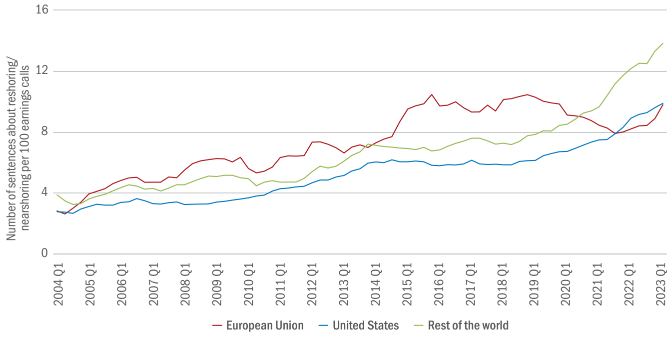
[11] See Khan (2023) and White (2023).
[12] See Energy Transitions Commission (2023).
[13] See https://lkab.com/en/press/europes-largest-deposit-of-rare-earth-metals-is-located-in-the-kiruna-area (last accessed on 8 August 2023).
[14] See Hook et al. (2023).
[15] See, for example, De Haas and Poelhekke (2019) and Aragón and Rud (2016).
[16] See Shapiro (2021).

Reshaping global supply chains

Greater attention being paid to reshoring and nearshoring

Firms have recently been paying greater attention to the resilience of their supply chains. Many responded to Covid-related disruption by increasing their stocks of inputs and sourcing the same inputs from additional suppliers.[17] In parallel, firms have also been expressing greater interest in shortening supply chains through reshoring and nearshoring (see Chart 2.11). Evidence from earnings calls suggests that this trend actually predates the Covid-19 pandemic, reflecting increased anti-globalisation sentiment in many economies and growing restrictions on international trade.[18]

CHART 2.11. Firms are talking more about reshoring and nearshoring



Source: NL Analytics and authors' calculations.
Note: Sentences are regarded as relating to reshoring/nearshoring if they contain the keywords "reshoring", "nearshoring", "onshoring", "regionalisation", "local sourcing", "nearshore", "insourcing", "localisation", "localise", "localising", "localised" or "local production".

Increased use of alternative invoicing currencies

Rising geopolitical tensions have translated into increased use of import tariffs and other administrative measures (such as approval procedures and economic sanctions) to reshape trade patterns.[19] In addition, Russia's invasion of Ukraine has also led to the rapid decoupling of trade and financial links between Russia and Western economies, with Russia being replaced by other trading partners (see Boxes 2.4 and 2.5).

These changes have, in turn, led to a rapid increase in the use of currencies other than the US dollar and the euro for settling trade between third countries. These shifts may reflect a preference for not clearing payments through the US or eurozone banking systems when dealing with sanctioned countries or fears that assets denominated in those currencies (including central bank reserves) could be frozen. They may also reflect difficulties with the clearing of payments denominated in those currencies, as well as the steady decline in the number of cross-border correspondent banking relationships (visible in data compiled by the Bank for International Settlements), which largely reflects the rising cost of compliance with sanctions and other restrictive regimes.

Notably, countries that did not impose economic sanctions in the aftermath of the invasion of Ukraine have made greater use of the Chinese yuan in their trade with Russia (see Box 2.4). Increased geopolitical risk has also affected the choice of trade finance instruments, with increased recourse to advance payments for riskier trades (see Box 2.5).

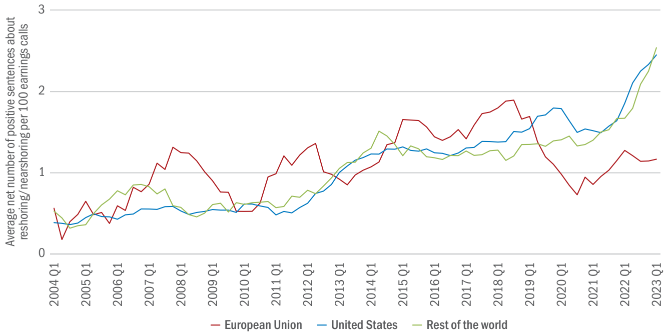
[17] See EBRD (2022).
[18] See, for example, Delis et al. (2019) and De Backer et al. (2016).
[19] See Freund et al. (2023).

Positive sentiment regarding reshoring and nearshoring

Against that backdrop of trade flows and terms being rapidly reshaped by rising geopolitical tensions, managers and investors in the United States have increasingly regarded reshoring and nearshoring as making a positive contribution to firms' business outlooks, particularly since 2020 (see Chart 2.12). That shift in the perception of nearshoring, as reflected in earnings calls, may have been driven by the Build Back Better Plan, which eventually led to the Inflation Reduction Act (IRA). Among other things, a domestic content bonus for clean energy projects and facilities that meet American manufacturing and sourcing requirements presents an opportunity for firms looking to reshore their production.[20]

In the EU, in contrast, sentiment regarding reshoring/nearshoring, although positive in net terms, has exhibited no clear upward trend over time, perhaps because EU manufacturing has been less affected by offshoring outside the EU, while incentives to reshore/nearshore production have not been as strong as in the United States.

CHART 2.12. Firms' sentiment on reshoring and nearshoring has improved



Source: NL Analytics and authors' calculations.
Note: Data as at 11 July 2023. The net number of positive sentences is the difference between (i) the number of sentences containing a reshoring/nearshoring-related keyword and a positive term and (ii) the number containing a reshoring/nearshoring-related keyword and a negative term. The keywords used are "reshoring", "nearshoring", "onshoring", "regionalisation", "local sourcing", "nearshore", "insourcing", "localisation", "localise", "localising", "localised" and "local production".

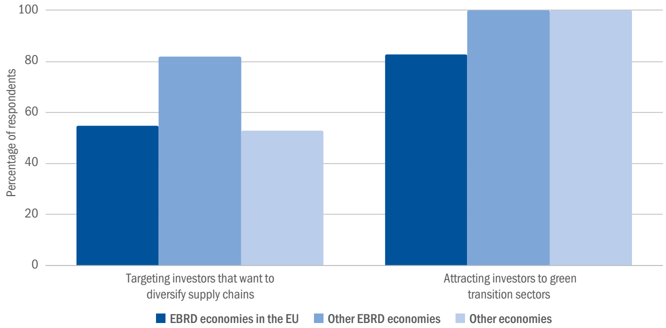
Has the red carpet been rolled out for the right investors?

In order to better understand countries' perspectives on opportunities related to the reshaping of global supply chains, the EBRD conducted an online survey of national IPAs in its shareholder economies between June and August 2023.[21] The analysis that follows is based on the responses received from 44 economies (including 27 in the EBRD regions) as at 7 August 2023. The survey collected basic information about each IPA, such as its year of establishment, details of its mandate and governance, perceptions regarding inward foreign direct investment (FDI), sector-specific information on investment promotion activities over time and incentives provided to foreign investors, details of restrictions on FDI inflows, and information on budgets and staff resources.

IPAs are government bodies tasked with attracting international investors. That focus on promoting investment reflects the fact that FDI can produce multiple benefits, including technological expertise, skills and jobs, helping to raise the quality of countries' exports and increase value added.[22]

More than 80 per cent of all IPAs across the EBRD regions regard the reshaping of global value chains as an opportunity for their country, and many are actively seeking to attract foreign investors that are looking to diversify their supply chains or plan to do so in the future (see Chart 2.13). Almost all IPAs have a stated interest in attracting investors to sectors relevant for the green transition.

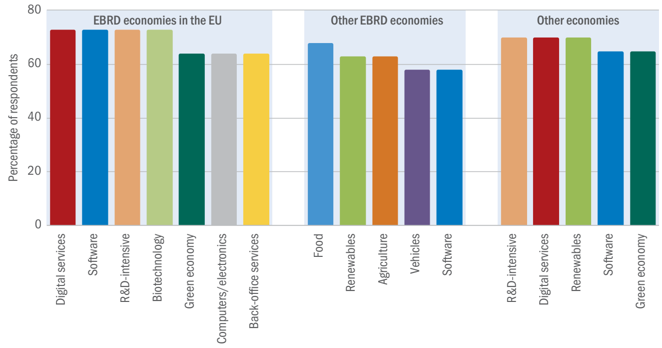
CHART 2.13. Many IPAs are targeting foreign investors that are looking to diversify their supply chains



Source: EBRD survey of IPAs and authors' calculations.

[20] See https://home.treasury.gov/news/press-releases/jy1477 (last accessed on 3 August 2023).
[21] This survey did not cover Belarus, Russia, Mexico (which closed its IPA in 2019) or Belgium (which does not have a national IPA – just two sub-national IPAs). Tunisia's two IPAs were both included.
[22] See Harding and Javorcik (2012).

CHART 2.14. Digital services, software, R&D-intensive sectors and the green economy are among the most targeted sectors for inward FDI



Source: EBRD survey of IPAs and authors' calculations.

Inward FDI is generally regarded as being at least as attractive now as it was five years ago, with IPAs in most countries in eastern Europe and the Caucasus (EEC) and Central Asia reporting an increased interest in FDI (perhaps reflecting recent success in this area).[23]

IPAs often focus on priority sectors when it comes to investment promotion, helping to concentrate efforts and increase FDI inflows (see Box 2.6 for details of developments in Egypt and Morocco, for instance).[24] The percentage of IPAs reporting such prioritisation ranges from 50 per cent of respondents in the EEC region and Central Asia to 100 per cent of respondents in the southern and eastern Mediterranean (SEMED) and Türkiye. There is substantial variation across countries in terms of the sectors that are targeted, as IPAs tend to focus on sectors where their economies have comparative advantages in terms of skills, production inputs, infrastructure or consumer markets. However, there are also remarkable similarities across countries.

Investment in software development is targeted across the board (see Chart 2.14). Most higher-income economies (including EU member states in the EBRD regions) also emphasise digital services, sectors requiring large amounts of research and development (R&D) and the green economy. In contrast, other economies in the EBRD regions remain focused on the automotive sector, transport equipment, other manufacturing industries, agriculture and food processing.

Picking the low-hanging fruit

While economies may target similar sectors, their ability to leverage shifts in global supply chains may depend on their existing skill-sets, technologies and business environments – which are, in turn, a reflection of the prevailing structure of production and exports. This section looks at economic opportunities for the EBRD regions in the context of the green transition on the basis of their exports to date. The analysis focuses on specific green transition sectors which saw growth in global exports of at least 25 per cent between 2012 and 2022: critical minerals (including platinum group metals), fuel cells, large-capacity batteries, and solar and wind power. (In contrast, growth in carbon capture, hydroelectric power, neodymium magnets and nuclear power fell short of the 25 per cent threshold.)

The analysis first identifies products where economies in the EBRD regions currently have a revealed comparative advantage (that is to say, products whose share of a country's exports exceeds their share of total international trade). For example, in 2022, lithium-ion batteries accounted for 2.4 per cent of Poland's total exports, but just 0.4 per cent of all international trade worldwide, so Poland has a revealed comparative advantage in exporting lithium-ion batteries.

[23] See, for instance, Silk Road Briefing (2023).
[24] See Harding and Javorcik (2011).

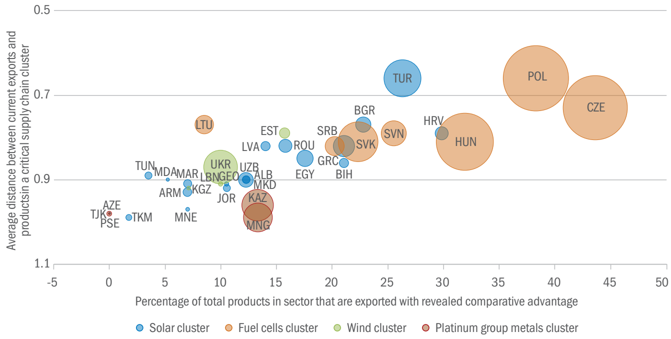
The analysis then assesses those products' proximity to the products that are needed to supply fast-growing green transition sectors. This proximity is measured in terms of the probability of product A being exported by a country (with a revealed comparative advantage) conditional on that country already exporting product B (and, conversely, the probability of a country exporting product B conditional on it already exporting product A). The higher the lower of those two probabilities is, the greater the proximity of the two products is considered to be (typically reflecting similar requirements in terms of technology, skills and other production inputs), and this is fixed globally. For example, the proximity score for transistors and diodes is around 0.8, while transistors and phosphorus have a score of 0 using this metric. In contrast, the "distance" between two products captures an individual country's ability to make a product in terms of technology, skills and other production inputs. A country that already exports transistors will find it easier to start producing diodes than phosphorus, for example.

If a product that a country has a revealed comparative advantage in is close to another product which is in a supply chain critical for the green transition, the country has a higher chance of successfully exporting that second product in the future, building on its existing production capabilities and leveraging the high level of global demand. With that in mind, the analysis presented in Chart 2.15 calculates the average distance between (i) the products that a country already produces and (ii) products in critical supply chain clusters (such as those related to fuel cells), plotting that distance (on the vertical axis) against the percentage of total products in the selected sector that the country currently exports with a revealed comparative advantage (on the horizontal axis).

This analysis suggests that, for the majority of countries, the most promising critical supply chain products to diversify into are those required by the solar power, fuel cell, wind power and platinum group metal sectors. The countries with the greatest potential can be found in the top-right corner of Chart 2.15. For example, Croatia already successfully exports 30 per cent of all critical supply chain products required by the solar power sector and its exports generally lie in reasonable proximity to the solar power sector. In the case of Türkiye, the distance between its existing revealed comparative advantages as an exporter and supply chain products required by the solar power sector is even smaller.

Fuel cell supply chains hold the greatest promise for the Czech Republic (which already exports 44 per cent of all products required by the fuel cell sector) and Poland (given that its existing exports lie in close proximity to that sector). Diversifying into products required by the wind power sector is the most promising option for Estonia, which has both the greatest average proximity to that sector and the largest established presence. Meanwhile, Kazakhstan and Mongolia have the most potential when it comes to platinum group metals (with most of the related products being raw materials).

CHART 2.15. Products required by the solar power and fuel cell sectors hold promise for many economies in the EBRD regions



Source: UN Comtrade and authors' calculations.
Note: The size of the circle is proportionate to the value of the economy's 2022 exports in the relevant sector in nominal thousand US dollars. The chart shows selected economies and clusters.

When it comes to the fastest-growing green energy sector – large-capacity batteries – opportunities for the EBRD regions are less clear-cut on the basis of existing export structures. Türkiye has the largest established presence in terms of exporting products required by that sector, while Poland's export structure is most compatible with an expansion into that sector based on existing know-how and capabilities.

Supply chains and carbon footprints

Global supply chains involve large carbon footprints – an issue that policymakers are increasingly conscious of. On average, the indirect (Scope 3) upstream emissions that are generated by a company's supply chains exceed its Scope 1 and 2 emissions (that is to say, those generated by the company's own production and energy consumption) by a factor of 11.[25] Those indirect emissions are, among other things, embodied in purchased goods (including their transport), outsourced back-office functions and commuting by company employees.

While supply chain decisions are based primarily on cost and the reliability of supply, they effectively involve outsourcing some of a firm's carbon emissions to foreign suppliers. In the case of US firms, that outsourced component's share of companies' total Scope 3 emissions has been rising over time.[26]

The disclosure of Scope 3 emissions may soon become a requirement under the EU's European Sustainability Reporting Standards (ESRSs), which were adopted on 31 July 2023. Moreover, the EU's proposed Corporate Sustainability Due Diligence Directive (CS3D) obliges firms to prepare and disclose

[25] See CDP (2023).
[26] See Dai et al. (2022).

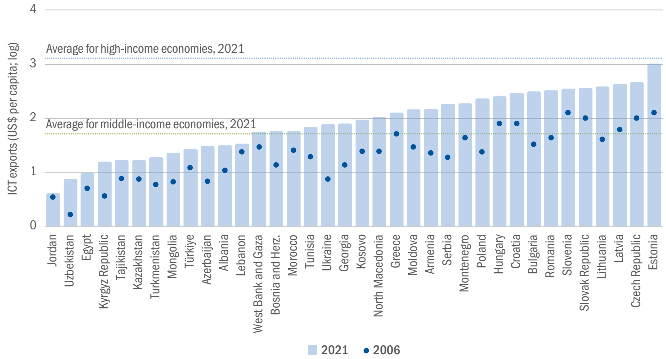
a transition plan demonstrating that their business model and strategy are compatible with the transition to a sustainable economy and limiting global warming to 1.5° C (see Box 2.7 for more details). In parallel, the US Securities and Exchange Commission (SEC) and the International Sustainability Standards Board (ISSB) have also proposed climate disclosure rules and standards.

The combination of those various standards may strengthen incentives for large firms to monitor and reduce emissions across the whole of their supply chains (see Box 2.8 on the greening of supply chains using sustainable supply chain finance for a discussion). The new emphasis on comprehensive reporting of embedded emissions may, in turn, lead to a review of outsourcing decisions. India, for example, has long been a preferred outsourcing destination for IT services owing to its low labour costs and its well-established software industry, but the associated emissions may prove to be large or hard to verify.

The potential reshaping of outsourcing with Scope 3 emissions in mind may present opportunities for other providers of services, from basic back-office processing of transactions to knowledge-intensive services. In the EBRD regions, exports of commercial ICT services per capita increased markedly between 2006 and 2021 (see Chart 2.16), rising more than fivefold in almost a third of economies. Despite that, those exports were still well below the level seen in India and the average for high-income economies.

In order to leverage the expansion and reshaping of cross-border exports of services, economies can invest in digitalisation and reduce administrative barriers to trade in services. Indeed, exports of commercial ICT services per capita tend to be higher in economies with less restrictive trade in services (as measured by an OECD index) and higher levels of digitalisation (including better digital infrastructure and more sophisticated regulations governing the provision of digital solutions and the use of digital technology by firms and individuals).[27]

CHART 2.16. Exports of commercial ICT services per capita increased in all EBRD economies between 2006 and 2021



Source: OECD-WTO Balanced Trade in Services (BaTIS) dataset and authors' calculations.

ON AVERAGE, THE EMISSIONS GENERATED BY A FIRM'S SUPPLY CHAIN EXCEED THE DIRECT EMISSIONS FROM THAT FIRM'S OPERATIONS BY A FACTOR OF

11

[27] See EBRD (2021) and OECD (2023).

Conclusion and policy implications

A successful transition to a green economy will require massive investment in clean energy and a wide range of critical raw materials. In many cases, China dominates the production and/or processing of those materials, as well as the manufacturing of intermediate inputs made from them, such as batteries. However, reserves of those minerals can also be found in other countries around the world, suggesting that there might be scope to diversify their supply as geopolitical tensions rise and the scramble for resources intensifies. That being said, new manufacturing facilities and – in particular – new mines will take many years to establish.

The EU and the United States, in particular, are working to reduce their dependence on China and other economies seen as strategic competitors by developing their own supply chains for critical raw materials. In the absence of sufficient reserves and/or production capacity for critical raw materials, economies may seek partnership agreements with countries that can supply them. The EU, for example, has already concluded partnerships with Canada, Kazakhstan, Namibia and Ukraine, and it is in negotiations with Argentina, Chile and the Democratic Republic of Congo.[28]

For mineral-rich countries seeking to leverage the opportunities afforded by the green transition, it is important to minimise the environmental, social and governance-related challenges that are associated with the mining and processing of critical raw materials. Legislation covering environmental and social standards for operations and due diligence reporting standards needs to be enforced, while signing up to the Extractive Industries Transparency Initiative can help to improve transparency and governance in the sector. Policymakers also need to pay due attention to the efficiency of planning and permit policies, while upholding adequate environmental standards.

At the same time as diversifying the supply of critical raw materials, policymakers can seek to manage demand through measures that accelerate improvements in technological efficiency (such as improved load factors for wind farms or shifts to cobalt- and nickel-free batteries). Such measures should include regulatory standards (for instance, rules favouring technologies with high levels of recycled content, or performance standards for new clean energy technologies, akin to fuel-efficiency standards for vehicles), as well as targeted inducements and R&D-related and economic incentives for recycling, such as cost-reflective land disposal fees. The EU's proposed Critical Raw Materials Act, for example, is aiming to have 15 per cent of total demand for certain metals met by recycled supply by 2030.

[28] See Banya (2023).

BOX 2.1.

Data on critical raw minerals

A novel database

This chapter constructs a novel database of critical raw materials (defined as those that are on the IEA's list or in the EU's proposed Critical Raw Materials Act) by combining (i) information on the location, ownership and reserves of 12,000 selected mines between 2013 and 2023 taken from S&P's SNL Metals & Mining database with (ii) country-level information on annual production of minerals between 2017 and 2021 taken from the Austrian Federal Ministry of Finance's World Mining Data (WMD) dataset and (iii) country-level data on reserves in 2022 taken from the US Geological Survey (USGS). Table 2.1.1 provides an overview of the data coverage.

The materials in the combined set are mapped to the critical mineral list. A mine can be mapped to more than one mineral. For example, "heavy mineral sands" in the S&P dataset of mines is mapped to zirconium, titanium, tungsten and rare earth elements, while in the country-level analysis, this mine is only counted once. Chromite and ferrochrome, on the other hand, are both mapped to chromium. The mapping is based on the primary commodity: a mine producing gold as the primary output and silver as the secondary output is considered to be a gold mine. The analysis also disregards closed or relinquished mines (which account for around 10 per cent of the total number); it also disregards mines where S&P was unable to obtain data for two years or more.

The owner of a mine is defined as the company that owns the largest equity share. The country of ownership is based on the location of the owner's headquarters. In the absence of equity shares, the first shareholder is considered to be the owner. Reserves are based on the most recent estimates/reports. Analysis of reserve ownership is based on S&P data, as other sources are not available.

Critical supply chain products

US Executive Order 14017 of 14 February 2021 was accompanied by a draft list of critical supply chains, with products defined on the basis of 8 or 10-digit HS codes and assigned to the critical minerals and materials, energy, ICT and public health sectors.[29] This chapter focuses on the first two sectors, which cover critical minerals, carbon capture, fuel cells, hydroelectric power, large-capacity batteries, neodymium magnets, nuclear power, platinum group metals, and solar and wind power.

Names of critical raw materials were manually assigned to relevant HS6 codes. For example, manganese ore (260200), manganese dioxide (282010), manganese articles, waste and scrap (811100), and bars and rods of silico-manganese steel (722820) were all classified as manganese. (Manganese

[29] See www.trade.gov/data-visualization/draft-list-critical-supply-chains (last accessed on 11 August 2023).

TABLE 2.1.1. Coverage of critical raw materials

	Listed by		Data available				Listed by		Data available		
Critical raw material	IEA	EU	S&P	USGS	WMD	Critical raw material	IEA	EU	S&P	USGS	WMD
Aluminium		✔	✔	✔	✔	**Rare earth elements (REEs)**	✔	✔	✔	✔	✔
Antimony		✔	✔	✔	✔	***Light REEs***		✔			
Arsenic	✔	✔		✔	✔	Cerium (Ce)		✔			
Baryte		✔		✔	✔	Lanthanum (La)		✔			
Beryllium		✔		✔	✔	Praseodymium (Pr)	✔	✔			
Bismuth		✔		✔	✔	Neodymium (Nd)	✔	✔			
Boron	✔	✔		✔	✔	Promethium (Pm)		✔			
Cadmium	✔			✔	✔	Europium (Eu)		✔			
Chromium	✔		✔	✔	✔	Gadolinium (Gd)		✔			
Cobalt	✔	✔	✔	✔	✔	Samarium (Sm)		✔			
Coking coal		✔			✔	***Heavy REEs***		✔			
Copper	✔	✔	✔	✔	✔	Dysprosium (Dy)	✔	✔			
Feldspar		✔		✔	✔	Terbium (Tb)	✔	✔			
Fluorspar		✔		✔	✔	Yttrium (Y)	✔	✔			
Gallium	✔	✔		✔	✔	Holmium (Ho)		✔			
Germanium	✔	✔		✔	✔	Erbium (Er)		✔			
Graphite	✔	✔[b]	✔	✔	✔	Thulium (Tm)		✔			
Hafnium	✔	✔		✔		Ytterbium (Yb)		✔			
Helium		✔		✔		Lutetium (Lu)		✔			
Indium	✔			✔	✔	Scandium (Sc)		✔	✔	✔	
Lead	✔		✔	✔	✔	Selenium	✔			✔	✔
Lithium	✔	✔	✔	✔	✔	Silicon	✔	✔[c]		✔	✔
Magnesium	✔	✔		✔	✔	Silver	✔		✔	✔	✔
Manganese	✔	✔	✔	✔	✔	Strontium		✔		✔	
Molybdenum	✔		✔	✔	✔	Tantalum	✔	✔	✔	✔	✔
Nickel	✔	✔[a]	✔	✔	✔	Tellurium	✔			✔	✔
Niobium	✔	✔	✔	✔	✔	Tin	✔		✔	✔	✔
Phosphorus		✔	✔	✔	✔	Titanium	✔	✔[c]	✔	✔	✔
Platinum group metals		✔	✔	✔	✔	Tungsten	✔	✔	✔	✔	✔
Platinum (Pt)	✔	✔				Vanadium	✔	✔	✔	✔	✔
Iridium (Ir)	✔	✔				Zinc	✔		✔	✔	✔
Palladium (Pd)		✔				Zirconium	✔		✔	✔	✔
Rhodium (Rh)		✔									
Ruthenium (Ru)		✔									
Osmium (Os)		✔									

Source: IEA (2021), European Commission (2023), S&P, US Geological Survey (2023) and World Mining Data dataset.
Note: [a] – battery grade, [b] – natural graphite, [c] – metal.

dioxide, for instance, is also used as a cathode in the production of lithium-ion batteries.) For the analysis of mines, minerals were, in turn, mapped to the subset of HS6 codes that is closest to mined ores (for example, 260200 in the case of manganese and 250410 and 250490 in the case of graphite).

BOX 2.2.

Critical supply chain products and friendshoring

This box focuses on relatively complex processed critical supply chain products (as opposed to raw materials) that experienced growth of at least 25 per cent in global exports between 2012 and 2022, with the total value of global trade exceeding US$ 500 million. Specifically, it examines a subset of those products where (i) Bloc 2 countries (those not geopolitically aligned with the West) account for more than 40 per cent of exports and (ii) Bloc 1 economies have the capabilities needed to manufacture those products and could prioritise an expansion of their production facilities as geopolitical tensions escalate.

For each of those products, the analysis identifies the top three exporters among Bloc 1 economies (see Table 2.2.1). For example, the Czech Republic is one of the top three exporters of certain computer parts and insulated electrical conductors, while Poland and Hungary are two of the top three exporters of lithium-ion accumulators, and Jordan is one of the top suppliers of inorganic acids (largely derived from minerals mined around the Dead Sea).

The analysis also identifies the three economies where existing export structures have the lowest average distance to the product in question (a group which may overlap with the top three exporters for that product). While those distance lists are dominated by the United States, Japan and larger economies in the EU, reflecting the diversified nature of their existing export bases, Poland is one of the economies that has the greatest potential to scale up exports of electrical machines and electrical static converters.

TABLE 2.2.1. Priority export products for Bloc 1 economies, the top three Bloc 1 exporters, and the three Bloc 1 economies that are best placed to start/expand production and exports of these products

HS code	Brief description	Top three exporters	Top three by distance
281119	Inorganic acids (other than hydrogen fluoride)	ISR **JOR** JPN	DEU ITA ESP
282690	Complex fluorine salts	KOR JPN USA	DEU ITA USA
284290	Salts of inorganic acids or peroxoacids (other than double or complex silicates)	KOR JPN USA	JPN DEU ITA
285390	Phosphides, rare gases and other inorganic compounds	JPN USA DEU	DEU ITA ESP
380110	Artificial graphite	JPN USA ESP	DEU ITA NLD
380190	Graphite	KOR DEU JPN	DEU ITA ESP
381800	Chemical elements doped for use in electronics	JPN USA KOR	DEU ITA ESP
392112	Plastics; polymers of vinyl chloride	USA DEU ITA	ESP FRA NLD
760900	Aluminium tube or pipe fittings	USA DEU ITA	FRA PRT NLD
841590	Air conditioning parts	USA **CZE** JPN	DEU ITA ESP
847150	Computer parts	USA **CZE** DEU	DEU ITA ESP
847180	Computer units	USA NLD DEU	DEU ITA ESP
850131	Electric motors (< 750w)	DEU JPN **HUN**	ITA ESP FRA
850440	Electrical static converters	DEU USA JPN	ITA ESP **POL**
850760	Lithium-ion accumulators	**POL HUN** DEU	DEU ITA ESP
853321	Electrical resistors for power (< 20w)	JPN DEU USA	ITA ESP USA
854110	Diodes (other than photosensitive or light-emitting diodes)	DEU JPN USA	ITA ESP USA
854129	Non-photosensitive transistors, dissipation (≥ 1w)	DEU JPN USA	ITA ESP USA
854141	Light-emitting diodes	JPN USA DEU	DEU ITA USA
854149	Photovoltaic cells/panels	JPN DEU USA	DEU ESP FRA
854151	Semiconductor-based transducers	DEU JPN ISR	ITA ESP USA
854231	Electronic integrated circuits: processors and controllers	USA KOR JPN	DEU ITA ESP
854232	Data storage	KOR JPN USA	DEU ITA USA
854233	Amplifiers	KOR USA JPN	DEU JPN ITA
854239	Electronic integrated circuits not included elsewhere	KOR JPN USA	DEU ITA ESP
854370	Other electrical machines and apparatus	USA DEU JPN	ITA ESP **POL**

Source: UN Comtrade annual data, Voeten (2013) and authors' calculations.
Note: See Box 2.1 for more details regarding critical supply chain products. Bloc 1 consists of countries that are more closely aligned with Western economies, while Bloc 2 contains the rest of the world.

BOX 2.3.

The hidden costs of pollution from mining

From excavation to transport and final processing, mining produces pollution, impacting local land, water and air quality. Exposure to air pollution, for example, has a detrimental effect on health through its impact on lung, heart and brain functionality, with babies even being affected in the womb.[30] This, in turn, can have negative long-term effects on people's labour productivity and earnings, as corroborated by a recent study looking at the long-term impact of pollution in the German Democratic Republic (GDR).[31]

In 1982, the GDR significantly increased its mining of lignite, following the abrupt discontinuation of its supply of cheap energy from the Soviet Union. Lignite ore cannot be transported cost-effectively over great distances, so it inevitably ends up being processed close to mines. Consequently, GDR districts located close to lignite mines were significantly more exposed to air pollution than districts located further away. Because freedom to change employers was severely curtailed under central planning, people living in mining areas were typically unable to respond to rising pollution by moving elsewhere. Freedom of movement then increased following the collapse of the Berlin Wall in 1989 and the reunification of Germany in 1990.

The analysis in Lubczyk and Waldinger (2023) focuses on individuals from the GDR who moved between German regions straight after the fall of the Berlin Wall and follows them over a 40-year period. In particular, it compares (i) individuals who moved to a certain destination post-reunification from a district located within 60 km of a lignite mine established after 1982 with (ii) individuals who moved to the same destination from other parts of the GDR. Other than being home to mines, the affected districts were similar to other parts of the GDR in terms of various regional characteristics.

That study finds that, up to four decades after the initial air pollution shock, individuals who had previously lived close to lignite mines experienced significantly worse labour market outcomes relative to those who had lived further away. On average, they earned 3 per cent less, spent four months less in employment and retired two months earlier. These effects alone add up to a cost in terms of social security payments which is equivalent to 1 per cent of the GDP of West Germany in 1989.

[30] See, for instance, Chay and Greenstone (2003).
[31] See Lubczyk and Waldinger (2023).

BOX 2.4.

Geopolitical tensions and invoicing currencies for international trade

International trade is often carried out using US dollars or – to a lesser extent – euros, including in situations where neither the producer nor the importer uses that currency as its local currency.[32] This has contributed to demand for US dollars and helped to put the currency in a highly privileged position, with low interest paid on US liabilities relative to the return on US dollar assets.[33]

Prior to March 2022, up to 80 per cent of Russia's imports were invoiced using those two currencies, with most of those imports coming from third countries (such as China) that were using the US dollar and the euro as "vehicle" currencies for trade (see Chart 2.4.1). Historically, the percentages of total trade that were denominated in the various currencies were fairly stable.

However, after Russia's invasion of Ukraine in February 2022, the United States, the EU and a number of other advanced economies imposed economic sanctions on Russia, which covered imports and exports of a wide range of goods, certain types of investment, the provision of financial services, and transactions involving a wide range of companies and individuals. Following the imposition of economic sanctions, more of Russia's imports began to be invoiced using the Chinese yuan (see Chart 2.4.1).

By the end of 2022, invoices in Chinese yuan accounted for 20 per cent of Russia's imports, up from just 3 per cent a year earlier, while the combined share of the US dollar and the euro fell to 67 per cent. Only part of this shift reflected the fall in exports from sanctioning economies and the growth in trade with China.[34] Indeed, by the end of 2022, yuan-denominated invoices accounted for 63 per cent of imports from China, up from 23 per cent a year earlier, with China's currency having displaced the US dollar (as well as the Russian rouble) as the currency of choice for such trade.

In trade with third countries (that is to say, countries that do not have the US dollar, the euro or the yuan as their national currency), the yuan's share of imports rose from 1.2 per cent to 4.2 per cent over the same period. Use of the yuan as a vehicle currency increased significantly more rapidly for trading partners that have an active currency swap line with the People's Bank of China (such as Mongolia and Tajikistan).[35] Such swap lines aim to promote trade and investment and make it easier for an exporter to make use of yuan received from a Russian importer.[36] However, the effect that swap lines have on use of the yuan can be seen only for third countries that have not imposed economic sanctions on Russia.

[32] See Gopinath and Stein (2021).
[33] See Gourinchas et al. (2010).
[34] See Chupilkin et al. (2023b).
[35] See the analysis in Chupilkin et al. (2023a).
[36] See Bahaj and Reis (2023).

BOX 2.4.

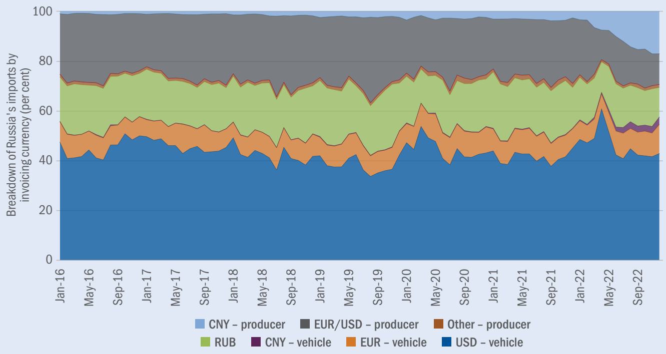
Geopolitical tensions and invoicing currencies for international trade

(Continued)

Use of the currencies of other exporters that have not imposed economic sanctions on Russia, such as the Turkish lira and the Indian rupee, has also increased, albeit such use has remained much more limited overall. For instance, rupee-denominated trade accounted for 12.5 per cent of India's exports to Russia in the fourth quarter of 2022, although this amounted to only 0.2 per cent of Russia's total imports.

This analysis covers only a relatively small percentage of international trade – the bilateral transactions of the 11th-largest economy in the world. However, it illustrates a broader point: rising geopolitical tensions, and the use of trade sanctions in particular, may reduce the attractiveness of the US dollar as a vehicle currency in international trade and facilitate the rise of new vehicle currencies, as well as greater use of producers' or importers' currencies for the settling of trades. This, in turn, could lead to greater fragmentation of global payment systems.

CHART 2.4.1 Use of the Chinese yuan as an invoicing currency in Russia's trade with China and third countries has increased since March 2022



Source: Chupilkin et al. (2023a).
Note: Shares are calculated on the basis of volumes of transactions expressed in US dollars at market exchange rates.

BOX 2.5.

Changing patterns in Türkiye's exports to Russia

By now, it is well established that the invasion of Ukraine has led to significant changes in Russian trade.[37] In particular, Russian imports from sanctioning countries have been replaced by imports from other countries. Thanks to its proximity to Russia and the already strong trade links between the two countries, Türkiye's share of Russian imports increased significantly following Russia's invasion of Ukraine. Relative to their value in January 2022, Turkish exports to Russia increased by an average of 69 per cent between February 2022 and February 2023 (in seasonally adjusted terms), compared with increases of 40 per cent for exports to other members of the Eurasian Economic Union and 9 per cent for exports to other countries.

This box uses detailed monthly Turkstat data on Turkish exports at the level of destination countries and six-digit HS product codes to investigate the channels through which international trade has responded to the Russian invasion of Ukraine.[38] The data used for this empirical analysis are broken down by payment method (open account, cash in advance, letter of credit or documentary collection) and invoicing currency (such as the US dollar, the euro or the Turkish lira). These unique additional dimensions allow us to look at the trade-offs faced by Turkish exporters to Russia during a period characterised by heightened risks.

The empirical analysis estimates the differential change in Turkish exports to Russia relative to exports to other destination countries following the invasion of Ukraine in February 2022, taking into account time-varying product-specific demand and time-invariant factors that determine product-country-level Turkish exports. The relative change in export-related outcomes for Russia is estimated on a monthly basis for a 26-month period starting in January 2021, with January 2022 being the base period.

The results suggest that the rise observed in the total value of exports to Russia primarily reflects growth in volumes, rather than increases in the unit values of goods being shipped. Relative to other countries and its value in January 2022, the typical value of monthly product-level Turkish exports to Russia increased by an average of 105 percentage points following the start of the war, 77 per cent of which was due to growth in volumes. The remaining 23 per cent is explained by higher unit values.

[37] See, for example, Chupilkin et al. (2023b) and Steinbach (2023).
[38] The analysis in this box is based on Demir and Javorcik (2023).

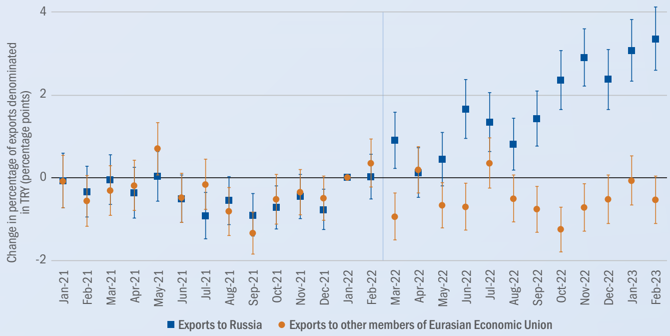
In the face of increased payment and currency-related risks owing to the war, Turkish exporters have not only adjusted their prices, but also reconsidered their payment methods for Russian importers. In particular, the heightened risks have led to a shift towards payment on cash-in-advance terms – the safest payment method for exporters, since it places all of the risks associated with an international trade transaction on the importer's shoulders. In 2021, three-quarters of Turkish exports to Russia were on open account terms (with trades needing to be settled within a certain time frame). That fell to about 65 per cent after the invasion of Ukraine – a decline that was almost completely matched by an increase in the percentage of payments made on cash-in-advance terms. Similar – albeit more limited – substitution (totalling about 6 percentage points) was observed for Turkish exports to other members of the Eurasian Economic Union.

In conclusion, price changes and adjustments to payment terms have both been used to counter the increased risks of exporting to Russia, with exporters typically choosing either one or the other. About half of the total value adjustment seen for Turkish exports to Russia following the invasion is explained by unit prices for exports on open account terms (the riskiest method of payment for exporters), and less than 8 per cent is explained by unit prices for exports on cash-in-advance terms (the safest method for exporters).

Another significant issue faced by firms that engage in international trade is currency risk. The volatility of the rouble's exchange rates has increased since the start of the war. As a result, the percentage of exports to Russia that are denominated in Turkish lira has increased by around 2.3 percentage points (see Chart 2.5.1).

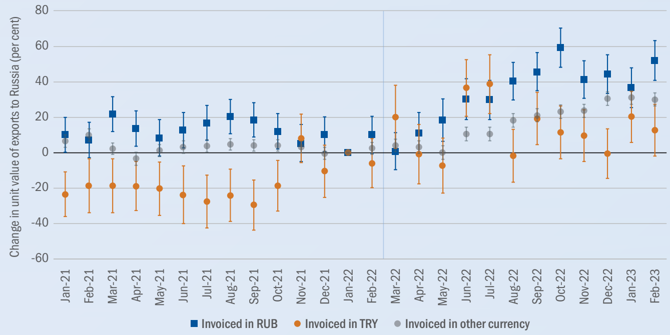
At the same time, in order to compensate for increases in currency risk, Turkish exports to Russia that are denominated in roubles now have a higher price premium (see Chart 2.5.2). Increases in the prices of exports explain less than 40 per cent of growth in the total value of lira-denominated trade, but almost 85 per cent of growth in the total value of rouble-denominated trade.

CHART 2.5.1. The percentage of Turkish exports to Russia that are denominated in Turkish lira has increased since February 2022



Source: Turkstat and authors' calculations.
Note: This chart shows the coefficients that are derived from a linear model regressing the average logarithm of the volume of Türkiye's exports by destination, month, HS6 product group and terms of contract on product-month and product-importer fixed effects and interaction terms combining dummy variables for each month with the variable of interest. January 2022 is the base period. 90 per cent confidence intervals are shown.

CHART 2.5.2. To compensate for the increase in currency risk, Turkish exports to Russia that are denominated in roubles now have a higher price premium



Source: Turkstat and authors' calculations.
Note: This chart shows the coefficients that are derived from a linear model regressing the average logarithm of the unit values of Türkiye's exports by destination, month, HS6 product group and terms of contract on product-month and product-importer fixed effects and interaction terms combining dummy variables for each month with the variable of interest. January 2022 is the base period. 90 per cent confidence intervals are shown.

BOX 2.6.

The activities of IPAs in Egypt and Morocco

Many SEMED economies have sought to strengthen their investment promotion policies in recent years, recognising that foreign investment can play an important role in driving employment creation, the transfer of technology and skills, and the upgrading of exports.

For example, Morocco has become a major automotive manufacturing hub, with strong integration into global value chains. Building on the legacy of the state-owned Moroccan Society of Automotive Construction, which was established in the 1960s, Renault and Peugeot (PSA) set up a series of automotive production facilities in 2012 and 2019 respectively, taking advantage of Morocco's relative economic and political stability, its proximity to Europe and its lower labour costs relative to central and eastern Europe.

Morocco's Agency for the Promotion of Investment and Exports, which was created in 2017, sought to foster a consensus across government entities that the automotive value chain should be prioritised by attracting and accommodating key global manufacturers. With that in mind, it developed a package of incentives focusing on access to local labour. The Moroccan government committed to covering the cost of recruiting employees for greenfield production facilities and established a specialist training facility (the Institut de Formation aux Métiers de l'Industrie Automobile), with the training curriculum being determined in close cooperation with firms and leveraging technical assistance from international partners such as the EBRD.

The automotive sector accounted for around a third of Morocco's manufacturing FDI between 2013 and 2018 (a total of US$ 2.6 billion), while the sector's exports increased from US$ 14 billion in 2007 to US$ 41 billion in 2022. While foreign inputs continue to account for a large percentage of the value-added content of exports, domestic content has increased over time. By 2026, Morocco expects to be using 15 per cent of its production capacity for the manufacture of electric vehicles.

Egypt, meanwhile, established its General Authority for Investment and Free Zones (GAFI) many years earlier (in 1971), tasking it with promoting investment, managing special zones, and supporting entrepreneurship and innovation. Between 2010 and 2015, Egypt saw a decline in foreign investment-driven manufacturing. Recent efforts to reverse that decline have focused on (i) improving the business environment for investors in the Suez Canal Economic Zone, with technical assistance from international partners such as the EBRD, and (ii) establishing a manufacturing hub for green hydrogen in that area. Administrative formalities have been streamlined with the introduction of a one-stop shop, and work on the digitalisation of investor services is ongoing.

BOX 2.7.

Legislative and voluntary initiatives aimed at improving due diligence for supply chains

Identifying and addressing risks relating to adverse environmental impacts and human rights abuses in global supply chains is challenging for firms. However, it is increasingly becoming a necessity, with mandatory due diligence and disclosure legislation being introduced across jurisdictions. In February 2022, the European Commission published a proposal for a Corporate Sustainability Due Diligence Directive, seeking to harmonise existing legislation following the adoption of national legislative instruments such as Germany's Supply Chain Due Diligence Law and France's Duty of Vigilance Act.

The proposed CS3D requires companies to address any adverse impact that their operations have on human rights and the environment, including by conducting proper due diligence on human rights and environmental risks arising from their supply chains and the operations of their subsidiaries. The scope of the CS3D's application in terms of company size and sector coverage has yet to be agreed. This is being discussed by the European Commission, the European Parliament and the Council of the European Union in the context of "trilogue" negotiations.

Meanwhile, due diligence obligations in respect of certain specific raw materials are set out in other EU instruments. For example, the Conflict Minerals Regulation (Regulation (EU)2017/821) requires EU importers that are buying tin, tantalum, tungsten and their ores from conflict-affected or high-risk areas to undertake supply chain due diligence and arrange independent third-party audits to verify the fulfilment of disclosure obligations. Furthermore, the new Batteries Regulation (Regulation (EU) 2023/1542) requires companies of a certain size which are selling batteries above a certain capacity to establish due diligence policies that check for actual and potential environmental and human rights issues in their supply chains, including as regards four critical materials for battery production: cobalt, natural graphite, lithium and nickel.

The EU's supply chain due diligence legislation will complement and strengthen its corporate sustainability disclosure framework. The CS3D's sustainability-related due diligence obligations, combined with the reporting obligations under the Corporate Sustainability Reporting Directive (CSRD; Directive (EU) 2022/2464), are designed to provide detailed sustainability-related information on supply chains. The CSRD applies to both EU and non-EU companies with employment and turnover above certain thresholds. Companies within its scope must comply with mandatory reporting requirements for environmental, social and governance-related matters under the European Sustainability Reporting Standards (ESRS) adopted in July 2023.

Under the ESRS, the identification and assessment of a company's sustainability-related risks, impacts and opportunities must cover its supply chain. This is in line with the IFRS Sustainability Disclosure Standards that were published by the ISSB in June 2023. Those IFRS standards require disclosure of the risks and opportunities that are material to a company's financial position.

In practice, supply chain due diligence and sustainability reporting requirements entail significant legal obligations and costs. Strong internal governance and operational arrangements will be critical if firms are to deliver on these requirements.

The Corporate Climate Governance (CCG) facility established by the EBRD aims to help its clients to assess and manage climate-related and other sustainability-related risks and opportunities by enhancing their governance arrangements, strategy, disclosure practices and risk management policies. For example, building on technical assistance provided by the EBRD, ofi (a major food and agribusiness company) is working towards improving the resilience of Turkish hazelnut farms in its supply chains in the face of climate change, including by providing new suppliers with training on sustainable agricultural practices.

BOX 2.8.

Greening of supply chains

Sustainable supply chain finance can be an effective tool when it comes to greening the supply chains of large firms. It offers technical assistance and incentive payments to small and medium-sized suppliers that meet sustainability-related targets, including targets pertaining to emissions. This box looks at how sustainable supply chain finance works using the example of Metso Oyj (Metso), a company providing mining equipment and services.

Having signed up to targets under the Science Based Targets initiative, Metso has expanded its decarbonisation efforts to encompass its supply chain and is participating in a sustainable supply chain finance programme designed by Citibank and the EBRD. Under that programme, selected suppliers of Metso in Türkiye which commit to science-based targets will become eligible for a discount on the cost of supply chain finance offered by Citibank. Supply chain finance involves a bank extending – for a fee – advance funds to a company against future payments due to be received from off-takers of the company's products (in this case, Metso). The advantage of this scheme is that the bank has recourse to a larger firm with a better credit rating, rather than small and medium-sized enterprises (SMEs) in the relevant supply chain.

Participants in the programme are offered donor-funded incentive payments administered by the EBRD, which are conditional on the achievement of certain outcomes (such as reductions in greenhouse gas emissions). The EBRD also provides technical assistance to suppliers to help them develop expertise in the area of environmental practices. That assistance starts with an energy-efficiency audit, which includes a baseline assessment of a supplier's Scope 1, Scope 2 and, if agreed, Scope 3 emissions, as well as recommending improvements to the firm's environmental practices. On the basis of those recommendations, an energy-efficiency investment plan assesses opportunities for improving energy efficiency and the associated investment needs. Consultants also carry out monitoring and verification of suppliers' performance against the agreed outcomes.

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