

The implications for OECD regions of the war in Ukraine: An initial analysis



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Russia's large-scale aggression against Ukraine has sown catastrophe in the country; destroying lives, homes, and infrastructure. The war has also created profound and asymmetric economic and social impacts across the world, including many that are likely to be long lasting. Managing the humanitarian crisis, and the flow of refugees, is an immediate priority. Yet, governments at all levels are also grappling with the implications of further disruptions to supply chains and travel, and rising prices, which are jeopardising efforts to rebuild their economies after COVID-19. Because these impacts will not be felt equally within OECD countries, they have important implications for regional development policies – not least in the wake of the spatial challenges caused by the COVID-19 pandemic. This paper presents an early assessment of the impact of the war in Ukraine across OECD regions looking at several dimensions including refugee flows, energy price increase, disruption of trade flows and GVCs, and tourism.

JEL codes: R10, R11, R12, O18, R23, R58

Keywords: war; Ukraine; regional development

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The paper was approved by the RDPC through written procedure on 10 June 2022

(CFE/RDPC(2022)12). This paper was authorised for publication by Lamia Kamal-Chaoui, Director, Centre for Entrepreneurship, SMEs, Regions and Cities, OECD.

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Acknowledgements

This paper was prepared by the OECD Centre for Entrepreneurship, SMEs, Regions and Cities (CFE), led by Lamia Kamal-Chaoui, Director. It was produced by a team composed, in alphabetical order, of Philip Chan, Claire Charbit, Majda Eddaifi, Michael Flood, Andres Fuentes, Enrique Garcilazo, Eric Gonnard, Maximilian Gunnewig Monert, Peter Haxton, Claire Hoffmann, Rene Peter Hohmann, Michelle Marshalian, Maria-Varinia Michalun, Lianne Raderschall, Margaux Tharoux, Geoff Upton, Paolo Veneri, Valentina Ventricelli, Wessel Vermeulen and Stephan Visser. The paper was coordinated by Delphine Clavreul, Policy Analyst in the Regional Development and Multi-level Governance Division (CFE), under the supervision of Rudiger Ahrend, Head of the Economic Analysis, Data and Statistics Division, Dorothee Allain-Dupré, Head of the Regional Development and Multi-level Governance Division, and Soo-Jin Kim, Acting Head of the Cities, Urban Policies and Sustainable Development Division of CFE.

The paper draws on other analysis produced by CFE including, the issues note “Cities’ actions in response to the war in Ukraine” prepared for the 31st Session of the Working Party on Urban Policy, and the note “The War in Ukraine: Identifying Vulnerable Regions in Europe and Beyond” prepared for the 42nd session of the Working Party on Territorial Indicators.

An earlier version of this paper was prepared as an Issues note for the Roundtable on “Impact of the war in Ukraine on OECD Regions: Managing human, social and economic challenges and building a more resilient future” organised on 12 May 2022 as part of the 46th Session of the Regional Development Policy Committee (RDPC) and benefited from useful insights of delegates who participated. It also includes experiences shared during the RDPC Workshop on “Enhancing local reception and integration of Ukrainian refugees: learning from the past, being prepared for the future” held on 12 May 2022.

The early assessment presented in this paper will be further developed in the coming months, including as part of the 2023 edition of the OECD Regional Outlook, as more information and data on the implications of Russia’s invasion on OECD regions are made available.

Thanks are due to Pilar Philip who prepared this paper for publication.

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Introduction

Russia's large-scale aggression against Ukraine has sown catastrophe in the country, destroying lives, homes and infrastructure. It has led to the largest wave of refugees in Europe since the Second World War with over a quarter of the country's population migrating. According to the International Organization for Migration (IOM) and the United Nations High Commissioner for Refugees (UNHCR), there have been over 8.4 million border crossings from Ukraine between 24 February and 28 June 2022.

Russia's invasion has created profound and asymmetric economic and social impacts, including many that are likely to be long-lasting. Managing the humanitarian crisis, and the flow of refugees, is an immediate priority. Yet, governments at all levels are also grappling with the implications of further disruptions to supply chains, travel, and rising prices - jeopardising efforts to rebuild their economies after COVID-19. According to the latest OECD projections (OECD, 2022^[1]), it is estimated that global economic growth will be more than one percentage point lower this year as a result of Russia's aggression against Ukraine, while inflation – already high at the start of the year – could rise by 2.5 percentage points on average around the world.

Because these impacts will not be felt equally within countries, they have important implications for regional development policies, not least in the wake of the spatial challenges caused by the COVID-19 pandemic. Russia's invasion of Ukraine has added new layers of complexity to an already rapidly changing and highly unpredictable world. In the face of such uncertainty, public policy cannot safely assume that past trends will continue or that the future will turn out as previously expected¹. It is therefore more important than ever to leverage on the transformative potential of regions to keep the recovery on track, and to build longer-term resilience against complex shocks.

¹ OECD (2022), *Future uncertainties and disruptions resulting from the Ukraine crisis: implications for public policies related to net zero transitions*, OECD Strategic Foresight: Draft Workshop Summary and Report, 28 April 2022

1 The flow of refugees fleeing Ukraine will affect regions differently

The territorial dimension of refugee reception and integration

The Russian invasion of Ukraine has caused the largest refugee crisis in Europe since World War II, and some regions and cities have been playing an essential role in receiving and integrating displaced populations. By end-April, there were more than 5 million refugees registered outside Ukraine and an additional estimated 8 million internally displaced in Ukraine². As of 12 July 2022, the UNHCR reported over 9.2 million border crossings from Ukraine since the start of Russia's invasion in February 2022³. Among them are also third-country nationals who lived in Ukraine. Many of these refugees initially crossed into neighbouring countries – including Poland, Romania, Slovakia, Hungary Czech Republic, and Moldova – and some will likely continue moving towards Western Europe and other OECD countries. Whilst the immediate humanitarian needs are vast and critical, solutions for the medium and longer-term need to be considered now as there is a possibility that Ukrainian displacement will persist over several years. Indeed, in the wake of the destruction caused by Russia's invasion, even if the conflict in Ukraine were to end soon, it would not immediately solve the refugee situation or the humanitarian needs⁴.

The immediate response is well under way in the European Union. Humanitarian response plans and appeals have been issued. The European Union has activated the Temporary Protection Directive, which not only facilitates quick reception of people fleeing (by removing complex asylum procedures) but also demonstrates the political commitment to help. EU Member States are rolling out its implementation. In addition, to support EU Member States welcoming and accommodating refugees fleeing Ukraine, on 6 April the EU Council endorsed a proposal to increase total pre-financing from the Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU) by EUR 3.5 billion. Once adopted, this immediate injection of liquidity, in combination with the flexibility introduced by Cohesion's Action for Refugees in Europe (CARE), will speed-up EU Member countries' access to funds to spend on infrastructure, housing, equipment and services in employment, education, social inclusion, healthcare and childcare, and thus alleviate the pressure on public budgets. EU Member States with a greater number of arrivals, as either transit countries or countries of final destination, will receive a larger share, which include countries bordering Ukraine (Hungary, Poland, Romania and Slovakia), as well as Austria, Bulgaria, Czech Republic, Estonia and Lithuania⁵.

² OECD (2022), Rights and Support for Ukrainian Refugees in Receiving Countries, OECD Publishing, Paris, <https://doi.org/10.1787/09beb886-en>.

³ UNHCR Official Data, <https://data2.unhcr.org/en/situations/ukraine> (accessed on 27 April)

⁴ OECD (2022), Responding to refugee crises: Evidence-based lessons for DAC members responding to the Ukraine refugee situation, Note prepared for the DAC Meeting on 6 April 2022, DCD/DAC/RD(2022)9

⁵ European Commission official site, <https://ec.europa.eu/european-social-fund-plus/en/news/increased-reacteu-welcoming-refugees-ukraine> (accessed on 27 April 2022)

Managing refugee reception and integration is inherently a territorial concern. Subnational governments, non-governmental organisations (NGOs), businesses - especially small and medium-sized enterprises (SMEs) – social economy organisations, associations and citizens directly play an essential role in welcoming refugees and supporting their integration in local communities now and in the long term. They help provide housing, language, health and social services, as well as education and employment opportunities – from delivering guidance on local labour market conditions to recognising foreign professional degrees. A locally-led response has the advantage of better access and deeper networks with the affected people, a better understanding of the history and cultural and geopolitical specificities of the area they reside in, and – as local actors are often themselves affected – a better understanding of what needs to be done with the motivation to do it. But motivation alone risks being eroded overtime. Raising the profile of the value added of successful refugee integration – including recognition of their vast contribution to local development – can help improve local communities' perception.

Cities mobilised quickly to provide basic services to refugees. A preliminary mapping by the OECD of immediate responses from cities and international city networks in response to the humanitarian crisis⁶ demonstrates how they have quickly adjusted to facilitate the arrival of refugees from Ukraine. They have taken measures that include rapidly allocating accommodation to families from Ukraine (e.g. repurposing public buildings); matchmaking refugees with local residents; offering accommodation; and providing free public transport, such as in Bialystok (Poland)⁷, Bratislava (Slovakia)⁸, Chişinău (Moldova)⁹, Gdansk (Poland)¹⁰, Krakow (Poland)¹¹, Leipzig (Germany)¹², Ljubljana (Slovenia)¹³ and Lublin (Poland)¹⁴. In addition, many cities have provided quick access to welfare and counselling services, such as in Hamburg (Germany)¹⁵ and Satu Mare (Romania)¹⁶, where hospitals are providing extra accommodation, combined with health support to wounded and sick refugees. Children from refugee families have also been given immediate access to kindergartens, primary schools and secondary schools, such as in Chisinau

⁶ See OECD Issues Note "Cities' actions in response to the war in Ukraine", prepared for the 31st Session of the Working Party on Urban Policy (9 May 2022).

⁷ https://www.komunikacja.bialystok.pl/?page=article&article_id=1214&article_category=1&category=news, (accessed on 8 April 2022)

⁸ <https://www.minv.sk/?ukraine-information-assistance>, (accessed on 8 April 2022).

⁹ <https://www.dw.com/en/moldova-shows-solidarity-with-ukrainian-refugees/a-61029418>, (accessed on 8 April 2022).

¹⁰ <https://www.gdansk.pl/wiadomosci/Dzialania-Gdanska-wobec-kryzysu-na-Ukrainie-To-jest-tak-samo-nasza-wojna-jak-wojna-ukrainska.a.214486>, (accessed on 8 April 2022).

¹¹ https://www.krakow.pl/aktualnosci/257682,26.komunikat.prezydent_wprowadzil_darmowa_komunikacje_dla_uchodzcow.html?_ga=2.267977293.278108108.1646909023-641266548.1646055172, (accessed on 8 April 2022).

¹² <https://www.lvz.de/Leipzig/Lokales/Ukraine-Krieg-Fluechtlinge-fahren-in-Leipzig-kostenfrei-Bus-und-Bahn>, (accessed on 8 April 2022).

¹³ <https://www.ljubljana.si/en/news/aid-for-ukraine-from-the-city-of-ljubljana/>, (accessed on 7 April 2022).

¹⁴ https://lublin.eu/lublin/aktualnosci/miasto-lublin-pomaga-obywatelom-ukrainy_9392,66,1.html, (accessed on 8 April 2022).

¹⁵ <https://www.lifepr.de/inaktiv/asklepios-kliniken-gmbh-hamburg/Hamburger-Asklepios-Kliniken-koennen-bis-zu-200-Fluechtlingen-aus-der-Ukraine-Unterkunft-bieten/boxid/889236>, (accessed on 8 April 2022).

¹⁶ <https://www.nineoclock.ro/2022/03/01/healthmin-rafila-ukrainian-refugees-benefit-from-all-medical-services-3-152-hospital-beds-prepared-to-treat-injured-people-in-ukrainian-conflict/>, (accessed on 8 April 2022).

(Moldova)¹⁷, Lublin (Poland)¹⁸, Paris (France)¹⁹ and Madrid (Spain)²⁰. Many cities have also organised either a direct transfer of essential goods and items to cities in Ukraine or neighbouring countries, or the distribution of donations in support of local humanitarian services to arriving refugees in their city, such as in Katowice (Poland)²¹, Krakow (Poland)²², Kielce (Poland)²³, King County (United States)²⁴, Leeds (UK)²⁵, Ljubljana (Slovenia)²⁶, Lille (France)²⁷, Mannheim (Germany)²⁸, Maribor (Slovenia)²⁹, Milan (Italy)³⁰, Montreal (Canada)³¹, Przemyśl (Poland)³², Perth and Kinross (United Kingdom)³³ and Riga (Latvia)³⁴.

Supporting regional and local authorities to enhance refugee integration

To meet refugees' needs, regions and cities in countries neighbouring Ukraine require special support that higher levels of government can provide effectively if the right coordination tools are in place. The concentration of refugees in certain regions and cities in countries bordering Ukraine is expected to generate new demands for infrastructure and services, and these places will need increased support and effective coordination with other levels of government to meet these demands. Managing the

¹⁷<https://www.chisinau.md/libview.php?l=ro&idc=403&id=37477&t=/Presa/Comunicate-de-presacolarizarea-copiilor-refugiator-ucraineni-in-institutiile-din-capitala>, (accessed on 8 April 2022).

¹⁸[The City of Lublin helps citizens of Ukraine / lublin.eu - the official portal of the city of Lublin](https://www.lublin.eu/en/the-city-of-lublin-helps-citizens-of-ukraine/), (accessed on 8 April 2022).

¹⁹<https://www.paris.fr/pages/how-paris-is-supporting-ukraine-20549>, (accessed on 8 April 2022).

²⁰<https://www.europapress.es/madrid/noticia-comunidad-ofrece-refugiados-ucranianos-alojamiento-transporte-gratuito-region-escolarizacion-20220228142743.html>, (accessed on 8 April 2022).

²¹<https://katowice.eu/dla-mieszka%C5%84ca/aktualnosci?ItemID=5170&ListID={75169DCB-89EF-46CD-A876-165C1E838909}>, (accessed on 8 April 2022).

²²https://www.krakow.pl/aktualnosci/257714,29,komunikat,razem_dla_ukrainy_dzialania_województwa_i_miasta.html?_ga=2.65217005.278108108.1646909023-641266548.1646055172, (accessed on 11 April 2022).

²³<https://www.vmr.gov.ua/en/serhii-morhunov-kielce-a-sister-city-of-vinnitsia-organized-a-fundraiser-for-ukrainians>, (accessed on 8 April 2022).

²⁴<https://kcemployees.com/2022/03/08/supporting-the-people-affected-by-the-war-in-ukraine/>, (accessed on 11 April 2022).

²⁵<https://news.leeds.gov.uk/news/council-launches-leeds-together-for-ukraine-appeal-in-response-to-refugee-crisis#:~:text=Leeds%20City%20Council%20has%20today,a%20donation%20of%20%C2%A350%2C000>, (accessed on 11 April 2022).

²⁶<https://www.ljubljana.si/en/news/aid-for-ukraine-from-the-city-of-ljubljana/>, (accessed on 8 April 2022).

²⁷<https://www.lille.fr/Actualites/Lille-mobilisee-pour-l-accueil-des-Ukrainiens>, (accessed on 8 April 2022).

²⁸<https://www.mannheim.de/de/nachrichten/15-tonnen-hilfsqueter-fuer-czernowitz>, (accessed on 8 April 2022).

²⁹https://maribor.si/maribor_novice/mestna-obcina-maribor-zbira-higiensko-in-materialno-pomoc-za-ukrajino/ (accessed on 8 April 2022).

³⁰<https://www.comune.milano.it/-/palazzo-marino-milanoaiutaucraina-aperta-la-raccolta-fondi-del-comune-e-di-fondazione-comunita-milano> (accessed on 11 April 2022).

³¹<https://montreal.ca/actualites/lasalle-annonce-un-don-de-10-000-pour-la-crise-humanitaire-en-ukraine-27056>, (accessed on 11 April 2022).

³²<https://www.samband.is/wp-content/uploads/2022/03/2022-03-10-cemr-ukraine-updates.pdf> (accessed on 8 April 2022).

³³<https://www.thecourier.co.uk/fp/news/perth-kinross/3063476/ukraine-donations/> (accessed on 8 April 2022).

³⁴<https://www.riga.lv/lv/jaunums/rigas-dome-nosoda-krievijas-agresiju-pieskirs-500-000-eiro-palidzibu-ukrainas-iedzivotajiem>, (accessed on 8 April 2022).

refugee flows is straining local public services in some regions and cities that have seen the largest share of refugees.

Mechanisms allowing for a better geographical distribution of refugees according to where they can find housing and work, and access public services, are needed. Dispersal of people across territories, as seen in some recent responses to refugee situations, is meant to limit geographical concentration, and address congestion of services in areas where demand is concentrated. But when driven only by housing accessibility, such dispersal may prevent the creation of a critical mass of users for support services and keep refugees far from areas rich in relevant job opportunities³⁵. However, if localisation is also incentivised by job opportunities, as seen in Lithuania, it can facilitate reception and integration. To be successful, it is important to provide the right all-encompassing support, for instance combining job and education solutions for Ukrainian women and their children. Quickly accessing a suitable job vital to economic and social integration and mental well-being that will enable refugees to participate in local development. Businesses associations in several countries – e.g. Canada (construction sector), Italy (health sector), Czech Republic, Estonia, Hungary, Poland (agricultural sector) or Portugal – are already taking action to help match refugees with labour shortages.

The need to move from reception and temporary solutions to longer-term integration measures will depend on the duration of the displacement and prospects for return. While it remains unknown when refugees who fled Ukraine will be able to return, it is important for subnational governments to take action quickly to welcome them, while supporting their integration process over time. Consequently, the OECD argues there is a need for innovative “dual intent” solutions that make sure that the skills of displaced Ukrainians continue to be built, while at the same time not hampering the possible return to Ukraine once the situation allows for that. But be it for the short term or the longer term, there is a multi-level governance imperative in the management of this refugee crisis, as local, regional and national governments need to work together to find appropriate responses and seek a balanced geographic repartition on the national territory.

Policy recommendations from work conducted under the aegis of the OECD’s Regional Development Policy Committee on the territorial approach to migrant integration can be distilled into high-level lessons that can help national and subnational authorities respond to the Ukraine refugee situation. The OECD has developed a [Checklist for public action to migrant integration at the local level](#) to help governments at different levels identify what makes local integration programmes work effectively. In addition, the OECD has [benchmarked](#) policy instruments for migrant integration across six OECD Countries and distilled useful lessons, including for local authorities now faced with the challenge of welcoming and integrating refugees from Ukraine. Furthermore, based on work across ten OECD countries, a [tool](#) is available to help policy makers understand the organisation of public action in key sectors for integration, i.e. employment, education, housing and health/welfare policies. Building on these strands of work, the following lessons can be relevant to the Ukraine situation:

- **Effectively coordinating different policy sectors at the local level:** as most refugees from Ukraine are women and children, un-coordinated approaches that separate childcare and job offers, for instance, will not work. Within countries, actors from different policy sectors and levels of government must work together to align social welfare services with migrant needs. This requires effective multi-level governance mechanisms that rely on a clear allocation of competences. Knowing *who* is in charge of *what* can also help ensure subnational authorities get adequate and timely support from higher levels of government to meet refugees’ needs, and those of their citizens.

³⁵ OECD (2022), *Responding to refugee crises: Evidence-based lessons for DAC members responding to the Ukraine refugee situation*, Note prepared for the DAC Meeting on 6 April 2022, DCD/DAC/RD(2022)9

- **Getting the support of local communities, including business actors and social economy organisations:** the implementation of efficient integration programmes will depend to a large extent on locals' perception of immigration. OECD past work has shown that, within countries, perceptions of immigration vary according to where people live, thus local policy makers must be given the means to implement localised integration policies and communication strategies based on the specific situation of each place, including to help raise awareness about the local benefits of immigration. Local private actors – especially SMEs and social economy organisations – can contribute to this effort, for instance by matching refugees with available jobs.
- **Strengthening local civil service capacity to respond to the needs of refugees:** local civil servants are not always equipped with the necessary skills to ensure equal access to the same services for all. It may be because of language barriers but also preconceived ideas and lack of experience in dealing with integration issues. Training is needed within municipal departments (including teachers, social workers, and employment services) about their roles in fostering migrant integration.

Box 1. Enhancing local reception and integration of Ukrainian refugees – learning from the past, being prepared for the future: Insights from an OECD workshop

The OECD Centre for Entrepreneurship, SMEs, Regions and Cities (CFE) organised a workshop on “Enhancing local reception and integration of Ukrainian refugees – learning from the past, being prepared for the future” as part of 46th Session of the Regional Development Policy Committee (RDPC) on 12 May 2022. The event built on extensive work produced by CFE on the territorial approach to migrant and refugee integration over the years.

During the workshop, participants discussed the specific integration challenges associated with the refugees fleeing Ukraine – many of whom are women and children – particularly to ensure successful education and employment solutions are provided. In the Czech Republic, 55% of Ukrainian refugees are children and 80% of adults are women. There are also specific urban challenges, whereby refugees have concentrated in large cities, many of which have seen their population sharply increase, such as Warsaw and Krakow (Poland) whose population has grown by nearly 20% (and by 9% for the whole country). Participants also discussed opportunities and challenges of multi-level governance approaches for refugee reception and integration. They highlighted the key role of local education systems in expediently integrating pupils – noting, for instance, that since the start of Russia's invasion, 7% of the pupils in Warsaw's schools are Ukrainian. The expedience of the Polish government in issuing national ID numbers was also cited, with it taking just 3 weeks.

The experience of Colombia was also cited, with similarities between the Venezuelan refugee crisis and Russia's aggression against Ukraine given its humanitarian and consequences. Modalities of refugee migration create unique challenges given the additional strain on border regions for registration and integration. Support for municipalities is therefore critical in their efforts to receive, register, and integrate refugees by providing access to all government services in one location, and working together with local chambers of commerce to provide employment solutions. Territorial integration is only made possible when data are collected and disseminated to understand refugee numbers and outcomes. It was also noted that the principle of subsidiarity is a key principle in integrating Ukrainian refugees, whereby local governments and social economy actors work together to provide health, employment and housing solutions above all.

Participants also discussed the important contribution of migrants and refugees to regional development. [Recent OECD analysis](#) has shown that migrants' labour market outcomes have improved in recent years (compared to the native population) but that an important gender gap persists.

Supporting migrant entrepreneurship and new business creation was also noted as an important integration lever, and SMEs play a critical role in providing opportunities. In Lithuania, work is underway to match the skills of Ukrainian refugees with key labour shortages, such as nurses, teachers, and teachers assistants.

Source: Draft Summary Record of the 46th Session of the Regional Development Policy Committee, 12-13 May 2022

2 The spike in energy prices raises major concerns for regions

Reliance on Russian energy supplies in European regions

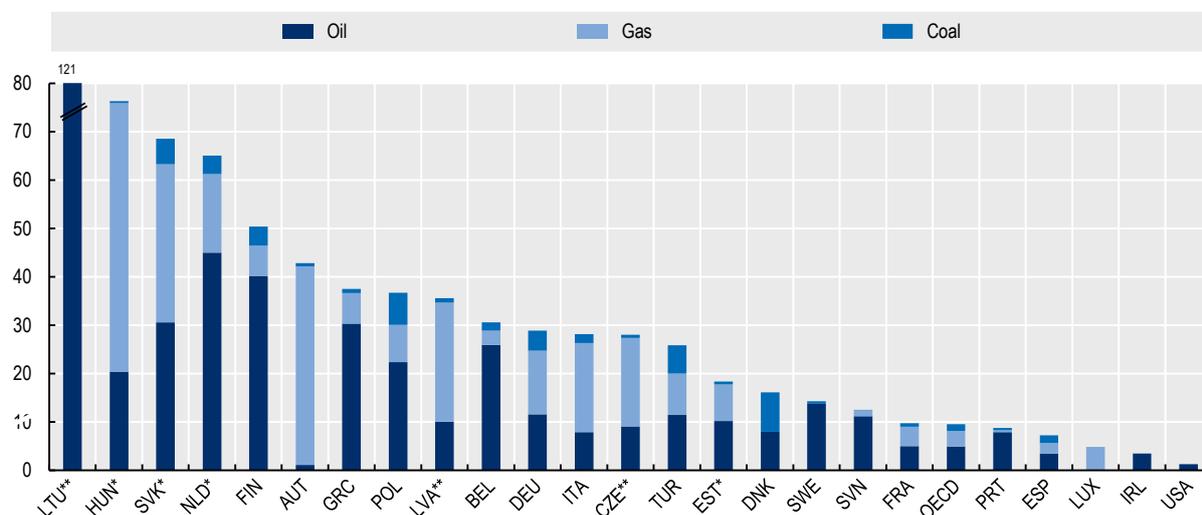
Russia is a major gas and oil supplier to several European countries. Russia supplies around 19% of the world's natural gas and 11% of oil. Europe, in particular, is highly dependent on Russian gas and oil. Before the invasion of Ukraine, Russia provided over 40% of European natural gas imports, a key source of heating for many EU households, a similar proportion of coal imports, and around one-quarter of oil imports (OECD, 2022^[2]). Ten OECD countries imported more than 30% of their energy supply from Russia (oil, gas and coal combined) (Figure 1). Furthermore, over 50 regions across European OECD countries rely on gas – in large part imported – for more than 50% of their electricity generation (Figure 2). About 20 regions – including Budapest in Hungary, Groningen in the Netherlands, and Lazio in Italy – depend on gas for more than 60% of electricity production, although in part sourced from domestic production. For example, Germany imports more than 90% of its natural gas – of which half was from Russia in 2020 (IEA, 2020^[3]) and, within the country, some regions have a relatively high share of their electricity generation from gas such as the North Rhine-Westphalia region where the share reaches almost 25%. What's more, these risks are not just restricted to the regions that produce electricity from gas, as electricity markets in Europe are highly integrated. Reducing dependence on Russian fossil fuel will require a combination of finding alternative suppliers, switching energy sources and changing production processes. Each of these options may take some time to realise, even if some customers may be protected by long-term contracts. As an example of a national response with a territorial component to the consequences of Russia's invasion, France developed a new Economic and Social Resilience Plan to mitigate the immediate and longer-term impacts of Russia's invasion of Ukraine, including rising energy prices, with twelve measures to protect businesses, jobs and the purchasing power of French citizens (Box 2).

Higher energy prices may have disproportionate impacts on some regions, especially in Europe. Since the summer of 2021, natural gas prices have risen from EUR 18.8 per megawatt hour (MWh) in January 2021 to EUR 85 per MWh by 24 May 2022, an increase of 350%.³⁶ The price shock is already hurting many households and threatens to disrupt the production of goods and services worldwide. Regions where natural gas is used for electricity generation, or that have a relatively high share of energy-intensive industries, are likely to face significant challenges in this adjustment. But as oil and gas markets are internationally interdependent, price rises will also affect regions, sectors and households that do not source their fossil fuel from Russia. Regional vulnerabilities vary also due to different consumption patterns, and the ability of consumers and businesses to absorb price increases. This will raise the risk of energy poverty and may reinforce existing inequalities between metropolitan areas, and regions with high car dependency (rural regions, suburban cities).

³⁶ OECD calculations based on Trading Economics.

Figure 1. Dependence on Russian energy supplies has been high in many EU countries

Imports of Russian energy products, % total energy supply, 2019

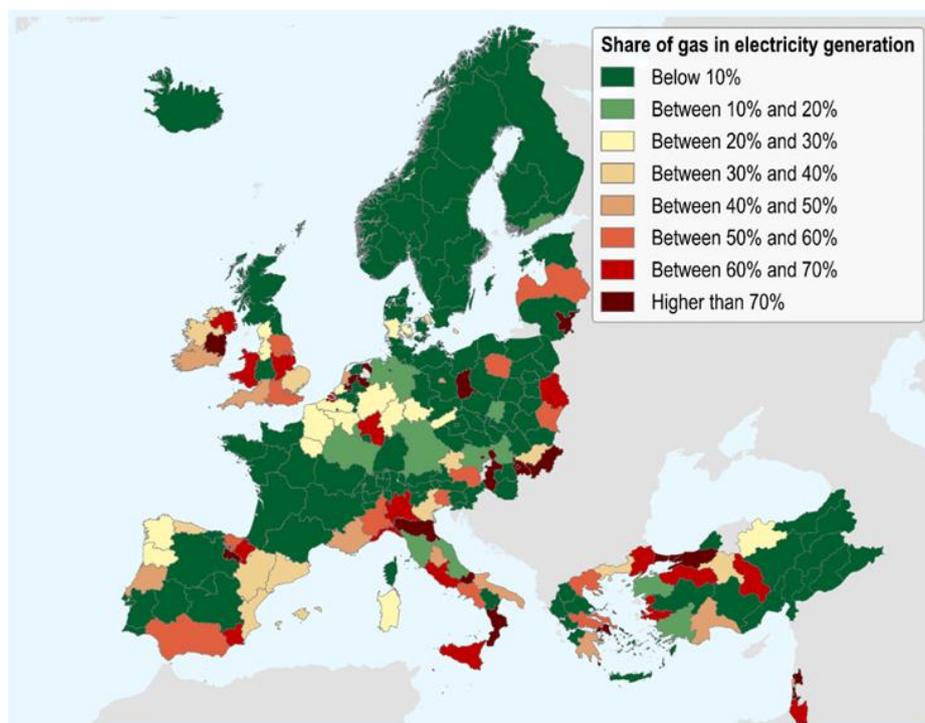


Note: * Country imports include transit trade figures ** Figures include amounts that went to stocks. Components for LTU are: oil (105.8%), gas (13.1%) and coal (2.3%).

Source: OECD (2022^[1]) based on IEA World Energy Balances database.

Figure 2. Natural gas is an important source of electricity across Europe

Share of electricity production from natural gas in large regions, 2019



Source: OECD calculations based on Byers, L. et al. (2021), A Global Database of Power Plants, <https://www.wri.org/publication/global-power-plant-database> and IEA (2022), "OECD - Electricity and heat generation", IEA Electricity Information Statistics (database), <https://doi.org/10.1787/data-00457-en>.

Box 2. France's Economic and Social Resilience Plan to mitigate the immediate and longer-term impacts of Russia's invasion of Ukraine

On 16 March 2022, in an effort to deal with the consequences of Russia's aggression against Ukraine and the sanctions against Russia, the French government adopted an Economic and Social Resilience Plan (*Plan de résilience économique et sociale*), with the core ambition to protect businesses, jobs and the purchasing power of French citizens. It sets out twelve objectives:

- Strengthen the 'tariff shield' to protect households and small businesses;
- Support companies where gas and electricity expenditures and electricity costs represent a high share of costs;
- Avoid the bankruptcy of companies affected by the shock;
- Support businesses affected by the sanctions;
- Facilitate the search for alternative markets for exporting companies;
- Provide targeted support to sectors most exposed to rising input costs;
- Make decision makers more responsible and promote bring into play the solidarity of sectors, including by ensuring a level playing field between actors within a same sector and assessing the impact of the crisis along value chains to identify additional support needs;
- Strengthen energy sovereignty;
- Strengthen Europe's food sovereignty;
- Strengthen the cybersecurity of administrations, businesses and infrastructure.

The new Plan is meant as a complementary framework to France's National Recovery Plan and its territorial component and is expected to be reflected in the new regional economic development, innovation and internationalisation strategies under development.

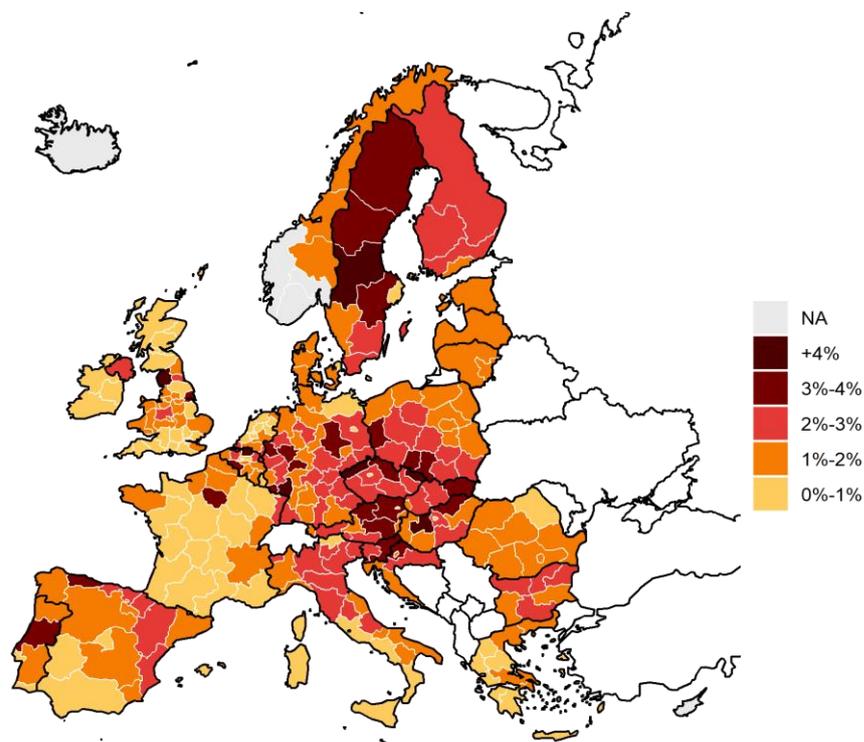
Source: <https://www.gouvernement.fr/info-ukraine/plan-de-resilience>

Regions with sectors that use natural gas intensively are more likely to be affected more by increases in the market price of natural gas. For instance, regions hosting industries in the petrochemical, metal, and non-metallic minerals sector are likely to be more exposed. Firms and sectors may see cost increases through rising electricity prices, in particular when large shares of electricity are generated from natural gas. OECD analysis³⁷ based on regional trade linkages and industrial structure in manufacturing shows that the employment shares in the five most gas-intensive sectors (manufacturing of coke and refined petroleum products, of chemicals and chemical products, basic metals, paper and paper products and non-metallic minerals) reaches 6% of total regional employment in some regions (Figure 3). These regions are particularly concentrated in Central European countries, notably Poland, the Czech Republic, Slovakia, Austria and Slovenia, as well as in Sweden, Finland and Northern Italy. The employment share in the five most gas intensive sectors of the top 10 most affected regions varies from 6.2% to 3.9% of regional employment. The spike in energy prices could provide a stepping-stone for longer-term shifts towards more sustainable energy sources and consumption and production patterns, particularly in these strongly dependant regions. How to sustain production and consumption in cities with energy sources that are affordable, secure and sustainable remains a key policy question.

³⁷ See OECD forthcoming note "How Vulnerable is European Manufacturing to Gas Supply Conditions? – A Regional Approach"

Figure 3. Employment shares of the most gas-intensive manufacturing sectors are largest in regions of Central Europe, Northern Italy, Sweden and Finland

Employment share of the five most gas intensive sectors, % of regional employment, TL2, 2019



Note: The combined regional employment share of the five sectors with the largest use of natural gas, including the share of natural gas that is used in electricity, Coke and refined petroleum products, chemicals and chemical products, basic metals, paper and paper products, and non-metallic minerals.

Source: OECD calculations based on Eurostat tables env_ac_pegasu, sbs_r_nuts06_r2, and nama_10r_3empers, all 2019. IEA, Electricity generation by source, 2019 and OECD Statistics, Regional economy, Regional Employment by Industry.

Non-metropolitan regions are more vulnerable to energy poverty

Higher energy prices erode real income, pushing precarious households into energy poverty.

Rising energy prices driven by inflationary pressures and Russia's invasion of Ukraine are increasing the vulnerability of households and regions to become energy poor, defined broadly as the inability to maintain adequate indoor temperature and undertake standard household activity³⁸. In 2020, it is estimated that around 36 million people in the EU were unable to keep their homes adequately warm. Beyond the EU, such as in Seoul, Korea, 10% of households are considered energy-poor (OECD, 2018^[41]). The lack of access to the necessary amount of energy can negatively impact health and well-being, educational opportunities, and social relations (Bosch J., 2019^[5]; Mari-Dell'Olmo M., 2017^[6]; Oliveras L., 2020^[7]). For example, it has been shown that low indoor temperatures are associated with a higher risk of infections and minor illnesses such as colds and flu, greater cardiovascular and respiratory morbidity and mortality

³⁸ Descriptively, energy poverty can be defined as the inability of a household to secure a satisfactory level of energy services in the home, notably of household temperature (between 18°C and 20°C in winter and around 25°C in summer) as well as energy for lighting, cooking, and washing (OECD, 2018^[33]; Oliveras L., 2020^[7]).

as well as fewer dietary opportunities and choices (J. Bhattacharya, 2003^[8]; P. Howden-Chapman, 2007^[9]; J. Rudge, 2005^[10]). Energy poverty is thus linked to public health problems, which are likely to be aggravated as energy prices rise.

Rural regions are particularly vulnerable to energy poverty, driven by the following factors:

- **Lower average household incomes.** Soaring energy prices driven by inflationary pressures and cuts in the supply of energy sources are increasing the vulnerability of rural households. Across 91 (large) regions from Spain, the Czech Republic and Portugal, metropolitan regions earn on average EUR 1841.43³⁹ more in terms of per-capita income each year than non-metropolitan regions. The income differential between non-metro and metro regions, and the somewhat non-discretionary nature of expenditures on energy, means that energy price increases will affect rural and non-metro households more, elevating their risk of energy poverty.
- **Lack of alternative transportation options.** For example, public transportation infrastructure is often less advanced in rural regions because population patterns lack density for it to be economical, distances are too long to be walked or cycled and alternative fuels are less common and still too expensive (OECD, 2021^[11]). This makes rural dwellers particularly car dependent.
- **Less economically diversified.** Rural regions face challenges to generate productivity due to their lack of density and economies of scale. Low-density regional economies have seen decreased and fragmented internal demand, coupled over the past two decades with competitive pressures from low-wage emerging economies. Moreover, because low-density regions produce a limited range of goods and services, they are more vulnerable to industry-specific shocks than the more diversified economic base of larger and denser regions (OECD, 2020^[12]).

Analysis in 91 regions from Spain, Czech Republic and Portugal confirm higher energy poverty in rural regions. Estimates of energy poverty show that 38% of non-metro regions are energy poor⁴⁰, with an additional 27% of regions being at risk⁴¹ (Figure 4). In general, living in a non-metro region itself increases the chance of energy poverty by 35%. Additional factors that increase energy poverty include; the share of elderly people in a region, low average income and high energy expenditures⁴². Some of these elements being prevalent in non-metropolitan regions means that energy poverty imparts an uneven impact across geographies, particularly on regions outside of small- and medium-sized cities, highlighting the need for a place-based response.

³⁹ Monetary values in this paper are expressed in 2015 constant prices.

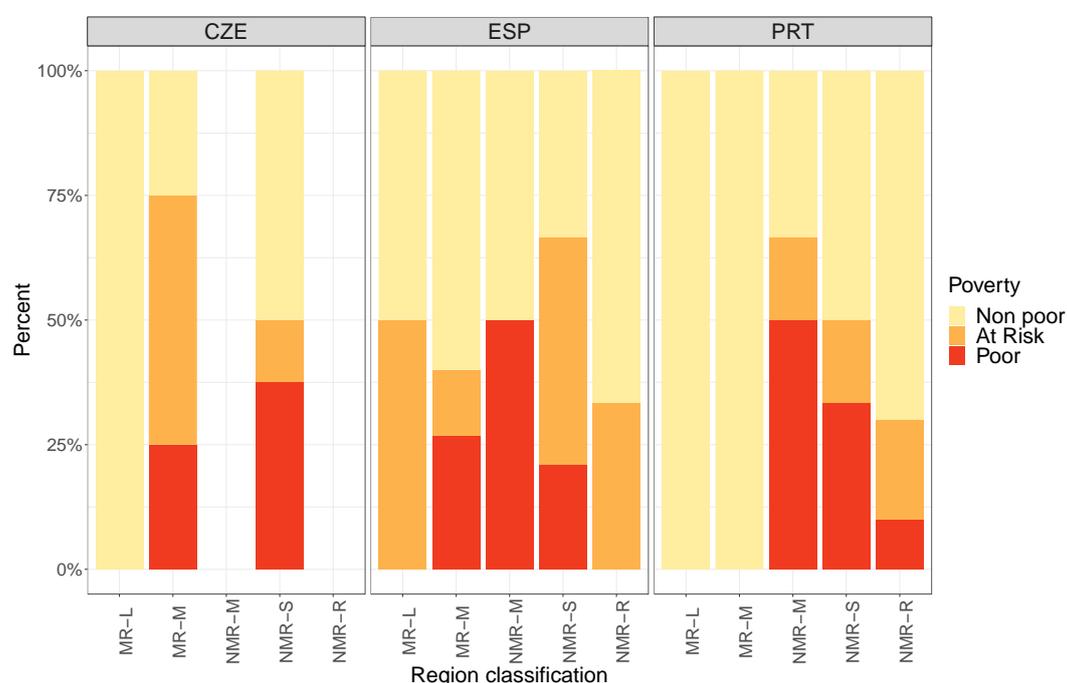
⁴⁰ In terms of measurement, we define a region as energy poor if the regional real disposable income per capita is below the national median and its energy consumption per capita is above the national median.

⁴¹ A region is considered at risk to be energy poor if its energy consumption is below the national median but higher than 90% of the median and/or if its income is larger than the national median but lower than 110% of the median. Authors own calculations.

⁴² Results are estimated using a binomial logit where the dependent variable is a binary indicator being energy poor or not based on the definition given above.

Figure 4. Large and medium sized urban regions are the least energy poor

Poverty shares for small TL3 regions by country



Note: Income data on TL3 is imputed by using the TL2 income to GDP ratio and multiplying this with the corresponding TL3 GDP level.

Source: Own elaboration using OECD Regional Database

Future energy price increases will further aggravate the energy poverty for households in non-metropolitan regions. Energy prices are expected to rise more than 50% in 2022 before easing in 2023 and 2024 (World Bank, 2022^[13]). Nevertheless, commodity prices are expected to remain well above the most recent five-year average. In a scenario where prices increase by 10%, the percentage of energy poor regions in non-metro regions increases from 27% to 38%. Although most policies are formulated at the national level – including reduced energy tax or VAT, transfers to vulnerable groups, targeted business support and retail price regulation (Bruegel, 2022^[14]) – subnational governments putting in place response measures to mitigate the effects of energy price increases. These include:

- Cities setting aside budgets to specifically support vulnerable households struggling to pay their energy bills. For instance, the city of Florence (Italy) has earmarked EUR 7.5 million from its 2022 budget and launched a crowdfunding call for donations to senior citizens.
- Flanders (Belgium) has decided to remove a tax imposed on electricity consumers for the electricity distributors' public service obligations, such as street lighting (vrtNWS, 2021^[15]).
- Korea is putting in place local measures to revitalise rural regenerations and local projects.
- Sweden in addition to temporary reductions in taxes has put in place a special contribution to car owners in rural areas.

Regions, cities and rural areas will need to reconsider their energy mix going forward – to provide greater security over supply and insulate against price volatility. Recent decisions by Russia's energy provider Gazprom to cut off natural gas supplies to Poland, Bulgaria, Finland and the Netherlands has further emphasised the need to rapidly secure alternative supplies. In doing so, it will be important to support regions with their transition to greener, renewable sources rather than domestic supplies of fossil fuels, and take steps to promote energy efficiency. Finland, for instance, has made important efforts to

develop its natural gas market over the past 10 years, notably with a pipeline project with Estonia. The United States is also actively developing natural gas resources and investing in new sustainable infrastructure that can support future industries and reduce reliance on fossil fuels. The increased focus on energy security will create opportunities for regions as governments seek to unlock endogenous energy resources. Regions with higher renewable energy potential (e.g. windy coastal regions, sunny regions) may see substantially increased investment in wind and solar energy systems that could be exported across Europe. The life of other existing energy infrastructure in Europe may be extended. Furthermore, there are risks associated with short-term measures to import gas from further afield, resulting in higher transport emissions, and the risk of reviving mining production such as coal, which had previously been seen as being in inexorable decline, in order to meet energy security needs.

3 The economic impact of strongly declining exports to Russia differs across regions

Exposure to Russian demand differs significantly across regions

OECD countries are looking to limit exports to Russia and Belarus. Many companies cannot export their products to Russia and Belarus given current sanctions or have themselves decided to limit their economic activities in these two countries. This sharp decrease of exports may have particularly strong effects on regions that have a port or other logistics centre for foreign trade, as well as for regions where firms had been exporting heavily to the two countries. Finding alternative export markets can be challenging, and firms may face substantial costs in entering new markets.⁴³

Russia and Belarus are relatively small export markets for goods for most OECD countries. Exporting mainly commodities, Russia and Belarus import more advanced technological products from OECD countries. However, for the large majority of OECD countries, exports to these two countries have been small as a share of GDP. However, for eight mainly Central and Eastern European OECD countries, the exports of goods to Russia and Belarus represents more than 2% of their GDP (Figure 5). Lithuania, Latvia, and Estonia face the largest adjustment, though their particularly high export shares may also partly reflect goods that only transit through the country. For example, in Lithuania, only 15% of the exports towards Russia and Belarus are goods of Lithuanian origin.

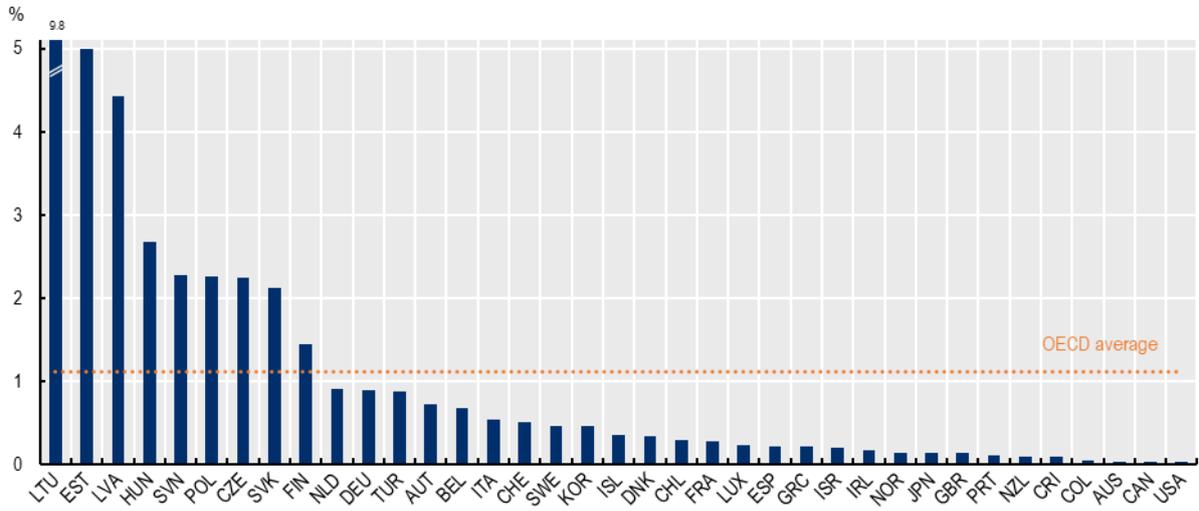
Some regions have had comparatively high shares of exports to Russia and Belarus (Figure 6), mainly resulting from their industrial specialisation. Bremen in Germany has had a particularly high exposure driven by exports of passenger cars (including Mercedes SUVs) which have represented almost half of its exports (47%) to Russia and Belarus over the last three years. Similarly, in Belgium, 42% of the Flemish region's exports to Russia and Belarus have been 'products of the chemical or allied industries', whereas for the Emilia-Romagna region of Italy, one third of exports to Russia concern 'machinery and equipment' (excluding transport vehicles).⁴⁴

⁴³ Reasons for such costs could for instance be the need to align with regulatory requirements and to establish new networks with potential clients.

⁴⁴ OECD calculations based on subnational trade data (see Annex 2 for details)

Figure 5. The Baltic countries are far above the OECD average in exports to Russia and Belarus.

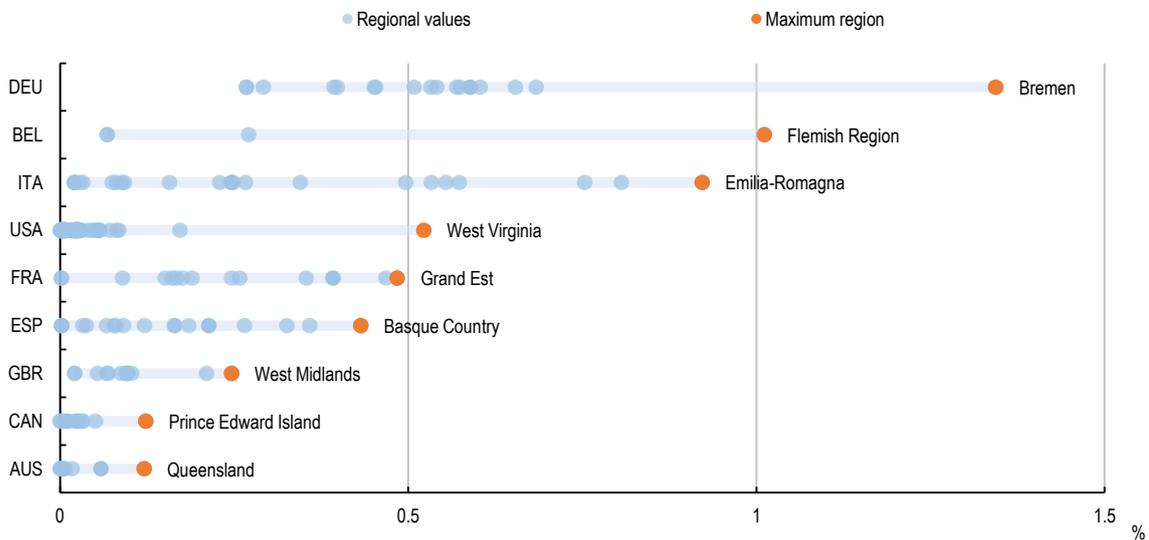
Exports to Russia and Belarus in % of GDP, average 2019-2021



Note: Exports of goods with Russia and Belarus. 2019-2021 average, except 2019-2020 for COL, CRI, FIN, FRA, GRC, HUN, IRL, IRS, ITA, KOR, NOR, SVK, SVN and TUR. OECD average is the unweighted average of the country values.
 Source: OECD (2022_[16]), "Trade in goods" (indicator), <https://doi.org/10.1787/1ea6b5ed-en> (accessed on 25 March 2022).

Figure 6. Exports to Russia and Belarus are unequally spread across regions within countries.

Regional exports to Russia and Belarus (in % of regional GDP), average 2019-2021



Source: OECD (2022), OECD Regional Statistics (database), <https://doi.org/10.1787/1ea6b5ed-en>, and ad-hoc data collection (see Annex B).
 Note: The overall numbers for regional exports may be different. Some regions may serve as trade hubs for other regions, for instance because they host a sea port, and often a significant amount of exports is not spatially attributed in official statistics, which may have more significant impacts on some regions. Each blue circle represents a regional value (large regions, TL2). The light blue bar represents regional disparities within countries. Only countries with regional trade statistics by partner countries are represented in this graph. Countries are ordered by decreasing value of their region with the highest value.

Some tourism-dependent regions may be particularly exposed

COVID-19 has taken its toll on the tourism sector globally, and Russia's invasion of Ukraine may create further challenges for some tourism-dependent regions. Tourism businesses were already in a vulnerable position due to the extensive travel restrictions that were put in place during the pandemic, and the conflict could slow the tourism recovery in those regions bordering Ukraine and Russia as well as those with high dependencies on Russian tourists, with potentially broader impacts driven by higher inflation, especially on air fares. Prior to the coronavirus outbreak, the Russian outbound market was the sixth largest in the world, worth EUR 32.5 billion in 2019, and representing around 3% of global spending on international tourism when combined with Ukraine. Many regions are highly exposed to the potential loss of tourism revenues from Russian visitors resulting from flight restrictions – particularly some regions in Estonia, Finland, Italy, Latvia, Lithuania, and Poland – for all of whom Russia is an important source market. However, even destinations that remain open to Russian airlines – such as Israel and Turkey – will be affected, as would-be Russian tourists face restrictions on card payments and volatility in the price of the rouble.

Tourism businesses around the world will also likely feel the impacts of the conflict indirectly. The travel sector is likely to be hard hit by increased fuel and energy prices, even if the effects on consumption may not be immediate as households look to benefit from the easing of COVID restrictions following 2 years of intermittent lockdowns. Furthermore, the effective closure of Russian airspace is interrupting international flight paths, adding, for example, an estimated 1000 nautical miles and 150 minutes to a flight between Paris and Tokyo. The UN World Tourism Organisation (UNWTO) estimates that a prolonged conflict could translate into a loss of over EUR 13.5 billion in tourism receipts globally in 2022 ([UNWTO, 2022](#)). However earlier fears about falling confidence, reflecting safety and security of travel to European destinations, and which saw flight bookings within Europe [fall by 23%](#) in the week after Russia's invasion, especially in countries close to the conflict zone, appear to have abated somewhat, with early anecdotal evidence from some countries pointing to a robust recovery; notwithstanding challenges of filling labour shortages following the COVID shock. (European Travel Commission, 2022_[17]). Previous experience suggests that the most affected local economies will not be able to bounce back quickly and the local labour markets could suffer for years to come, exacerbating regional disparities in unemployment, economic inactivity and job quality.

4 Some regions and sectors will bear the brunt of supply chain disruptions

Which regions are most exposed to disruption of trade with Russia and Belarus?

OECD countries may face a shortage of inputs as Russia is an important global exporter for specific metals, such as nickel, palladium and platinum. Between 2019 and 2021, Russia was the largest net exporter of palladium and nickel products, accounting for 23% and 12% of global world exports, respectively. Similarly, Russia was the second largest exporter of platinum, accounting for 6% of global world export. Other large exporters are South Africa for platinum and palladium, and Canada and Sweden for nickel products. Nickel, for instance, is used in the manufacture of batteries and steel, palladium's most common use is in catalytic converters for cars, and platinum is used in the chemical industry, including for fertilizers (OECD, 2022^[1]). Aircraft and chip manufacturing may also be particularly affected by increases in the price of certain raw materials. OECD countries and regions that rely on these metals as inputs to their manufacturing, may be disproportionately affected, in particular if a large share of their imports has come from Russia. Large manufacturing countries, including the US, Japan and China are the largest net importers of these commodities.⁴⁵

Russia's aggression against Ukraine has affected the prices of these precious metals. In particular, between January and April of 2022, the price of nickel increased by 62% and the price of palladium increased by 31%. The price of platinum increased by 18% between January 2022 and mid-March, but has since returned largely to January levels.⁴⁶

While Russia is an important producer for such commodities, OECD countries in general are well diversified with respect to the countries that are supplying them. The share of imports of nickel and platinum group metals from Russia is relatively small overall, as shown in Figure 7. OECD countries import Nickel and Platinum from a diversified set of countries. While Finland seems an exception, with 85% of import of these metals from Russia and Belarus, the large majority of these imports are subsequently re-exported. However, in certain sub-groups, imports from Russia have been playing an important role. The most notable is palladium, where for certain countries (e.g. Canada, the US, Italy, Korea and Germany) Russia has accounted for substantial shares of their imports. In these countries, regions that are more strongly depending on imports of palladium could face particularly significant problems in certain industries. Additional analysis and more detailed data gathering at regional level will need to be done in the coming

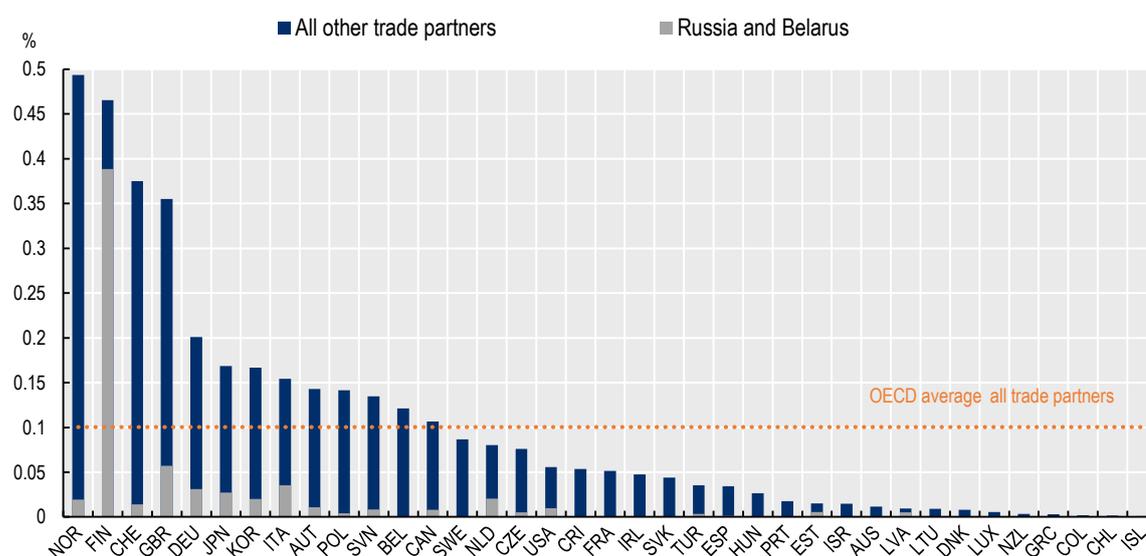
⁴⁵ Data from UN Comtrade, average over 2019-2021.

⁴⁶ OECD calculations based on Trading Economics data (Nickel, 5 January 2022 to 19 April 2022), Financial Times Markets data (Platinum and Palladium, 5 January 2022 to 20 April 2022).

months to identify more precisely the potentially affected regions and further assess the regional implications of trade disruption.

Figure 7. OECD countries import Nickel and Platinum from a diversified set of countries.

Imports of nickel and platinum group (in % of GDP), average 2019-2021



Note: Imports of goods with Russia and Belarus. 2019-2021 average, except 2019-2020 for COL, CRI, FIN, FRA, GRC, HUN, IRL, IRS, ITA, JPN, KOR, NOR, SVK, SVN and TUR. OECD average is the unweighted average of the country values. Data on nickel and platinum include the respective 2017 Harmonised System commodity codes: 2604 - Nickel ores and concentrates and 75 - Nickel and articles thereof; 7110 - Platinum, unwrought or in semi-manufactured forms, or in powder form.

Source: OECD (2022), "Trade in goods" (indicator), <https://doi.org/10.1787/1ea6b5ed-en> (accessed on 25 March 2022).

Russia's invasion has deepened food insecurity in certain regions

Prices of wheat and maize have also increased significantly since the start of the year.⁴⁷ Ukraine is a major world producer of staple commodities, including wheat and maize which prices have increased by 41% and 34% respectively since January, and may have difficulties harvesting in the current season and seeding for the next. Major concerns according to the FAO include: disruption to winter harvesting and spring planting; agricultural labour availability, impacted by displacement; access to and availability of agricultural inputs; disruption of logistics and food supply chains; abandonment of and reduced access to agricultural land; damage to crops due to military activity; and destruction of food system assets and infrastructure (FAO, 2022^[18]). According to the Ukrainian Committee on Agrarian and Land Policy, as of 14 April 2022, the projected sown areas of major spring crops for the 2022 harvest in the territory controlled by Ukraine are just over 14 million hectares, which is 2.9 million hectares less than last year. Furthermore, Russia and Belarus supplies of energy and fertilisers are increasingly closed to OECD markets following sanctions. Price of potash, a common compound used in fertilisers, has increased by 154% between January and March 2022.⁴⁸

The ongoing conflict is disrupting agricultural production and is strongly affecting the global food supply chain. Russia's large scale aggression dramatically worsened the outlook for already inflated

⁴⁷ OECD calculations based on Trading Economics (wheat) and Financial Times markets data (Corn).

⁴⁸ World Bank Commodities Price Data (The Pink Sheet), 4 April 2022.

global food prices. Over the past 30 years, the Black Sea region has positioned itself as an emerging leader in grain and oilseed supply. Egypt itself is the largest wheat importer from Ukraine (USD 1.3 billion), followed by Indonesia (USD 656 million) (Best, 2022^[19]). In addition, the Russian Federation supplies 25% of European nutrients such as nitrogen, phosphate and potash to grow, as well as 55% of nitrogen imports to Eastern Canadian regions where farmers are wholly dependent on this supply for local production (Lori Thompson, 2022^[20]).

While these disruptions are having severe economic impacts in developed and emerging markets, they are also directly affecting poorer regions and populations in developing countries, increasing food stress, poverty and threatening famine. According to the UN Food and Agriculture Organisation (FAO), this could lead to a global food crisis and a major humanitarian crisis in the most vulnerable regions of the world. Early estimates suggest that at least 10 million more people could be pushed into poverty due to rising food prices in Sub-Saharan Africa (U.S. Department of the Treasury, 2022^[21]). This runs the risk of worsening world hunger, putting increased pressure on the vulnerable, with policy action likely to be required to avert the prospect of increased food poverty in low-income and other affected regions and to integrate the possible new waves of migrants that could flow from the most impacted regions.

The ripple effect of Russia's invasion exposes the importance of some regional and sectoral linkages between Ukraine and the EU, beyond just energy and food. The economy of Ukraine began a move westward in the decade preceding Russia's aggression against Ukraine with higher value-added economic activity being concentrated in Western regions like Lviv Oblast and boosted by a small – but strategically relevant – uptick in FDI from Europe, notably German investment in manufacturing sectors (Neffke, Hartog and Li, 2022^[22]). In fact, electrical wire for automobile production was the single largest Ukrainian export to Germany in 2019. This has come to the fore with the closure of some assembly lines at Volkswagen and BMW due to supply disruptions for electrical wire (Automotive News Europe, 2022^[23]). Moreover, two Ukrainian companies, one in Mariupol and the other in Odessa, produced roughly 50% of the world supply of neon gas, a critical component in the production of semiconductor chips, before ceasing operations as a result of the invasion causing inflationary pressures and supply shortages worldwide and affecting those regions that concentrate heavily on automotive and consumer electronic production. To better manage these shocks, it is important for policy-makers to better understand the position of regions in global value chains through the more frequent collection and dissemination of subnational input-output data that illustrates the gravity of these regional and sectoral linkages.

The impact of Russia's invasion on GVCs has created a renewed focus on reshoring and nearshoring of critical industries in regions. This is part and parcel of a broader trend of the macro-regionalisation of supply chains since the global financial crisis, which has been further accelerated by the COVID-19 crisis albeit recognising that diversified supply chains can also be a source of resilience. This creates both opportunities and challenges for subnational governments. Indeed, Russia's aggression against Ukraine calls for a supply chain reinvention, elevating the importance of just-in-case modes or production relative to just-in-time, and diversifying the bases for certain key inputs, which may, in some cases, also result in relocating production closer to the point of consumption. Moreover, this requires leveraging technology to increase transparency from end to end and to better understand and predict supply chain interruptions, whilst also working to improve the environmental and social spill overs of production networks (World Economic Forum, 2022^[24]).

Other challenges emerging from Russia's invasion are expected to affect regions, including cybersecurity risks and increased defence spending are expected to affect regions

Regional and local governments will need to enhance the cybersecurity of critical infrastructure and systems. Russia's invasion of Ukraine has elevated concerns for cybersecurity incidents and the

resilience of critical business functions. The Ukraine crisis is revealing the importance of ensuring the cybersecurity of public and private infrastructure and systems and developing defences against malicious actors. Regions should be prepared to respond to disruptive cyber activity, in particular targeting critical regional infrastructure such as energy, transportation, and healthcare. Countries are mobilising efforts to reinforce cybersecurity of subnational administrations and infrastructure, such as Latvia for instance. In France, the new Economic and Social Resilience Plan includes a dedicated objective on cybersecurity that supports 1,000 local authorities, public institutions and health establishments to quickly strengthen their cybersecurity systems (see Box 2).

Changes to defence spending will have concentrated impacts in regions with a larger defence industry and some regions in NATO border countries. Following the commencement of the Ukraine crisis, many EU countries have announced plans to increase significantly defence spending. Regions with large defence industries may see increased economic activity. Strategic regions for NATO have already had an increased presence of troops, which could strongly affect local economies and communities (Gotland, Sweden; Estonia, Latvia, Romania, etc.). Germany, Finland, Poland and Sweden will likely allocate more budget to defence and increasing their military presence in some strategic regions, especially those that concentrate military production or with a higher military presence (e.g. border regions in Poland and Finland, as well as Gotland in Sweden).

Annex A: Further analysis on natural gas intensive manufacturing and regional employment in Europe

Some manufacturing sectors rely strongly on natural gas (Figure 8). Manufacturing of coke and petroleum products and of chemical products are the most gas-intensive sectors, followed by basic metals, paper and paper products and non-metallic minerals. Sectoral intensity of gas use also varies across countries. This may reflect different specialisations of specific chemicals production, the weight of other fossil fuels, such as coal, in the manufacturing of chemicals and basic metals, and differences in the efficiency of energy and raw materials use. While the natural gas intensity of production gives a reasonably good approximation of which sectors could be directly affected by price swings of natural gas, to understand regional implications, however, it may be more meaningful to look at the share of regional employment in gas-intensive sectors. The following analysis will hence be based on such employment shares. Box 3 lays out the data sources that are underlying the assessment presented here.

Box 3. Data on natural gas use by sector and sectoral employment across regions.

The identification of sectors builds on the work of the OECD/CFE on the energy transition implications for sectors and regions. OECD, (forthcoming^[25]; forthcoming^[26]) look at emissions at the sectoral and regional level in order to classify which are most vulnerable to the green transition.^a

Eurostat provides data on energy, electricity and natural gas by two digit NACE sectors for each country and regional employment by sector. Regional employment data also comes from OECD statistics for the UK and Iceland^b All data are for 2019 as a pre-COVID19 pandemic benchmark of employment, value added and energy use.

The IEA provides data on the type of energy used to create electricity, which is used to calculate the share of natural gas-based electricity generation by country.^c The total natural gas use of a sector is the sum of the direct use of natural gas of the sector and the share of natural gas used to create the electricity that is used in the sector.

Sectoral intensity in natural gas is calculated as the total use of natural gas per worker in the sector. This measure will emphasise sectors with high energy use and relative small employment, but may use more capital and intermediate inputs in production towards a higher value added. In general, sectors with high values of natural gas use over employment tend to also be large users of natural gas. Only the food and beverage sector tends to have high energy, including natural gas use, across countries, while also employing more people relative to other natural gas intensive sectors.

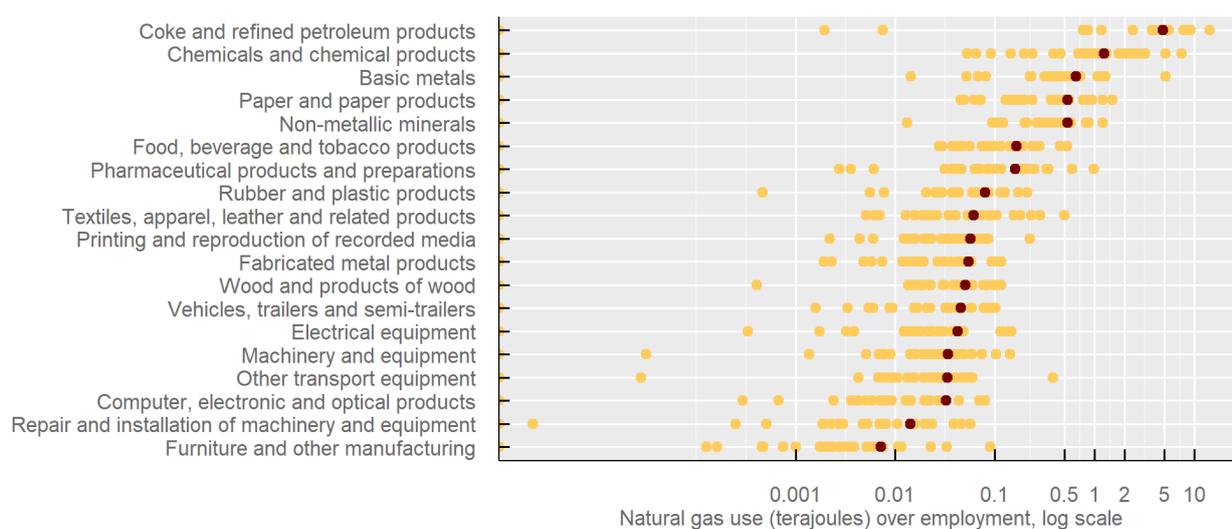
Notes: ^a We implement two modifications to the methodology. 1) The classification does not include emissions from fossil fuels and chemicals. The focus is on natural gas use directly, not the impact on greenhouse gas emissions. 2) Account for natural gas use of electricity by country-sector.

^b Energy, electricity, gas per sector, per country: Eurostat, Physical flow of energy accounts, Energy supply and use by NACE Rev. 2 activity, table env_ac_pegasu, 2019. Sectoral employment by NUTS2 regions and by country: Eurostat, structural business statistics, SBS data by NUTS2 regions and NACE Rev. 2, table sbs_r_nuts06_r2, 2019 or latest year available, NUTS2 total employment: Eurostat, Regional economic accounts, Employment by NUTS3 regions, table nama_10r_3empers, 2019. UK and Iceland regional employment: OECD Statistics, Regional economy, Regional Employment by Industry, (Iceland 2019, UK 2018).

^c Electricity generation by country: IEA, Electricity generation by source, 2019.

Figure 8. Natural gas intensity is highest in manufacturing sectors producing basic materials

Average natural gas intensity by sector across 38 European countries, 2019



Note: Natural gas intensity includes the natural gas share in electricity. The highlighted dot for each sector represents the simple average across European countries. The non-highlighted dots represent a country for each sector.

Source: OECD calculations based on Eurostat tables env_ac_pegasu, sbs_r_nuts06_r2, nama_10_a64, and nama_10r_3empers, all 2019. IEA, Electricity generation by source, 2019.

Table 1. Top 10 European regions based on the employment share of highest gas use sectors

Country	Region name	Employment percentage
DE	Rheinhessen-Pfalz	6.2
SE	Norra Mellansverige	6.2
UK	Cumbria	5.2
CZ	Severozápad	5.0
CZ	Moravskoslezsko	4.7
HU	Közép-Dunántúl	4.7
BE	Prov. Antwerpen	4.2
DE	Düsseldorf	4.0
DE	Arnsberg	4.0
DE	Sachsen-Anhalt	3.9

Note: The combined regional employment share of the five sectors with the largest use of natural gas, including the share of natural gas that is used in electricity.

Source: OECD calculations based on Eurostat tables env_ac_pegasu, sbs_r_nuts06_r2, and nama_10r_3empers, all 2019. IEA, Electricity generation by source, 2019 and OECD Statistics, Regional economy, Regional Employment by Industry

Annex B. Subnational trade data

Bilateral data on imports and exports by region is collected from dedicated national websites of selected countries. Table 2 accounts for the sources used in the figures of the main text.

Table 2. Overview of sources on subnational trade

Country	Source	Link
AUS (1)	ABS	https://explore.data.abs.gov.au
BEL	National Bank of Belgium	https://stat.nbb.be/Index.aspx?DataSetCode=EXTTRADEBENAT
CAN (2)	Statistics Canada	https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1210011901
DEU (3)	Destatis	Statistisches Bundesamt Deutschland - GENESIS-Online: Suche (destatis.de)
ESP	Spanish Tax Agency (Agencia Tributaria)	https://sede.agenciatributaria.gob.es/Sede/estadisticas/estadisticas-comercio-exterior/2021-territoriales.html
FRA	French Customs (Douanes)	https://www.douane.gouv.fr/index.php/node/4253
GBR (4)	HM Revenue & Customs	https://www.uktradeinfo.com/trade-data/rts-custom-table/
ITA	Italian Istat database	https://www.coeweb.istat.it/predefinite/tutto_merce_territorio.asp?livello=L1&riga=MERCE&territorio=S
USA	U.S. Census Bureau	USA Trade Online (census.gov)
SVN	Slovenia SiStat database	https://pxweb.stat.si/SiStatData/pxweb/en/Data/-/2430113S.px

Note: (1) AUS: regional trade data do not correspond to national level due to the fact that regional data do not take in account specific adjustments made at national level, and that confidentiality rules have been applied at subnational level on specific commodities. (2) CAN: the regional trade by partner include only Russia (Belarus data not publicly available). (3) Due to limitation in data availability, German data by commodity include only 'Nickel and nickel alloys, with waste, scrap', platinum data are not available. (4) GBR: the combined effects of coronavirus (COVID-19) national and international lockdown restrictions and EU exit uncertainty have all been contributing factors to the erratic nature of recent UK and global trade (ONS, 2021^[27]).

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