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Foreword

This Survey is published on the responsibility of the Economic and Development Review Committee of the OECD, which is charged with the examination of the economic situation of member countries.

The Secretariat's draft report was prepared for the Committee by Robert Grundke, Zeev Krill, and Marius Bickmann under the supervision of Mame Fatou Diagne. Research inputs from Cesar Barreto, Christoph Boehringer, Dennis Seifert and Donal Smith as well as Cyrille Schwellnus and Antton Haramboure are gratefully acknowledged. Statistical research assistance was provided by Corinne Chanteloup and editorial assistance by Laura Fortin and Emily Derry. Other valuable inputs and comments were received from the OECD's Centre for Tax Policy and Administration, the Directorate for Employment, Labour and Social Affairs, the Environment Directorate, the Directorate for Science, Technology and Innovation, the Directorate for Public Governance, the Financial Action Task Force, the Directorate for Financial and Enterprise Affairs, the Trade and Agriculture Directorate and the Statistics and Data Directorate.

The economic situation and policies of the Germany were reviewed by the Economic and Development Review Committee on the 21 February 2023 with participation of representatives of the German authorities. The draft report was then revised in the light of the discussions and given final approval as the agreed report of the whole Committee on 11 April 2023.

The previous Survey of Germany was issued in December 2020. Information about the latest as well as previous Surveys and more information about how Surveys are prepared is available at http://www.oecd.org/eco/surveys.

Table of contents

Tables

Figures

BASIC STATISTICS OF GERMANY, 2022

Numbers in parentheses refer to the OECD average[1]

LAND, PEOPLE AND ELECTORAL CYCLE					
Population (million, 2021)	83.2		Population density per km² (2021)	238.1	(38.7)
Under 15 (%, 2021)	13.9	(17.4)	Life expectancy at birth (years, 2020)	80.9	(79.0)
Over 65 (%, 2021)	22.2	(17.7)	Men (2020)	78.6	(76.2)
International migrant stock (% of population, 2019)	15.7	(13.2)	Women (2020)	83.4	(82.0)
Latest 5-year average growth (%)	0.2	(0.5)	Latest general election	September-2021	
ECONOMY					
Gross domestic product (GDP)			Value added shares (%, 2021)		
In current prices (billion USD)	4 067.2		Agriculture, forestry and fishing	0.9	(2.6)
In current prices (billion EUR)	3 860.4		Industry including construction	29.6	(26.6)
Latest 5-year average real growth (%)	0.5	(1.6)	Services	69.5	(70.8)
Per capita (thousand USD PPP, 2021)	58.6	(50.8)			
GENERAL GOVERNMENT Per cent of GDP					
Expenditure (OECD: 2021)	49.8	(46.3)	Gross financial debt (2021)	77.6	(111.8)
Revenue (OECD: 2021)	47.1	(38.7)	Net financial debt (2021)	30.7	(70.6)
EXTERNAL ACCOUNTS					
Exchange rate (EUR per USD)	0.95		Main exports (% of total merchandise exports)		
PPP exchange rate (USA = 1)	0.72		Machinery and transport equipment	43.2	
In per cent of GDP			Chemicals and related products, n.e.s.	18.5	
Exports of goods and services	50.2	(33.2)	Manufactured goods	12.6	
Imports of goods and services	48.2	(34.8)	Main imports (% of total merchandise imports)		
Current account balance	3.7	(-1.3)	Machinery and transport equipment	32.4	
Net international investment position (2020)	69.1		Chemicals and related products, n.e.s.	15.7	
			Manufactured goods	12.6	
LABOUR MARKET, SKILLS AND INNOVATION					
Employment rate (aged 15 and over, %)	59.6	(57.5)	Unemployment rate, Labour Force Survey (aged 15 and over, %)	3.0	(5.0)
Men	64.6	(65.4)	Youth (aged 15-24, %)	5.9	(10.9)
Women	54.7	(50.2)	Long-term unemployed (1 year and over, %, 2021)	1.2	(1.7)
Participation rate (aged 15 and over, %, 2021)	60.6	(60.3)	Tertiary educational attainment (aged 25-64, %, 2021)	31.1	(39.9)
Average hours worked per year (OECD: 2021)	1,341	(1,727)	Gross domestic expenditure on R&D (% of GDP, 2020)	3.1	(3.0)
ENVIRONMENT					
Total primary energy supply per capita (toe, 2021)	3.5	(3.8)	CO_2 emissions from fuel combustion per capita (tonnes, 2021)	7.5	(7.9)
Renewables (%, 2021)	15.6	(11.6)	Water abstractions per capita (1 000 m³, 2019)	0.2	
Exposure to air pollution (more than 10 µg/m³ of PM 2.5, % of population, 2019)	86.8	(61.7)	Municipal waste per capita (tonnes, 2021, OECD: 2020)	0.6	(0.5)
SOCIETY					
Income inequality (Gini coefficient, 2019, OECD: latest available)	0.296	(0.315)	Education outcomes (PISA score, 2018)		
Relative poverty rate (%, 2019, OECD: 2018)	10.9	(11.7)	Reading	498	(485)
Median disposable household income (thousand USD PPP, 2019, OECD: 2018)	32.1	(25.5)	Mathematics	500	(487)
Public and private spending (% of GDP)			Science	503	(487)
Health care (2021, OECD: 2020)	12.8	(9.7)	Share of women in parliament (%, 2021)	34.9	(32.4)
Pensions (2019)	10.4	(9.5)	Net official development assistance (% of GNI, 2017)	0.7	(0.4)
Education (% of GNI, 2020)	4.4	(4.4)			

Note: The year is indicated in parenthesis if it deviates from the year in the main title of this table.

1. Where the OECD aggregate is not provided in the source database, a simple OECD average of latest available data is calculated where data exist for at least 80% of member countries.

Source: Calculations based on data extracted from databases of the following organisations: OECD, International Energy Agency, International Labour Organisation, International Monetary Fund, United Nations, World Bank.

Executive summary

The energy crisis calls for accelerating structural reforms

Russia's war of aggression against Ukraine disrupted a strong recovery from the COVID-19 pandemic. A spike in energy prices has fuelled inflation and reduced the purchasing power of households. High uncertainty, particularly related to energy security, weighs on investment.

The government has acted swiftly to secure energy supply and support households and firms. The relief measures include strong energy saving incentives and support consumer and investor confidence. However, they could be better targeted to limit fiscal costs. The short-time work scheme has protected jobs, but incentives for training and job-search could be improved.

Table 1. The economy will slowly recover

Growth rates, unless specified	2022	2023	2024
Gross domestic product	1.9	0.3	1.3
Private consumption	4.4	-0.2	1.4
Government consumption	1.2	0.3	0.4
Gross fixed capital formation	0.6	-1.8	1.3
Exports of goods and services	3.0	1.8	3.1
Imports of goods and services	6.1	1.4	2.9
Unemployment rate (% of labour force)	3.0	3.0	2.9
Harmonised index of consumer prices	8.7	6.6	3.0
Harmonised index of core inflation	3.9	5.7	3.4
Financial balance (% of GDP)	-2.7	-2.2	-1.0
Government debt (Maastricht, % of GDP)	66.5	65.8	65.6
Current account balance (% of GDP)	3.7	5.7	6.3

OECD calculations based on the Economic Outlook 112 database.

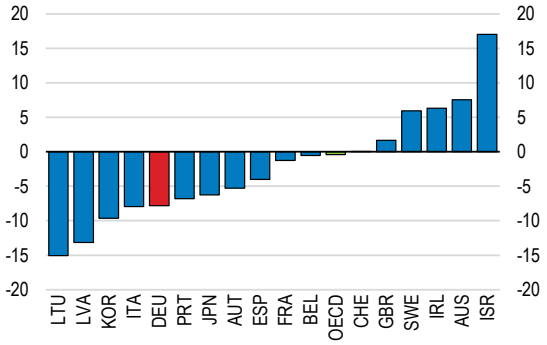
The economy will slowly recover due to easing supply-chain bottlenecks, a large order backlog and a pickup in export demand. Despite rising interest rates, investment will recover due to high corporate savings and investment needs related to the relocation of supply chains and renewable energy expansion, as well as rising public investment. High inflation will persist due to a lagged pass-through of producer to consumer prices and rising wage pressures, but will gradually moderate during 2023 on the back of monetary and fiscal tightening and falling energy prices. Real wages will grow in 2024, supporting a recovery of private consumption.

Accelerating the green transition will help to strengthen energy security but requires more investment, innovation and business dynamism, which will also support productivity and potential growth. Since the 2000s, Germany has experienced a large outflow of private capital due to weak domestic demand and business dynamism. Reviving investment and innovation and accelerating the green transition require better public governance to lower the administrative burden, particularly for infrastructure planning, and more effective support for research and development (R&D). It also calls for a stronger competition framework and better access to finance to reduce barriers for young and innovative firms.

Rapid population ageing will exacerbate labour shortages, lowering potential growth and raising fiscal pressures (Figure 1**).** It will also weigh on many manufacturing sectors, which already suffer from high energy prices. Comprehensive structural reforms are needed to maintain fiscal space, raise productivity and sustain living standards despite a declining workforce. Better incentives to work longer should be combined with improved adult education, training programmes and working conditions for the elderly. Raising labour supply of women and low-skilled adults, facilitating skilled migration and improving educational quality for disadvantaged children are key.

Figure 1. Rapid population ageing will exacerbate labour shortages

Working-age (15-64) population, % change, 2020-30



Source: United Nations (2019), World Population Prospects: The 2022 Revision, Online Edition.

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Modernising the state to support the green and digital transition

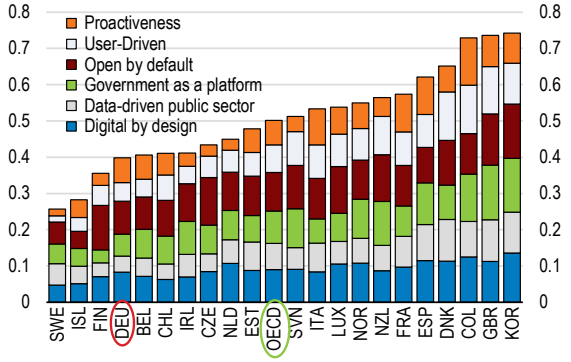
A large infrastructure backlog and investment needs for the green and digital transition require raising spending efficiency, better prioritising spending and reducing tax expenditures. Digitalising the public sector is key to reduce the administrative burden, raise the quality of public spending through better policy targeting and evaluation, and improve tax enforcement (Figure 2**).**

The fiscal framework needs to be updated. Several special funds are used to address the investment backlog, but expenditures under these funds are not included in the core budget, weakening transparency and the credibility of the fiscal framework. Gradually re-including them into the core budget should be combined with more flexibility in the fiscal rules to allow for adequate investment spending, while better incorporating spending reviews in budgeting procedures at all levels of government.

Labour taxes are among the highest across OECD countries, hampering labour supply, particularly of second earners and low-skilled workers. Around 48% of women work part-time, and many are overqualified for their jobs. Shifting the tax burden from labour towards capital income, property, inheritance and consumption taxes and reforming the current joint income taxation rules for couples would help to raise labour supply.

Figure 2. Digitalisation of the public administration is low

OECD Digital Government Index, 2019, score 0 to 1



Source: OECD Survey on Digital Government 1.0.

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Effective inheritance and gift tax rates are low, particularly for wealthy households, while wealth inequality is high. Reducing tax-allowance thresholds and business asset exemptions, while further extending instalments for tax payments, would raise revenue and reduce inequality.

Cutting tax exemptions for real estate and VAT and raising property taxes would reduce distortions, increase fairness and raise revenue. Tax expenditures for income from selling or renting real estate are regressive and lead to a misallocation of capital, contributing to rising housing prices. Many municipalities suffer from volatile revenues, but municipal property tax revenues are low in international comparison, despite soaring real estate prices.

Strengthening tax enforcement is key for levelling the playing field and raising revenue. Large firms and wealthier households make greater use of tax avoidance or evasion strategies to lower their effective tax rates, which puts smaller firms and other taxpayers at a disadvantage. Improving tax enforcement requires stronger incentives for the Laender to scale up their enforcement capacities, better IT infrastructure and cooperation across the Laender, which would allow for more specialisation and targeting of enforcement efforts.

Some progress has been made in the fight against money laundering and corruption. Data quality on asset ownership and cooperation across agencies and levels of government is still weak. Establishing a new federal agency to combat financial crime, with sufficient investigative powers, skilled staff and data access would improve capacities to fight complex financial crimes and money laundering. Providing sufficient staff and IT resources to implement and enforce the new lobby register and include a legislative and a regulatory footprint would help to make lobbying activities more transparent.

The digitalisation of the public administration holds large potential to raise spending efficiency, growth and welfare. The high administrative burden particularly hurts young and innovative firms and weakens business dynamism and innovation. The federal

government made online access to public services mandatory from 2023 but failed to introduce mandatory common standards on design and interlinkage of data and IT tools for all levels of government. Establishing a centralised and transparent e-procurement platform and encouraging joint procurement initiatives across municipalities would strongly improve spending efficiency. Digitalising the public sector also requires updating the skills of public employees, which calls for better recruitment procedures, incentive structures and training opportunities.

Reaching net zero while safeguarding competitiveness and social cohesion

Germany released 39% less GHG emissions in 2021 than in 1990 and set an ambitious target of reaching climate neutrality in 2045, which requires tripling the speed of emission reductions. High energy prices and the need to replace Russian energy imports have amplified the determination to act.

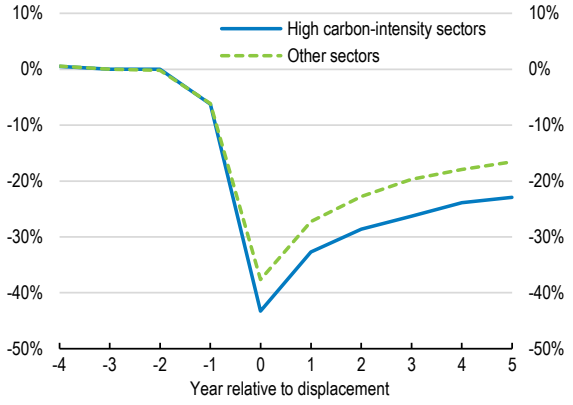
Emission pricing can effectively help to reduce emissions, but effective price levels are too low and unpredictable and differ substantially across sectors due to many tax expenditures and subsidies. Price signals should be strengthened by aligning the emission cap in the national trading system with national targets, phasing out fossil fuel subsidies and tax expenditures, and expanding the use of measures that reduce regulatory risks to green investments.

Stronger emission reductions risk hurting energy-intensive industries that are exposed to international trade. Output-based and renewable energy subsidies can support these industries, but they are costly and lead to higher emissions in other countries. The risk to these industries would be better managed by streamlining the planning and approval procedures for renewable energy projects, subsidising green R&D and pushing for international agreements that enforce faster global emission reduction.

The transition to net zero will require reallocation of labour across sectors and firms and risks increasing inequalities. Workers displaced in high-carbon-intensity sectors tend to suffer more lasting and significant decreases in earnings than other workers, because they tend to be older, work in more specific occupations and are geographically concentrated (Figure 3). Expanding the scope of active labour market programmes – focusing on vocational education and training, and mobility subsidies – could reduce adjustment costs for affected employees. Improving adult education opportunities and the offer of partial qualifications combined with recognition of informal prior learning can facilitate the uptake of vocational education, particularly for low-skilled adults. Using revenue from carbon pricing to support households can minimise adverse distributional effects more generally.

Figure 3. Workers displaced by the green transition will need support

Changes in earnings relative to pre-displacement average (in %)



Source: (Barreto, Grundke and Krill, Forthcoming).

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Gradually phasing out non-targeted subsidies as well as subsidies for mature technologies would improve the cost-effectiveness of mitigation efforts. In the housing sector, untargeted subsidies should be replaced by minimum efficiency standards and energy performance certification for existing buildings, while providing loan support for credit-constrained households. In transport, the focus should shift from subsidising electric cars towards expanding the deployment of charging points, while enhancing competition in the charging points market. Further increasing public investment in rail while accelerating the digitalisation of the control and signalling systems and improving competition would help the shift to a sustainable transport system.

Main findings	Key recommendations
Updating the fiscal framework, raising spending efficiency and reforming the tax system	
Core inflation and wages are rising. Fiscal policy will add to inflationary pressures if energy prices and corresponding subsidies remain high.	Avoid an expansionary fiscal stance to contain inflationary pressures, while standing ready to support vulnerable households.
A rising number of extra-budgetary funds at federal and Laender level reduces transparency and weakens the credibility of the national debt brake. Investment needs are high.	Gradually include extra-budgetary funds in the core budget, while introducing more flexibility in the fiscal rules to allow for adequate investment spending.
An increasing share of spending at lower levels of government is financed by the federal level with limited accountability and incentives for spending efficiency.	Foster a culture of impact evaluation by developing the necessary data sharing infrastructure, strengthening spending reviews in budgeting procedures and encouraging peer learning across levels of government.
Mandatory common standards on design and interlinkage of data and IT tools are missing across levels of government, hindering the digitalisation of public services.	Set mandatory common IT standards and encourage the harmonization of administrative procedures and joint software development across levels of government.
Joint income taxation rules for couples in combination with the Mini-Job regulation lead to steep labour tax schedules for second-earners, reducing labour supply incentives, particularly for women.	Raise labour supply incentives for second and low-wage earners by reforming the joint taxation rules for couples, while reducing the income threshold at which social security contributions progressively increase
High inflation increases real effective income tax rates, particularly for low- and middle-income earners, and lowers labour supply incentives.	Lower personal income taxes by raising tax-free allowances and decreasing tax rates.
Generous exemptions to gift and inheritance taxes reduce effective tax rates, in particular for wealthier households. Wealth inequality is high.	Reduce allowance thresholds for gift and inheritance taxes and exemptions for business assets, while extending instalments for tax payments.
Generous tax expenditures for income from selling or renting real estate distort capital allocation, contribute to rising housing prices and increase inequality. VAT exemptions are costly and regressive.	Improve tax collection and reduce distortions by abolishing tax expenditures for income from selling or renting real estate and VAT exemptions.
Improving tax enforcement and the fight against money laundering and corruption	
Tax collection and enforcement is under the responsibility of the Laender, including for taxes shared between Laender and the federal level, which creates incentives to underinvest in tax enforcement.	Set binding guidelines on tax enforcement capacities and performance for the Laender, using Laender-specific tax gap estimates, and regularly publish guidelines and performance outcomes.
Capacity constraints and weak cooperation and data exchange between law and tax enforcement authorities of the Laender complicate the fight against money laundering and tax crimes.	Implement plans to establish a Federal Financial Police and improve cooperation and data analysis across levels of government as well as the enforcement of reporting requirements.
The new transparency register for lobbying activities excludes certain lobby organisations and lower levels of the administration, where many lobbying activities take place to influence draft bills.	Provide sufficient staff and IT resources to implement and enforce the new lobby register, increase its coverage, including contacts with lower administration levels, and introduce a legislative and regulatory footprint.
Reaching net zero cost-effectively	
Germany prices 90% of its GHG emissions, explicitly or implicitly, but levels are too low and differ substantially across sectors.	Set an emissions cap for all sectors not covered by the EU ETS, which is in line with the national targets, until the European trading system for road transport and heating starts operating.
Many fossil fuel subsidies and tax expenditures weaken price signals and can jeopardise climate goals	Gradually phase out fossil fuel subsidies and tax expenditures, replacing them with abatement subsidies or direct transfers to households if needed.
The quality of the rail services deteriorated in the pre-pandemic years. Investment in rail is lower than in leading countries.	Increase public investment in rail, subject to cost-benefit analysis, and accelerate the digitalisation of the control and signaling systems.
The limited supply of publicly available charging stations is slowing electric vehicles' uptake.	Expand the deployment of charging capacity, while enhancing competition in and access to the market by targeting support at small players, standardizing pricing, and setting performance requirements.
Landlords have limited incentives to invest in energy-saving measures as tenants pay for energy costs. The efficiency standards in existing buildings have not been raised since 2009.	Increase minimum efficiency standards and apply energy performance certification to all existing buildings.
Carbon pricing makes solar and wind technologies price competitive. Renewable energy subsidies can help to reduce electricity prices, but they are costly and can lead to higher emissions in other EU countries.	Gradually shift support from renewable energy subsidies towards more targeted subsidies for green R&D and the deployment of near-zero emission industrial technologies to reduce future abatement costs.
Protecting social cohesion and addressing skilled labour shortages	
The effective age of labour market exit is still significantly below the legal retirement age. Strong incentives for early retirement exist and many older workers have difficulties updating their skills.	Reduce incentives for early retirement, while cooperating with employers to improve adult learning opportunities and working conditions for older workers.
Educational outcomes for children from disadvantaged background are weak. Access to childcare and early-childhood education is limited due to informal and decentralised application procedures which act as a barrier for disadvantaged households.	Further expand access to early-childhood education by centralising application procedures within municipalities. Raise the quality of basic education by using performance evaluations to better target support to children with weaker learning outcomes.

1 Key policy insights

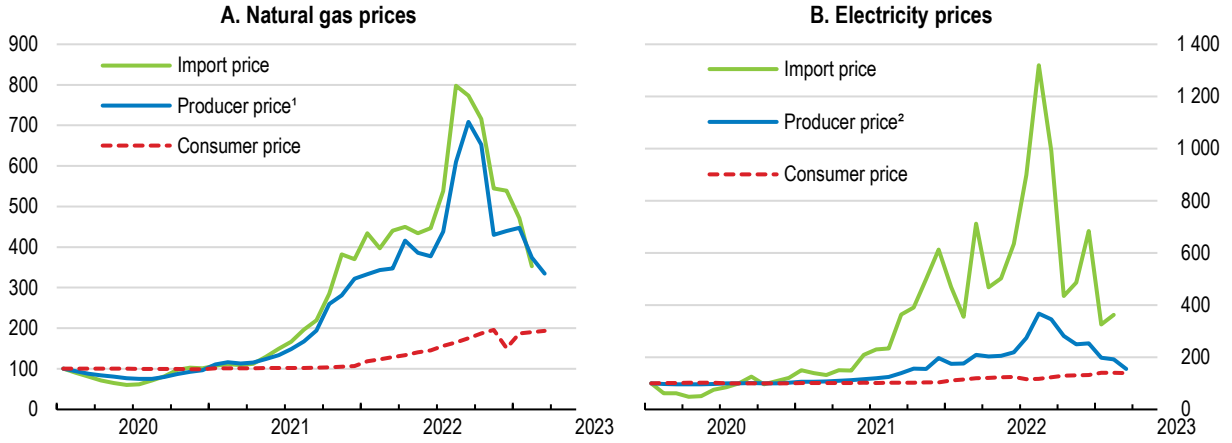
After a decade of strong export-led growth, decreasing unemployment and fiscal surpluses, the pandemic and the energy crisis have revealed structural vulnerabilities and emphasised the need for accelerating the green and digital transitions. At the same time, rapid population ageing increases public spending pressures and exacerbates skilled labour shortages. Reducing labour taxes, particularly for low-income and second earners, facilitating skilled migration, and improving adult education and training, particularly for low-skilled and older workers, is key to address skilled labour shortages. Education quality needs to improve, with a particular focus on children from disadvantaged households, to better equip younger generations with the skills needed for the green and digital transition. Fostering business dynamism, investment and innovation by lowering market entry barriers, strengthening competition, and improving access to finance for start-ups is crucial to raise productivity growth. This requires, in particular, the modernisation of the public administration to lower the administrative burden and improve the quality of public services. Addressing the existing infrastructure backlog and investment needs for the green and digital transitions will require significant public resources. To tackle these challenges while safeguarding fiscal sustainability, it is crucial to reduce tax expenditures, strengthen tax enforcement, increase public sector spending efficiency and better prioritise spending.

The energy crisis emphasises the need for accelerating the green transition and structural reforms

After a decade of strong export-led growth, decreasing unemployment and fiscal surpluses, a strong recovery from the pandemic was under way when Russia's war of aggression against Ukraine started. A spike in energy prices due to the war has fuelled inflation and reduced the purchasing power of households (Figure 1.1). It also weighs on the competitiveness of firms, particularly energy-intensive ones, and increases uncertainty related to energy security, as Germany is highly dependent on energy imports. The government has acted swiftly to secure energy supply and support households and firms facing record high energy prices, but this comes at a significant fiscal cost, compounded by rising defence spending. Energy prices will likely stay high for longer, deteriorating Germany's terms of trade and weighing on potential growth.

Figure 1.1. Energy prices remain high

Gas and electricity prices (January 2020 = 100)



1. Producer price index of natural gas when supplied to industry.
2. Producer price index of electricity when delivered to special contract customers.

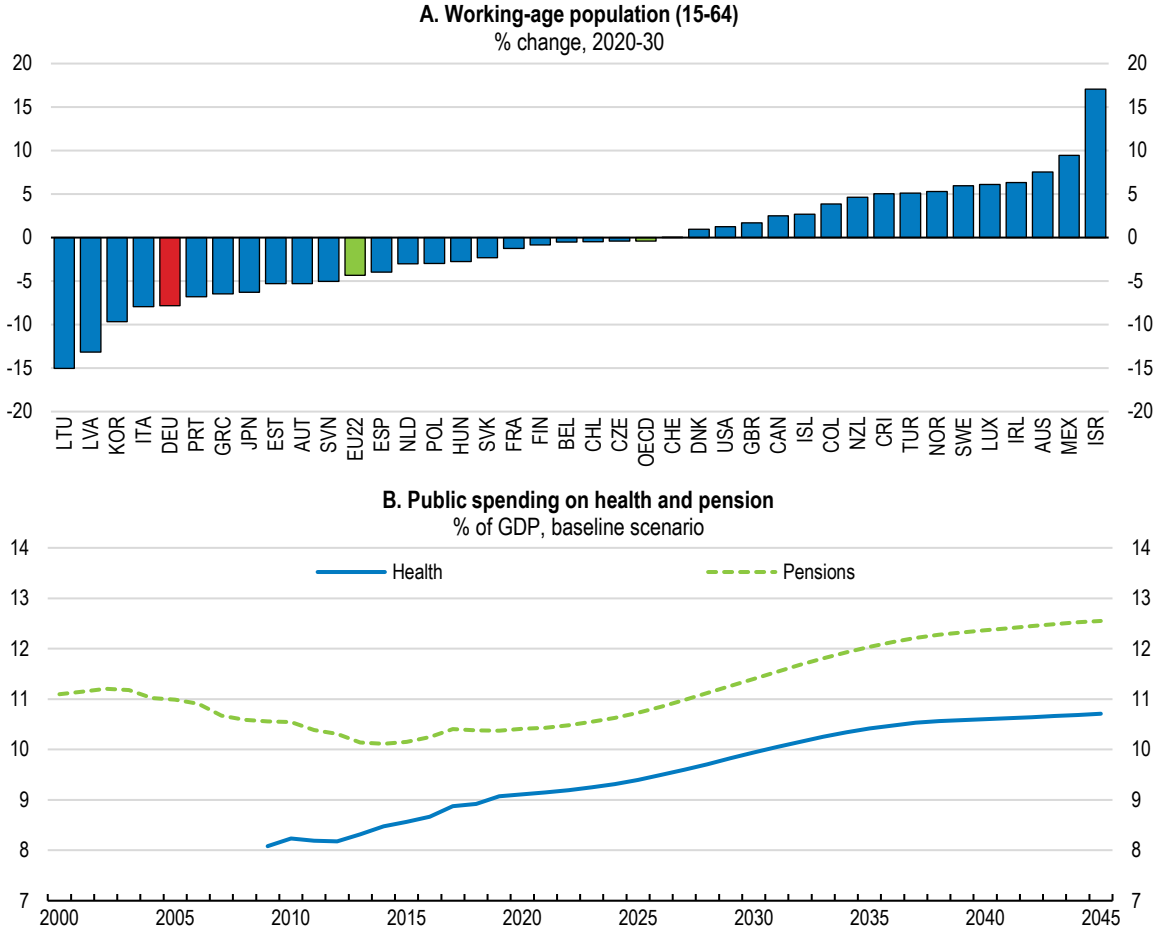
Source: Federal Statistical Office.

StatLink https://stat.link/ric3jz

Accelerating the green transition holds great potential to strengthen energy security, encourage the development of new business models and support growth, but this will have costs and require more investment and support for workers that need to change jobs (see Chapter 2). Germany has made great progress in greening its economy, with the share of renewables in total electricity production reaching 41% in 2021, up from 8% in 2000. However, reducing greenhouse gas emissions to net zero in 2045 will require more ambitious mitigation policies.

At the same time, rapid population ageing puts pressure on public pension, health and long-term care spending (Figure 1.2). It exacerbates skilled labour shortages lowering potential growth and the comparative advantage of many manufacturing sectors, in addition to energy security concerns (Bickmann, Grundke and Smith, forthcoming[1]). According to the United Nations, the working age population is projected to shrink by more than 8% by 2030, which is far more than in the average OECD country (Figure 1.2). Labour shortages will not only become a severe bottleneck for increasing investments in green, digital and housing infrastructure, but will also affect public administration. Labour shortages already pose a significant challenge to the provision of high-quality services in education, health and long-term care (KOFA, 2022[2]).

Figure 1.2. Rapid population ageing will exacerbate labour shortages and increase fiscal pressure



Note: The graphs show baseline projections for Germany based on latest policy announcements and following the methodology of (Guillemette and Turner, 2021[3]).
Source: Panel A: United Nations (2022), World Population Prospects: The 2022 Revision, Online Edition. Panel B: OECD Long Term Model.

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Although Germany managed the initial stages of the COVID-19 crisis well, consecutive waves of the pandemic have underscored the lack of digitalisation in the public sector as well as significant coordination problems across levels of government (Nationaler Normenkontrollrat, 2021[4]). This is hampering the capacity of the state to deliver high-quality public services and risks to hold back the green transition. Complex and lengthy planning and approval procedures for infrastructure investments are a major bottleneck for the expansion of renewable energy supply and other crucial infrastructure (as discussed in the previous OECD Economic Survey of Germany). Accelerating the digitalisation of the public administration will require further investments in digital infrastructure and the skills of public employees as well as better coordination and harmonisation of administrative procedures across levels of government (BMWK, 2021[5]).

Managing the green and digital transformation and addressing the infrastructure backlog will require significant public resources. The average tax burden including social security contributions stood at 39.5% of GDP in 2021, which is around five percentage points higher than the OECD average, but reaching net-zero would significantly reduce revenue from environmental taxes, which amounted to about 2.6% of GDP in 2022 (OECD, 2022[6]; Baer et al., 2023[7]). Moreover, raising labour supply to address skilled labour shortages will require lowering labour taxes, particularly for low-income and second earners. As statutory tax rates are already high in international comparison, the necessary fiscal space should be created by

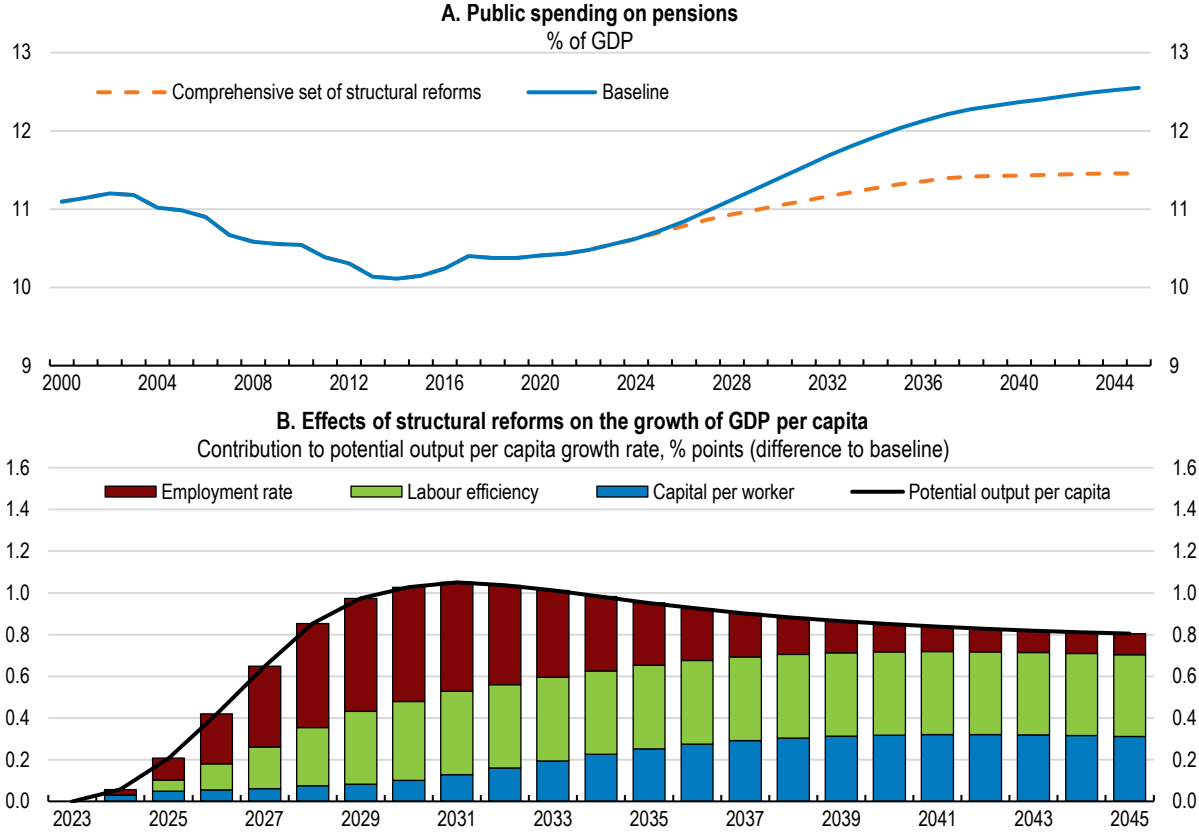
reducing tax expenditures, strengthening tax enforcement, increasing public sector spending efficiency and better prioritising spending. Subsidies and tax expenditures are high and, in many cases, introduce distortions that counteract the key policy objective of greening the economy (see chapter 2). Simplifying the tax system and closing regressive tax exemptions, for example concerning capital gains and inheritance taxes, and strengthening tax enforcement could raise a significant amount of revenue and reduce inequality. It would also lower administrative burden and level the playing field, contributing to a more efficient allocation of capital and fostering entrepreneurship and innovation. Strengthening impact evaluation of policy programmes and making broader use of spending reviews have the potential to significantly raise public spending efficiency and help to better prioritise spending.

Structural reforms are needed to raise productivity and sustain growth despite a declining workforce and to reduce fiscal pressure from rapid population ageing (Figure 1.3, Table 1.1). Improving work incentives in the tax and transfer system, adult education and training programmes and working conditions is key to raise the labour supply of women, low-skilled workers and the elderly. This should be combined with facilitating skilled labour migration and better preparing younger generations with the skills needed for the green and digital transitions, with a particular focus on children from disadvantaged households. It is also crucial to revive business dynamism, investment and innovation. This requires more public investment in infrastructure and research and development (R&D), but also lowering market entry and growth barriers for young and innovative firms. This entails reducing the administrative burden, strengthening the competition framework, raising transparency on political lobbying from established incumbent firms, and improving access to finance. Creating a more favourable environment for start-ups will contribute to developing and adopting the disruptive technologies necessary for the green transition and maintaining Germany's export strength in the future (see the previous OECD Economic Survey of Germany).

Against this background, the main messages of the Survey are:

- Create fiscal space for the green and digital transitions by reducing tax expenditures, strengthening tax enforcement, increasing public sector spending efficiency and better prioritising spending. Accelerate the modernisation of the public administration to improve public governance.
- Continue to address the economic consequences of ageing by implementing a comprehensive policy package to support the labour market integration of women, elderly and low-skilled workers, facilitate skilled labour migration, and expand adult learning opportunities. Raise education quality, particularly for children from disadvantaged households, and improve access to early-childhood education.
- Reduce emissions cost-effectively by aligning the emission cap in the national trading system with the targets, phasing out environmentally harmful subsidies and tax expenditures, and expanding support for green R&D, focusing on insurance mechanisms and unmatured technologies. Use carbon tax revenues to support vulnerable households and expand the scope of active labour market and adult learning policies to facilitate structural change and reduce inequalities.

Figure 1.3. Structural reforms are needed to preserve growth and reduce fiscal pressures



Note: The effects of structural reforms are quantified using the methodology of (Guillemette and Turner, 2021[3]). The set of structural reforms comprises: a reduction in labour tax wedges by a quarter of the difference to the OECD average; improving the Product Market regulation Index to the average of top five performers and the quality of public governance by half of the difference to the average of top five performers; reducing the distance between educational outcomes of children from the highest and the lowest decile of the household income distribution and average education outcomes to the ones observed in Canada, which is a top performer; improving access to adult education to lower the share of adults without completed basic education by 50% and raising spending for active labour market policies by 50%; increasing public investment as a share of GDP to the OECD average and R&D expenditure to the average of top five performers; improving access and quality of child care and early child hood education by increasing public spending as a share of GDP to the average of top five performers.
Source: OECD Long Term Model.

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Table 1.1. Structural reforms will address the negative consequences of ageing and raise living standards

Average yearly additional growth in GDP per capita during the next 10 years (in percentage points)

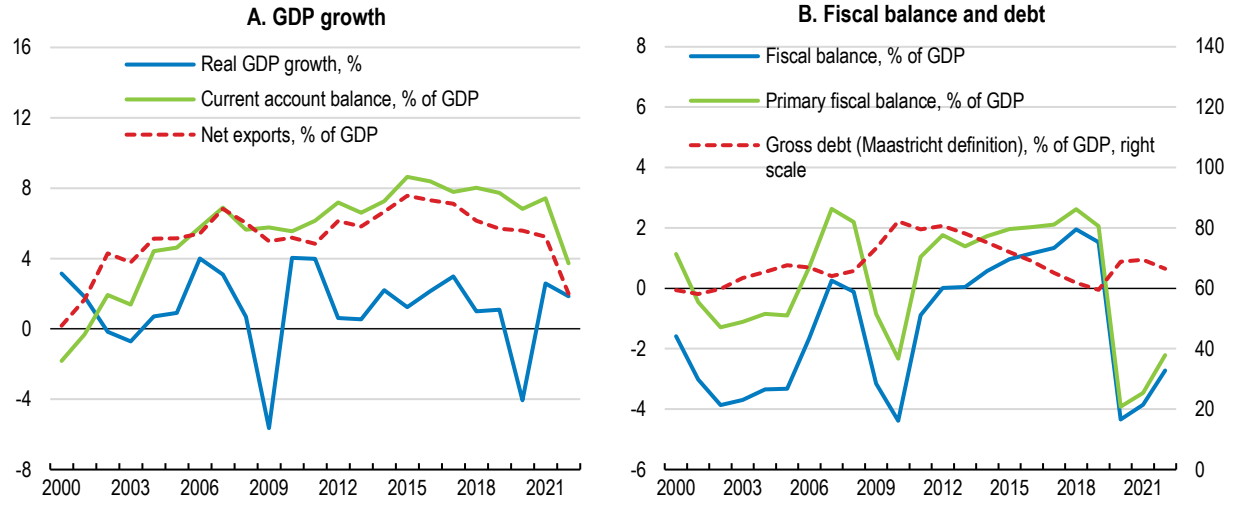
Structural reform	Additional GDP per capita growth (in percentage points)
Raising public investment in infrastructure and R&D	0.1
Improving public governance and reducing the administrative burden	0.1
Reducing labour taxes, particularly for low-income and second earners	0.1
Improving access to childcare and early-childhood education	0.1
Improving adult education and expanding active labour market policies	0.2
Improving education quality, particularly for children from disadvantaged households	0.1
Total	**0.7**

Note: Same as for Figure 1.3.
Source: OECD Long Term Model.

Learning from recent crises to lay the foundations for a strong recovery

Before the COVID-19 pandemic hit, the economy had prospered on the basis of a strong export-oriented manufacturing sector and booming construction (Figure 1.4, Panel A). Skilled labour migration from other European countries supported a strong expansion of employment and mitigated labour shortages related to population ageing. The unemployment rate declined from 11% in 2005 to 3% in 2022. The introduction of a national debt brake, which limits the federal structural deficit to -0.35% of GDP and those of the Laender to zero, contributed to strong fiscal consolidation with positive fiscal balances and rapidly decreasing public debt (Panel B).

Figure 1.4. Germany enjoyed strong export-led growth and fiscal surpluses over the past decade



Source: OECD Economic Outlook database.

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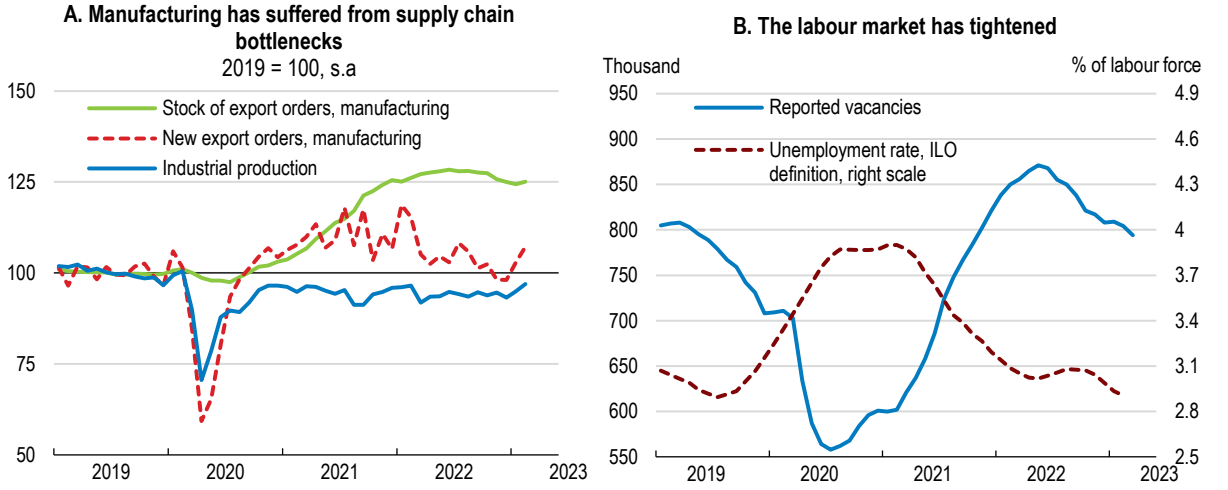
When the pandemic hit, the government used its ample fiscal space to support households and firms with measures amounting to a total of 5.5% of GDP from 2020 until 2022 (Box 1.1). This was enabled by a suspension of the national debt brake for 2020 and 2021, which was extended to 2022. While grants to firms and the short-term work scheme helped to protect jobs and sustain domestic demand, their design likely hindered the reallocation of production factors to booming sectors and firms, thereby exacerbating existing labour shortages and capacity constraints (Box 1.1). To better target support measures during the next crisis, policy impact evaluation needs to improve, which notably requires abolishing legal constraints to access, merge and analyse administrative micro data. The short-term work scheme would benefit from stronger incentives for training and job-search, which should increase over time.

A strong health system kept COVID-19 related death rates lower than in many other EU countries (OECD, 2022[8]). However, a lack of digitalisation in health administration complicated test-track-and-trace strategies, and an initially limited availability of vaccines made the extension of containment measures necessary, hampering the effect of the strong fiscal support on private consumption (Schularick, 2021[9]). Supply chain bottlenecks related to the swift global recovery from the pandemic particularly hit German manufacturing sectors, which are highly integrated into global value chains, leading to a large export order backlog (Figure 1.5). Intensifying labour shortages, exacerbated by mobility restrictions during the pandemic, also help to explain the weak recovery of industrial production, particularly in construction.

Figure 1.5. A strong post-pandemic recovery was mitigated by supply chain bottlenecks and labour shortages



Source: Federal Statistical Office.

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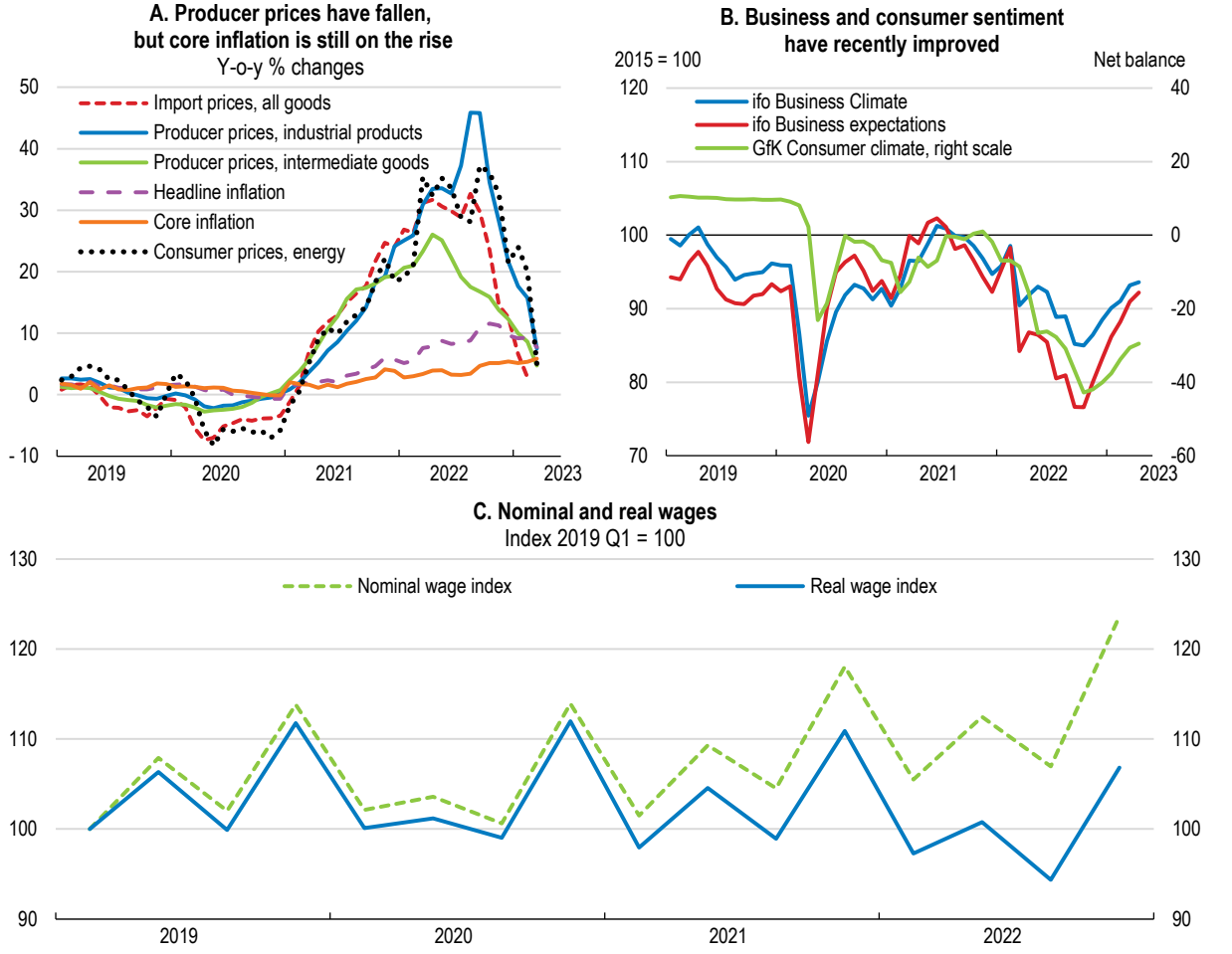
When Russia's war of aggression against Ukraine began, a strong recovery was under way. Private consumption started to rebound due to large excess savings of households and the easing of pandemic-related containment measures. Manufacturing was set to rebound with the loosening of supply chain bottlenecks later in the year. However, rising inflation and plummeting consumer and investor confidence due to the war have slowed down the recovery (Figure 1.6). Producer prices had strongly increased due to soaring energy costs and persistent supply chain bottlenecks, and the pass-through to consumer prices has broadened inflationary pressures. High inflation has reduced real incomes and excess savings, dampening the rebound of private consumption. Real wages were down by 4.6% in the third quarter of 2022 compared to a year earlier, but have recovered since then due to rising nominal wages (Figure 1.6, Panel C). Business confidence has plunged, particularly related to rising uncertainty about energy security, weighing on investment.

The government took bold actions to support households and firms, reduce uncertainty and secure energy supply, contributing to recent improvements in business and consumer confidence (Figure 1.6). Three relief packages estimated at EUR 95 billion (2.6% of GDP) and an energy support fund of EUR 200 billion (5.5% of GDP) financed by credit allowances were put in place. The relief packages include various measures to support real incomes, comprising both targeted transfers through social assistance and housing allowances, and non-targeted ones such as one-off payments to all employees, pensioners and students as well as a temporary VAT tax reduction for gas and hospitality services. Besides temporary measures and one-off transfers for 2022 and 2023, the three relief packages also include many permanent policy changes, which had been planned by the government in the 2022 and 2023 budgets, such as an inflation adjustment of the income tax schedule, the abolishment of the renewable energy surcharge or a reform of the housing allowance system. These measures can be executed within the current budgets for 2022 and 2023, as high inflation led to upward revisions for tax revenues.

Figure 1.6. Inflation and uncertainty are high and nominal wages have started to pick up



Source: Federal Statistical Office; Eurostat; ifo business surveys; GfK.

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The debt-financed energy support fund will finance liquidity support, equity injections and grants for firms as well as a subsidy of electricity and gas bills until December 2023, with an option to prolong it until April 2024 (Box 1.2). The subsidy scheme preserves incentives to save energy and adapt to potentially permanently higher prices, but it is not well targeted at vulnerable households and highly exposed firms. Although the government made the subsidies subject to personal income taxes above a threshold of yearly income of EUR 67,000, which introduces a progressive element, improving energy use data, for example by accelerating the roll-out of smart meters, and allowing linking this with other household data is key to improve the targeting of future support measures. A cash-transfer system is being developed to support vulnerable households during the green transition. While the system could also have helped to better target energy price support, its development has been hampered by IT and data protection issues and a lack of coordination and cooperation across ministries and levels of government. Accelerating the development of the system should be a key priority. Developing short-term monthly indicators on the financial situation and cost structures of firms, such as indicators used for the German Business Panel, could help to better target firm support measures ex-ante (Box 1.1). Early-warning systems to detect firms at risk of insolvency can help to target support during and after a crisis and have been implemented in Denmark and France (Moeller and Mukherjee, 2019[10]; Epaulard and Zapha, 2022[11]; Demmou et al., 2021[12]).

Excluding permanent policy measures that are not related to the energy crisis as well as equity injections, total energy price support is estimated at about 1% of GDP in 2022, 2.4% in 2023, and 0.6% in 2024, although falling retail energy prices resulting from falling wholesale prices, as observed since December

2022, would strongly reduce the fiscal costs (Box 1.2) (OECD, 2022[13]). The electricity price subsidy is to be partly financed by a windfall tax on electricity producers. To stabilise the gas market, the government nationalised the biggest gas importer, which was on the brink of default due to the stop to Russian gas imports and high spot market prices, with an estimated budgetary cost of EUR 40 billion (around 1% of GDP). Allowing for the adjustment of contract prices for its clients to reflect higher purchasing costs could help to reduce fiscal costs and provide additional incentives for gas savings, but could also imply a higher number of gas consumers applying for energy price support (Bundesbank, 2022[14]).

To become independent from gas imports from Russia, the government has required private operators to fill up gas storage tanks while providing guaranteed loans (gas storage levels reached 100% in November 2022 and stood at 66% in April 2023), accelerated the construction of LNG terminals and helped to negotiate trade deals with LNG exporters. Electricity production using gas has been reduced and replaced by reactivated coal power plants, while the three remaining nuclear power plants, which were to shut down on 1 January 2023, continued operating until April 2023. The possibility of further postponing the end of nuclear power use to stabilise energy supply in the short term has been discussed, but was rejected, as the extension for a short duration would be costly in regard of the need to order the necessary nuclear fuel and update security measures.

Box 1.1. Evaluation of Covid-19 support measures

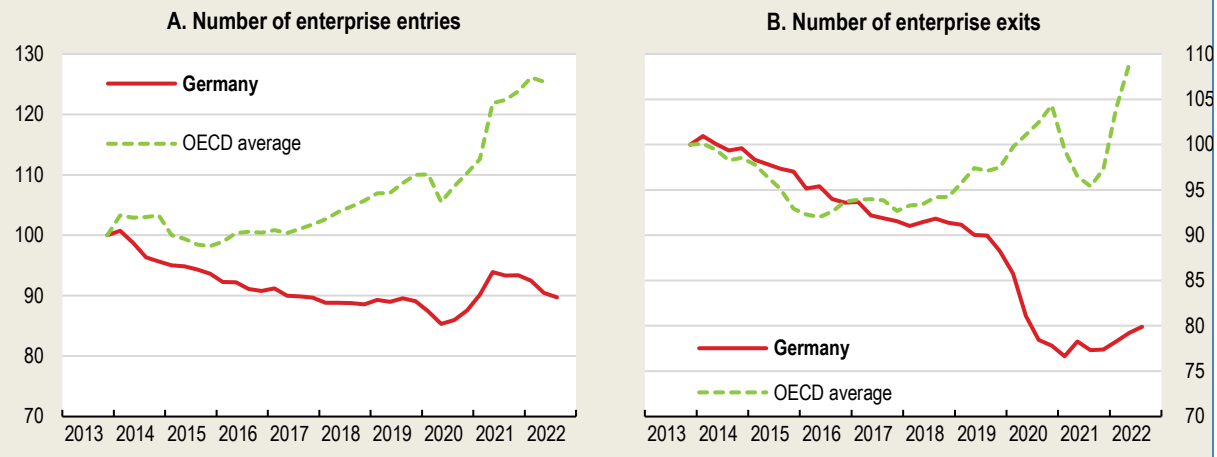
Pandemic related fiscal support was high compared to other EU countries and comprised grants to firms (2.1% of GDP), subsidised credit lines (1.65% of GDP), loan guarantees (0.5% of GDP) and more generous short-term work support (1.3%) (BMWK, 2022[15]). Analysis using data from the German Business Panel shows a positive stabilisation effect of these measures (Bischof et al., 2021[16]). In industries most affected by the pandemic, which also received the highest share in distributed grants (hospitality with 33%, retail with 14% and culture, recreation, and entertainment with 12%), the firm survival probability increased on average by 35 percentage points compared to a counterfactual without support measures.

However, there are signs that the generous support might have also slowed down business dynamism (Barnes et al., 2021[17]). The number of firm exits fell significantly below the OECD average and is still significantly lower than before the pandemic (Figure 1.7). Firm entries have slightly increased, but the gap to other OECD countries has widened significantly. Most firms did not use available credit lines but opted for generous grants that reimbursed a share of fixed costs depending on firm-specific revenue losses. These grants have not only covered the aggregate pandemic shock, but potentially also firm-specific shocks. This could have been prevented by conditioning grants on sector-wide revenue losses and cost structures, for example by using indicators from the German Business Panel, or focusing support on liquidity provision through subsidised loans and loan guarantees or tax deferrals (Bischof et al., 2021[16]; Demmou et al., 2021[12]). Focusing on liquidity support instead of grants might have been a better solution, as the equity ratio of small and medium size firms had strongly increased from 18% in 2002 to 32% in 2019, making corporate over-indebtedness due to increased emergency loans less likely (KFW, 2022[18]).

Moreover, Germany was the only EU country with rising replacement rates over time in the short-term work scheme. This in combination with an extended eligibility period of 24 months has strongly reduced job-search incentives and labour reallocation (Heinemann, 2022[19]; Calligaris et al., forthcoming[20]). Training uptake within the scheme was low as the pandemic-related special clause, which reimbursed 100% of social security contributions for employers, counteracted the training incentives of the main scheme, which consist in reimbursing 50% of social security contribution during training periods. The total fiscal costs of the short-term work scheme amounted to about EUR 42 billion in 2020 and 2021.

Figure 1.7. Business dynamism has markedly slowed down

Enterprise entries and exits (2013 Q4 = 100, 4-quarter moving average)



Source: OECD Timely Indicators of Entrepreneurship database.

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Box 1.2. Electricity and gas price support

The gas price subsidy follows a two-step approach. In the first step, households and SMEs received a transfer equal to one twelfth of the estimated annual consumption for 2022 multiplied by the gas price for December 2022. To provide timely relief, the upfront payment for the gas bill was waived in December, while the actual transfer will be settled later. In the second step, the gas bill will be subsidised from January 2023 until December 2023 with an option to be prolonged until April 2024. Households and SMEs will receive a discount equal to the difference between their contract price and the targeted subsidised price level (12 cent/kWh) multiplied by 80% of past average consumption. This lump-sum scheme fully preserves gas savings incentives, as lower consumption reduces the final gas bill without affecting the transfer. For large industrial clients, a gas price subsidy based on 70% of past average consumption is in place since January 2023. The subsidy is capped between 2 and 150 million euros, depending on whether a company is part of an energy-intensive sector, proves to have suffered a sufficiently high rise in energy costs and drop in earnings, accepts restrictions on paid bonuses and dividends, and agrees to keep its employment in Germany at current levels until 2025. Similar to gas, the use of other heating materials is subsidised. The subsidy for electricity prices, in place from January 2023 onwards, is designed similarly and partly financed by a windfall tax on electricity producers. Estimates for the fiscal costs of the gas, heating and electricity price subsidies amount to EUR 54 billion and EUR 43 billion, respectively.

A main advantage of the schemes is that the subsidised price levels for households and SMEs remain about 100% and 33% above pre-crisis levels for gas and electricity, respectively, which preserves incentives to raise energy efficiency and adapt to permanently higher fossil energy prices which will come along with carbon pricing. Moreover, the lump-sum nature of the subsidy preserves saving incentives even below the level of 80% of past average consumption, which is key to bring down energy wholesale prices and reduce the likelihood of gas rationing. As the subsidy is tied to contract prices, this ensures that the subsidy declines if retail energy prices fall as a consequence of decreasing wholesale prices.

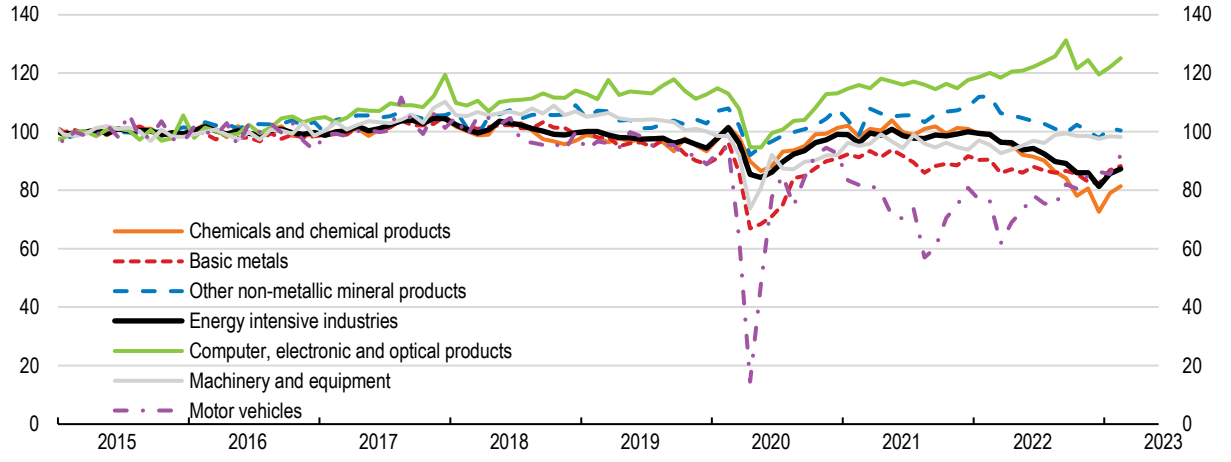
High energy prices and uncertainty related to energy security particularly affect energy-intensive industries, which compete with foreign firms in domestic and foreign markets (Figure 1.1, Figure 1.8). Average output in energy-intensive industries has dropped by about 10% in 2022, but has increased since then due to falling energy prices. Not all industries and firms have been equally affected, and total industrial production has been broadly stable since the onset of the war (Figure 1.5). Even in high energy-intensity industries, the import substitution of certain highly energy-intensive products stabilised other production processes. Although output in the chemical industry has declined by 26% in 2022, substituting ammoniac production by imports has allowed to continue other key production processes and helped to mitigate negative spill-overs to other sectors (Bachmann et al., 2022[21]; Mertens and Mueller, 2022[22]). Production in automotive, machinery and equipment and computer, electronic and optical goods industries has significantly increased since the onset of the war, mainly driven by easing supply chain bottlenecks.

Many firms sell high-quality products and have considerable market power to pass-on higher input costs to domestic and international clients (Figure 1.9) (Böhringer, Rutherford and Schneider, 2021[23]; Rangnitz, 2022[24]). Despite increasing relative export prices, export quantities expanded by 3% in 2022, particularly driven by automotive, computer and electronic products, and machinery and equipment, which account for a major share of exports (Figure 1.8, Figure 1.10). Many large firms made record profits up to the third quarter of 2022 (Sommer, 2022[25]). Thus, firm support for rising energy costs should be well-targeted to firms that have difficulties to obtain short-term financing. It should mainly consist of short-term liquidity provision to not impede necessary structural change, for example by providing subsidised loans and credit guarantees or tax deferrals, and maintain energy saving incentives (Box 1.1,Box 1.2) (Heinemann, 2022[19]).

As higher energy costs may persist during the green transition, the best policy to support firms is to improve the business environment and foster innovation to enable quality upgrades of products and services. This should include lowering the administrative burden by accelerating the digitalisation of public administration, streamlining planning and approval procedures for infrastructure investments, simplifying the tax system, strengthening competition enforcement and addressing skilled labour shortages (see below). To ensure affordable and stable energy supply in the medium run, it is key to accelerate the expansion of renewable energy supply, upgrade the grid and storage infrastructure and better integrate European electricity and energy markets (see Chapter 2) (Bundesnetzagentur, 2023[26]; Abrizio et al., 2022[27]). Simulations for this survey using a multi-sector and multi-country computable equilibrium model show that emission abatement and higher carbon prices will negatively affect some energy-intensive and trade-exposed industries in the medium term, such as metal and oil refinery industries (see Chapter 2). However, other industries, such as machinery and equipment and the automotive industry, can more easily substitute away from fossil fuel, replace highly energy-intensive domestic inputs by imports and pass on higher input costs to domestic and foreign consumers. Electricity prices are likely to increase, but a better integration of the European electricity grid and facilitating the expansion of renewable energy supply can significantly mitigate risks.

Figure 1.8. Not all industries suffer equally from high energy prices

Output of energy intensive and other industries (Production index, 2015 = 100)



Source: Federal Statistical Office.

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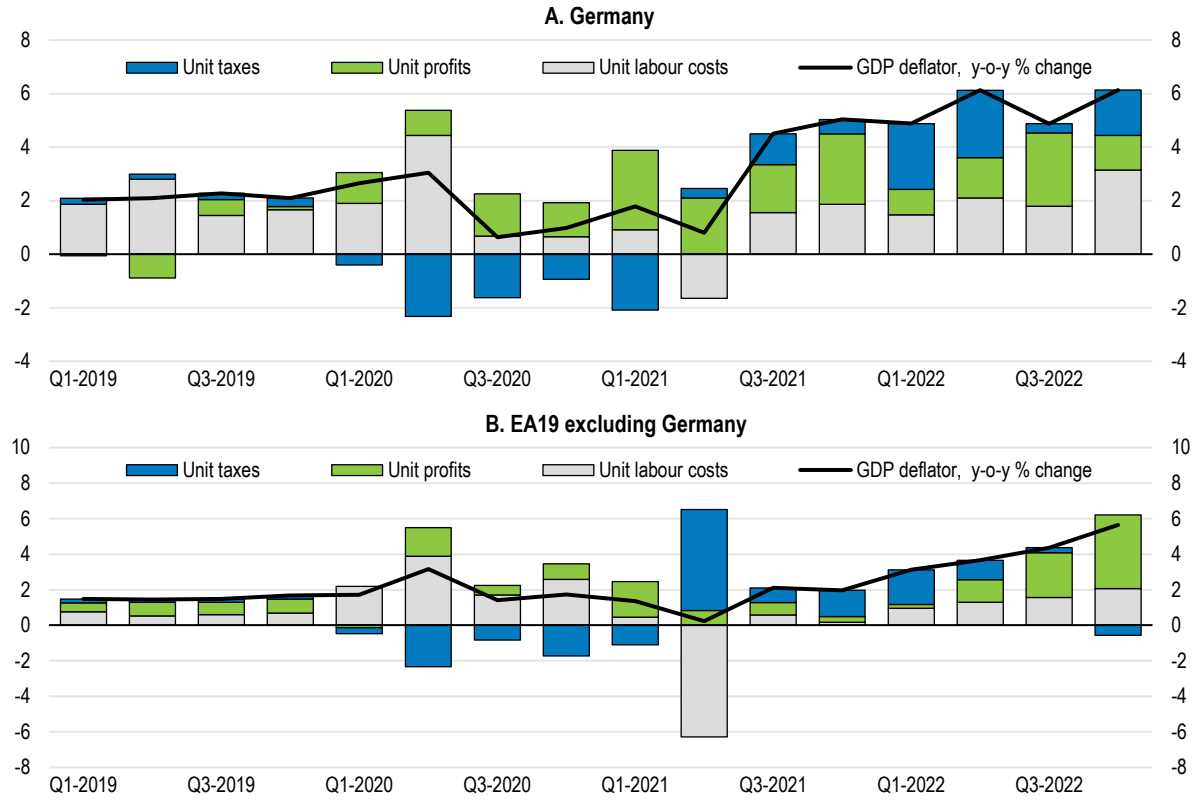
Figure 1.9. Many firms were able to pass on higher inputs costs and raise profits

GDP deflator decomposition by income side, contributions, % points



Source: OECD calculations based on OECD National Accounts database.

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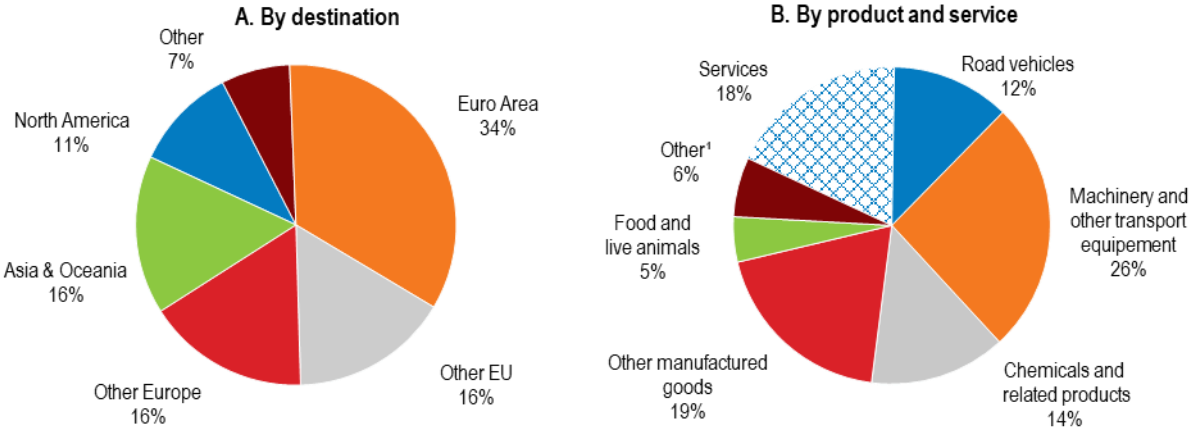
Figure 1.10. Manufactured capital goods dominate exports

Exports of goods and services, % of total, 2020



Note:1. Other category includes crude materials and inedible materials, mineral fuels, lubricants and related materials, animal and vegetable oils, fats and waxes, commodities and transactions.
Source: OECD International Trade Statistics.

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Russia's war of aggression against Ukraine and related economic sanctions have affected trade with Russia, which amounted to 2.3% of total trade in 2021. Before the start of the war, Germany was highly dependent on Russian gas, oil and coal, with around one-third of primary energy supply coming from Russia. Since then, energy imports from Russia have strongly declined due to the EU coal and oil embargo, the destruction of gas pipelines, and the rapid diversification of energy suppliers. In February 2023, less than 1% of German energy imports still came from Russia. The value of German exports to Russia has decreased by 45% on average in 2022 compared to 2021, mainly driven by plummeting exports of automotive, machinery and equipment and chemical products, while pharmaceutical exports strongly increased. In 2020, the stock of German foreign direct investment (FDI) in Russia amounted to about EUR 20 billion, 1.5% of the total German FDI stock abroad. Many German companies have closed their subsidiaries and production plants in Russia, but the losses from trade with Russia have not led to major firm failures.

The war has also led to a net inflow of about 1 million refugees from Ukraine by February 2023 (1.3% of the population), many of them women and children. In 2022 and 2023, the federal government supports municipalities and the Laender with EUR 4.25 billion to facilitate the integration of children into schools and to provide housing and social assistance for refugees. The Laender, which are responsible for the education system, offer online courses and Ukrainian teaching material to help pupils to continue Ukrainian school classes. Moreover, several hundred Ukrainian teachers have been temporarily hired by German schools via fast-track procedures. For adult refugees, free access to labour market programmes and language courses and a two-year residence permit was granted. However, less than 22% have found a job so far, partly due to limited transferability of skills and weak German language skills (Panchenko and Poutvaara, 2022[28]). Further facilitating recognition procedures for qualifications through skill validation, particularly in highly regulated sectors with high labour shortages such as education and health, and improving the supply of childcare facilities are key to support labour market integration.

The economy will slowly recover, driven by exports

The economy will slowly recover due to the easing of supply chain bottlenecks, a large export order backlog and a pickup in export demand (Table 1.2, Figure 1.5). Real GDP is projected to grow by 0.3% in 2023 and 1.3% in 2024. Growth will be subdued in 2023 as high inflation reduces real incomes and savings and holds back private consumption (Figure 1.6). Rising interest rates and uncertainty amidst energy price volatility weigh on investment, particularly in housing, but strong government support and lower energy prices will continue to improve investor confidence. Investment will eventually pick up due to high corporate savings and investment needs related to the relocation of supply chains and renewable energy expansion, as well as rising public investment. The unemployment rate will slightly decrease to 2.9% in 2024.

Inflation will remain high in 2023, averaging 6.6%, due to the pass-through of energy and producer prices to consumers and rising wage pressures, but will gradually moderate over the projection period. Due to longer-term contracts expiring in 2023, consumer prices for electricity and gas will continue to rise as providers pass on higher input costs when contracts are renewed (Figure 1.1). Wage growth will rise, helped by the minimum wage increase from 48% to 60% of the median wage in October 2022, continued labour shortages and pressure from unions to preserve the purchasing power of workers. Tighter monetary conditions, fading energy price pressures and fiscal tightening will help to bring down inflation to 3% in 2024. Real wages will grow in 2024 supporting a recovery of private consumption.

Table 1.2. Macroeconomic indicators and projections

Annual percentage change, volume (2015 prices)

	2019 Current prices (billion EUR)	2020	2021	2022	Projections 2023	2024
Gross domestic product (GDP)	**3 479.4**	-4.1	2.6	1.9	0.3	1.3
Private consumption	1 807.4	-5.9	0.4	4.4	-0.2	1.4
Government consumption	703.2	4.0	3.8	1.2	0.3	0.4
Gross fixed capital formation	745.4	-3.0	1.0	0.6	-1.8	1.3
Housing	222.4	3.7	0.3	-2.0	-5.8	-1.5
Final domestic demand	3 256.0	-3.1	1.3	2.7	-0.5	1.2
Stockbuilding[1]	24.9	-0.2	0.5	0.5	0.5	0.0
Total domestic demand	3 280.9	-3.3	2.0	3.2	0.1	1.1
Exports of goods and services	1 627.6	-10.1	9.5	3.0	1.8	3.1
Imports of goods and services	1 429.1	-9.1	8.9	6.1	1.4	2.9
Net exports[1]	198.5	-1.0	0.8	-1.1	0.2	0.2
Other indicators (growth rates, unless specified)						
GDP without working day adjustments	3,473.3	-3.7	2.6	1.8	0.1	1.3
Potential GDP	. .	1.0	1.0	0.9	0.8	0.7
Output gap[2]	. .	-3.7	-2.2	-1.3	-1.7	-1.1
Employment	. .	-0.9	0.4	2.6	0.9	0.5
Unemployment rate (% of labour force)	. .	3.7	3.6	3.0	3.0	2.9
GDP deflator	. .	1.8	3.1	5.5	6.6	3.1
Harmonised index of consumer prices	. .	0.4	3.2	8.7	6.6	3.0
Harmonised index of core inflation[3]	. .	0.7	2.2	3.9	5.7	3.4
Household saving ratio, net (% of disposable income)	. .	16.4	15.1	11.3	11.3	11.5
Current account balance (% of GDP)	. .	6.8	7.4	3.7	5.7	6.3
General government financial balance (% of GDP)	. .	-4.3	-3.9	-2.7	-2.2	-1.0
Underlying government primary financial balance[2]	. .	-1.9	-2.3	-1.6	-0.7	0.4
General government gross debt (% of GDP)	. .	78.5	77.6	78.4	77.7	77.5
General government gross debt (Maastricht, % of GDP)	. .	68.9	69.4	66.5	65.8	65.6
General government net debt (% of GDP)	. .	32.2	30.7	31.3	31.4	31.2
Three-month money market rate, average	. .	-0.4	-0.5	0.3	3.2	3.4
Ten-year government bond yield, average	. .	-0.5	-0.4	1.1	3.0	3.3

1. Contribution to changes in real GDP.
2. Percentage of potential GDP.
3. Harmonised consumer price index excluding food and energy, alcohol and tobacco.
Source: OECD calculations based on the OECD Economic Outlook 112 database.

A major downside risk arises from rising gas prices and potential gas rationing next winter that could imply severe production disruptions, if planned fiscal support measures do not sufficiently preserve price incentives for gas savings, weather conditions are unfavourable, and delays occur in building up the LNG infrastructure. Despite filled up gas storage and the opening of three LNG terminals since December 2022, gas consumption needs to be reduced by around 20% to further reduce the risk of gas shortages next winter. Industry has reduced gas consumption by around 23% in January (compared to the average over 2018-21), including through imports of gas-intensive products and modest output reductions in some energy-intensive industries (Mertens and Mueller, 2022[22]). Energy savings should be further incentivised by a gas auction mechanism for firms to supply their excess gas capacity. Households and small firms reduced gas consumption by 23% due to high prices and relatively warm weather in January compared to the 2018-21 average, indicating that maintaining price incentives is key to incentivise gas savings.

New waves of the pandemic could further depress private consumption or exacerbate supply chain bottlenecks. Geopolitical tensions could lead to further trade disruptions and the need to relocate supply chains. Reshoring and rising protectionism will particularly hurt export sectors. Rising interest rates could cause strong corrections in housing markets, affecting financial markets. On the upside, a quicker end of the war could restore investor and consumer confidence and lower energy prices. The easing of containment measures in China will raise demand for German exports and contribute to the easing of supply chain bottlenecks (Box 1.3).

Table 1.3. Events that could lead to major changes in the outlook

Risks	Possible outcomes
A cold winter and high gas demand leading to gas rationing.	The closing down of activities that are not easily substitutable by imports would lead to cascade effects and decreasing production in other sectors. Unemployment would rise and firm failures would raise banking sector risks. Inflation would further increase damping private consumption.
New disruptive waves of the pandemic.	New containment measures could constrain consumption, leading to firm failures and increased unemployment. Disrupted supply chains would hurt production, while depressed global demand would weigh on exports.
Further increases in trade barriers and other trade distorting measures, such as subsidies and local-content rules, globally.	A new wave of protectionism, trade distorting subsidies and local-content rules would lower global trade and would be particularly harmful for the German economy, which is highly integrated in international supply chains.
High and persistent inflation requiring steep monetary tightening.	High mortgage rates could lead to falling housing prices, reducing mortgage values, which together with falling real incomes could raise loan defaults and expose vulnerabilities in the financial system. Higher interest rates could complicate loan rollovers, particularly for energy-intensive firms suffering from high energy prices, raising firm insolvencies and defaults.
The war in Ukraine ends faster than expected and geopolitical tensions decrease.	Confidence would recover spurring investment and private consumption. Energy prices could decrease, lowering inflationary pressures and allowing central banks to loosen monetary policy, which would stimulate domestic demand.

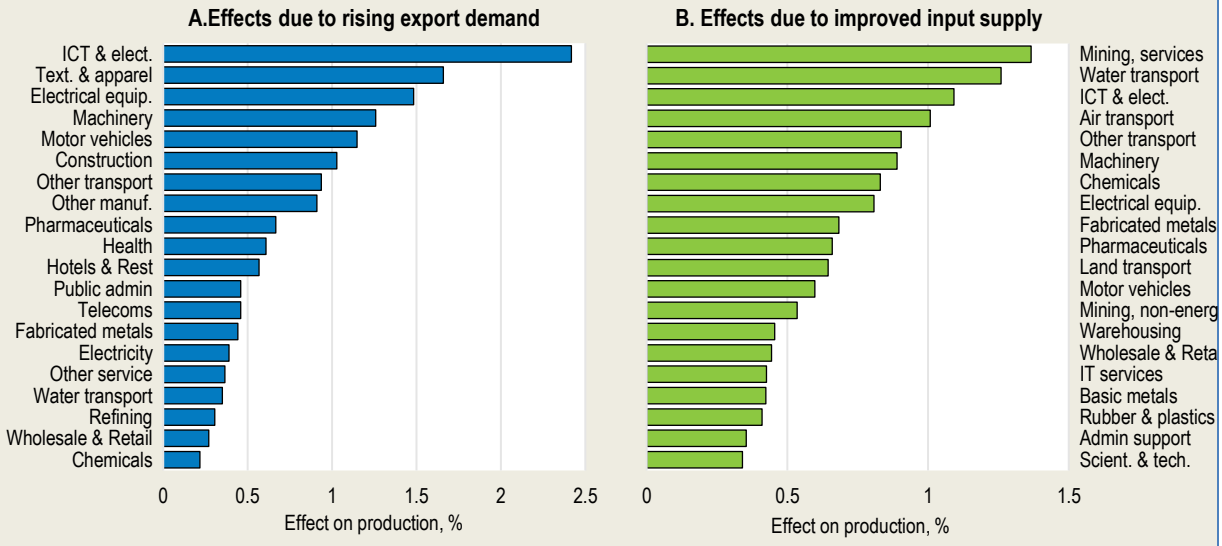
Germany's high exposure to global value chain risk underlines the need for diversification. For example, the share of semiconductors imported from outside of Europe is much higher than in the United Kingdom and Italy (Haramboure et al., forthcoming[29]). Expanding research and development for high-end technology, such as semiconductors which are key for the green and digital transition, can help to reduce supply-chain risks but should be done in close cooperation with other EU countries to realise economies of scale. Higher demand for resilient supply chains will provide sufficient incentives to scale up production of mature technologies in the European Union. As resilience is a top priority for many trading partners, international coordination is key to prevent a subsidy race, which would distort international investment decisions and have a high fiscal cost.

Box 1.3. The effects of an easing of mobility restrictions in China on German industries

An OECD analysis conducted for this survey estimates the effects of reduced mobility restrictions in China on industrial production through rising export demand and improved input supply (Haramboure et al., forthcoming[29]). The demand shock leads to significant output gains, particular in the ICT, textile and electrical equipment sectors (Figure 1.11). The positive effects through easing supply chain bottlenecks are smaller, but still significant and most pronounced in mining, ICT and transport.

Figure 1.11. Germany benefits from easing mobility restrictions in China

Simulated effect of a decrease in Chinese mobility restrictions by 20 percentage points of the Oxford stringency index



Note: The mobility shock roughly corresponds to the decrease in mobility restrictions observed in China from August to December this year, measures by the Oxford stringency index. The sample is restricted to the 20 most affected industries in Germany.
Source: OECD calculations based on (Haramboure et al., forthcoming[29]).

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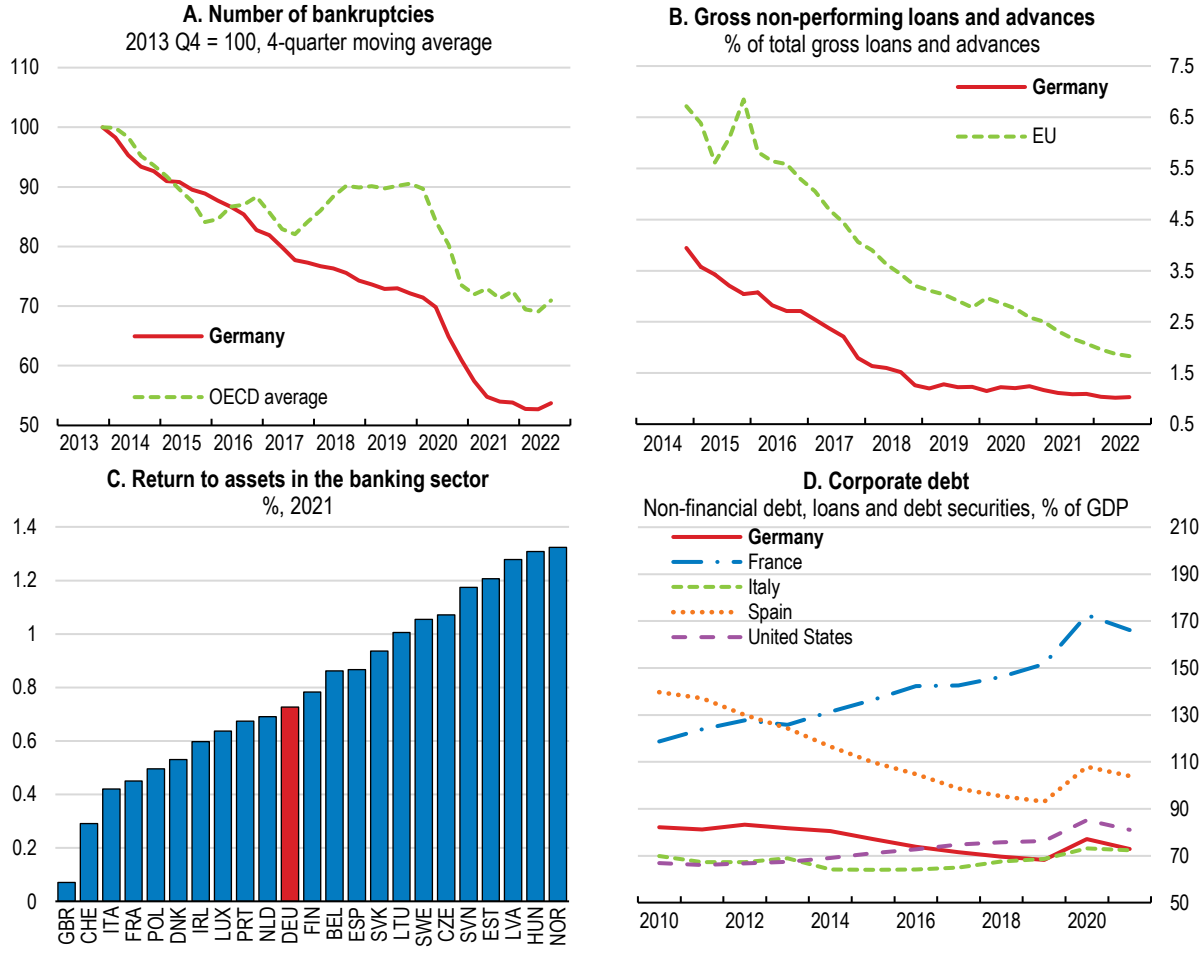
Tightening monetary conditions and high energy prices increase financial market vulnerabilities

The financial sector has weathered the COVID-19 crisis well owing to generous support measures for firms, low interest rates, and high non-financial corporate savings in previous years, as well as to macroprudential and supervisory measures taken during and before the pandemic. The number of corporate insolvencies declined in 2020 and 2021, and is still much lower than in 2019 (Figure 1.12, Panel A). The ratio of non-performing loans stood at 1.1% in the second quarter of 2022 (Figure 1.12, Panel B). Nonetheless, faster-than-expected rises in interest rates, the expiration of COVID-19 support measures in June 2022 and persistently high energy prices might raise the number of firm insolvencies, particularly of energy-intensive companies. Unlike the pandemic, the war might have longer-term structural impacts on energy markets and supply chains. Concerns over short-term liquidity of energy utilities have prompted the government to implement a EUR 67 billion emergency support scheme in the form of short-term liquidity lines and loan guarantees. However, uptake has been low, as the nationalisation of the two biggest gas importers with a fiscal cost of up to EUR 50 billion has stabilised the sector.

Structurally low bank profitability remains a persistent source of vulnerability, even though it has improved since 2021 due to rising interest rates (Figure 1.12, Panel C) (Altavilla, Canova and Ciccarelli, 2020[30]; IMF, 2022[31]). The recent turmoil in the European and US banking sector could lead to higher risks,

increased costs and lower profitability. After narrowing since the pandemic, the fallout from the war has raised spreads for Credit Default Swaps (CDS) on the back of low profitability, and the two largest German commercial banks continue trading at a discount relative to many European peers. The value of some bank assets, such as long-term bonds, could further decline due to the rise in interest rates. Nonetheless, the share of bonds in the balance sheets of banks and the net duration risk, which measures how much banks lose if interest rates rise, are relatively low (ECB, 2022[32]). The capital buffers of German banks remain at comfortable risk-weighted levels due to tighter regulatory measures since the global financial crisis (IMF, 2022[31]; ECB, 2022[32]). Credit growth was in line with GDP growth in recent years and, in contrast to other OECD countries, the debt of non-financial firms remains stable and at moderate levels (Figure 1.12,Panel D).

Figure 1.12. Vulnerabilities related to corporate debt remain contained so far



Source: OECD Timely Indicators of Entrepreneurship database; ECB; IMF Financial Soundness Indicators database; IMF.

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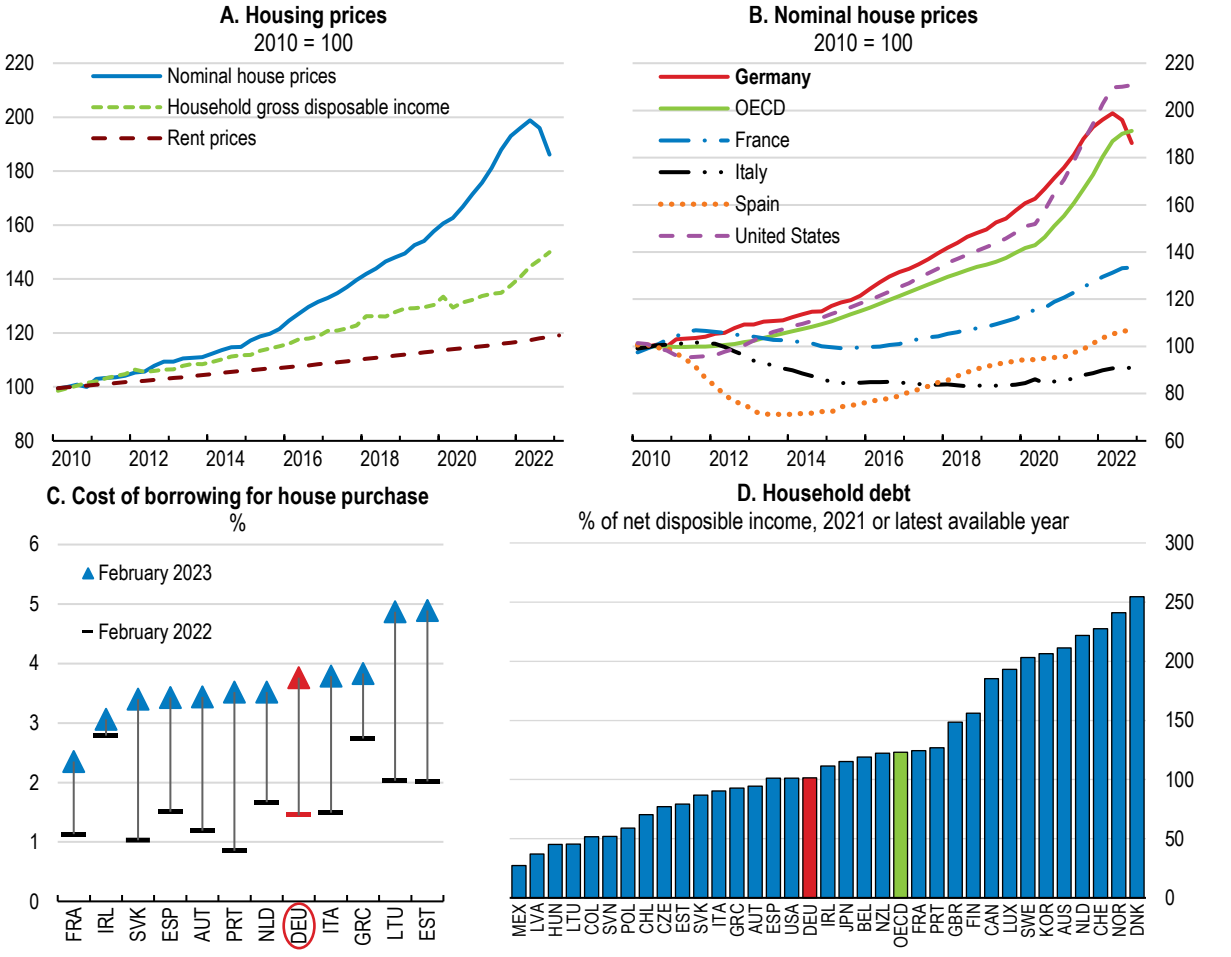
Monetary policy tightening and rising mortgage rates might lead to strong corrections in housing prices, raising risks related to household debt. House prices have outpaced rents and household income significantly since 2012 (Figure 1.13, Panel A and B). Housing loans continued to grow at record levels until the second quarter of 2022, but have sharply declined thereafter (IMF, 2022[31]). The Bundesbank estimated that residential property was overvalued by 15% to 40% in 2021 (Bundesbank, 2022[33]). Mortgage borrowing costs have risen by 1.6 percentage points since September 2021, raising the risk of a strong downward correction in housing prices (Battistini, Gareis and Moreno, 2022[34]). As the share of fixed-rate loans is high, rising mortgage rates will mainly affect credit risk through decreasing housing

prices and mortgage values (Figure 1.13, Panel C). Moreover, high energy prices and inflation strongly reduce real incomes, raising default risks, particularly for poorer households, although average household debt remains below the OECD average (Figure 1.13, Panel D).

The sensitivity of banks' balance sheets to evolving risks related to housing markets and corporate debt should be closely monitored. Recently tightened macroprudential measures should remain in place. To reduce banks' vulnerability to changes in housing prices, the authorities appropriately raised the counter-cyclical capital buffer to 0.75%, from zero previously, and introduced a sectoral systemic risk buffer of 2% on loans secured by domestic residential real estate to apply from February 2023. Borrower-based measures, such as limits on loan-to-value and debt-to-income ratios on new lending, should be strengthened, which requires more granular data on borrowers' risk profiles and lending standards of banks as well as credit statistics by region and type of lender. In addition, financial sector resilience can be strengthened by better assessing and disclosing risks from climate change and mitigation policies (Chapter 2).

Figure 1.13. Housing market related risks have increased



Source: OECD Analytical House Price database; Eurostat; ECB; OECD National Accounts database.

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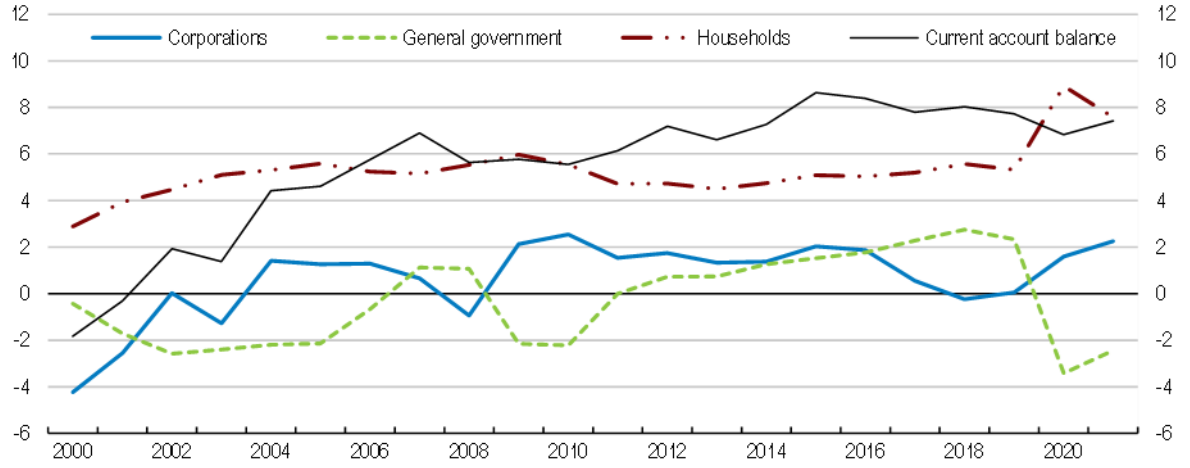
High domestic saving could help to support start-ups and innovation

Germany's large current account surplus reflects the gap between high saving of corporates and households and low domestic investment, leading to substantial capital outflows (Figure 1.14). High capital outflows are strongly related to structural factors that weaken domestic investment demand and business

dynamism (see the previous OECD Economic Survey of Germany). These include high administrative burden and other regulatory barriers to market entry and competition, but also skilled labour shortages, weak entrepreneurship skills and a banking sector that has difficulties in providing credit to young and innovative firms with high growth potential (Falck et al., 2022[35]; Klug, Mayer and Schuler, 2021[36]). Moreover, generous tax exemptions for income from selling or renting real estate distort investment decisions and hinder allocation of capital to innovative start-ups (see below). Rising public investment in the green and digital transition has the potential to crowd in more private investment but should be complemented by addressing existing structural barriers.

Figure 1.14. A large share of domestic saving is not invested in Germany

Saving-investment balances by sector and current account, % of GDP



Source: OECD National Accounts database; OECD Economic Outlook database.

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Investment in ICT and knowledge-based capital (KBC) is particularly low, and the contribution of ICT capital to growth in Germany is half that of the United States (see the previous OECD Economic Survey of Germany). This is related to an underdeveloped venture capital sector and the risk-aversion and limited expertise on new technologies in many banks. The government established an equity fund for future technologies, which is administered by the public development bank KfW, directly providing funding for the growth phase of start-ups and high-risk innovation and crowding in private capital. However, more should be done to foster the contribution of institutional investors to risk-related finance. Less than 8% of assets of retirement saving plans are invested in equity, as against 27% on average across OECD countries (OECD, 2021[37]). The contribution of institutional investors to VC funds is much smaller in Germany than in Nordic countries. Allowing public and private pension funds, such as company pension funds, and other retirement saving plans to invest a larger share of their assets in VC funds, while introducing loss-prevention guarantees for VC investments, could help to improve innovation finance (OECD, 2022[38]). Facilitating the use of stock-ownership option plans (ESOPs) could ease financing constraints of start-ups, allowing them to substitute wage payments by offering employees company shares.

Table 1.4. Past recommendations and actions taken on support for start-ups and innovation

Previous recommendations	Action taken
Improve conditions for firms to invest in knowledge-based capital, including by reviewing the cap for R&D tax incentives to make them more applicable to mid-range companies.	No action taken.
Improve the effectiveness of start-up and growth financing instruments, including by avoiding complexity, scaling up later stage funding and improving conditions for institutional investors to invest in venture capital.	In 2021, the government established the Future Fund, which was equipped with EUR 10 billion, to improve access to credit for the growth phase of start-ups and further develop the venture capital market.
Accelerate SMEs' digital transformation by swiftly implementing existing SME support, increasing it if needed, and ensuring that investment incentives for physical capital do not discourage expenditures on digital services.	The new start-up strategy published in July 2022 aims to improve access to data and finance for young firms, tackle the shortage of skilled workers, and reduce bureaucratic hurdles.

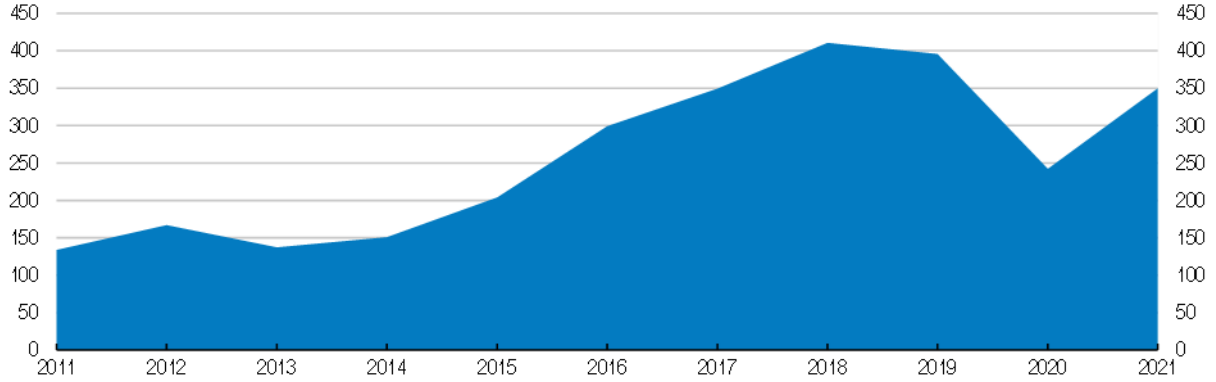
Addressing skilled labour shortages is key to improve the business environment

Skilled labour shortages have intensified and pose a major business risk to many companies (Figure 1.15) (DIHK, 2022[39]). The average duration of vacancies increased from 61 days in 2009 to 119 in 2021, with shortages particularly severe in the areas of nursing, medical professions, construction, craft occupations as well as information technology (IT) (BA, 2022[40]). Capacity constraints in the construction sector pose a serious challenge to expand renewable energy supply and greening the housing and transport sectors (see Chapter 2). Population ageing will further aggravate these shortages with negative effects on potential growth (Figure 1.2). This also risks to significantly reduce the competitiveness of many manufacturing sectors (Box 1.4).

To address skilled labour shortages, it is crucial to support the labour market integration of women, elderly and low-skilled workers, facilitate skilled labour migration, and expand adult learning opportunities (Table 1.1). A labour tax reform would help to raise labour supply of women and low-skilled workers, while better incentives to work longer combined with better working conditions would help to raise effective retirement ages (see below). Improving adult learning and continued vocational education and training (CVET) opportunities, with a specific focus on low-skilled and older workers, and supporting labour mobility are key to help workers affected by the green and digital transition to adjust to changing skill demands and relocate to booming sectors and occupations (see Chapter 2). Improving educational quality to equip younger generations with the skills needed for the green and digital transition, with a particular focus on children from disadvantaged households, will support potential growth in the medium to long term. This should be combined with policies to strengthen business dynamism and innovation, including the adoption of digital technologies, which has large potential to raise productivity and mitigate labour shortages (see Chapter 2 and the previous OECD Economic Survey of Germany).

Figure 1.15. Skilled labour shortages are mounting

Skilled labour gap (number of vacancies that cannot be filled), thousand



Note: The skilled labour gap is equal to the number of qualified workers missing in a specific occupation to fill all open positions within a region aggregated over all occupations and regions.
Source: KOFA (2022).

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Increasing skilled migration is one key policy lever to address skilled labour shortages and would also help to stabilise the pension system (see below). To maintain competitiveness of export-oriented manufacturing sectors, supply of workers with vocational education and training (VET) is particularly important (Box 1.4) (Bickmann, Grundke and Smith, forthcoming[1]). A recent draft bill aims to facilitate obtaining a work permit for migrants with a job offer and job experience by waiving the obligatory recognition of foreign degrees in non-regulated professions under certain conditions. It also aims to promote job seeker visas through a point-based system, where a recognised foreign degree is an advantage but not a pre-condition anymore. This planned point-based system should not be confused with the point-based systems used in Canada, Australia and New Zealand, which are used to select migrants with a long-term capacity to integrate and grant immediate permanent residence without the requirement to find a job within a certain period. Despite these significant reform steps, complex and lengthy administrative procedures necessary to receive a visa and work permit and a lack of digitalisation cause uncertainty and high costs for migrants and potential employers. Accelerating the digitalisation of bureaucratic processes, particularly the visa application, and establishing centralised migration offices in the Laender that coordinate the different necessary administrative processes is key. A recent OECD survey points to large potential demand for high-skilled migrants in the German labour market, particularly engineers and IT experts. Potential migrants value the career and employment opportunities, high quality of life and security in Germany and are willing to learn German if this improves their chances to work in Germany (OECD, 2022[41]). As intra-EU migration will likely slow down due to population ageing, scaling up current advertisement and recruitment measures in non-EU countries, improving support for job-search and promoting German language courses abroad is crucial to make the most of this migration potential. Since Germany is already highly active in the field of international VET cooperation, these initiatives could also help to attract future skilled migrants (Azahaf, 2020[42]).

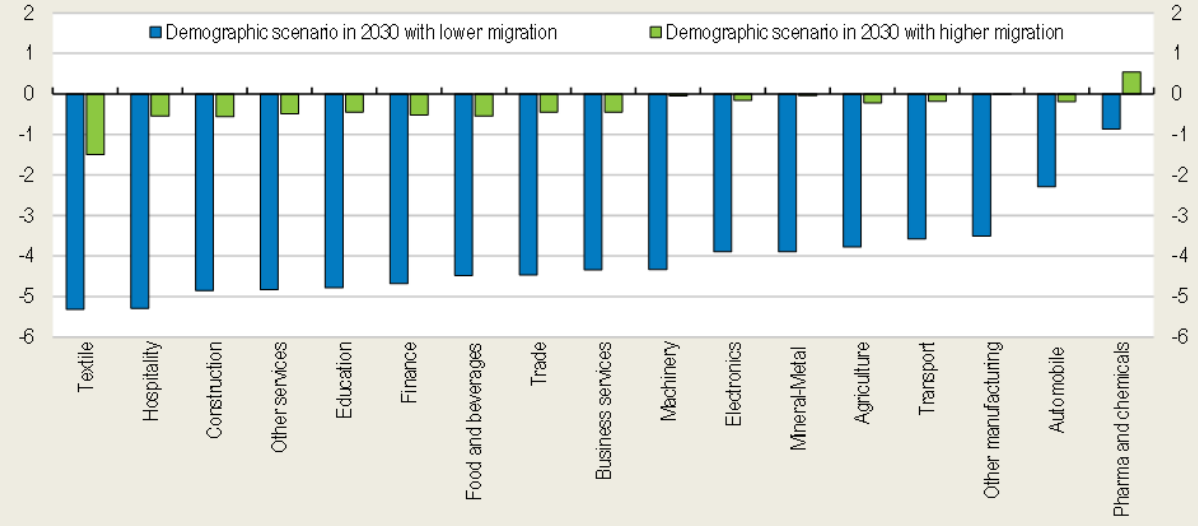
Box 1.4. Migration can help to maintain the competitiveness of manufacturing

The OECD's METRO model is a multi-country and multi-sector computable general equilibrium (CGE) model that allows to analyse the consequences of global demographic change and migration on the German economy (Bickmann, Grundke and Smith, forthcoming[1]; Smith, Kowalski and van Tongeren, 2022[43]). The United Nations (UN) World Population Prospects for 2030 are used to simulate the economic effects of various migration scenarios compared to a baseline with working age population data from 2020 and average international migration flows from 2010-2020. The simulations abstract from technological change and automation, which could mitigate negative effects of labour shortages on production potential. However, they allow for the substitution between capital and labour. Capital is mobile across sectors, but the total endowment is fixed. The structural parameters of the model are calibrated using data on international input-output tables from 2014.

In a scenario that uses the UN mid-point estimates for population projections for 2030, population ageing leads to a strongly declining workforce in many countries compared to 2020 (Figure 1.2). This decreases GDP in Germany by 4.5% and leads to large output losses in almost all sectors and strong decreases in exports (Bickmann, Grundke and Smith, forthcoming[1]). Labour-intensive sectors such as textiles, construction and hospitality contract the most, but export-oriented manufacturing sectors are also strongly hit and decrease output and exports, such as electronic equipment, machinery, motor vehicles as well as minerals and metals (Figure 1.16). Raising net-immigration to around 600 000 per year, however, can significantly mitigate the adverse effects of ageing, provided that migrants are well integrated into the labour market (Figure 1.16). To maintain export competitiveness, attracting professionals with vocational skills is crucial. Machinery and equipment, electronics, mineral-metal and automobile industries, which account for over half of total exports (Figure 1.10), depend mostly on VET professionals for their production processes.

Figure 1.16. Labour shortages can be mitigated by higher levels of labour immigration

Changes in sectoral output, in % (compared to the baseline with working age population in 2020)



Note: The low migration scenario is based on the mid-point estimate of the UN World Population Prospects for 2030, which presumes an average yearly net immigration of around 130 000 in Germany. The higher migration scenario adds the average net migration for Germany observed in the past ten years, equal to around 500 000.
Source: (Bickmann, Grundke and Smith, forthcoming[1]).

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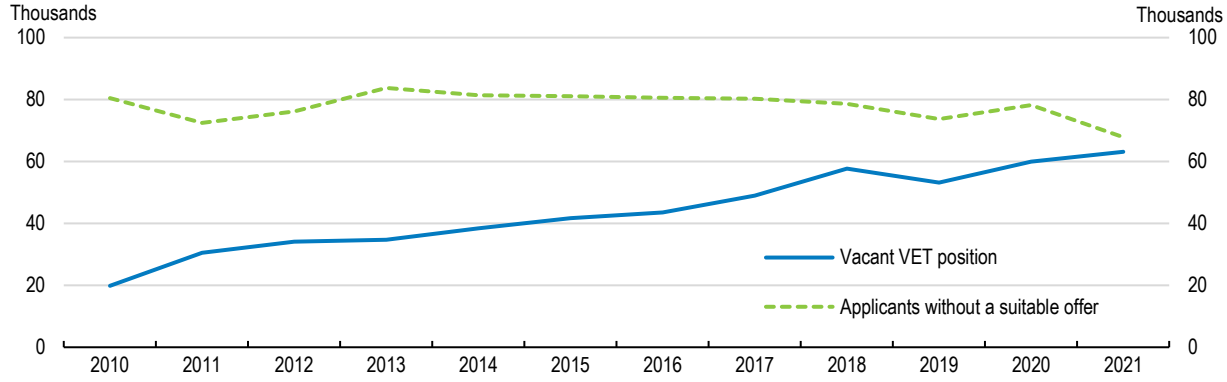
Better informing students in lower secondary education about occupations in high demand is also key to reduce skilled labour shortages. A rising number of VET positions remains unfilled, yet about 16% of applicants did not receive a suitable offer in 2021 (Figure 1.17). Vacancy rates are highest for many occupations in the construction and health sectors. To reduce the existing mismatch, it is key to improve the current VET transition system (*Übergangsbereich*), which supports young adults who have not succeeded in finding a VET position in a firm on their own. So far, several federal and state-level programmes coexist, with a lack of coordination, systematic information and guidance services (Enquete-Kommission Berufliche Bildung, 2021[44]). Furthermore, on-the job training needs to be strengthened in the transition system. An internship programme subsidised by the federal employment agency proved to be successful in matching VET applicants with employers and should be expanded (BIBB, 2022[45]; Enquete-Kommission Berufliche Bildung, 2021[44]). Implementing plans to guarantee every interested lower secondary student a VET position (*Ausbildungsgarantie*) in combination with personalised counselling services and mobility subsidies would be an important step forward. Moreover, unemployment rates among low-skilled adults without a professional degree are high, even for workers with job experience in sectors with severe labour shortages. This calls for better supporting low-skilled workers to start and complete a VET degree, for example by strengthening the recognition of prior learning and expanding the use of partial-qualifications and adult education opportunities (see Chapter 2). The social security reform (*Buergergeld*) is welcome, as it abolishes the obligation to prioritise job uptake and facilitates adult education and the completion of VET degrees, including by improving financial assistance.

Figure 1.17. A rising number of VET positions remains unfilled, yet many applicants do not receive a suitable offer



Note: The graph shows the number of vacant VET positions and applicants without a suitable offer at the end of the application cycle in each year (30 September).
Source: Datenreport zum Berufsbilungsbericht 2022 (BIBB).

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Better equipping children with the skills needed for the green and digital transition is another important policy lever to address future labour shortages and support potential growth (Figure 1.1, Table 1.1). Inequality in education outcomes is among the highest across OECD countries and has been exacerbated by school closures during the pandemic (DIPF, 2022[46]; OECD, 2019[47]). This is related to weak access to early-childhood education, particularly for children from disadvantaged backgrounds. Although special federal funds support municipalities to expand infrastructure for early-childhood education, many disadvantaged households have difficulties finding a place (Jessen, Schmitz and Waights, 2020[48]). This is because information and applications are not centralised within municipalities, selection is based on bilateral interviews, and access costs are high in some Laender (Hermes et al., 2021[49]). Raising subsidies for vulnerable households should be combined with centralising application procedures within municipalities and improving guidance. It is also key to address severe labour shortages in childcare and basic education, which risk reducing educational quality, by improving recruitment and training, and raising salaries (Bock-Famulla et al., 2022[50]). Weak targeting of support measures for disadvantaged school

children is another important issue, which should be addressed by using more frequent learning evaluations to better target support, as for example successfully done in Hamburg. The federal EUR 2 billion fund to address pandemic-related learning losses is welcome but should be complemented by an evaluation of learning deficits and policy tools across Laender to improve spending efficiency and foster peer learning.

Table 1.5. Past recommendations and actions taken on training, education and labour market policies

Recommendations	Action taken
Prioritise early education by increasing spending on primary education, and improve foundational skills of VET graduates, for example by strengthening general education within the VET track or postponing between-school tracking.	In the context of the pandemic-related stimulus package, the federal government has increased financial transfers to lower levels of government in 2020 and 2021 to improve access to and quality of early-childhood education.
Increase ICT training for teachers to ensure effective use of ICTs. Introduce computational thinking earlier (particularly benefitting girls) while avoiding gender stereotypes in education and career guidance.	No action taken.
Strengthen support for unskilled adults to obtain professional qualifications.	The 2023 reform of basic income support for jobseekers (introducing the new citizen's benefit *Buergergeld*) is a major step forward. It prioritises training over job uptake and improves financial support for longer-term training and education courses for job seekers to obtain professional qualifications. It also aims to improve access to basic education for jobseekers.
Provide financial incentives for employers to provide workplace learning for the low-skilled.	The government plans to significantly improve financial support for employees to participate in adult learning and to obtain professional degrees.
Facilitate participation of low-skilled individuals in adult education by taking further steps to validate uncertified skills, including those acquired-on-the job, and through workplace outreach.	No action taken. The pilot project ValiKom has not been expanded so far.
Improve transparency in the adult education market and facilitate access to guidance on adult training. Carefully monitor the outcome of financial support programmes for adult learning and education.	A National Continuing Education Online Platform ("Nationale Online-Weiterbildungsplattform - NOW") is being developed to increase transparency in and access to adult learning by providing appropriate information on courses, financing opportunities and skill needs in the labour market. The platform is planned to be launched in early 2024.
Liberalise occupational entry conditions, prioritising sectors subject to supply constraints (such as construction) and preserving the strengths of the vocational education and training system.	In 2020, the obligation to hold a master's craftsman degree when owning a craftsman business was reintroduced in 12 occupations, which restricted entry conditions further.
Scrutinise compulsory membership and chamber self-regulation in the professional services and crafts chambers for entry barriers and lower entry requirements where possible.	No action taken.

Modernising the state to support the green and digital transition

After a decade of fiscal surpluses and strongly decreasing public debt, the fiscal balance turned negative due to pandemic-related fiscal support (Table 1.6). The fiscal deficit is likely to remain high in 2023 due to energy price support, although falling retail energy prices would lead to a lower deficit as support measures are conditional on retail energy price levels (Box 1.2). If the announced volume of energy price support of more than 2.4% of GDP in 2023 materialises, an expansionary fiscal stance would risk further increasing core inflation (Figure 1.6) (Bundesbank, 2023[51]). To contain inflationary pressures, it is key to avoid an expansionary fiscal stance, while standing ready to further support vulnerable households if needed. Possible adjustments could comprise financing a larger part of the energy price support by cutting spending in other areas and raising tax revenue, for example by lowering the threshold above which the energy price subsidy is subject to personal income taxation. If energy price support is smaller than expected due to lower retail energy prices or if tax revenues are higher than expected in 2023, the additional resources should be used to reduce the fiscal deficit.

Table 1.6. The fiscal balance has turned negative during the pandemic

General government, % of GDP

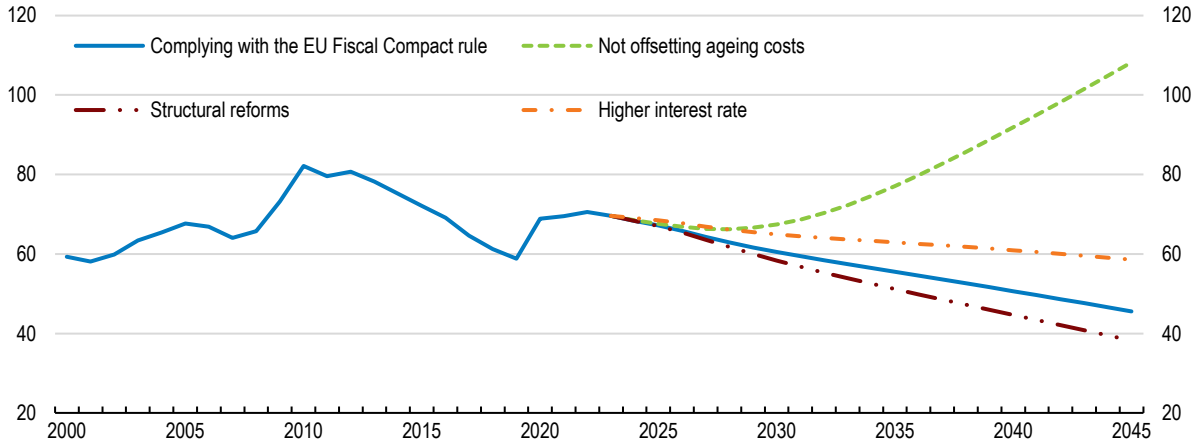
	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total revenues	**45.0**	**44.9**	**45.1**	**45.5**	**45.5**	**46.3**	**46.5**	**46.1**	**47.5**
Taxes on production and imports	10.9	10.7	10.8	10.7	10.6	10.6	10.6	10.2	10.9
Current taxes on income and wealth	12.1	12.1	12.3	12.7	12.9	13.2	13.2	12.6	13.5
Social contributions received	16.6	16.5	16.6	16.7	16.8	17.0	17.2	17.9	17.6
Capital taxes and other revenues	5.4	5.6	5.4	5.4	5.2	5.4	5.5	5.5	5.6
Total expenditures	**44.9**	**44.3**	**44.1**	**44.4**	**44.2**	**44.3**	**45.0**	**50.4**	**51.3**
Social protection	19.0	18.8	19.1	19.5	19.4	19.3	19.6	21.6	20.9
Education and health	11.4	11.5	11.4	11.4	11.3	11.4	11.6	13.0	13.2
General public services	6.5	6.3	5.9	5.8	5.7	5.7	5.8	6.1	6.2
Economic affairs	3.3	3.2	3.2	3.2	3.2	3.3	3.2	4.6	6.0
Other[1]	4.7	4.5	4.5	4.5	4.5	4.6	4.7	5.1	4.9
Net lending	**0.0**	**0.6**	**1.0**	**1.2**	**1.3**	**1.9**	**1.5**	**-4.3**	**-3.9**
Primary balance	1.4	1.7	2.0	2.0	2.1	2.6	2.1	-3.9	-3.5
Gross debt	**84.0**	**83.8**	**79.8**	**77.1**	**72.3**	**69.1**	**67.5**	**78.5**	**77.6**
Gross debt, Maastricht definition	**78.2**	**75.2**	**72.0**	**69.1**	**65.1**	**61.8**	**59.5**	**68.9**	**69.4**
Net debt	44.0	43.6	40.0	37.7	33.1	30.2	27.1	32.2	30.7

1. Defence; public order and safety; housing and community amenities; recreation, culture and religion; environment protection.
Source: OECD National Accounts database; Economic Outlook database.

In the medium term, it is crucial to address rising fiscal pressures from ageing to maintain fiscal sustainability. This will require structural reforms to address skilled labour shortages and raise productivity (Figure 1.18, Figure 1.3, Table 1.1). Moreover, offsetting ageing-related costs while preserving fiscal space to address high investment needs in times of rising interest rates and adverse economic effects of the war of Russia against Ukraine will also require better prioritising spending, increasing spending efficiency, reducing tax expenditures and strengthening tax enforcement (Table 1.7). Reducing labour taxes, particularly for low-income and second earners, should be financed by reducing tax expenditures and strengthening tax enforcement, while not raising the overall tax burden. As reaching net zero in 2045 will significantly reduce revenue from environmental taxes, which amounted to about 2.6% of GDP in 2022, further adjustments in the tax mix will be necessary, for example by raising property taxes (see below) (Baer et al., 2023[7]). On the spending side, significant fiscal space can be created by better prioritising spending and raising spending efficiency across levels of government, which can be used to finance important investment needs in infrastructure and innovation as well as to improve the quality and access to education and training. Importantly, these investments in physical and human capital will raise potential growth in the medium and long term, reducing their total fiscal costs and creating additional fiscal space by 2045 (Table 1.1, Table 1.7). This will help to mitigate the strongly rising fiscal pressures due to ageing, as pension and health related spending is estimated to increase by about 4.6 percentage points of GDP until 2045 (Figure 1.2, Figure 1.18).

Figure 1.18. Addressing the fiscal effects of ageing is key to safeguard fiscal sustainability

Gross government debt, % of GDP (Maastricht definition)



Note: The scenario "Complying with the EU Fiscal Compact rule" uses the projected growth path from the OECD Long-Term model and assumes that the structural fiscal deficit reaches 0.5% of GDP in 2026 and is constant thereafter. The scenario "not offsetting ageing related costs" builds on the previous scenario, but assumes that ageing related additional costs in pension, health and long-term care systems are not offset and deteriorate the primary fiscal balance by 4.6 percentage points until 2045. The "Structural reform scenario" shows the effect of a comprehensive set of structural reforms on public debt (Table 1.1). The scenario "Higher interest rates" raises interest rates by 1 percentage point during the projection horizon.

Source: OECD Long term model.

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Table 1.7. Potential fiscal impact of OECD recommendations

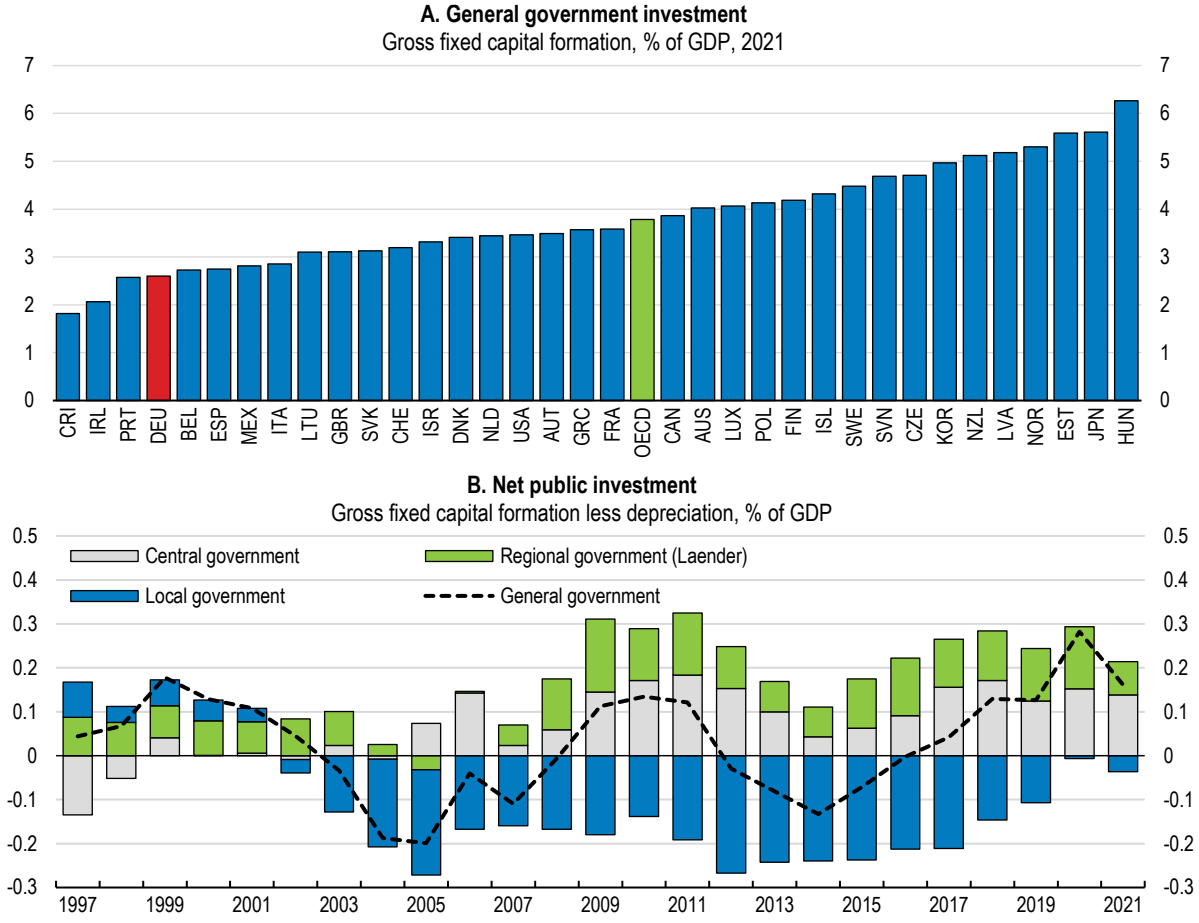
Recommendation	Short-term fiscal impact (in percentage points of GDP)	Long-term fiscal impact (in percentage points of GDP) in 2045
Tax revenue related recommendations		
Reduce the labour tax wedge, in particular for low-income and second earners, and reform the joint taxation for couples	-1.4	-0.9
Abolish tax expenditures for income from selling or renting real estate	0.3	0.3
Reduce generous allowance thresholds for gift and inheritance taxes and reduce exemptions for business assets	0.2	0.2
Use the ongoing update of property values to better link property taxation to asset values and raise revenue	0.2	0.2
Reducing VAT exemptions and improving tax enforcement	0.3	0.3
Reduce environmentally harmful tax expenditures	0.4	0
Total fiscal impact tax revenue measures	**0.0**	**0.1**
Spending related recommendations		
Reduce environmentally harmful subsidies	0.1	0.0
Strengthening spending reviews in budgeting procedures and raise spending efficiency through better impact evaluation and policy targeting at all levels of government	0.8	0.8
Improving public procurement procedures at all levels of government	0.5	0.5
Expand active labour market policies and improve adult education	-0.1	0.3
Raise public investment in infrastructure and R&D	-1.0	-0.5
Improve educational quality and access to childcare and early-childhood education	-0.2	-0.1
Total fiscal impact spending related measures	**0.1**	**1.0**
Total fiscal impact of revenue and spending related measures	**0.1**	**1.1**

Note: The effects of reforms related to prioritising spending and raising spending efficiency at all levels of government are difficult to quantify using available methodologies, but would significantly contribute to increasing fiscal space. The estimate for the fiscal impact of improved public procurement procedures is derived from an OECD study which has estimated the gains in spending efficiency to be about 1 percentage point of GDP, if risk assessment and analysis of market capacity for infrastructure contracting decisions are improved across all levels of government by applying the OECD Support Tool for Effective Procurement Strategies (STEPS) (Makovšek and Bridge, 2021[52]; OECD, 2021[53]).
Source: OECD calculations based on the OECD Long-Term Model.

Updating the fiscal policy framework

Since the 2000s, weak public investment has led to a large investment backlog in education, transport and digital infrastructure (see the previous OECD Economic Survey of Germany). The net capital stock has strongly declined since 2003, especially in municipalities, which are responsible for school and transport infrastructure. During the pandemic, many schools were not equipped with the necessary digital infrastructure to continue classes online, causing average learning times to drop more than in other European countries (Freundl, Stiegler and Zierow, 2021[54]). School closures had strong negative consequences on skills development, particularly among children from disadvantaged households, adding to existing structural weaknesses in basic education, increasing inequality and lowering future growth potential (see above) (Fuchs-Schuendeln, 2022[55]; DIPF, 2022[46]).

Figure 1.19. Public investment has increased, but remains low



Source: OECD Economic Outlook database; OECD National Accounts database.

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To improve the finances of municipalities and address the investment backlog in municipalities, the federal government has set up several special funds (*Sondervermoegen*) since 2007, for example to expand childcare and early-childhood education facilities or improve digital and green infrastructure (Box 1.5). Spending under these funds is outside of the core budget, and, since the second supplementary budget of 2021 balances of spending outflows and revenue inflows of special funds do not affect the fiscal deficit in the definition of the national debt brake anymore (Bundesbank, 2022[56]). Instead, the fiscal deficit in the definition of the debt brake increases when special funds receive transfers or borrowing allowances from the core budget. The government took advantage of the pandemic-related suspension of the federal debt brake from 2020 to 2022 to transfer EUR 26 billion in 2020, borrowing allowances of about EUR 60 billion, which were not used due to lower-than-expected take-up of COVID-19 support measures in 2021, and EUR 6 billion in 2022 to the climate and transformation fund to support future investments in the green transition. In 2022, the parliament approved specific borrowing allowances of up to EUR 200 billion for the recently established energy support fund and EUR 100 billion for a special fund to improve defence infrastructure. As net spending of these funds does not affect the fiscal deficit in the definition of the national debt brake, significant spending and investment plans of the special funds for the next years can be combined with the reinstatement of the national debt brake from 2023 (Box 1.5). At the same time the structural fiscal deficit according to the Maastricht criteria, which includes net balances of special funds, is projected to stay significantly above 0.5% of GDP (Table 1.2), the threshold applied under EU fiscal rules until the activation of the general escape clause in 2020.

Box 1.5. The fiscal framework and the accounting of special funds

The German debt brake

In the EU Fiscal Compact, ratifying countries, including Germany, have committed to a medium-term structural deficit limit of 0.5% of GDP, while countries with a debt-to-GDP ratio below 60% can target a higher structural deficit of 1% of GDP. Under the German constitutional debt brake, a structural deficit limit of 0.35% of GDP applies to the federal government and balanced budget rules to the Laender, independently of debt levels. Any deviation from the 0.35% federal target is posted to a control account, with consolidation measures implemented during upswings if the control account exceeds a negative balance of 1% of GDP. Structural borrowing in excess of 0.35% of GDP is only allowed under an emergency situation, which is outside the control of government, has a major negative fiscal impact and has been declared by the parliament, and must be accompanied by an amortisation schedule. The exemption clause of the debt brake was invoked in 2020, 2021 and 2022. The Laender parliaments can independently decide on whether an emergency situation justifies the exemption clause for the debt brake at the Laender level. Surpluses from earlier years allocated to reserves, such as the refugee reserve, can be used to temporarily fund additional spending. This provides additional flexibility and can help meet the debt brake target by allowing surpluses to be shifted from one year to another, which can be significant given the size of reserves that amounted to EUR 48 billion (1.3% of GDP) in 2022. In contrast, the control account, which had a balance of EUR 48 billion (1.3% of GDP) in 2022, cannot be used to fund structural deficits in excess of 0.35% of GDP.

An important part of the constitutional debt brake is the computation of the output gap and the cyclical component, which allows to adjust the maximum threshold for actual net borrowing according to the business cycle in a symmetric way. The cyclical component increases the possibility of net borrowing in downturns and lowers it in upswings. The government is currently evaluating to which degree the output gap and the cyclical component are vulnerable to major revisions of GDP and tax revenues, and whether this has led to pro-cyclical adjustments of fiscal policy in the past (Ochsner and Zuberer, 2022[57]; Bundesbank, 2022[58]).

The accounting of special funds

Two types of special funds exist, which are separated from the core budget and are treated differently by the national debt brake. For all special funds, net spending and net borrowing are recorded in the fiscal deficit and the debt statistics according to the Maastricht criteria.

First, special funds with their own borrowing authorisations, such as the defence fund, the economic stabilisation fund (used to finance the energy price support fund), the financial market stabilisation fund and the investment fund (ITF), coordinate their annual borrowing in the form of government bonds with the Ministry of Finance or the Finance Agency of the federal government. In principle, the managers of each special fund decide on the required annual amount of borrowing, subject to the maximum amount of borrowing allowances, the specific purpose and the time period defined by the law establishing the fund. Usually, there is no restriction concerning the budget year in which the borrowing takes place, although for financing the energy price support, the economic stabilisation fund was given a net borrowing authorization of EUR 200 billion valid only for 2022. Only the economic stabilisation fund is covered by the national debt brake. Its net borrowing adds to the fiscal deficit, while net spending does not. The defence fund has been completely excluded from the national debt brake by a two thirds majority in both chambers of the parliament in 2022. For both funds, a repayment plan is necessary that specifies when the core budget will start to repay the issued debt. In contrast, the financial market stabilisation and the investment fund are outside of the national debt brake and do not need any amortisation plans, because they have been established before the national debt brake and benefit from a grandfathering rule.

The second type of special funds are funds without their own borrowing allowances, such as the climate and transformation fund, the digital infrastructure fund, the fund to support municipal investments, the childcare infrastructure fund for primary school children and the special funds to finance infrastructure rebuilding after the floods of 2013 and 2021. These funds are financed by direct transfers from the core budget or by specific earmarked revenues, such as revenues from carbon pricing which are allocated to the climate and transformation fund. Before 2022, any transfer from the core budget to these funds was neutral to the fiscal deficit in the definition of the debt brake, while the yearly balance of spending and revenues of these funds added to the fiscal deficit in the definition of the debt brake. With the second supplementary federal budget of 2021, however, the accounting method was changed. Since then, transfers from the core budget to these funds are recorded in the fiscal deficit in the definition of the debt brake, while net spending of these funds does not add to the fiscal deficit of the debt brake anymore. The new rules apply ex-post to all budget operations concerning special funds without their own borrowing allowances since 2016, which required to re-compute fiscal deficits and the control account for all years since 2016 (Bundesbank, 2022[56]). This change in accounting rules allowed to take advantage of the pandemic-related exemption clause of the debt brake to transfer borrowing allowances of EUR 60 billion, which had not been used due to low up-take of support measures during the pandemic, to the climate and transformation fund in 2021. These borrowing allowances can be used in subsequent years to finance important investment spending needs by issuing federal government bonds without affecting the fiscal deficit in the definition of the debt brake. However, as the repayment for pandemic-related borrowing allowances is set to start in 2028 (stretched over a 30-year period), this operation will only temporarily increase fiscal space, while reducing fiscal space from 2028.

The strong increase in the number and size of extra-budgetary funds reflects structural problems in the fiscal framework (IMF, 2022[31]). Including the recently established energy support and defence fund, the total size of existing special funds is about EUR 400 billion (or 10% of GDP) (Bundesbank, 2022[14]). Although emergency situations such as the pandemic justify the suspension of fiscal rules to enable strong fiscal support, it is less obvious why structural investment spending in key policy areas such as defence, digital and green infrastructure or education should be separated from the core budget and not accounted for by the fiscal deficit under the national debt brake. This decreases the transparency of fiscal accounts and risks to reduce the credibility of the fiscal framework. Some Laender have already started to use the debt brake exemption clause to create their own extra-budgetary funds in 2023, making it increasingly difficult to compare the financial situation of sub-national governments based on fiscal accounts and risking fiscal slippage (Bundesbank, 2022[59]). For example, Saarland has created an extra-budgetary fund of about 9% of its GDP by suspending the debt brake to finance the fund with additional debt, arguing that challenges related to the green transformation constitute an emergency situation (von Weizsaecker, 2022[60]).

To improve transparency and strengthen the credibility of the debt brake, the government should gradually re-include spending under the extra-budgetary funds into the core budget while introducing more flexibility in the fiscal rules to allow for adequate investment spending. Including structural spending in the core budget would help to facilitate the necessary political discussions on how to finance important investment needs, which spending to prioritise and how to raise additional revenue. This is particularly important as fiscal pressure from social security and health systems will strongly increase over the coming years and repayment for the debt issued during the pandemic will start from 2028 (Figure 1.2). For example, aligning national with EU fiscal rules would provide some additional fiscal space, as this would raise the upper limit of the structural deficit to 0.5% of GDP and allow for a deficit of 1% as long as public debt is lower than 60% of GDP, as discussed in the previous Economic Survey of Germany (Bundesbank, 2022[61]). Complying with a structural deficit of 0.5% of GDP from 2026 onwards would lower public debt to 60% of GDP by 2030 (Figure 1.18). However, changing the debt brake rule will demand building a broad political consensus, as it requires changing the constitution with a two-thirds majority in both chambers of the

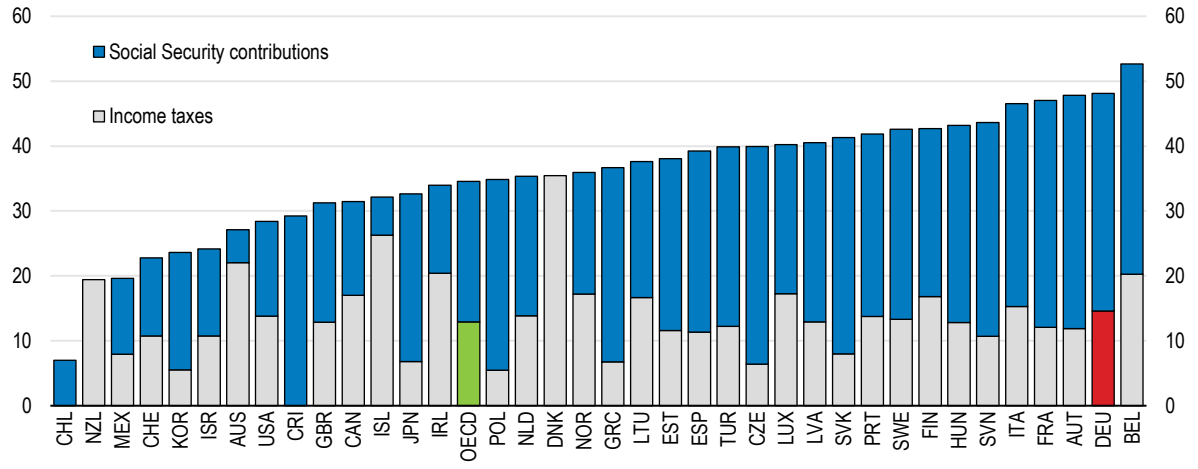
parliament. Until a consensus is reached, any published reports and data about the core budget at the federal and the Laender level should automatically include transparent information on spending from extra-budgetary funds. This should be combined with a transparent quantification of contingent liabilities associated with quasi-fiscal activities of state-owned banks (such as the development KfW), the public rail company and other state-owned enterprises, which are currently not accounted for in public debt statistics according to EU rules (IMF, 2022[31]; Asatryan, Heinemann and Nover, 2022[62]). Issues related to financial difficulties of many municipalities would be better addressed through a comprehensive tax reform and spending efficiency improvements by modernising public administration and enhancing cooperation across municipalities (see below).

Reforming the tax and transfer system

Labour taxes are among the highest across OECD countries, reducing incentives for labour supply (Figure 1.20). This is mainly driven by social security contributions, which are earmarked to fund pension, health and long-term-care spending. With rapid population ageing, it is crucial to reform the tax system and shift the tax burden from labour towards other taxes, such as capital income, property, inheritance and consumption taxes (Figure 1.21). This would help to raise labour supply incentives and mitigate the ageing related decline of the working age population and potential growth (Figure 1.3).

Figure 1.20. Labour taxes are high

Average tax wedge decomposition, % labour costs, 2021



Source: OECD Taxing Wages database.

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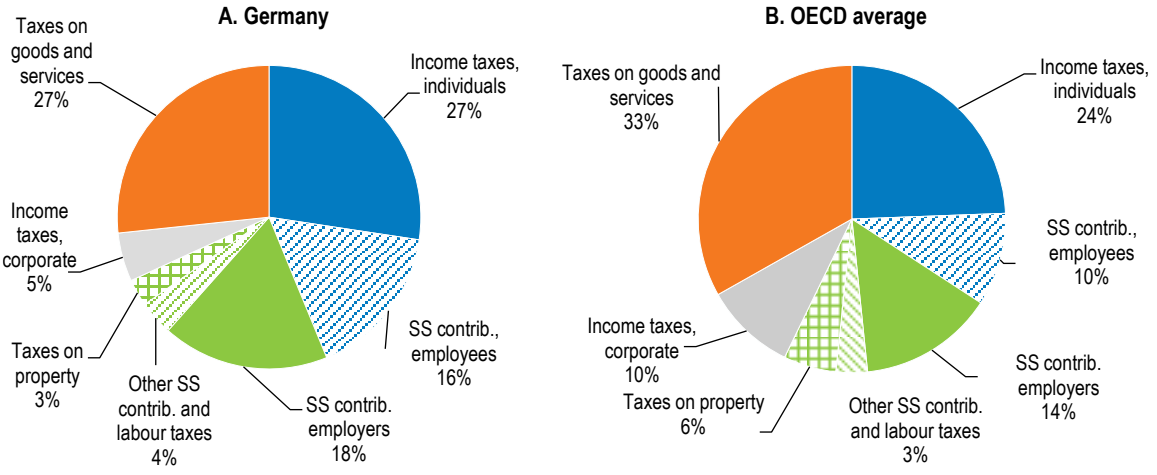
Figure 1.21. The tax mix is skewed towards labour taxes

General government tax revenues, % of total, 2019



Source: OECD Tax Revenue Statistics database.

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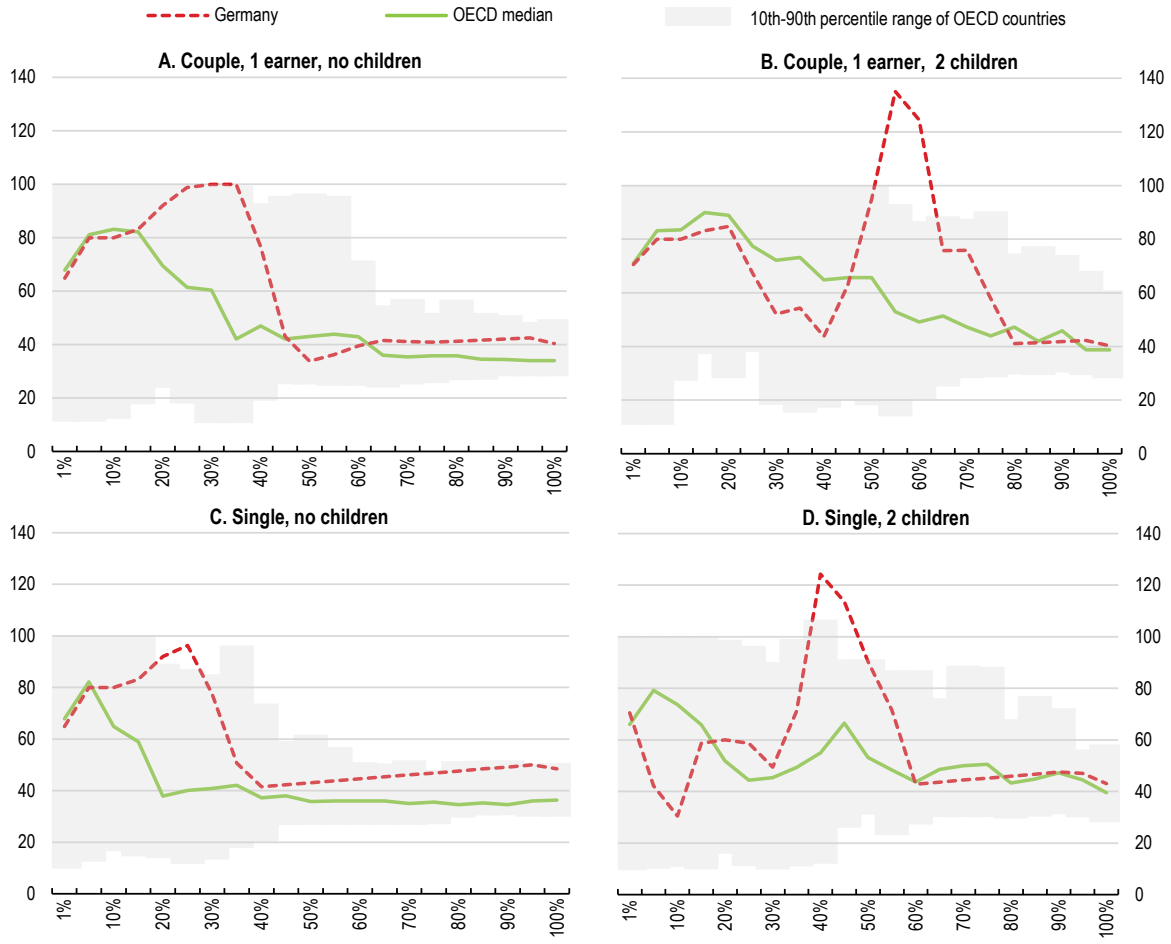
Improving incentives to raise labour supply

Incentives in the tax and transfer system to expand working hours are weak for low-wage earners and their employers. The share of workers in the lowest quintile of the salary distribution, who would like to work at least four hours more than they currently do, strongly increased from 8% in 1993 to 23% in 2018 (Beckmannshagen and Schröder, 2022[63]). Despite recent reforms to smooth the labour tax schedule for low-income earners, effective marginal tax rates were still close to 100% or above in early 2022 (Figure 1.22). This is due to the design and withdrawal of different transfers, for example family benefits for households with children, which causes net incomes to remain constant or even decrease with an increase in gross income (Bloemer et al., 2021[64]; SVR, 2019[65]). The recently adopted reform of social assistance will decrease withdrawal rates of subsistence benefits, which should lower effective marginal tax rates for earners without children, but more should be done to lower effective marginal tax rates for households with children. The planned reforms of housing benefits and child allowances should be carefully designed and coordinated with regulations for other social transfers so that higher benefit levels do not translate into higher effective marginal tax rates when benefits are withdrawn.

Due to the current joint income taxation rules for couples and the exemption of *Mini-job* income (below a monthly income of EUR 520) from income tax and social security contributions, marginal effective tax rates are particularly steep for second-earners (Figure 1.23) (OECD, 2022[66]; Bloemer and Consiglio, 2022[67]). This is one important reason why 48% of women work part-time in jobs for which they are over-qualified. To motivate women to expand their labour supply and thus address rising skilled labour shortages, it is crucial to reform the current joint taxation rules by introducing a separate tax-free allowance for couples. This could have sizable effects on labour supply and at the same time raise additional tax revenue of EUR 10 billion per year (Bach et al., 2020[68]). These additional revenues would come from increased female labour supply as well as raising revenue collection from richer single-earner couples, who are benefitting from the current legislation. Additional revenues from the reform could be used to further improve access to high- quality childcare and early-childhood education, which would not only raise educational outcomes of the future workforce, but also help to expand female labour supply (see the previous OECD Economic Survey of Germany).

Figure 1.22. Labour supply incentives are weak for low-income earners

Effective marginal tax rate (in %) per gross income measured in % of average earnings, 2022



Note: The vertical axis shows the effective marginal tax rate in % for a 10 percentage point increase in earnings at various gross employment income levels (measured in % of average income on the horizontal axis). Scenarios with children are based on two children at the ages of 4 and 6. Annual housing costs are assumed to be 20% of average wage. Median and percentile values for OECD are based on OECD countries except Germany. Results are based on rules as of 1 January 2022 for Germany, and as of 1 January 2019 for the OECD average.
Source: OECD calculations from OECD Tax-benefit model, http://oe.cd/taxBEN.

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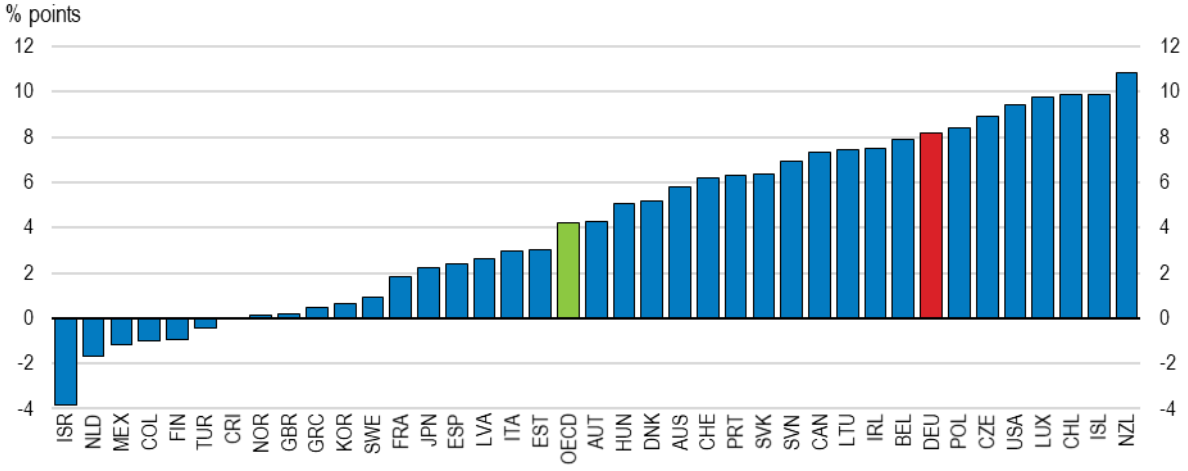
The reform of the joint income taxation rules should be combined with a reform of the *Mini-Job* regulation. Subsidising employment by exempting *Mini-Jobs* from income taxes and employees' social security contributions has been successful in stimulating employment for low-skilled workers, but in combination with other features of the tax and transfer system, such as the joint income taxation of couples, it has locked in many workers in part-time jobs with low levels of social protection, training access and career prospects (Bruckmeier et al., 2022[69]). More than 7 million workers or about one sixth of the work force are currently working in *Mini-Jobs,* 4 million of which have no other regular job, while more than 65% are women (Bundesagentur fuer Arbeit, 2022[70]). *Mini-Jobs* are most prevalent in hospitality, retail and domestic services. Although a recent reform has introduced smoothly increasing social security contributions for employees above the *Mini-job* income threshold, thereby improving labour supply incentives, second-earners with a *Mini-Job* still face steeply increasing effective marginal tax rates due to joint income taxation rules for couples, which reduces their net income when expanding labour supply (Bloemer and Consiglio, 2022[67]). To partly finance the decrease of contributions for employees above the threshold, employer contributions above the threshold were increased, which creates incentives for firms

to shift employment from regular jobs to *Mini-jobs* (Bruckmeier et al., 2022[69]). Below the *Mini-job* threshold employers pay a rate of about 31%, which due to the reform decreases smoothly to the standard rate of 26%, instead of a rapid drop. The income threshold until which social security contribution rates progressively increase for employees was raised from EUR 1 600 to EUR 2000 (*Midi-jobs*), raising labour supply incentives and real incomes for low-wage earners, but incentivising workers with incomes above this threshold to reduce working hours (Bloemer and Consiglio, 2022[67]).

To improve the attractiveness of regular jobs, the income threshold at which social security contributions progressively increase (Midi-jobs) should be lowered towards zero, which would decrease the scope for Mini-jobs (Walwei, 2021[71]; Bruckmeier et al., 2022[69]). Many countries such as Israel have introduced progressive social security contribution rates for low-wage earners and their employers, which had positive effects on labour supply and job creation (OECD, 2022[66]; Eckstein, Lifshitz and Larom, 2018[72]). Arguments against restricting the use of *Mini-jobs* include lower administrative burden and firing costs, which provides more flexibility to firms in sectors with high demand fluctuations (Sperrmann, 2022[73]). However, the market for temporary work agencies is well-developed in Germany, providing firms with a flexible pool of about 1 million workers (Spermann, 2013[74]). In addition, firms also have the option to hire workers on temporary contracts which can be extended up to two years (Feld, Iglesias and Weigert, 2015[75]). Although *Mini-jobs* might help to reduce informality in sectors such as hospitality, recent studies indicate that since the introduction of *Mini-jobs* in the early 2000s informality has not decreased on average and remained at about 16-17% of GDP (Elgin et al., 2021[76]; Kelmanson et al., 2019[77]). The better policy lever to fight informal work is to improve enforcement capacities and introduce an obligation to document working hours of employees. Particularly in times of high labour shortages, it seems unlikely that reducing the scope for *Mini-jobs* would lead to a strong drop in employment. The resources freed by reducing this expensive and untargeted employment subsidy would be better used to improve training and adult education opportunities for low-skilled workers or expand targeted employment subsidies for long-term unemployed (see above and chapter 2).

Figure 1.23. Labour taxes are particularly high for second earners

Difference in the average tax wedge between two- and one-earner family, % points, 2021



Note: The tax wedge is the sum of personal income tax, employee plus employer social security contributions, minus social benefits as a percentage of labour costs. The chart shows the difference in the average tax wedge for a married couple with two children between a two-earner and a one-earner family. In the first case, the family has two salaries: the primary earner earns the average wage, and the secondary earner earns 67% of the average wage. In the second case, there is only one breadwinner that earns the average wage. A positive difference indicates that the marginal tax on the second earner is high.
Source: OECD Revenue Statistics database.

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High inflation increases real effective personal income tax rates, as thresholds in the progressive income tax schedule are not indexed to inflation. This leads to particularly detrimental effects of inflation on labour supply decisions and real incomes of low- and middle-income households (Bach, 2021[78]; Immervoll, 2005[79]). Although the government periodically adjusts the tax schedule and tax allowances, adjustments have not been sufficient to fully account for inflation (Dziadkowski, 2022[80]). Linking tax-free allowances and the tax schedule directly to inflation would prevent further automatic increases in real effective tax rates and a deterioration of labour supply incentives for low- and middle-income households. This should be combined with a reform of the tax schedule that improves labour supply incentives by raising tax-free allowances and applying a linear progressive tax schedule smoothing kinks (Bach, 2021[78]). It is key to complement this with a reform of the joint taxation rules for couples (see above), as raising tax-free allowances without such a reform will further reduce labour supply incentives of second earners (Bloemer and Consiglio, 2022[67]). The total fiscal cost of a comprehensive reform of labour taxation depends on the exact design of reforms but will likely need to be financed by raising revenue from other taxes (Bloemer et al., 2021[64]).

Reducing tax expenditures and closing loopholes to level the playing field and raise revenue

To finance a comprehensive labour tax reform and raise additional revenue to address investment needs, effective tax rates on capital income, property, inheritance, and consumption taxes should be increased by reducing generous tax expenditures (Figure 1.21). This should be complemented by improving tax enforcement (see below). Another option to finance the decrease in labour taxes is to extend the tax base for social security contributions to capital or corporate income, as in France or as is currently the case with the *Solidaritaetszuschlag* to finance infrastructure investments in East-Germany. Rising revenue from carbon and other environmentally-related taxes could be used to finance infrastructure investments, but not the decrease in labour taxes, as these revenues are likely to fall rapidly when firms and households adapt their behaviour and reduce emissions (Black et al., 2021[81]).

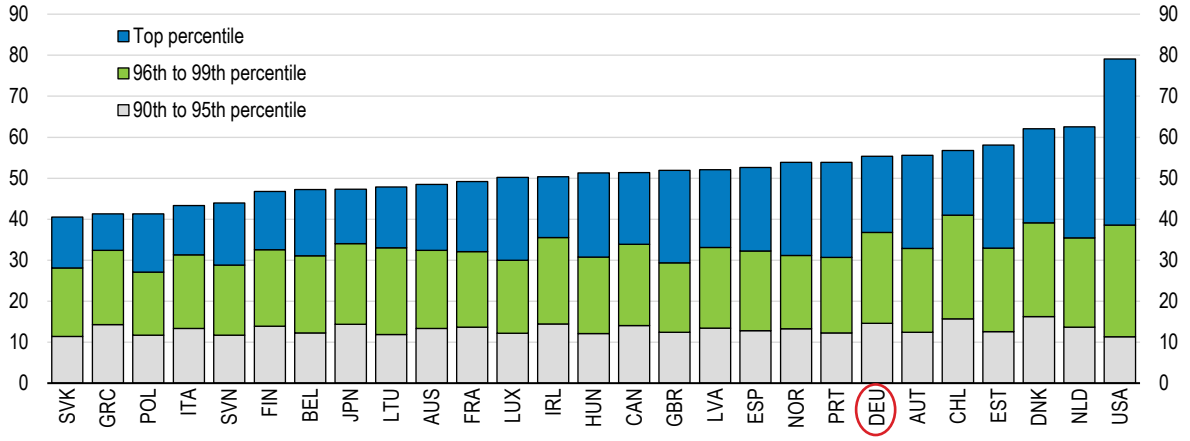
Abolishing regressive and distortive tax expenditures and loopholes for real estate investments across different tax types would raise up to EUR 12 billion per year, contribute to reduce inequality and improve the allocation of capital to its most productive use (Fuest, Hey and Spengel, 2021[82]; Bach and Eichfelder, 2021[83]). Capital gains from selling real estate are fully exempted from personal income tax, if the property has been held for more than 10 years, leading to revenue losses of around EUR 6 billion per year. Moreover, taxable rental income is reduced by overly generous tax depreciation allowances that strongly reduce tax burden on immovable property (Bach and Eichfelder, 2021[83]). Profits of real estate companies are fully exempted from the *Gewerbesteuer*, which is a municipal-level corporate income tax with an average rate of 15%, entailing a revenue loss of around EUR 5 billion. Loopholes also allow real estate holdings to avoid paying the tax on land acquisition (Bach and Eichfelder, 2021[83]). Finally, real estate property above 299 apartments is automatically classified as a business asset and exempted from the inheritance tax, which is not the case for smaller properties, leading to revenue losses of about EUR 1 billion (see below) (Bach and Eichfelder, 2021[83]). In combination with low interest rates, the generous tax treatment of real estate has attracted many institutional and wealthy private investors to the German real estate market, leading to misallocation of capital. As this beneficial treatment was not only granted for new constructions, but also for investments into the existing housing stock, they contributed to strongly rising property prices (Figure 1.13). This has also exacerbated the concentration of real estate assets in the hands of the highest income-decile and crowded-out many middle-class households searching for owner-occupied property (Fuest, Hey and Spengel, 2021[82]).

Although taxes on wealth and its transfer, such as inheritance and gift taxes, likely create less distortions than labour or capital income taxes and contribute to raise the equality of opportunities, Germany makes little use of them (OECD, 2021[84]; Scheuer and Slemrod, 2021[85]; Guvenen et al., 2019[86]; OECD, 2022[87]). Moreover, wealth inequality is high compared to other OECD countries, mainly because of the high concentration of home and business ownership (Figure 1.24) (OECD, 2021[84]; Schularick, Bartels

and Albers, 2022[88]). A wealth tax was abolished in 1997 following a supreme court ruling that outdated valuations of buildings led to a beneficial tax treatment of real estate compared to other assets. A re-evaluation of buildings is currently undertaken in the context of the ongoing property tax reform. Introducing a wealth tax rate of 1% above a personal tax-free allowance of EUR 2 million would generate around EUR 24 billion per year (Bach, 2021[78]). However, administrative costs of a wealth tax can be high, which is why inheritance and gift taxes are more frequently used across countries (OECD, 2021[84]).

Figure 1.24. Wealth inequality is high

Share of total net household wealth held by the top 10% of the wealth distribution, 2019 or latest available year



Note: Data were not available for Korea and a breakdown of wealth held by the top 10% was not available for New Zealand. The data on net private household wealth does not include occupational pensions, which are an important component of the wealth portfolio of households in some countries, for example in the Netherlands and Denmark (Balestra and Tonkin, 2018[89]).
Source: OECD Wealth Distribution Database, oe.cd/wealth.

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To strengthen inheritance taxation, the government should raise the effective tax rate on inheritances and gifts by reducing tax exemptions and closing loopholes (Box 1.6) (OECD, 2021[84]). According to tax data, about EUR 118 billion have been donated or inherited in 2021, while only EUR 11 billion were collected in inheritance and gift taxes, implying an effective tax rate of around 9% (Destatis, 2022[90]). The effective tax rate, however, is estimated to be much lower, as tax data does not include gifts to family members below thresholds for tax-free allowances, which are among the most generous across OECD countries (OECD, 2021[84]). Every ten years, each child can receive tax free gifts of up to EUR 400,000 from each of its parents, and in addition EUR 200,000 from each grandparent. Recent studies estimate that from 2017 until 2027 around EUR 400 billion of assets are transferred to family members and other persons per year, which resulted in an effective tax rate of below 3% in 2021 (Grabka and Tiefensee, 2017[91]; Jirmann, 2022[92]). Improving data collection on wealth transfers, reducing tax allowances for gifts to family members to average levels in OECD countries and accounting for tax exempted gifts when applying tax allowances for inheritance could significantly contribute to raising tax revenue and improving equality of opportunities. Planned updates in the valuation of real estate assets from 2023 onwards are welcome and will raise inheritance tax revenue but need to be complemented by reducing tax exemptions.

Generous inheritance and gift tax exemptions for business assets including shares result in tax expenditures of up to EUR 10 billion per year, which are highly regressive (Jirmann, 2022[92]; BMF, 2021[93]). The 2016 inheritance and gift tax reform has introduced a progressive taxation of business assets above a value of EUR 26 million, but it is still legally possible to receive a full exemption for large business assets in the case of illiquidity of the recipient (*Verschonungsbedarfspruefung*). The objective of these exemptions is to prevent the forced split-up of large family-owned firms due to liquidity issues and ensure the successful continuation of family management of firms providing well-paid jobs (Box 1.6). However, an

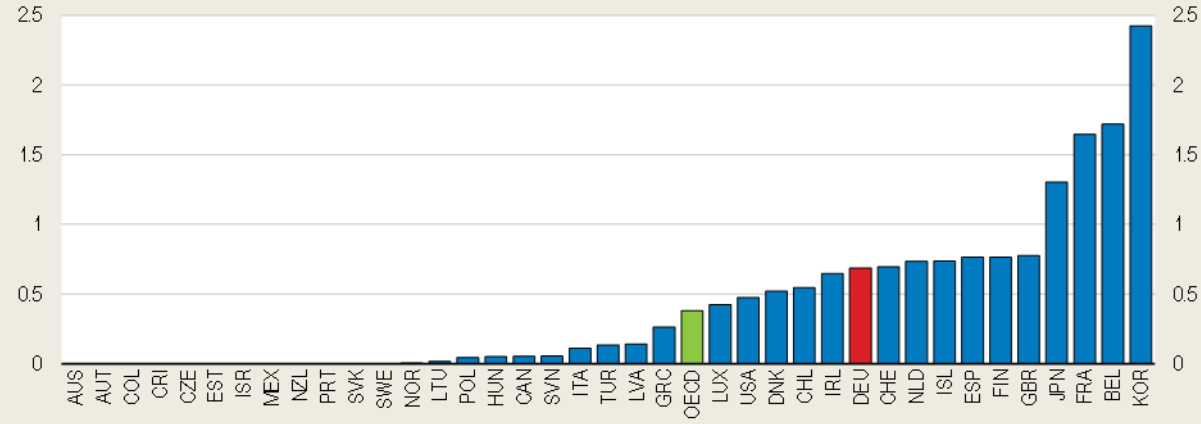
empirical evaluation of the 2009 German inheritance tax reform, which had strongly expanded tax exemptions for family business successions, concluded that the less generous system before 2009 had not jeopardised business succession of family firms due to liquidity issues (Houben and Maiterth, 2011[94]). Moreover, these tax exemptions facilitate tax avoidance schemes that allow to declare private wealth as business assets and lead to very low effective inheritance and gift tax rates for wealthy households, one example being the possible declaration of real estate above a threshold of more than 300 apartments as tax exempted business assets (Trautvetter and Schwarz, 2021[95]). Limiting tax exemptions to business assets below a value of EUR 26 million as foreseen in the 2016 reform, and lowering personal tax allowances could be combined with decreases in tax rates and would still significantly raise revenue (Grabka and Tiefensee, 2017[91]; Bach, 2021[78]). To address concerns about forced liquidation of family-owned firms, instalments for tax payments could be further extended (Box 1.6).

Box 1.6. Inheritance taxation across OECD countries

Many OECD countries make use of taxes on wealth transfers, such as inheritance, estate or gift taxes, but effective tax rates vary strongly across countries. Korea, Japan, France and Belgium collect about 0.7% of GDP in inheritance, estate and gift tax revenue, whereas other countries such as Austria or Sweden have completely abolished taxation of wealth transfers. Germany has collected around EUR 11 billion or about 0.3% of GDP in 2021. Low effective tax rates are mainly due to generous personal tax allowances and exemptions for certain asset classes such as business assets. Wealth transfers are expected to rise strongly during the next decades due to ageing of the baby-boom generation, which has accumulated significant wealth during their working life. This is an opportunity to re-design inheritance and gift taxes to improve the equality of opportunities and raise tax revenue needed to finance the green and digital transition.

Figure 1.25. The use of inheritance and gift taxes varies across countries

Inheritance, estate, and gift tax revenues (in % of total tax revenues), 2021 (or latest year available)



Source: OECD Revenue Statistics.

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Recipient-based inheritance taxes have many advantages compared to net wealth taxes. Distortive effects of inheritance taxes on savings behaviour and work efforts of wealthy taxpayers are found to be relatively small, while the effects on labour supply of the heirs are significantly positive. When combined with an exemption for low-value inheritances, recipient-based inheritance taxes can significantly lower wealth inequality and contribute to the equality of opportunities. The administration of inheritance taxes is less costly than other forms of wealth taxation, and recent advances in international tax transparency and data exchange greatly facilitate the ability of countries to tax wealth transfers, although more needs to be done to improve beneficial ownership registers, particularly concerning the real estate sector (Bomare and Le Guern Herry, 2022[96]). There is evidence of tax planning and migration among the

very wealthy in response to inheritance taxation, but these behaviours could largely be addressed through better tax design. To address migration reactions of very wealthy taxpayers, some countries apply exit taxes or subject emigrants to inheritance tax obligations for many years after they have left the country.

The main argument used against inheritance taxation in Germany is that it might lead to unwarranted liquidation of family-owned firms, in case the heirs face liquidity constraints, and thus cause job losses. However, this concern might be overstated as experiences from Germany and other countries that apply inheritance taxes on business assets show (Bennedsen and Nielsen, 2016[97]; Houben and Maiterth, 2011[94]). Demark, for example, levies a 15% inheritance tax on business assets (and all other asset classes) and allows heirs of business assets up to 30 years to pay instalments. Empirical studies for other countries show that if firm-ownership is passed on within the family, profit rates and managerial quality tend to deteriorate compared to other firms (Bennedsen et al., 2007[98]; Bloom and Van Reenen, 2010[99]). Thus, inheritance taxation can improve resource allocation as it prevents locking in capital in poorly performing firms. However, for small firms that generally face more severe liquidity constraints than larger firms, reduced tax rates or higher allowances could be warranted.

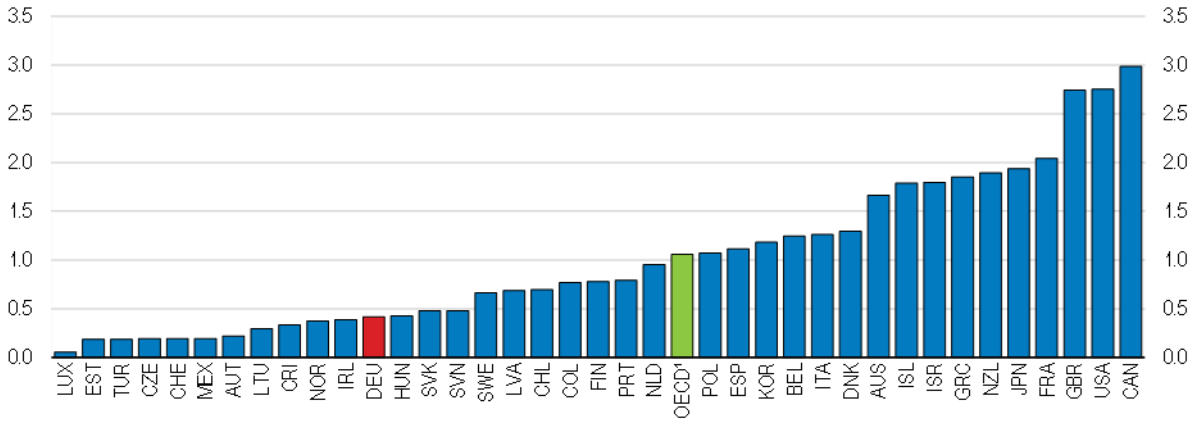
The relatively low public acceptance of inheritance and gift taxes is another argument against their use. However, recent studies have shown that inheritance and gift tax schedules and wealth inequality statistics are often not well known and that better information can significantly increase public support for taxes on wealth transfers (Kuziemko et al., 2015[100]; Stantcheva, 2021[101]; Bastani and Waldenström, 2021[102]). Reducing tax exemptions and loopholes benefitting wealthy households in combination with lowering tax rates for the average household would increase public support. Allowing tax payments in instalments and deferrals under certain conditions for asset-rich but income poor households and clearly communicating these options is also important. In terms of communication, framing reforms aiming to raise more revenue from inheritance taxation as instruments for equality of opportunity and inequality reduction, and combining such reforms with a more comprehensive tax reform, including for example decreases in labour tax rates, may help increase their public acceptability.

Source: (OECD, 2021[84]).

Revenue from taxes on immovable property such as land or buildings are low compared to other countries and have stagnated as a share of GDP since the 1990s, although land prices have more than doubled and real estate prices have increased by about 80% during the last 10 years (Figure 1.26) (Fuest, Hey and Spengel, 2021[82]; Bach and Eichfelder, 2021[83]). This is particularly problematic, as within the federal framework these taxes constitute the second major autonomous revenue source for municipalities besides the *Gewerbesteuer*, whose revenues fluctuate with the business cycle. High fluctuations of revenues of municipalities complicate long-term planning of infrastructure projects, which is one main reason for the large infrastructure backlog in Germany, as municipalities are responsible for a large share of public infrastructure, such as education and road infrastructure (see the previous OECD Economic Survey of Germany). As taxes on immovable property provide relatively stable revenue streams, increasing effective tax rates would help to reduce the large fluctuations in municipal tax revenue (OECD, 2021[103]). The ongoing reform of the land tax (*Grundsteuer*) is an important step into the right direction, as it introduces a regular update of land and property values, whereas so far valuations from the 1960s (and 1930s) were used to determine the property tax base in West- (and East-) Germany (Bach and Eichfelder, 2021[83]). Linking land and property taxation more directly to updated property values and establishing a minimum tax rate could help to reduce inequality and raise revenues for many municipalities (Bach and Eichfelder, 2021[83]; OECD, 2021[104]).

Figure 1.26. Revenue from property tax is low

Recurrent taxes on immovable property, % of GDP, 2021 or latest available year



Note 1. Unweighted average.
Source: OECD Revenue Statistics.

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Raising the minimum rate of the *Gewerbesteuer* could also help to improve the financial situation of many municipalities. Detrimental tax competition between municipalities has led to a "race to the bottom" in the past, with tax rates close to 0% to attract firms, which has led the federal government to introduce a minimum tax rate of 7% in 2004 (Dinauer, Kammerer and Ott, 2022[105]). However, due to their weak financial situation many poorer municipalities need to set higher rates, which can lead to shifting of economic activity and profits between regions (Beznoska and Hentze, 2019[106]; Trautvetter and Schwarz, 2021[95]; OECD, 2021[103]). Increasing the minimum statutory tax rate for municipalities to 10% would improve capital allocation across regions and reduce the scope for profit shifting, while leading to a combined minimum tax rate of 25% (the federal corporate income tax rate is 15%), which would be slightly above the OECD average of 23.3% in 2021 (OECD, 2022[87]; Trautvetter and Schwarz, 2021[95]). Abolishing the *Gewerbesteuer* and compensating this by increasing the share municipalities receive from VAT tax revenues and raising the federal corporate income tax rate is another option that would help to structurally improve municipal finances (Beznoska and Hentze, 2019[106]; OECD, 2021[103]).

Abolishing generous VAT exemptions for real estate, financial and insurance services, education services, and gold, silver, precious stones and art pieces has large revenue raising potential (Trautvetter, 2020[107]). Many of these exemptions are regressive. Reducing VAT exemptions and establishing transparent criteria for remaining ones would raise tax revenue and improve tax fairness (OECD, 2022[87]).

Table 1.8. Past recommendations and actions taken on fiscal and tax policy

Recommendations	Action taken
Further increase spending on high-quality public investment, including through funding to municipalities.	The Climate and Transformation Fund (KTF) has received additional funding of about EUR 92 billion from the core budget, when the national debt brake was suspended from 2020 to 2022, which will be used to finance green infrastructure projects during the coming years.
Reduce taxation of labour income, while removing inheritance tax exemptions, raising reduced VAT tax rates to the standard rate, and strengthening environmental, property and capital income taxation.	To lower personal income taxes the basic allowance, the lump sum allowance for work-related expenses, and the allowance for commuting for long distances were increased in January 2023.
Lower the tax burden on wage income of second earners. Link health insurance premiums to the number of adults in a household.	No action taken.
Target preferential tax treatment of Mini-jobs towards low-wage workers. Tax subsidies should not be provided for combining jobs.	No action taken.
Reduce marginal effective tax rates for low-income earners through slower and more coordinated withdrawal of social assistance, child supplement and housing benefits.	The recently adopted reform of basic income support for jobseekers (introducing the new citizen's benefit - *Buergergeld*) will decrease withdrawal rates of subsistence benefits. A reform to better coordinate basic income support for jobseekers, child and housing benefits is planned, but still pending. Income thresholds and rates for progressive social security contributions of Midi-job earners were revised in 2022 to smooth and reduce effective marginal tax rates for low-income earners. Workers with a Midi-job receive full pension benefits due to the reform.
Raise the tax rates applying to household capital income towards marginal income tax rates applying to other household income.	No action taken.

Strengthening tax enforcement

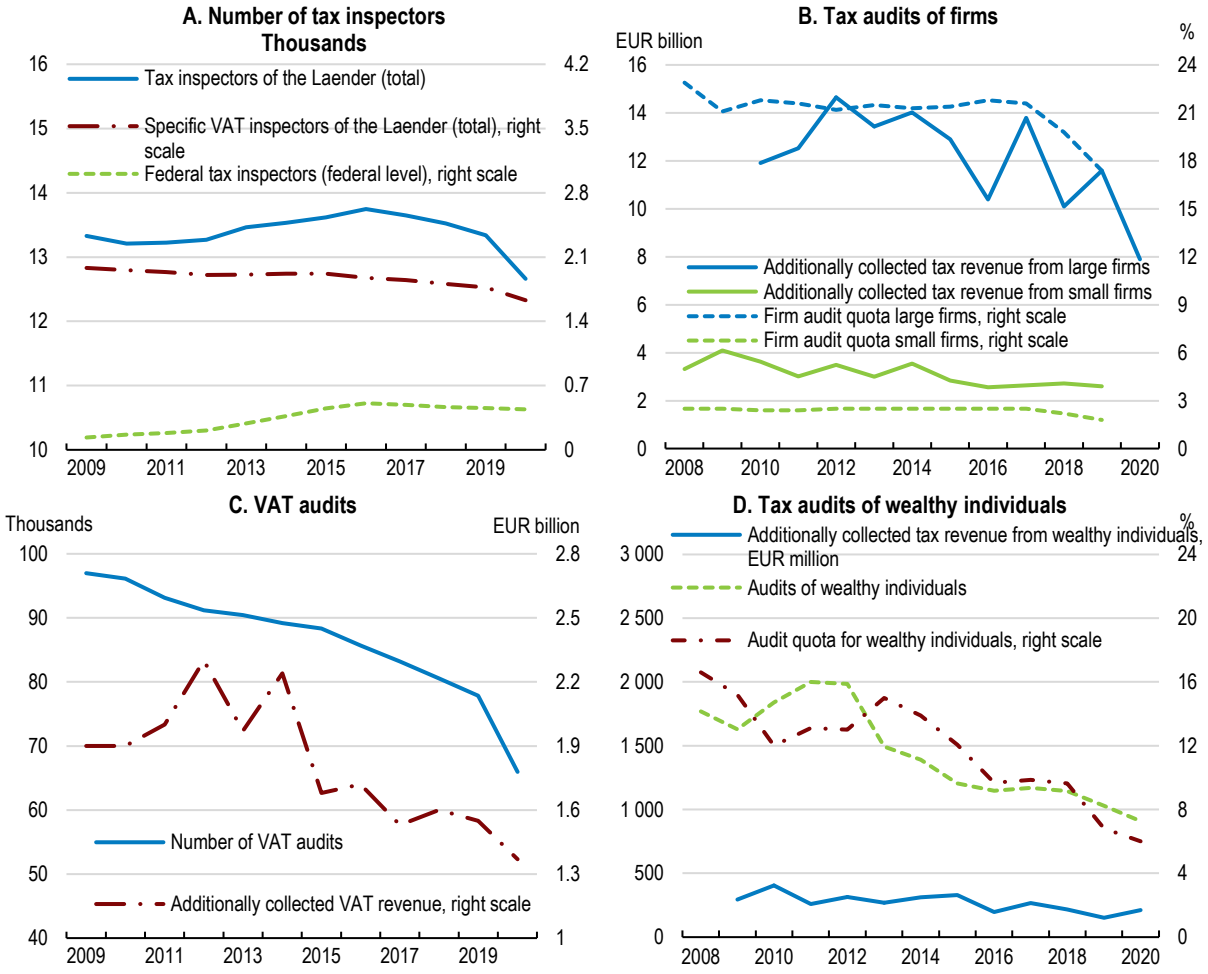
Strengthening tax enforcement and reducing tax evasion is not only key for raising revenue and reducing inequalities, but also for levelling the playing field between firms and raising productivity. Multi-national firms make larger use of tax-avoidance schemes to lower their effective tax rates compared to domestic firms, as they can exploit loopholes due to differences between complex national tax systems and can afford the high fixed costs of specialised tax optimisation services (Sarin and Summers, 2019[108]; Tørsløv, Wier and Zucman, 2022[109]). Similarly, richer households are more likely to reduce their effective tax rates by under-declaring income and wealth and evading taxes (Alstadsæter, Johannesen and Zucman, 2019[110]; Guyton et al., 2021[111]). Simplifying national tax systems and improving international cooperation to foster information exchange are crucial steps to reduce the scope for tax avoidance and tax evasion (OECD, 2022[112]). Strengthening the capacities of national tax administrations, by investing in better IT equipment, data infrastructure and human capital, and stricter reporting requirements also hold large potential to raise tax revenue (Sarin and Summers, 2019[108]).

To better target tax enforcement efforts, it is crucial to know more about the extent of tax evasion by tax type (IMF, 2021[113]; Murphy, 2019[114]). In the United States, the Internal Revenue Service regularly publishes tax gap estimates by tax type, which amount to a total tax gap due to non-compliance of about 15% of tax revenues (Sarin and Summers, 2019[108]). In Germany, however, domestic information on tax gaps is not available, mainly due to data protection and IT issues, which are exacerbated by the decentralised tax administration system and strict tax secrecy rules (BMF, 2020[115]). The government plans to establish a tax research network bringing together the tax administration, the Federal Statistics Institutes and the research community to facilitate collecting information on tax gaps and analysing the effects of planned tax reforms. However, this will only be successful if issues related to data protection and tax secrecy rules are solved across levels of government and the necessary data infrastructure is provided to the research community. Earlier plans to establish an independent fiscal institute should be considered again, as this might facilitate the build-up of the necessary data infrastructure while maintaining high data protection standards and ensure an objective and independent analysis of tax data. In the field of labour market analysis such an independent research institute with secured comprehensive data access, namely the Institute for Employment Research (IAB), has greatly facilitated policy impact evaluation. An objective

assessment of tax gaps is key, as it could inform the tax enforcement authorities and the public on where additional enforcement efforts would be most effective. Regularly updated tax gap measures could also serve as performance measures to incentivise staff within the tax administration or to improve incentives for tax collection in the decentralised German tax administration system (Sarin and Summers, 2019[108]).

Although global profit shifting, tax avoidance and tax evasion activity has increased since the 2000s, the number of tax inspectors for firms and wealthy households has decreased (Figure 1.27) (Tørsløv, Wier and Zucman, 2022[109]; Wier and Zucman, 2022[116]). This has contributed to a lower frequency of tax audits of firms and wealthy taxpayers. Additional tax revenues collected due to inspections have also decreased, indicating that the decline in human resources has not been compensated by a rise in labour productivity due to digitalisation, for example by better using digital tools to target audits to firms and individuals with a high-risk profile (BMF, 2020[115]). One important factor for the lack of digitalisation and weak tax enforcement capacities is the problematic incentive structure within the decentralised tax administration system (Trautvetter, 2021[117]; BMF, 2004[118]). Tax collection and enforcement is under the responsibility of the Laender, including for federal and co-participated taxes, which is a unique feature of the German system compared to other federal countries like the United States or Australia. The federal fiscal allocation and equalisation scheme reduces incentives for the tax administrations of the Laender to improve tax enforcement, as only a small share of additionally collected tax revenue will accrue to the sub-jurisdiction. Analysis conducted for this Survey indicates that Laender with lower marginal revenue from an additionally collected euro also show lower effective VAT rates (or larger VAT tax gaps) (Figure 1.28). Reducing effective tax rates by underinvesting in tax enforcement might also serve to attract firms and wealthier households to the sub-jurisdiction, similar to detrimental international tax competition (Troost, 2016[119]; BMF, 2004[118]; OECD, 2021[103]).

Figure 1.27. Tax enforcement capacity has decreased



Source: Information provided by Laender parliaments and collected by Netzwerk Steuergerechtigkeit (Trautvetter, 2021[117]).

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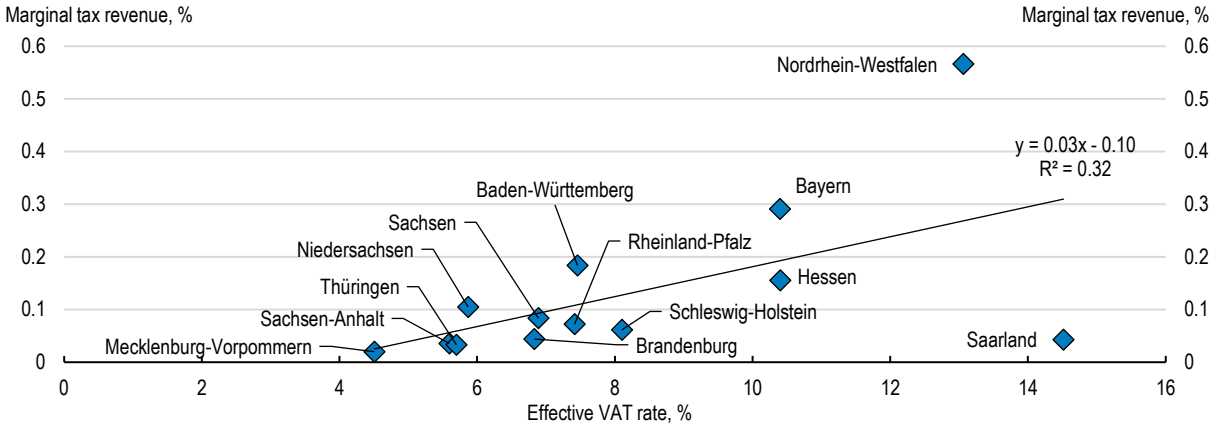
To address this issue, the federal government sets binding guidelines for the Laender to coordinate tax administration efforts, which can be rejected by the Laender with a simple majority. However, existing guidelines only include targets to lower the administrative burden of tax declarations for businesses and households, but do not target tax enforcement capacities (Trautvetter, 2021[117]). Including targets on tax enforcement capacities in the binding guidelines could be a first step and should be complemented by introducing performance targets for the Laender as soon as the new tax research network can provide Laender-specific tax gap estimates. In addition, the guidelines as well as data on the capacity and performance of tax administrations should be publicly available to hold Laender governments accountable (BMF, 2004[118]). A full centralisation of tax collection of federal and co-participated taxes at the federal level would be the first best solution and has been recommended by the OECD in earlier Economic Surveys of Germany, but seems unfeasible given political and constitutional constraints.

Figure 1.28. Effective VAT rates are lower in Laender with weaker tax enforcement incentives due to the fiscal equalisation scheme

Marginal increase of tax revenue (in %) from an increase in VAT tax collection (by 10%); effective value added tax rates (in %)



Note: Effective VAT rates are calculated by dividing the total amount of collected VAT revenue by private consumption for each Land. Effective VAT rates are reported for the year 2020 as data on private consumption on the Laender level is not yet available for 2021. The marginal total tax revenue refers to the percentage change in total tax revenues of a Land (including tax revenues of its municipalities) from increasing VAT revenue collection in this Land by 10%. The calculated marginal total tax revenues takes into account the contributions and comprehensive redistribution mechanisms within the Finanzkraftausgleich. The city states Berlin, Hamburg and Bremen are excluded from the analysis due to the construction of the effective VAT rate measure: while the collected VAT revenue relates to purchases made in one particular Land, the measure for private consumption is derived from expenditure estimates for households living in a given land. If a non-negligible share of the collected VAT revenue can be attributed to purchases made by persons living in another Land, as is the case for the large city states, the measurement error for effective tax rates is large. The graph shows correlations and does not control for other factors that might be correlated with effective VAT rates and the marginal total tax revenue from an additionally collected euro of VAT.
Source: Federal Ministry of Finance, Federal Statistical Office, Statistical Offices of the Laender and OECD calculations.

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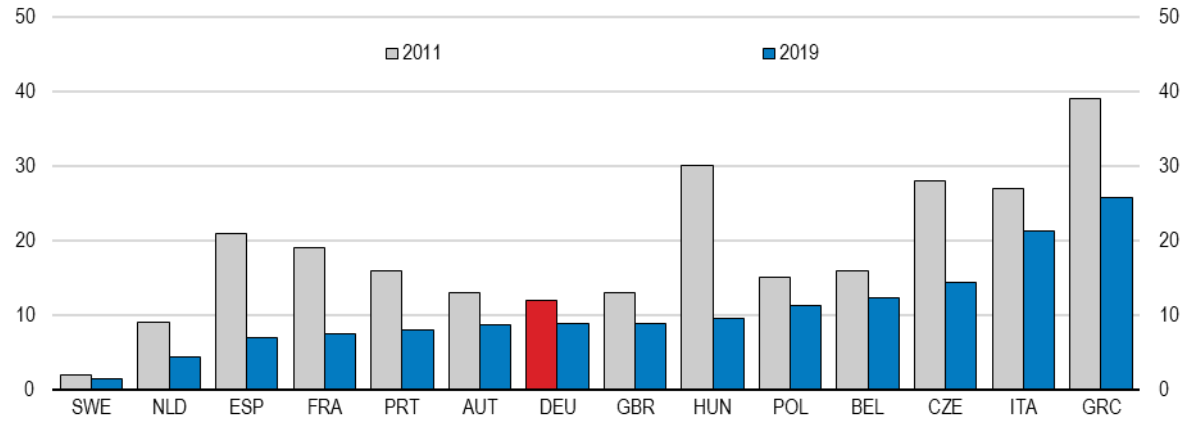
Estimations of the VAT gap by the European Commission indicate that Germany loses around 9% of VAT revenue, equivalent to EUR 22 billion each year, related to fraud and evasion schemes (Figure 1.29). Although this share is about average across EU countries, progress in tax enforcement has been weak since 2011, as the number of VAT inspectors and VAT related inspections declined, and the IT infrastructure and the coordination between enforcement authorities of the Laender and with European enforcement agencies are still weak (Figure 1.27) (Bundesrechnungshof, 2020[120]). Recent policy changes have allowed to significantly raise the number of registered online traders and strengthened the receipt requirements for commercial activities. However, there is still no obligation for all firms to use electronic cash registers or automatic e-invoicing and a maximum threshold for cash payments does not exist (OECD, 2022[121]; OECD, 2022[122]). Moreover, cross-border VAT fraud schemes, which deceive tax administrations to refund VAT payments for inputs that have never been paid, have flourished, causing tax revenue losses of up to EUR 14 billion per year (Frunza, 2016[123]). Reversed-charge procedures have closed existing loopholes in certain markets, but led to the shifting of VAT fraud schemes to other products and services (Bundesrechnungshof, 2020[120]). One technical solution to reduce VAT fraud at border-crossings would be to introduce an electronic clearing procedure that documents all cross-border transactions of goods and services and sends the collected data to tax authorities and statistical institutes (Braml and Felbermayr, 2021[124]). Spain, Italy, Hungary and Chile, for example, have successfully implemented mandatory electronic invoicing at the national level (OECD, 2022[125]). To prevent VAT evasion and fraud schemes it is key to introduce the obligation to use electronic cash registers and automatic e-invoicing for all firms, including an electronic clearing procedure for border crossings, and set a maximum threshold for cash payments by implementing the EU anti-money laundering regulation.

Figure 1.29. Progress in strengthening VAT collection has been weak

VAT gap, % of VAT Total Tax Liability (VTTL)



Note: The VAT gap is the overall difference between the expected VAT revenue and the amount actually collected.
Source: European Commission, Directorate-General for Taxation and Customs Union, VAT gap in the EU : report 2021, Study to quantify and analyse the VAT gap in the EU-27 Member States : report 2013.

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Other large-scale tax fraud cases, such as so-called cum-ex and cum-cum deals, have led to tax revenue losses of more than EUR 60 billion and highlighted the weaknesses of the decentralised German tax administration system (Spengel, 2017[126]; Spengel, 2021[127]). In cum-ex schemes, international investors in cooperation with German banks (including public banks) have used high-frequency trading around the dividend payment date and differences in tax liabilities to deceive tax authorities and receive refunds of withholding tax for dividends several times, although the tax had been paid only once. This fraud scheme has reduced public resources by more than EUR 10 billion and was facilitated by weak IT infrastructure, a missing tax register for capital gains taxes due to secrecy rules, weak governance structures at supervising authorities and strong lobby influence of the banking industry (Spengel, 2017[126]; Spengel, 2016[128]; BMF, 2020[115]). Although legislative action has narrowed the existing loopholes and strengthened enforcement, significant challenges remain. The dividend tax payment and the refund are still two separate administrative procedures and loopholes related to differing tax liabilities according to resident status and between dividends and profits from selling or lending stocks remain (Spengel, 2021[127]). Cum-cum schemes have exploited the same loopholes, causing tax revenue losses of more than EUR 50 billion (Spengel, 2021[127]). These cum-cum deals have been ruled to be illegal under certain circumstances in 2020, but capacity constraints and weak cooperation among decentralised tax enforcement and prosecution authorities complicate further investigations. The responsible regulator (BAFIN) should gather more data on past financial transactions related to these deals and combine them with data on dividend tax refunds from the federal tax agency to allow gauging the size of foregone tax revenue and better support enforcement authorities (Spengel, 2020[129]; BMF, 2020[115]).

To effectively enforce existing tax laws, it is key to improve the IT and data infrastructure and enable a better cooperation and specialisation of tax enforcement authorities across the Laender and better coordination with other countries (BMF, 2020[115]). Many tax fraud schemes, such as the cum-ex, cum-cum or VAT fraud schemes, operate across national borders and involve complex transactions. Effective detection and investigation of these schemes requires linking tax registers of different tax types and combining them with other data sources to improve analytical and risk-based approaches (OECD, 2021[130]; BMF, 2020[115]). Although special task-forces in the federal tax agency (*Bundeszentralamt fuer Steuern*) for capital markets and VAT fraud as well as a risk-management system have been established, the necessary data infrastructure is still weak (BMF, 2020[115]; Bundesrechnungshof, 2020[120]). This is due to the strict tax secrecy principle, the prohibition of linking administrative firm and individual data and the

fact that tax register data is under the authority of the Laender, which do not provide direct data access for data analysis and risk-based approaches. Tax data on individuals paying dividend taxes is missing, as the tax is collected on an anonymous basis from banks (BMF, 2020[115]). Moreover, tax inspectors and investigators at the sub-regional level do not automatically share information on investigations with other inspectors and investigators, even in the same Land. Establishing shared case files across tax enforcement authorities at the national level could prevent duplicating investigations and allow for a more efficient use of resources and more specialisation (Trautvetter and Schwarz, 2021[95]). Digitalisation of the tax administration can be supported by learning from best practices in other countries, including through the OECD working group on digitalising the tax administration (OECD, 2022[131]).

Due to global profit shifting of multinational enterprises (MNEs), Germany likely loses substantial corporate income tax revenues, which have been estimated to stand between 8% and 29% per year, although measurement is challenging due to limited data availability (Tørsløv, Wier and Zucman, 2022[109]; Fuest et al., 2022[132]; BMF, 2020[115]). To shift profits out of high-tax to low-tax jurisdictions, tax avoidance strategies of MNEs exploit complex trade and financial interactions between subsidiaries of the same firm located in different countries (OECD, 2015[133]). Although the complexity of these transactions has increased over time, the number of tax inspectors and frequency of firm audits as well as audit revenue have decreased (Figure 1.27) (Wier and Zucman, 2022[134]). Strengthening reporting requirements for firms, implementing the planned single electronic firm identifier to facilitate data linkage and improving the existing risk-management system would allow to better focus inspections and audits on high-risk cases and support greater specialisation of tax inspectors. At the same time, it is crucial to continue international cooperation to reduce the scope for global profit shifting. The recent introduction of a minimum tax on profits of German MNEs in line with the Inclusive Framework on Base Erosion and Profit Shifting (BEPS) is an important step forward and will allow Germany to recover some of the foregone tax revenue due to profit shifting.

Tax evasion is strongly linked to asset hiding and money laundering (OECD, 2021[130]). Since 2010, tax enforcement authorities from some Laender have purchased data on hidden financial accounts of German residents in Switzerland and other low-tax countries. This has led to rising revenue related to tax investigations and caused a strong rise in voluntary declarations of offshore accounts (Schwarz and Trautvetter, 2021[135]). Since 2017, the implementation of the OECD common reporting standards has led to very large data inflows on offshore accounts and unreported capital income (OECD, 2017[136]). However, staff and IT capacity constraints at the federal tax agency and tax enforcement agencies of the Laender risk to hinder data analysis and tax investigations. The frequency of audits of high-income taxpayers with yearly income of more than EUR 1 million has even decreased from 15% in 2009 to 5% in 2021, while heterogeneity across tax enforcement districts is large (Figure 1.27) (Trautvetter, 2021[117]).

Fighting money laundering and corruption

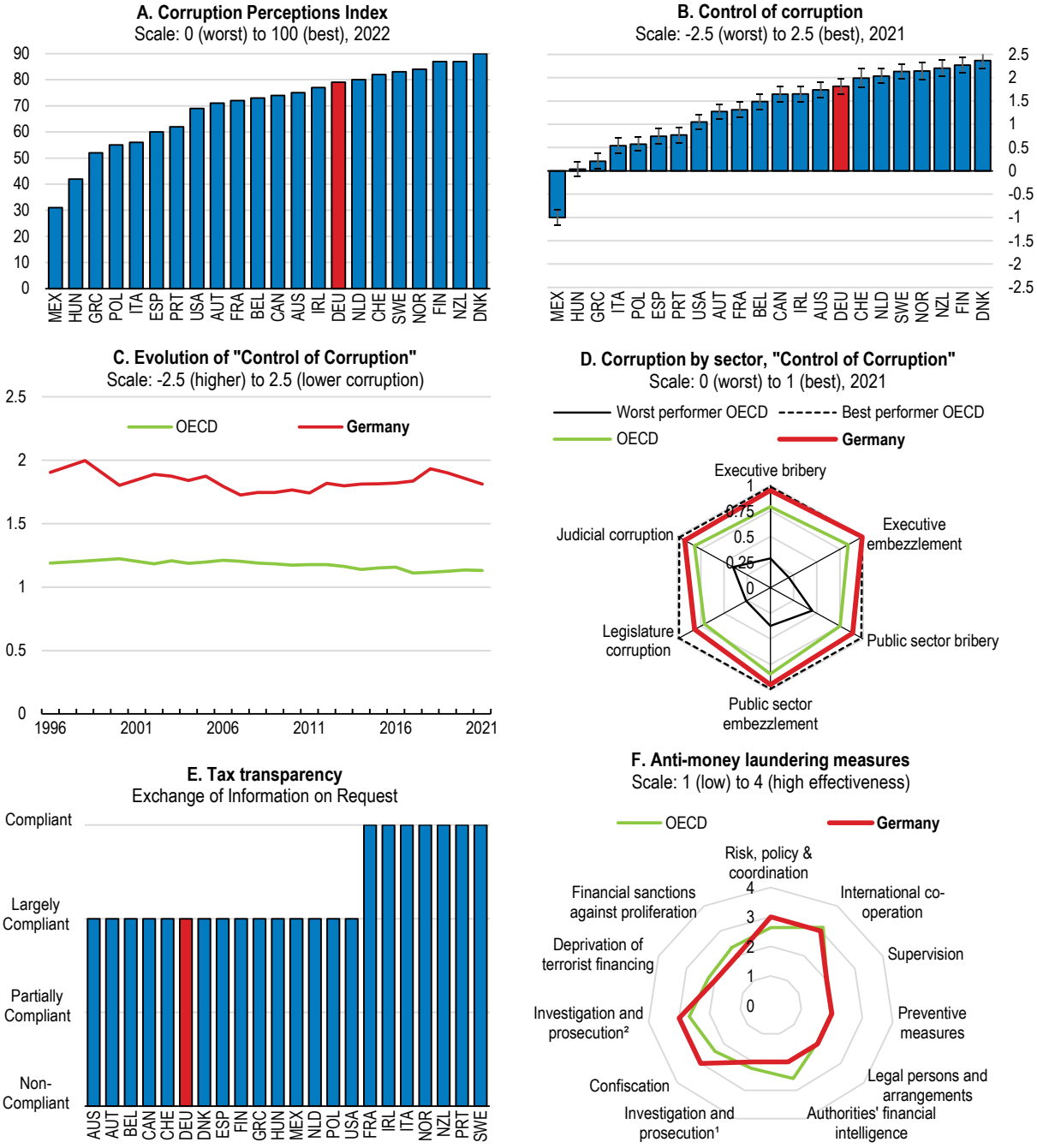
In recent years, Germany has strengthened its fight against money laundering (FATF, 2022[137]). This includes the introduction of a national risk assessment (NRA) process, improved coordination between different agencies and levels of government, a significant increase in human and IT resources for the main financial sector regulator (BAFIN) and the Financial Intelligence Unit (FIU), removing limitations in asset recovery and the money laundering offence, and establishing the Transparency Register to improve access to information on beneficial ownership (FATF, 2022[137]). However, significant challenges remain.

To further improve the fight against money laundering and tax evasion it is crucial to continue improving information on asset ownership and better cooperate with enforcement authorities in other countries (Figure 1.30). The recent upgrade of the central transparency register on beneficial ownership to a full register and making registration mandatory are important steps in the right direction, but need to be complemented with higher sanctions for non-compliance and better supervision and verification of information (Collin, Hollenbach and Szakonyi, 2022[138]). Recent issues in enforcing EU sanctions have

shown that information remains incomplete, particularly related to real estate. In Germany, ownership information is missing for around 55% of foreign-owned housing assets, which facilitates tax evasion of capital gains and corporate income taxes (Miethe, Peichl and Trautvetter, 2022[139]; Trautvetter, 2020[107]). As the OECD common reporting standard introduced in 2014 does not include real estate assets, illicit financial flows seem to have increasingly targeted real estate investments world-wide (Bomare and Le Guern Herry, 2022[96]; Johannesen, Miethe and Weishaar, 2022[140]). Accelerating the digitalisation and inter-linkage of municipality-specific commercial, real estate and company registers and allowing to link them with other data including on bank accounts and financial assets would support and accelerate the establishment of a comprehensive transparency register of beneficial ownership (Nationaler Normenkontrollrat, 2017[141]). Newly introduced legislation to prohibit cash payments for real estate purchases will help to reduce the scope for money laundering activities, but cash payment thresholds should also be introduced for other asset purchases by implementing the EU anti-money laundering regulation (FATF, 2022[137]).

The plan to create a federal financial police and centralise the supervision of anti-money laundering regulation for the non-financial sector and sanction enforcement under the roof of a new federal agency to combat financial crime is an important step forward (BMF, 2022[142]). This agency will also integrate the Financial Intelligence Unit (FIU), which collects and analyses suspicious transaction reports (STR) related to money laundering. So far, a lack of coordination and capacity constraints among the 300 mostly under-staffed Laender agencies, which have been responsible for the supervision and enforcement of anti-money laundering regulation in the non-financial sector, has led to weak enforcement of reporting requirements and a low quality of suspicious transaction reports (STR) submitted to the FIU (Figure 1.30) (Transparency International, 2021[143]; FATF, 2022[137]). Due to weak coordination and cooperation between the FIU and law and tax enforcement authorities of the Laender, capacity constraints and restricted data access to the transparency register of beneficial ownership, tax registers, and police data, only a small amount of financial intelligence collected by the FIU is used by law enforcement authorities in criminal proceedings (Figure 1.30, Panel F) (FATF, 2022[137]). The government has recently launched an evaluation of the anti-money laundering framework which should be used to set up the new financial police agency so to address these coordination and cooperation issues within the federal system and improve financial intelligence.

Figure 1.30. There is room to improve the fight against money laundering and corruption



Note: Panel B shows the point estimate and the margin of error. Panel D shows sector-based subcomponents of the "Control of Corruption" indicator by the Varieties of Democracy Project.. Panel E summarises the overall assessment on the exchange of information in practice from peer reviews by the Global Forum on Transparency and Exchange of Information for Tax Purposes. Peer reviews assess member jurisdictions' ability to ensure the transparency of their legal entities and arrangements and to co-operate with other tax administrations in accordance with the internationally agreed standard. The figure shows first round results from the ongoing second round when available, otherwise first round results are displayed. Panel F shows ratings from the FATF peer reviews of each member to assess levels of implementation of the FATF Recommendations. The ratings reflect the extent to which a country's measures are effective against 11 immediate outcomes. "Investigation and prosecution[1]" refers to money laundering. "Investigation and prosecution[2]" refers to terrorist financing.

Source: Panel A: Transparency International; Panels B & C: World Bank, Worldwide Governance Indicators; Panel D: Varieties of Democracy Institute; University of Gothenburg; and University of Notre Dame; Panel E: OECD Secretariat's own calculation based on the materials from the Global Forum on Transparency and Exchange of Information for Tax Purposes. Panel F: OECD, Financial Action Task Force (FATF).

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If the new federal agency to combat financial crime is sufficiently equipped with investigative powers, skilled staff, IT and comprehensive data access to conduct forensic data analysis, it will significantly improve capacities to detect complex financial crimes, tax fraud and money laundering, and to identify asset ownership. To improve the quality of STRs from the non-financial sector, it is important that information on complex money laundering and tax fraud schemes is disseminated regularly to law enforcement and supervision authorities of the Laender as well as to concerned non-financial sector agents obliged to report suspicious transactions, such as notaries, lawyers, tax consultants, auditors and accountants, and car, precious metal and jewellery dealers (FATF, 2022[137]). Tax authorities should also be better informed, as they are hesitant to submit suspicious information to the FIU due to strict tax secrecy rules, and money laundering risks should be included in the risk criteria to guide tax audits (OECD, 2019[144]). Moreover, increasing awareness of risks and reporting requirements related to money laundering for non-financial sector agents, promoting implementation of preventive measures, improving feedback on reports, and reviewing the interpretation of professional secrecy requirements is key, as the non-financial sector may underreport suspicious transactions (FATF, 2022[137]). This also applies to the financial sector, where the respective supervision authority (BAFIN) focuses on preventive measures, but conducts relatively few independent firm audits and could make more effective use of sanctions (Europaeischer Rechnungshof, 2021[145]; FATF, 2022[137]). This is also an issue for the auditing watchdog, whose investigative capacities suffer from understaffing (Storbeck, 2022[146]).

In addition, more prosecutors specialised in financial crime and money laundering and better international cooperation are needed (Figure 1.30, Panel F). Criminal prosecution is a responsibility of the Laender, and the same incentive issues described above for tax enforcement may also relate to the underinvestment of the Laender in criminal prosecution of money laundering and financial crimes. Capacity constraints at regional prosecution offices have led to a concentration of efforts on simple and small-scale money laundering schemes, but complex and large international money laundering and tax crimes are under-investigated (BMF, 2020[147]; BMF, 2019[148]; Transparency International, 2021[143]; FATF, 2022[137]). One option is to establish binding guidelines for the Laender to ensure sufficient specialised capacities to prosecute financial crime and money laundering and establish a close cooperation among them as well as with the new federal financial police, for example by establishing centralised case file management and tracking. Nordrhein-Westfalen and Hessen can serve as positive recent examples for raising law-enforcement capacities. Continuing to strengthen international cooperation, similar to the European public prosecutor office or joint investigation teams, is crucial to address complex international corruption and money laundering cases (European Commission, 2021[149]; Transparency International, 2021[150]).

Complementing recently improved regulation to confiscate ill-obtained assets with an unexplained suspicious wealth order could support the fight against money laundering and the enforcement of sanctions. However, more effective confiscation would require more specialised staff and a well-functioning transparency register of beneficial ownership. Improving data collection on confiscation and case-related information would help to better understand the structural patterns and scale of money laundering activities (Transparency International, 2021[143]). Improving asset recovery could have the potential to raise public revenue, as an estimated EUR 100 billion of illicit financial flows enter Germany each year (Transparency International, 2021[143]; BMF, 2019[148]).

The perceived risk of corruption remains low, but there is room to improve transparency (Figure 1.30) (Transparency International, 2021[150]). Recent corruption scandals related to public procurement of protective equipment during the pandemic risk reducing trust in institutions and the democratic process. In reaction to the scandals, transparency related to side activities of legislators has been increased and remunerated lobbying activities of legislators were prohibited (Deutscher Bundestag, 2021[151]). The existing criminal offence of bribery of members of parliament was recently upgraded to felony carrying a sentence of imprisonment of one to ten years. However, this only covers actions while exercising the legislative mandate, excluding any other side-activities where legislators might use their status to unduly influence public administration, for example procurement decisions (Bundesgerichtshof, 2022[152]).

Broadening the definition of corruption to also include trading in influence, in which a person who has a real or apparent influence on the decision-making of a public official exchanges this influence for an undue advantage, would align German law with international best practices and strengthen the fight against corruption (Lobby Control, 2021[153]; OECD, 2020[154]). Data on side activities of legislators has still not been published by the responsible administration of the parliament due to IT issues (von Salzen, 2022[155]). Transparency related to campaign and party financing can also be strengthened, as thresholds for immediate disclosure of individual donations are relatively high and many loopholes related to sponsoring activities and campaign financing exist (Lobby Control, 2021[153]). Maximum thresholds for party donations and campaign financing, which exist in 19 EU countries, are absent (OECD, 2016[156]). Transparency rules need to be strengthened and better enforced by creating an independent body and a centralised and publicly available up-to-date data base on donations, sponsoring and campaign financing activities.

Increasing transparency on lobbying activities to influence the design of laws and regulations is key to level the playing field and reduce the scope for corruption (OECD, 2021[157]). The introduction of the mandatory transparency register for lobbying activities has been an important step forward, but excludes certain lobby organisations and lower-levels of the administration, where many lobbying activities take place to influence draft bills (OECD, 2022[158]). It also does not track the objectives and outcomes of lobbying activities (Lobby Control, 2021[153]). The current government plans to expand the circle of representatives of special interests which have to register in compliance with fundamental rights, include contacts with lower administration levels in the register, and introduce a legislative footprint, which links lobbying activities to their legislative outcomes. This new register has great potential to strengthen transparency and integrity as well as trust in the political process, but implementing and enforcing the planned register will require equipping the responsible administration of the parliament with sufficient staff and IT capacity (Lobby Control, 2021[153]). In addition to the planned legislative footprint, the register should also contain a regulatory footprint that details the stakeholders who were consulted for drafting regulation, the inputs taken on board, and steps taken to ensure inclusiveness in the development of regulations, as this would further strengthen transparency. Moreover, the public integrity framework for public officials should be better adapted to the specific risks of lobbying by establishing more detailed standards and guidelines for interactions with lobbyists and other stakeholders at all levels of government (OECD, 2021[157]).

Corruption can also be related to the revolving door, when politicians start working at firms or other organisations directly after ending their mandate and use their acquired network and insider information for private interests (Luechinger and Moser, 2014[159]; Lüchinger and Moser, 2022[160]). Although regulation on cooling-off periods of political officials has been introduced in 2015, supervision and enforcement are still weak as the three members of the responsible advisory body are selected by the government and sanctions for non-compliance with the regulation do not exist (European Commission, 2022[161]; GRECO, 2019[162]). The maximum cooling-off period of 18 months seems too short, as empirical studies show that economic benefits from the revolving door can last much longer, and has rarely been applied by the responsible government body (Luechinger and Moser, 2020[163]; Lobby Control, 2021[153]). As lobbying activities of former politicians and high-level bureaucrats have played an important role in the Wirecard scandal, the parliamentary inquiry has recommended to explore reform options to make the notification of any activity mandatory after leaving public office (Deutscher Bundestag, 2021[164]; Lobby Control, 2021[153]). Supervision and enforcement need to be strengthened by introducing rules on the composition and work of the advisory body and sanctions for non-compliance with its decisions. Moreover, data on job transitions and applied cooling-off periods could be improved and made publicly available, in particular for state secretaries and directors.

Whistle blower protection in the private sector needs to be strengthened to support the fight against money laundering and corruption (OECD, 2021[165]). Protection is dependent on relevant court decisions, as in the so-called “Diesel scandal”, reducing incentives for whistleblowing. When transposing into national law the EU Directive to protect whistle blowers, reporting on breaches of German law should also be included in the protection.

Table 1.9. Past recommendations and actions taken on tax enforcement, money laundering and corruption

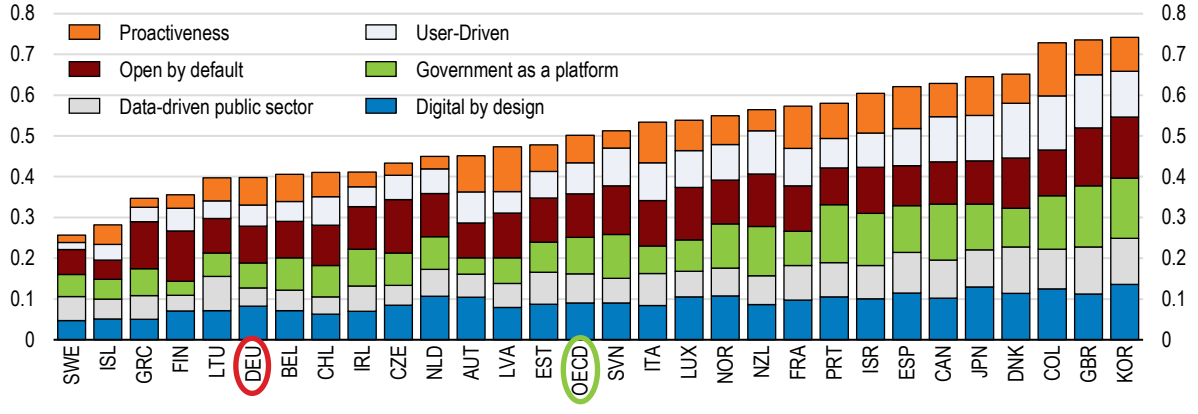
Recommendations	Action taken
Re-design inter-governmental transfers so as to reduce the disincentive effects for states to develop their own tax base.	A reform of some aspects of the fiscal federal equalization system has been introduced in 2020, but incentives to improve tax enforcement are still weak for many Laender.
Re-allocate administration of the collection of taxes which accrue to the federal government or are shared between the different layers of government from the Länder to the federal government.	No action taken.
Strengthen transparency on the role of lobbies in the design of new legislation and regulation, for example by providing more information in the lobbying register.	In January 2022, a Lobbying Register for the Representation of Special Interests vis-à vis the German Bundestag and the Federal Government entered into force.

Modernising the public sector and raising spending efficiency

The modernisation and digitalisation of the public administration is a big challenge, but holds large potential to raise spending efficiency, growth and welfare. According to the OECD Digital Government Index, the public sector is less data driven than in other countries (Figure 1.31). Improving data sharing and IT infrastructure, including access to linked micro data by independent researchers, would facilitate impact evaluation and targeting of policy programmes and raise the quality of public spending (BMWK, 2021[5]). Digitalising public services and the administrative procedures and making them more user-friendly could significantly improve welfare and reduce administrative burden for young and innovative firms, thereby raising business dynamism and productivity (see the previous Economic Survey of Germany) (Figure 1.32). It can also have positive spill-over effects on the adoption of digital technologies in the private sector (Sorbe et al., 2019[166]). Moreover, digitalisation of the public sector can help to address rising skilled labour shortages.

Figure 1.31. Digitalisation of the public administration is low

OECD Digital Government Index, 2019, score 0 to 1



Note: Data are not available for Australia, Hungary, Mexico, Poland, Slovakia, Switzerland, Türkiye and the United States. The OECD Digital Government Index (DGI) is based on the six dimensions of the OECD Digital Government Policy Framework (DGPF): digital by design, data-driven, government as a platform, open by default, user driven and proactiveness. It measures the capacity of the public sector to deliver a coherent and human-centric digital government transformation, as well as the strategic approaches, policy levers, implementation, and monitoring mechanisms in place to deliver the digital government strategy. Thus, it captures much more than just digitising analogue processes (OECD, 2020[167]).

Source: OECD Survey on Digital Government 1.0.

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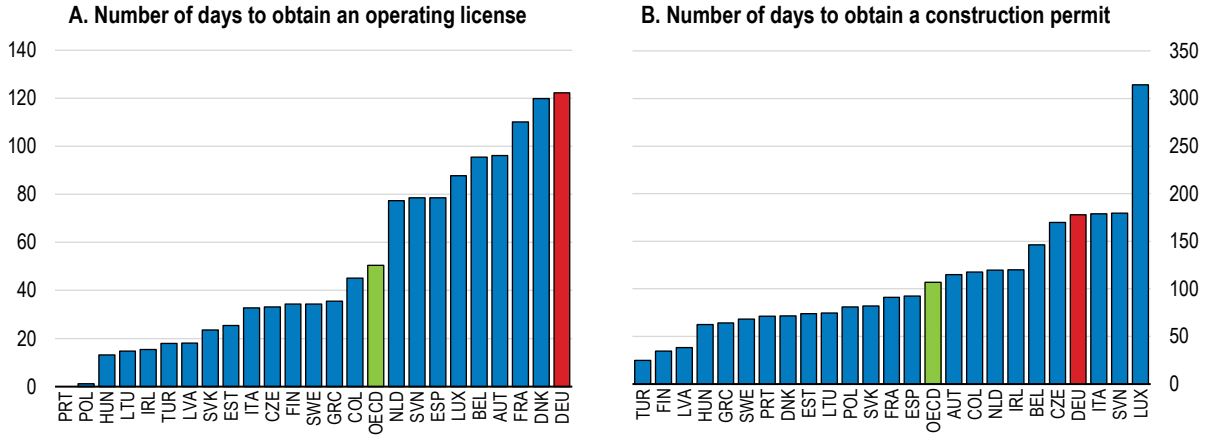
Figure 1.32. The administrative burden is high

Time needed to get operating licences and construction permits (in days), 2021



Source: The World Bank Group, Enterprise Surveys, www.enterprisesurveys.org.

StatLink https://stat.link/xd0oiu

A lack of coordination and cooperation across levels of government complicates the digitalisation of the public administration and reduces spending efficiency (BMWK, 2021[5]). The "Online-Zugangsgesetz" has made online-access to public services mandatory from 2023, but failed to introduce mandatory common standards on design and interlinkages of data and IT tools for all levels of government. Data access and sharing is further complicated by heterogenous interpretations of the EU data protection legislation across Laender administrations and courts. Many municipalities have developed different IT systems for different types of public services, which does not allow to exchange information between databases within nor across municipalities and levels of government, and unique individual identifiers do not exist. This has also strongly reduced spending efficiency, as each municipality signed separate procurement contracts with private providers, who developed similar IT systems for the same public service without using economies of scale across municipalities (BMWK, 2021[5]). Although establishing joint IT development initiatives across municipalities would require a harmonisation of administrative procedures and reduce municipal autonomy to a certain extent, potential spending efficiency gains are large (Nationaler Normenkontrollrat, 2021[4]). Moreover, such initiatives could also lead to significant improvements in the quality of public services due to peer learning effects. The Laender should incentivise such joint initiatives through financial incentives for their municipalities, similar to the federal regulation that funding of IT development is only provided if the solution benefits several Laender and municipalities, and build on the experiences of the municipal think-tank *Kommunale Gemeinschaftsstelle* (KGSt, 2022[168]). At the Laender-level, the one-for-all initiative has been successful in developing common IT solutions, for example the digital portal to apply for COVID-19 support, and in Schleswig-Holstein a group of municipalities has successfully created an IT procurement group and used a dedicated central purchasing body (OECD, 2019[169]). Common IT standards and data formats should be developed and made mandatory for all levels of government, including obliging all IT services providers to develop products for the public administration in conformity with these standards.

Speeding up planning and approval procedures for infrastructure projects is key to raise public and private investments. Public administrations in municipalities, which are responsible for infrastructure planning and approval, have suffered from financial difficulties and spending cuts that caused staff shortages and insufficient investment in ICT equipment since the early 2000s (see the previous OECD Economic Survey of Germany). These capacity constraints and overly complex and heterogenous regulation across municipalities have led to a high administrative burden for infrastructure projects (Figure 1.32). Improving municipal finances through a comprehensive tax reform (as discussed above) should be complemented by better cooperation between municipalities to bundle resources for infrastructure planning (Allain-Dupré,

Hulbert and Vincent, 2017[170]). Improving risk assessment and analysis of market capacity for contracting decisions is key to raise spending efficiency, as exemplified by the OECD Support Tool for Effective Procurement Strategies (STEPS) (Makovšek and Bridge, 2021[52]; OECD, 2021[53]). Implementing STEPS to improve public procurement procedures related to infrastructure projects across all levels of government could yield spending efficiency gains of more than 1% of GDP. Frequent litigation of local interest groups against infrastructure projects and capacity constraints in the judicial system also contribute to long approval times (Budras, 2022[171]). Recent legislation to simplify planning and approval procedures and prioritise energy and train infrastructure over local environmental concerns have the potential to significantly speed up infrastructure projects. However, this should be combined with earlier and better stakeholder involvement in planning procedures complemented with reduced litigation possibilities and the establishment of specialised courts and fast-track procedures.

The federal government has introduced spending reviews in 2015, but their scope and role in budget planning procedures to align spending with policy objectives remains limited due to weak monitoring capabilities (OECD, 2021[172]). Budget allocations are decided with few linkages to policy impact evaluation. This is related to a missing culture of impact evaluation in the public administration, but also to data protection legislation and heterogenous interpretation by Laender courts and data protection agencies that prohibits the use and linkage of micro data across levels of government (Nationaler Normenkontrollrat, 2017[141]; Bachmann, Peichl and Riphahn, 2021[173]). For example, there is no comprehensive real-time household database that would allow better targeting energy price support measures to vulnerable households or evaluate current policies to improve their design. The same is true for firm support measures: so far no impact evaluation of COVID-19 firm support programmes has been conducted due to legal issues related to accessing and linking databases. A subsidy report is published annually by the Ministry of Finance, but it applies a narrow subsidy definition and includes evaluations for only half of the measures, although many subsidies introduce distortions and counteract climate policy objectives (see Chapter 2 for further details) (BMF, 2021[93]; Laaser and Rosenschon, 2020[174]). Moreover, it only covers a narrow set of tax expenditures (Burger and Bretschneider, 2021[175]). Conducting a comprehensive review of existing tax expenditures could help to better prioritise the use of public resources at all levels of government, as tax expenditures tend to be scrutinised less than direct spending which is inspected in yearly budget negotiations (OECD, 2020[176]).

Creating a culture of impact evaluation, establishing the necessary data and IT infrastructure and strengthening the spending review framework in budgeting procedures is key to improve the quality of public spending (Box 1.7) (Tryggvadottir, 2022[177]). This is particularly the case for lower levels of government, where an increasing share of spending is financed by the federal level, weakening accountability and incentives for spending efficiency. If a comprehensive federalism reform to disentangle responsibilities and strengthen the fiscal equivalence principle is not possible, it is key to improve policy impact evaluation to enhance peer learning opportunities across lower levels of government and introduce performance budgeting (Nationaler Normenkontrollrat, 2021[178]). A comprehensive reform of the data sharing infrastructure and corresponding regulation, including the *Rueckspielverbot* that prohibits accessing, linking and analysing administrative data by the authorities, is crucial to facilitate evidence-based policy making, improve public services and raise spending efficiency at all levels of government (Riphahn, 2023[179]). Some progress has been made, however, in register modernisation. The introduction of a uniform nationwide firm identifier from 2024 will facilitate data sharing and reduce the administrative burden, as firms will need to register their core data with the administration only once. Moreover, the development of a register-census will provide reliable regionalised information at higher frequency.

Box 1.7. Institutionalising comprehensive spending reviews – examples from other OECD countries

Spending reviews can take the form of targeted reviews of specific sectors or programmes to improve public services, as currently done in Germany, or comprehensive reviews, which cover a broader share of the budget. In the Netherlands and Finland, comprehensive spending reviews are launched at the onset of each new government. Both types of spending reviews require high quality data and IT infrastructure as well as specific knowledge, which needs to be developed over a longer time horizon and cannot just be activated within an annual budget cycle. Linking administrative microdata from various sources and providing access to researchers could be one way to improve the quality of data needed for the process.

Each year, the Netherlands conducts regular reviews as part of the annual budget cycle. The review topics and terms of reference are prepared by the Ministry of Finance and presented to the Cabinet at the same meeting at which the budget is presented. The budget director in the Ministry of Finance chairs an interdepartmental steering committee that oversees the process while working groups carry out the specific reviews. An independent chairperson leads each working group of independent experts and civil servants from the Ministry of Finance, the prime minister's office, and the line ministries. The team's reports and recommendations have an independent, analytical, and non-political status. The Cabinet decides which recommendations to include in the next budget but does not change the reports before publication. Instead, it communicates a "Cabinet's View", which is included in the report.

Source: (IMF, 2022[180]; Tryggvadottir, 2022[177]).

Some progress has been achieved in the digitalisation of procurement and cooperation across levels of government. A centralised database collects and publishes information on public procurement at all levels of government since 2021, but response rates are low due to weak coverage of e-procurement and a high administrative burden for many municipalities. Mandatory information on tenders, particularly the ones below the EU threshold, is not sufficiently detailed to allow for investigating bidder collusion and spending inefficiencies (BMWK, 2022[181]; OECD, 2019[169]). Many countries, such as the United Kingdom, have established databases of public tenders, improving accountability and facilitating data analysis to detect irregularities and bidder collusion. The introduction of a competition register in 2022 including all firms convicted for corruption or other relevant crimes, which has to be consulted during any public procurement procedure, is an important step forward.

As about 30,000 decentralised procurement bodies are responsible for procurement volumes of around 15% of GDP, scope for raising spending efficiency through e-procurement and more coordination and cooperation across municipalities is large (OECD, 2019[169]). A central e-procurement platform is planned, which would comprise public tenders at all levels of government and significantly lower barriers to bidder participation, particularly for smaller and younger firms, improving competition. Centralised purchasing bodies exist at the federal level and in some Laender, but joint procurement initiatives of municipalities should be further encouraged to reap gains from specialisation and economies of scale, particularly in IT and software procurement (OECD, 2019[169]). However, also at the federal level scope for raising procurement efficiency exists, particularly in defence procurement. Quality of procured equipment has been weak, delivery times long and prices high (Bundesrechnungshof, 2022[182]). Improvements are urgent to ensure the efficient implementation of the EUR 100 billion defence fund.

To modernise and digitalise the public administration and create a culture of impact evaluation, it is crucial to improve skills development and recruitment policies. The public administration suffers from staff shortages and low investment in ICT equipment, which weakens state capacity at all levels of government (Schularick, 2021[9]). As skilled labour shortages are mounting, the public sector needs to improve its recruitment procedures, and invest more in the skills of current staff (Nationaler Normenkontrollrat, 2021[183]). Centralising recruitment procedures, as currently planned at the federal level, would bundle

resources and raise the quality of recruitment, and facilitate mobility across institutions improving peer-learning, coordination and cooperation across different parts of the government. Including higher administration posts in standardised recruitment procedures and opening recruitment to external and international candidates could significantly improve management skills sets and organisational quality, and help making the administration more agile, client-oriented and less risk averse, for example concerning the use of digital tools. Improving performance incentive structures and providing sufficient training opportunities, particularly related to digital, management and language skills, would strengthen skills development of current staff. The federal Digital Academy is an important step forward and should encourage similar efforts at the Laender level. Introducing more flexibility in current pay schedules to offer better conditions for specialised posts with high shortages, such as IT or infrastructure planning and procurement experts, and better defining career paths and job profiles is necessary to compete with the private sector and accelerate the modernisation of the public sector (European Commission, 2020[184]).

Table 1.10. Past recommendations and actions taken on modernisation of the public administration and raising spending efficiency

Recommendations	Action taken
Introduce spending reviews more broadly at the federal and Länder levels and use them to reallocate funding across broad spending fields	Since 2015, targeted spending reviews have been used while preparing the annual German federal budget. However, the scope of spending reviews remains limited, particularly in the Laender, which according to the Constitution are independent in managing their budgets.
Bolster local planning capacity through inter-municipal cooperation, training and expanding staffing in key technical roles	A planned pact between the national government and federal states for accelerating infrastructure project planning, approval, and implementation is still pending. At the federal level, in-house consulting capacities have been strengthened through the 100% publicly owned consultancy company (PD Advisors to the Public Sector GmbH), which also provides services for Laender and municipalities.
Accelerate progress towards digital government and a data-driven public sector, focusing on high-impact services, collaboration across levels of government and open government data, and systematically collect and use data from e-procurement processes.	The objective of ensuring online access to all public services mandated by the Online Access Law remained to be met as of January 2023.
Assign an independent advisory body with responsibility for preparing a long-term strategic infrastructure plan.	No action taken.
Streamline planning processes and improve public procurement through better data collection and compilation.	Planning procedures for infrastructure projects related to renewable energy and the electricity grid have been simplified in 2022. Based on a recent cabinet decision, the scope of these simplified planning procedures will be expanded to also include selected priority projects in rail and road infrastructure. A centralised database collects and publishes information on public procurement at all levels of government since 2021, but response rates are low due to weak coverage of e-procurement and a high administrative burden for many municipalities.

Raising labour supply to reduce fiscal pressures on the pension system

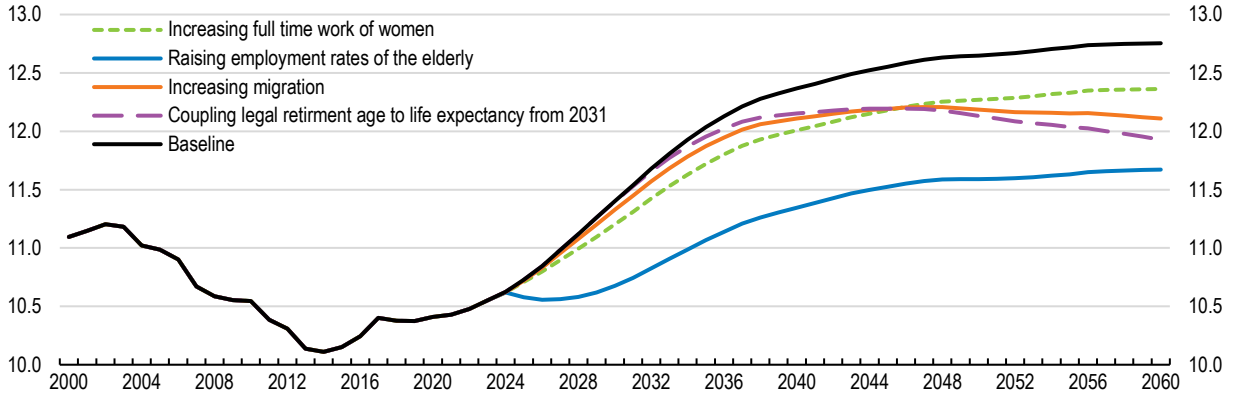
Without further policy changes, rapid population ageing will increase yearly public spending on pension benefits by around 2 percentage points of GDP until 2040 (Figure 1.2). Recent reform efforts are not sufficient to stabilise the pension system. After raising the retirement age to 67 in 2007, the introduction of generous early retirement options, for example the *Rente mit 45 Beitragsjahren* which allows individuals with at least 45 working years to retire without loss of pension entitlements, reduced incentives to work longer. In 2018, a minimum threshold for the replacement rate (48%) and a maximum threshold for the contribution rate (20%) were fixed until 2025. The government plans to make the threshold for the replacement rate permanent. Keeping this promise would raise spending pressures substantially and reduce fiscal space for public investment and other key expenditures (BMWI, 2021[185]) (Bundesbank, 2022[186]). Better balancing burden sharing between contributors and recipients of pension benefits,

including across generations, is needed. However, as the risk of old age poverty is relatively high compared to other countries such as Denmark or the Netherlands, this could comprise a guaranteed minimum pension or an increase in the existing basic income support for old age (BMWI, 2021[185]; OECD, 2021[187]).

Creating the conditions for older workers to work longer is key to stabilise the pension system. Germany made remarkable progress in fostering employment among older workers. Employment rates of persons between 60 and 64 years grew continuously from 20% in 2000 to 61% in 2021. However, while the average retirement age strongly increased during the 2000s, it has not changed much since 2012 (BMAS, 2022[188]). The average effective age of labour market exit is 63 for men and women, which is still about one year below the OECD average for men, while for women the difference is only about 0.2 years (OECD, 2021[187]). The extensive use of early retirement options keeps the effective retirement age significantly below the legal retirement age of currently 66, which will increase to 67 in 2031 (see below). Simulations using the OECD Long Term Model show that further raising employment rates of the elderly would be most effective in stabilising the pension system and reducing fiscal pressures, when compared to other scenarios such as raising immigration, raising the labour force participation of women or coupling the legal retirement age to life expectancy from 2031 onwards (Figure 1.33). Supporting longer working lives should be combined with enabling women to work more. This requires further expanding access to early-childhood education and childcare, including by facilitating and enhancing the quality of childcare services in small groups and all-day care, and reforming joint income taxation for couples (see above and the previous OECD Economic Survey of Germany). Facilitating skilled migration would support potential growth and help to stabilise the pension system, as it increases the number of contributors (see above). Linking the legal retirement age to life expectancy from 2031 is a necessary step to stabilise the pension system in the longer term. In the medium-term, efforts should focus on raising the effective retirement age.

Figure 1.33. Raising the effective retirement age is crucial to stabilise pension spending

Public spending on pensions (% of GDP)



Note: The graphs show the effects of different scenarios for public spending on pensions in Germany using the methodology of (Guillemette and Turner, 2021[3]). The scenario "Increasing full time work of women" assumes that the share of women working part time is reduced to the one in Denmark until 2035. The scenario "Raising employment rates of the elderly" assumes that the effective retirement age increases by 0.6 years until 2029 relative to the baseline (and by 1.6 years until 2045). The scenario "Increasing migration" uses the population projections from Destatis which assume high net migration inflows over the projection horizon (300 000 per year from 2030 onwards), whereas the baseline assumes the Destatis baseline of 206 000 migrants per year).
Source: OECD Long Term Model.

StatLink https://stat.link/qh1wgs

Reducing fiscal disincentives to work longer is key to extend working lives. Since 2014, individuals with at least 45 working years can retire without loss of pension entitlements. For individuals with at least 35 working years, pension benefit reductions for early retirement are much smaller than in other OECD countries, explaining the relatively high share of workers that retire early and accept pension benefit reductions (OECD, 2021[187]). Moreover, since 2017 partial pensions and wage earnings can be combined more flexibly without loss of pension entitlements before reaching the statutory retirement age (*Flexi-*

Rente). This provides incentives to raise labour supply for individuals who have retired early but might at the same time encourage early retirement. The *Flexi-Rente* also provides incentives to continue working beyond the statutory retirement age by introducing the option to raise pension benefits by working longer. Redesigning early retirement options and evaluating the incentive structures of the *Flexi-Rente* and eventually adapting them is needed to raise incentives to work longer. The abolishment of the maximum threshold for wage earnings that are not deducted from pension entitlements received before the statutory retirement age should be carefully evaluated, as this might further increase incentives to retire earlier.

To promote longer working lives, it is also crucial to improve adult learning. Due to increasing labour shortages firms have greater incentives to retain older employees. While only 26% of companies wanted to keep their workers who were eligible for pensions in 2015, the share increased to 58% in 2018. However, more than half of workers, who were retained after reaching the statutory pension age, switched to part-time employment, mostly in *Mini-Jobs* that are exempted from social security contributions (Westermeier and Wolf, 2020[189]). Fostering regular employment of older workers requires continuous updating of skills, particularly digital skills. Elderly workers with higher basic digital skills have better employment chances, higher wages and are less likely to be replaced by technology (Falck, Lindlacher and Wiederhold, 2022[190]). However, older workers are much less likely to participate in adult learning, which is mainly related to ageist attitudes of employers, time constraints at work and limited or inadequate training opportunities, but also to lower basic skills and motivation of older workers (OECD, 2021[191]; OECD, 2019[192]; van Dalen and Henkens, 2019[193]). A promising step to tackle the participation gap was taken by the Skills Development Opportunities and Work of Tomorrow Acts, which cover training costs of workers older than 45 years for SMEs. However, continuing vocational education and training (CVET) programmes need to be better targeted and adapted to older workers, for example by providing greater support when using digital learning devices, and combined with targeted career advice and guidance services (KOFA, 2022[194]; OECD, 2019[192]).

Working conditions will have to adapt to promote longer working lives. Increasing the retirement age of women from 60 to 63 has increased psychological diseases, obesity and arthrosis among women affected by the reform, as many employers have not adapted working conditions (Barschkett, Geyer and Haan, 2022[195]). Improving preventative health services at the workplace is key to enable longer working lives. To adjust working conditions to the needs and capacities of older employees, firms should offer more flexible working hours, more part-time work, more vacation and extend home office arrangements (KOFA, 2022[194]). Promoting longer working lives is also key for the public sector. In 2018, only 20% of public employers planned to retain their workers eligible for retirement, which is significantly below the average in the private sector (Westermeier and Wolf, 2020[189]).

Plans to strengthen the funded elements of the pension system are welcome but should be scaled up. Existing funded individual pensions (*Riester Rente*) are decentralised and mostly take the form of insurance-based products, restricting investment opportunities and resulting in high commissions and low expected returns, which explains their limited uptake (BMF, 2022[196]). The government plans to introduce a standardised investment product with an opt-out option, which could lower costs and raise returns and participation in funded individual pension schemes. A debt-financed fund of EUR 10 billion will be introduced, which will transfer its investment returns to the public pension system in the 2030s. While this could help to reduce fiscal pressures from the public pension system, the success of this measure critically depends on the interest rate differential between government bonds and equity returns. In an environment of heightened uncertainty, monetary tightening and rising debt levels, the room to exploit the interest rate differential might be severely restricted. Allowing the new public fund as well as individual pension plans to invest part of their assets in VC funds for start-ups could improve returns and support innovation and business dynamism.

Table 1.11. Past recommendations and actions taken on pensions

Recommendations	Action taken
Index the legal pension age to life expectancy.	No action taken.
Make enrolment in public old-age pension mandatory for the self-employed who are not covered by old-age pension insurance.	The coalition treaty foresees the introduction of an obligation to provide for old-age pension for newly self-employed. These workers shall be covered by the public pension system if they do not opt out for private pension insurance. The draft bill is still pending.
Raise the pension premium for starting to draw old-age pensions later in life and do not reduce pensions for old-age pensioners who work.	The threshold of wage earnings that are not deducted from pension benefits has been abolished from January 2023 onwards.
Reduce operating costs of subsidised, individual pension plans by improving comparability among providers.	No action taken.
Remove barriers to the portability of civil servant pensions.	No action taken.
Strengthen supervision of direct pension commitments of employers. Make contributions to the risk-pooling scheme dependent on risk indicators.	No action taken.

KPI findings and recommendations (key recommendations in bold)

Main findings	Recommendations
Updating fiscal policy and addressing risks in financial markets	
Core inflation and wages are rising. Fiscal policy will add to inflationary pressures if energy prices and corresponding subsidies remain high.	**Avoid an expansionary fiscal stance to contain inflationary pressures, while standing ready to support vulnerable households.**
The design of energy support measures and the short-term work scheme risk to hinder factor reallocation to thriving sectors and firms and exacerbate skilled labour shortages.	Accelerate the development of data and IT infrastructure to better target support to vulnerable households and to firms. Redesign the short-term work scheme to improve incentives for training and job-search.
A rising number of extra-budgetary funds at the federal and the Laender level reduce transparency and weaken the credibility of the national debt brake. Investment needs are high.	**Gradually include extra-budgetary funds in the core budget, while introducing more flexibility in the fiscal rules to allow for adequate investment spending.**
An increasing share of spending at lower levels of government is financed by the federal level with limited accountability and incentives for spending efficiency.	**Foster a culture of impact evaluation by developing the necessary data sharing infrastructure, strengthening spending reviews in budgeting procedures and encouraging peer learning across levels of government.**
Overheated housing markets, rising interest rates and falling real incomes have increased risks related to household debt. Persistently high energy prices might raise risks related to corporate debt of energy intensive firms.	Maintain recently tightened macroprudential measures to safeguard financial stability and continue to improve data on lending standards and borrower's risk profiles.
Corporate and household savings are high and often invested abroad. Many young and innovative firms have difficulties to access growth financing.	Allow public and private pension funds and other retirement saving plans to invest a larger share of their assets in VC funds.
Reforming the tax system	
Joint income taxation rules for couples in combination with the Mini-Job regulation lead to steep labour tax schedules for second-earners, reducing labour supply incentives, particularly for women.	**Raise labour supply incentives for second and low-wage earners by reforming the joint taxation rules for couples, while reducing the income threshold at which social security contributions progressively increase**
High inflation increases real effective income tax rates, particularly for low- and middle-income earners, and lowers labour supply incentives.	**Lower personal income taxes by raising tax-free allowances and decreasing tax rates.**
Generous exemptions to gift and inheritance taxes reduce effective tax rates, in particular for wealthier households. Wealth inequality is high.	**Reduce allowance thresholds for gift and inheritance taxes and exemptions for business assets, while extending instalments for tax payments.**
Generous tax expenditures for income from selling or renting real estate distort capital allocation, contribute to rising housing prices and increase inequality. VAT exemptions are costly and regressive.	**Improve tax collection and reduce distortions by abolishing tax expenditures for income from selling or renting real estate and VAT exemptions.**
Revenue from taxes on immovable property, accruing to municipalities, is low, although house and land prices have strongly risen. Financial difficulties of many municipalities and the high fluctuation of their revenues complicates much needed infrastructure investments.	Use the ongoing update of property values to better link property taxation to asset values and raise revenue.
Improving tax enforcement	
Estimations of tax gaps by tax type serve to hold the government accountable and better target tax enforcement efforts. In Germany, this information does not exist due to data protection and IT issues, while a platform on empirical tax research is being established	Establish the necessary data sharing and IT infrastructure and create an independent fiscal institute to collect and publish information on tax gaps, including at the Laender level, and to analyse the effects of planned tax reforms.
Tax collection and enforcement is under the responsibility of the Laender, including for taxes shared between Laender and the federal level, which creates incentives to underinvest in tax enforcement.	**Set binding guidelines on tax enforcement capacities and performance for the Laender, using Laender-specific tax gap estimates, and regularly publish guidelines and performance outcomes.**
Around 9% of VAT revenues may be lost due to fraud and tax evasion. Use of cash is still wide-spread, facilitating money laundering and VAT evasion.	Introduce the obligation to use electronic cash registers and automatic e-invoicing for all firms, including an electronic clearing procedure for border crossings, and set a maximum threshold for cash payments.
Cooperation and coordination across tax administrations and prosecution authorities of the Laender is weak due to weak data and IT infrastructure and tax secrecy rules.	Allow for linking tax registers of different tax types and combining them with other data sources, including by establishing a single electronic firm identifier.
Fighting money laundering and corruption	
The transparency register for beneficial ownership is incomplete due to weak enforcement and verification of information. This hinders investigations and sanction enforcement and facilitates tax evasion, particularly related to income from real estate.	Accelerate the digitalisation and inter-linkage of municipality-specific commercial, real estate and firm registers and allow linking them with other data including on bank accounts and financial assets.

Capacity constraints and weak cooperation and data exchange between law and tax enforcement authorities of the Laender complicate the fight against money laundering and tax crimes.	**Implement plans to establish a Federal Financial Police and improve cooperation and data analysis across levels of government as well as the enforcement of reporting requirements.**
Transparency related to campaign and party financing is weak, as thresholds for immediate disclosure of individual donations are high and many loopholes related to sponsoring activities and campaign financing exist. Maximum thresholds for party donations and campaign financing do not exist.	Create an independent body and a centralised and publicly available up-to-date data base on donation, sponsoring and campaign financing activities.
The new transparency register for lobbying activities excludes certain lobby organisations and lower-levels of the administration, where many lobbying activities take place to influence draft bills.	**Provide sufficient staff and IT resources to implement and enforce the new lobby register, increase its coverage, including contacts with lower administration levels, and introduce a legislative and regulatory footprint.**
Raising spending efficiency and digitalising the public administration	
Mandatory common standards on design and interlinkage of data and IT tools are missing across levels of government, hindering the digitalisation of public services.	**Set mandatory common IT standards and encourage the harmonization of administrative procedures and joint software development across levels of government.**
Legal provisions prevent accessing, linking and analysing administrative micro datasets, which hinders better targeting and impact evaluation of policy programmes.	Allow for accessing, linking and analysing administrative datasets across levels of government, while ensuring adequate data protection and confidentiality standards.
Public procurement is highly decentralized at lower levels of government, with high potential gains from economies of scale and specialisation, particularly concerning the digitalisation of public services. Competition in tenders is restricted due to information asymmetries.	Implement plans for a centralised and transparent e-procurement platform for tenders from all levels of government and encourage joint procurement initiatives of municipalities through financial incentives.
Digitalisation of the public sector requires updating the skill sets of public employees. Skilled labour shortages are mounting.	Improve standardised recruitment procedures (including higher administration posts) and performance incentive structures and provide sufficient training opportunities, particularly related to digital, management and language skills.
Improve labour supply and reduce fiscal pressures on the pension system	
The effective age of labour market exit is is still significantly below the legal retirement age. Strong incentives for early retirement exist and many older workers have difficulties updating their skills.	**Reduce incentives for early retirement, while cooperating with employers to improve adult learning opportunities and working conditions for older workers.**
Educational outcomes for children from disadvantaged background are weak. Access to childcare and early-childhood education is limited due to informal and decentralised application procedures which act as a barrier for disadvantaged households.	**Further expand access to early-childhood education by centralising application procedures within municipalities.** **Raise the quality of basic education by using performance evaluations to better target support to children with weaker learning outcomes.**
A rising number of VET positions remains unfilled, despite many applicants who do not find a suitable offer.	Improve the VET transition system through better coordination across levels of government, providing systematic information and guidance services and strengthening on-the-job training.
Complex and lengthy administrative procedures for work permits and a lack of digitalisation that slows down the process of visa issuance cause uncertainty and high costs for migrants and potential employers.	Accelerate the digitalisation of administrative processes for migrants, notably with respect to visa issuance, and improve the coordination of the different processes in centralised migration offices at the Laender level.

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2 Reaching net zero while safeguarding competitiveness and social cohesion

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Robert Grundke

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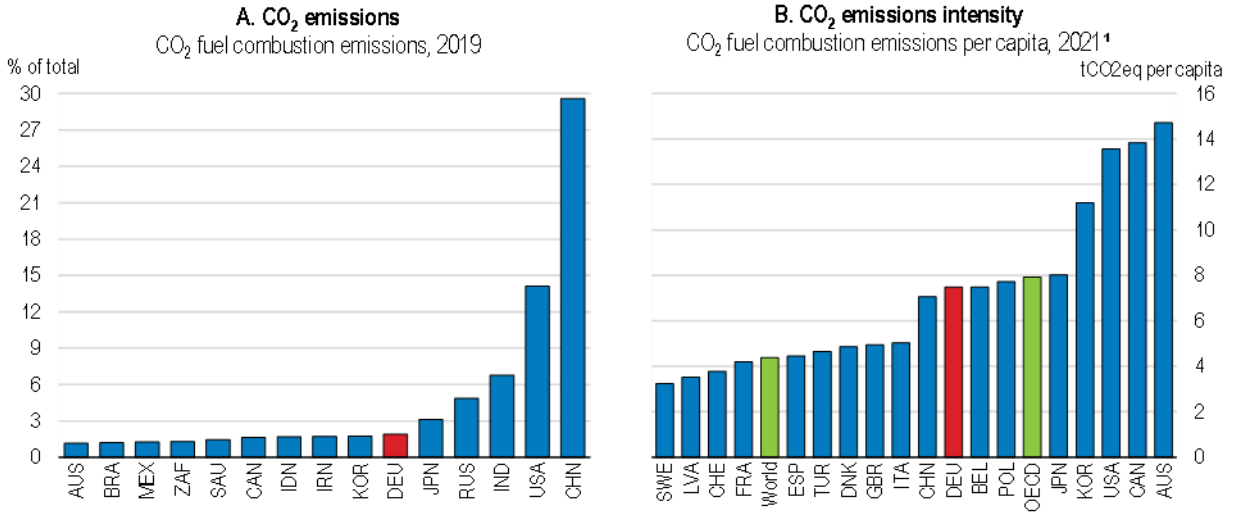
Germany intends to reach climate neutrality in 2045, tripling the speed of emission reductions that was achieved between 1990 and 2019. Soaring energy prices and the need to replace Russian energy imports have amplified the urgency to act. Various policy adjustments are needed to ensure implementation and achieve the transition to net zero cost-effectively. Lengthy planning and approval procedures risk slowing the expansion of renewables, while fossil fuel subsidies and generous tax exemptions limit the effectiveness of environmental policies. Germany should continue to rely on carbon pricing as a keystone of its mitigation strategy and aim to harmonise prices across sectors and make them more predictable. Carbon prices will be more effective if complemented by well-designed sectoral regulations and subsidies, especially for boosting green R&D, expanding sustainable transport and electricity network infrastructure, and decarbonising the housing sector. Subsidies for mature technologies and specific industries should be gradually phased out. Using carbon tax revenue to compensate low-income households and improve the quality of active labour market policies would help to support growth and ensure that the transition does not weaken social cohesion.

Introduction

Germany is still a large emitter of greenhouse gases (GHG) (Figure 2.1), but it is also at the forefront of efforts to reduce emissions. Germany released 39% less GHG emissions in 2021 than in 1990. It intends to reach climate neutrality in 2045, which requires tripling the speed of emission reductions, and lowering the usage of fossil fuels in electricity generation to zero in 12 years by strongly expanding renewable energy supply. This is a massive challenge with considerable economic and social costs. Still, it also holds large potential to create new economic opportunities and improve people's lives, as well as to help to avoid the much higher economic costs of missing global climate change mitigation targets. Russia's war of aggression against Ukraine has revealed vulnerabilities due to an over-reliance on energy imports from Russia and emphasised the possible contribution of renewables to raise energy security. Furthermore, renovating the existing housing stock would improve housing quality and lower energy bills, while shifting to net zero transport would bring greener and less polluted cities. As a country with high technological capacity, Germany can benefit by developing new technologies and providing key competences for the development of new value chains, such as the one for green hydrogen.

Figure 2.1. Germany is still a large emitter of greenhouse gases



1. 2019 for China and World.
Note: Panel A shows countries with the highest share of global emissions.
Source: IEA Greenhouse gas emissions from energy database.

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This chapter identifies a mix of policies, which would help to achieve the transition to net-zero cost-effectively while ensuring that the costs of the transition are shared in a fair way. As the global climate is a public good, the chapter emphasises the important role of international cooperation in addressing carbon leakage and other externalities to achieve substantial progress towards a net-zero global economy. The analyses and recommendations are informed by two new OECD studies on the economic and distributional consequences of different mitigation policy options for Germany (Bickmann et al., forthcoming[1]) as well as on labour market transitions of workers displaced from high carbon-intensity sectors during the last three decades (Barreto, Grundke and Krill, forthcoming[2]). The remainder of the chapter is structured as follows: after describing the high costs of climate change for Germany, the chapter discusses recent progress towards the national climate targets. It then highlights the policy instruments needed to reach a net-zero economy cost-effectively, including by addressing carbon leakage and other challenges to manufacturing. The following section analyses the distributional consequences of more ambitious mitigation policies and discusses ways to reduce adjustment costs for workers and households and build strong public support for the green transition. The last section discusses targeted policies for three main emitting sectors: electricity, transport, and housing. A discussion of the agricultural sector, land use, land

use change and forestry (LULUCF) as well as an in-depth chapter on climate change adaptation and nature-based solutions can be found in the OECD Environmental Performance Review of Germany (OECD, forthcoming[3]).

Climate change already has high costs for Germany

Germany is increasingly affected by the consequences of climate change. Since 1951, the number of days with temperatures above 30°C has almost tripled and since 1881, when measurements began, winter precipitation has increased by 27%. The average annual temperature is already 1.6 degrees higher than in 1881 (German Environment Agency, 2021[4]). This has strong effects on the economy and human lives. According to the European Environmental Agency, economic losses due to extreme climate-related events since 1980 accumulated to about 3% of 2020 GDP, with higher losses per capita than in most EU countries (2022[5]). In a recent study conducted for the German Federal Government, the estimated economic loss was almost three times as high (Prognos, IOW and GWS, 2022[6]). Floods and heavy rains caused most of the damage to properties and infrastructure, while heatwaves caused 99% of fatalities, estimated at 1,400 a year (Box 2.1). Existing studies likely underestimate the actual costs of climate change, as indirect effects on biodiversity and health are hard to quantify using available data.

Box 2.1. The 2021 flood disaster as an extreme example of climate risks

The floods that hit Germany in 2021 swept away many buildings and caused severe damage to infrastructure. More than 180 people were killed, and over 800 were injured. The overall damages are estimated at EUR 40 billion, the single most costly event in post-war history of Germany. Climate change increases the likelihood of such an event by a factor of 1.2 to 9, implying that the damage of the floods that could be attributed to climate change ranges from EUR 7.1 to 35.9 billion (Prognos, 2022[7]).

The floods highlighted weaknesses in the German insurance coverage for natural hazards as well as in the warning and response systems and communication channels (OECD, forthcoming[3]). About 30% of the affected residents did not receive any warning. Of those who were warned, 85% did not expect a very severe flooding and 46% did not know what to do (Thieken et al., 2022[8]). In addition, most of the buildings that were hit were not insured against flood damage, which led the government to establish a special fund (of EUR 30 billion) to partially compensate for the losses (Osberghaus, 2021[9]).

With climate change, occurrences of extreme events such as heatwaves, drought and heavy rainfall will rise sharply, and so will the related economic costs (German Environment Agency, 2021[4]). In 2022, a severe drought led to historically low water levels in the Rhine, which disrupted ship transport from Rotterdam to the economic centres in the Southwest of Germany. This further exacerbated supply chain bottlenecks, hindering the post-pandemic rebound of industrial production (see Chapter 1). Climate extremes would occur most frequently in the south, southwest and east of Germany (Figure 2.2) and would have a great impact on agriculture, water management and biodiversity. Loss of yields, forest fire risks and a reduction in fish species and water quality are all among the potential risks, even if better adaptation policies could reduce some of the damages (German Environment Agency, 2021[4]) (Box 2.2).

Box 2.2. Strengthening resilience for a changing climate

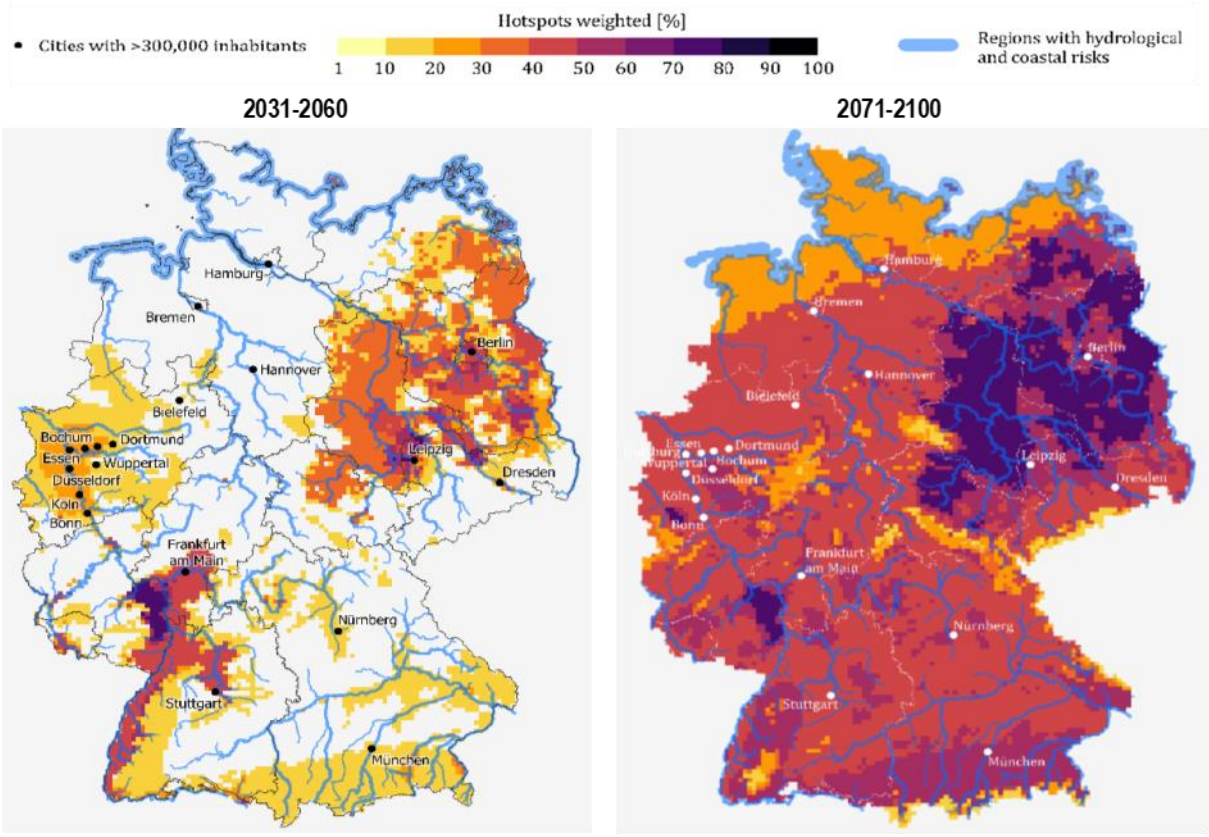
Germany's adaptation efforts have focused on developing regular, robust climate risk assessments. Its results have informed a whole-of-government approach to building climate resilience based on the overarching national adaptation strategy established in 2008. The federal government's role in building climate resilience is focused on technical guidance, facilitation and co-ordination. At the same time, investment and the implementation of adaptation measures are under the responsibility of sectoral agencies and Laender governments. Implementation progress has been sluggish and heterogenous across sectors and regions, with many localities remaining highly exposed and vulnerable to climate change. To improve climate resilience, information should be shared more efficiently with those expected to act, namely local and regional policymakers, infrastructure investors, businesses and property owners. Additionally, incentives to scale up preventive adaptation action need to be strengthened, and measures to support the availability and take-up of insurance against natural hazards should be examined (Box 2.1).

The government sets out an ambitious vision for strengthening its climate adaptation engagement in the 2022 Immediate Programme for Climate Adaptation. It aims to develop a Federal Climate Change Adaptation Act, complementing the Federal Climate Change Act. It shall give the federal government the mandate for developing a new adaptation strategy, revising the nationwide funding mechanism for adaptation, and developing measurable targets to increase accountability for adaptation actions carried out by different actors. The act provides an opportunity to clearly determine roles and responsibilities at different governance levels, and to rethink how adaptation resources can be mobilised in favour of preventative action.

Source: OECD (2023), Environmental Performance Reviews: Germany 2023, OECD Publishing, Paris, forthcoming.

Climate change will affect Germany even more through its economic consequences in other parts of the world. Climate risks are higher for low and medium-income economies that have difficulties to cope with the consequences of climate change due to weaker infrastructure and institutional quality and higher reliance on sectors that are adversely affected by climate change (German Council of Economic Experts, 2021[10]). As a result, climate change will significantly affect trade with and migration flows from these countries.

Figure 2.2.Climate extremes would occur most frequently in the southwest and east of Germany



Note: Maps of extreme values show regions that could be affected by a particularly large number of climatic extremes.
Source: (German Environment Agency, 2021[4])

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Germany has reduced its emissions and set ambitious mitigation targets

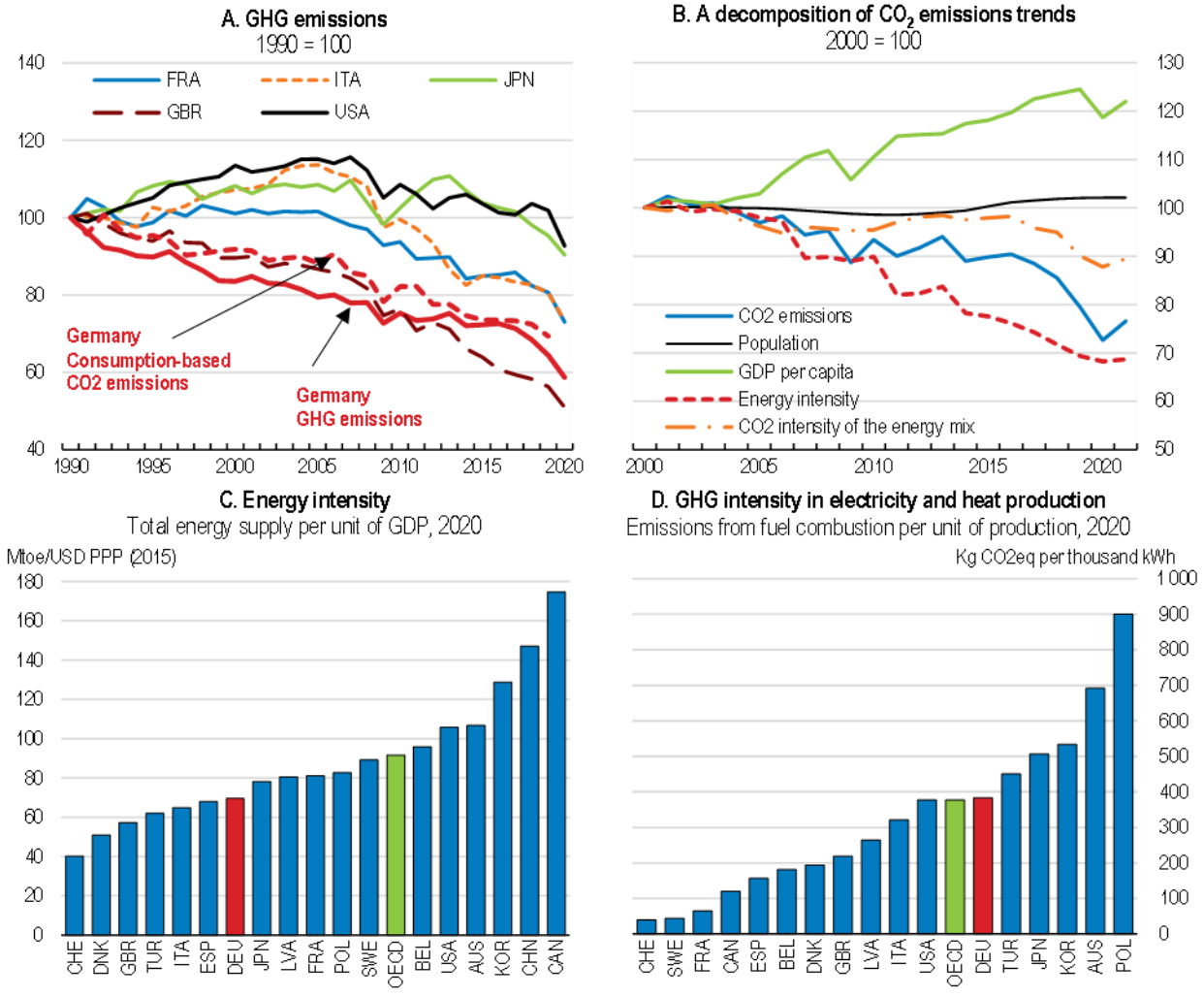
Germany is at the forefront to reduce greenhouse gas emissions

Germany has made considerable progress in reducing greenhouse gas emissions (Figure 2.3, Panel A). Yet, it remains one of the largest emitters of GHG per capita among OECD countries, mainly due to the high share of industry in GDP and fossil fuels, including coal, in the production of power and heat. It has reduced production-based emissions by 36% from 1990 to 2019, among the largest reductions in the OECD and G20 countries, while at the same time GDP increased by 54%. This was achieved without increasing the displacement of emissions to other countries, as the trend after including emissions embodied in imports is similar. Some of the improvement was due to particular circumstances after reunification and not due to policy measures, efficiency gains or structural change (Schleich et al., 2001[11]). From 1989 to 1994, emissions in East Germany fell by almost half, mainly due to a reduction in lignite-based power generation.

So far, the decoupling of emissions from economic activity has been reached mainly by reducing energy use per unit of GDP (Panel B), which is now below most OECD countries (Panel C). Progress in reducing emissions per unit of energy produced has been slower, and the use of fossil fuels in the production of power and heat is still high (Panel D). Nevertheless, progress has accelerated in recent years due to remarkable growth in renewable energy supply and a decline in coal use (Figure 2.4). Germany's share of electricity generation from solar and wind is amongst the highest in G20 countries.

The COVID-19 pandemic and its associated restrictions reduced emissions by 9% in 2020, so that Germany reached its 2020 emissions reduction target. However, little of this reduction is set to be permanent, with over half of the emission reduction due to the temporary drop in economic activity (Council of Experts on Climate Issues, 2021[12]). Already in 2021 (when COVID-19 restrictions continued), emissions increased by about 4.5%. Some changes to working and consumption patterns might persist, but their effects on emissions are uncertain and likely to be limited. For example, if 15% of employees work full time from home, direct effects on emissions due to reduced car commuting are expected to amount to 4.5 million tons of CO_2, about 3% of emissions in the transport sector (Bachelet, Kalkuhl and Koch, 2021[13]). However, over the longer term, working from home can incentivise to move away from expensive inner cities and commute greater distances or slow down the shift to more efficient cars for those who will commute less (Marz, 2022[14]).

Figure 2.3. Germany is at the forefront of efforts to reduce GHG emissions



Note for panel A: CO_2 emissions from fuel combustion. GDP per capita refers to GDP USD PPP at 2015 prices divided per population, energy intensity refers to total energy supply per unit of GDP (USD PPP at 2015 prices), and CO_2 intensity of the energy mix refers to CO_2 emissions per unit of total energy supply.

Source: IEA Greenhouse gas emissions from energy database; Our World in Data based on the Global Carbon Project; OECD (2022), Green Growth Indicators, OECD Environment Statistics (database); IEA (2021), IEA World Energy Statistics and Balances (database)

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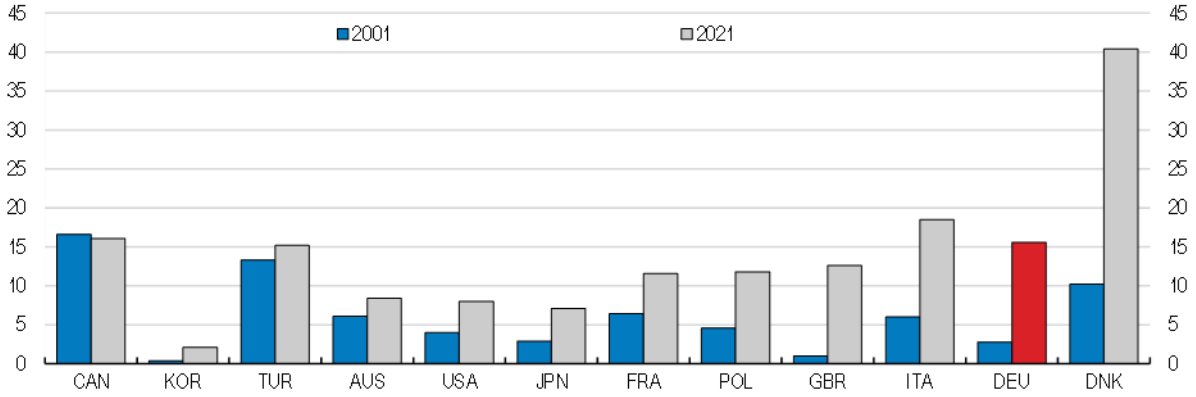
Figure 2.4. The share of renewables has been increasing rapidly

Share of primary energy from renewable sources, %



Note: Renewable energy sources include hydropower, solar, wind, geothermal, wave, and tidal. Countries ordered by the change (in percentage points) in the share of renewables since 2001.
Source: IEA World Energy Balances database.

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The strong reduction of GHG emissions is a result of sustained political will, substantial changes to the regulatory framework, targeted support, and a history of cooperation with neighbouring countries. Above all, establishing a feed-in tariff scheme in the 1990s encouraged the creation of a protected niche market for renewables, without prioritising a specific technology. The scheme spurred a significant development and deployment of renewable technologies and helped to reduce abatement costs in Germany and other countries. It is a good example of a successful innovation policy, which was adjusted after the market matured (Box 2.3). The ecological tax reform of 1999 and the introduction of the EU emissions trading system (EU ETS) in 2005 have also strongly contributed to breaking the link between GHG emissions and economic growth.

The OECD Environmental Policy Stringency index illustrates the rise of climate mitigation efforts in Germany in the last two decades (Figure 2.5). Like in the average OECD country, non-market-based policy instruments such as performance standards contributed most to this increase. However, in recent years the technology support sub-index shows a significant rise as well. For example, the sub-measure of support for wind energy has increased significantly since 2018. The EU ETS contributed to the increase in the stringency of market-based policies since 2006, and the introduction of the national emissions trading mechanism in 2021 is another important step in that direction. Nonetheless, the scope for market-based policies, including higher and more unified carbon pricing, remains significant (see below).

Box 2.3. The corner stones of the German Energy Transition Strategy

Germany is a pioneer in producing and deploying renewables. Already in 1991, it instituted one of the world's first feed-in tariff schemes to encourage renewables, allowing the related administration to develop technical competence and relevant knowledge. In 2000, the German government decided to gradually phase out nuclear power over 30 years and to expand the feed-in tariff scheme for a wide range of renewable energies that were not yet competitive (the Renewable Energy Sources Act, or EEG). The tariffs incentivised investment by covering the difference between the cost of production and the electricity market price. This was financed by the renewable energy surcharge on electricity consumption.

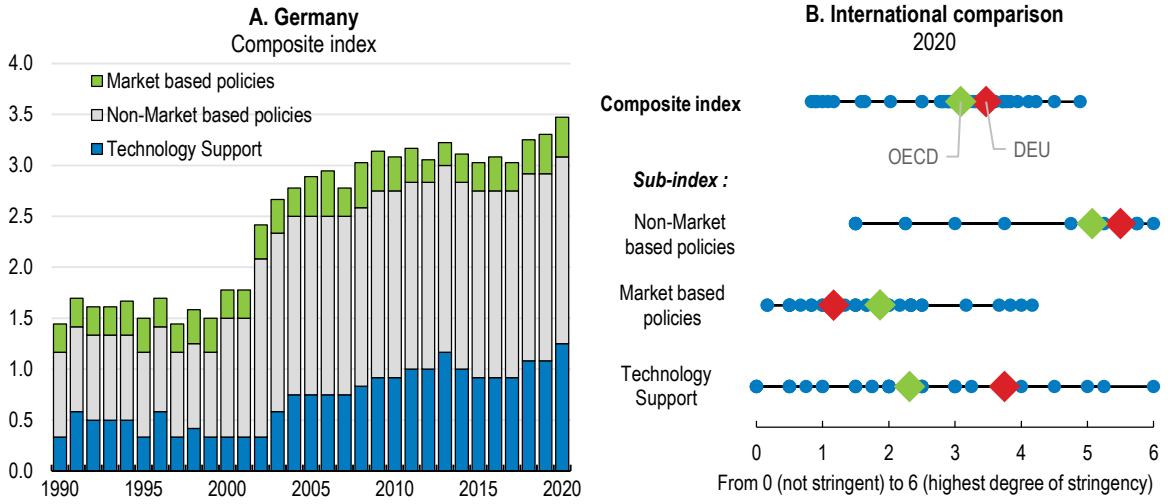
The tariff spurred significant deployment of solar technology, bringing down its cost. However, in 2008 the drop in solar photovoltaic prices, while tariffs adapted only slowly, led to soaring subsidy costs. In response, Germany reformed the scheme and moved to rely on auctions in setting the target price. This brought down the subsidies to less than five cents per kWh in 2017, while keeping renewables competitive (relative to coal). Overall, solar and wind capacities soared from about 9 gigawatts to 118 gigawatts between 2000 and 2015. During this time, Germany accounted for about a third of total renewable installations within the European Union. In addition, new industries were created, and German companies became global champions in the production of renewables by developing cutting-edge technologies. At its peak in 2011, more than 150 000 individuals worked in the solar energy sector. Since then, German distributors have turned to China for scaling up supply at a reduced cost, relying on technology standards and certification that provide reliability.

The cost reductions enabled Germany to increase the ambition of its renewable energy targets. Already in 2010, the government set targets for renewable energy expansion, energy efficiency, CO_2 reduction, and low-carbon transportation. The nuclear fleet was maintained as a "bridge technology", but following the accident in Fukushima the nuclear exit was advanced to the end of 2022. Moreover, during the late 1990s', Germany liberalised and decentralised its domestic energy market. The Federal Network Agency was established in 1998 as part of this process. Its task is to regulate the electricity and gas markets while ensuring fair competition and overseeing the transmission networks.

Sources: (Journalism for the energy transition, 2015[15]), (Pflugmann et al., 2019[16]), (Nemet, 2019[17]), (Pahle et al., 2018[18]).

Figure 2.5. Environmental policies have become increasingly stringent

The OECD Environmental Policy Stringency Index, from 0 (not stringent) to 6 (highest degree of stringency)



Notes: The Environmental Policy Stringency Index includes climate change and air pollution policies, such as performance standards for NOx, SOx, and PM. OECD is an unweighted average of countries with available data.
Source: Kruse, T., et al. (2022), "Measuring environmental policy stringency in OECD countries: An update of the OECD composite EPS indicator", OECD Economics Department Working Papers, No. 1703, OECD Publishing, Paris, https://doi.org/10.1787/90ab82e8-en.

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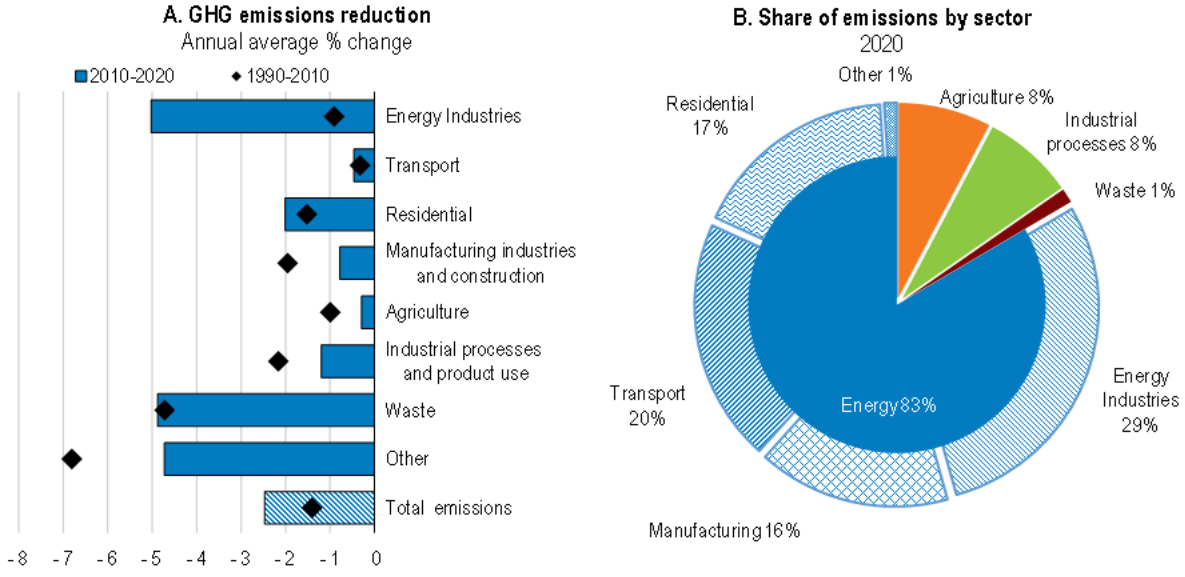
Despite progress in lowering overall emissions, Germany struggled to meet its 2020 sectoral emission reduction targets. So far, electricity production has been the largest source of emission reductions, with a rapid shift in electricity generation away from coal towards renewable energy. The share of renewables in electricity generation increased from 17% in 2010 to 41%% in 2021. However, progress is slower in other sectors (Figure 2.6). Emissions in international aviation, for example, rose sharply since 2005, and in 2021, emissions in the transport and buildings sectors were above the annual targets specified in the Federal Climate Change Act. The uneven progress largely reflects differences in matured green technologies and abatement costs between sectors, with higher costs in the building and transport sectors (Council of Economic Experts, 2019[19]). Nonetheless, too many people use motorised vehicles for most of their trips due to urban sprawl and the allocation of public space and investment in favour of private cars. Low coverage of effective policy instruments such as carbon pricing also plays a major role in explaining the variation in mitigation progress between sectors.

Progress is also uneven across households. The average emissions per capita in the highest decile of the household income distribution is 5.8 times larger than in the bottom 50% of the distribution. Even though a large share of emission reductions has come from higher-income households, their reduction has been smaller in relative terms. Emissions in the upper decile declined by 42% from 1990 to 2019, whereas the average decline was 57% for individuals in the bottom half of the income distribution (Chancel, 2021[20]).

Figure 2.6. The progress in emission reduction is uneven across sectors

GHG emissions (excluding land use, land-use change and forestry)



Source: OECD Environment Statistics.

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Germany has set ambitious emission reduction targets

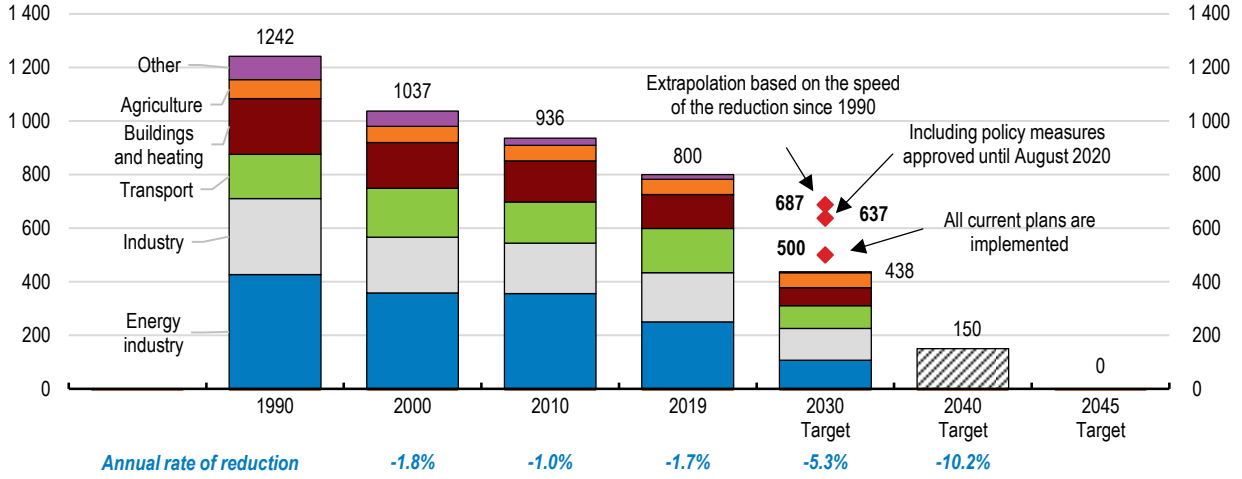
Germany has raised the ambition of its climate targets, building on a strong consensus across the population on the importance of fighting climate change and in a reaction to a Supreme Court decision in April 2021, which declared the Climate Change Act as partly unconstitutional because it shifted the burden to future generations. In June 2021, the German Bundestag passed an amendment of the Federal Climate Change Act, aiming to reach climate neutrality (net-zero) by 2045, five years earlier than previously planned. In addition, GHG emissions shall be reduced by 65% in 2030 compared to 1990 levels (excluding Land Use, Land-Use Change and Forestry) and by 88% in 2040. This would require tripling the speed of progress since 1990. The Act also stipulates permissible annual emission volumes for each sector. After 2050, negative greenhouse gas emissions are to be achieved. The EU Fit for 55 proposal and the national targets are broadly aligned in terms of emission reduction (see below).

Until recently the announced policy measures were insufficient to triple the speed of emission reduction and reach these ambitious targets (Figure 2.7) (Umweltbundesamt, 2022[21]). However, the Federal Government introduced two ambitious policy packages: the “Easter Package” in April 2022 and the “Summer Package” in July 2022, focusing on expanding renewables capacity. The legally binding goal is to double the share of renewables in total electricity supply, to reach 80% by 2030 (Table 2.1). Planning and approval procedures for infrastructure investments were facilitated by a law that declares the expansion of renewable energy production as an objective of national interest and prioritises it over nature protection objectives as well as other social and environmental concerns. Likewise, the law obligates Germany’s large states to dedicate between 1.8% to 2.2% of their lands (depending on their wind conditions) to onshore wind power by 2032. Moreover, the policy packages introduced measures to accelerate the expansion of the electricity grid and boost incentives for switching to renewables for heating (e.g., from gas heating to heat pumps). Likewise, the renewable energy surcharge, which is a levy on electricity consumption to finance renewables subsidies, was abolished to lower electricity prices and incentivise switching to electric driving and heating systems. The new government also aims to phase out coal “ideally by 2030”, ahead of the previously agreed timelines. It is the first industrialised economy aiming to phase out both nuclear and coal. According to the Climate Action Tracker, if all measures planned in

the coalition treaty were implemented in legislation, Germany would get close to its domestic emissions target by 2030, with emissions cut by 57% to 63% below the 1990 level (Climate Action Tracker, 2022[22]). Nonetheless, achieving carbon neutrality in 2045 will require full implementation of these measures and many additional policy adjustments to reach the target cost-effectively.

Figure 2.7. Emission reductions need to accelerate

Greenhouse gas emissions (excluding LULUCF), tonnes of CO_2 equivalent, millions



Note: The Climate Protection Act also states that the footprint of the LULUCF must be improved to at least -25m tonnes of CO_2 eq. by 2030, at least -35 million tonnes of CO_2 eq. by 2040, and at least -40 million tonnes of CO_2 eq. by 2045.
Source: OECD Environment Statistics; Umweltbundesamt, Climate Action Tracker.

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Table 2.1. Main emission reduction policies by sector

Sector	Main instruments in place
Electricity generation	EU ETS; phase-out of coal generation, ideally by 2030 and no later than 2038; 2% of Germany's territory is to be dedicated to onshore wind energy; roofs of new commercial buildings are to be used for solar energy; policies to expand electricity grids; improving grid connections with neighboring countries.
Manufacturing, Industrial processes and product use	EU ETS (large emitters); subsidised loans by KfW; Funding green hydrogen plants and pilot programmes; minimum quotas of climate-neutral products in public procurement.
Transport	Expanding the rail network and better connecting the train with airport hubs; excise duty on transport fuels; National Emissions Trading System in the heating and transport sectors; limiting new registrations of cars and vans to carbon-neutral vehicles from 2035 onwards (EU regulation); purchase premium for carbon-neutral cars until the end of 2025; technology development support to manufacturers; public investment in public charging points and support for the installation of private charging points; distance-based toll charges for trucks of more than 7.5 tonnes.
Heat and buildings	National Emissions Trading System in the heating and transport sectors; building standards for energy efficiency; various funding schemes to support energy efficiency and heat pumps, including on-site energy consultation with experts; every newly installed heating system is to be run on at least 65% renewable energy from 2024; banning the installation of oil-fired heating systems from 2026.
Agriculture	Agri-environmental payment schemes (voluntary programmes paying farmers to achieve environmental criteria); expansion of organic farming; aid programmes to protect forests and encourage carbon sink.

Source: Author's compilation based on various sources.

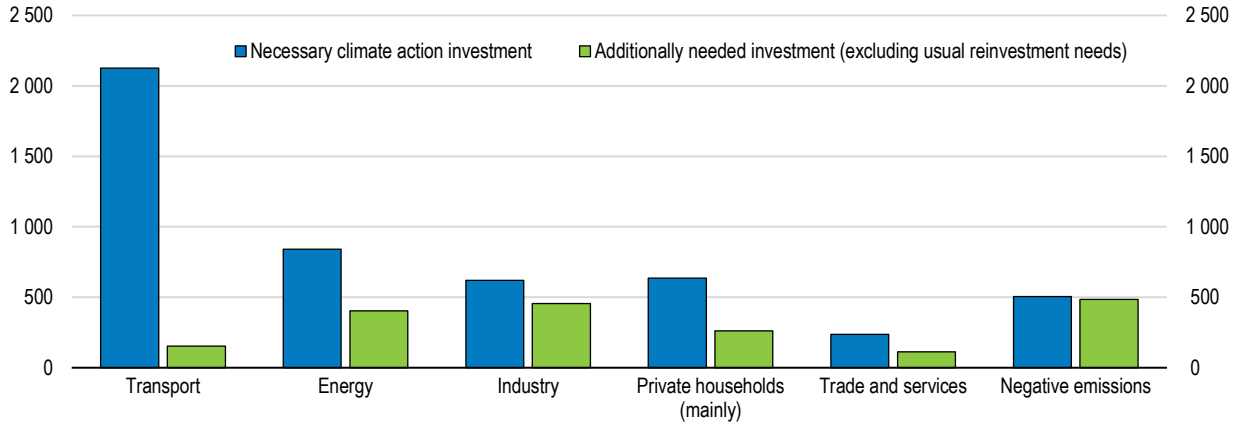
The energy crisis due to Russia's invasion of Ukraine has helped to build the necessary consensus to accelerate the transition towards renewables, which could also raise energy security. Soaring fossil fuel prices created strong incentives to shift to renewables and have facilitated consensus on new measures across levels of government. Nonetheless, some measures to raise energy security could turn out to be counterproductive for climate policy. For example, a sequence of gas supply deals, such as the agreed 15-year gas supply partnership with Qatar (supply is expected to start in 2026), and further expansion of LNG import infrastructure risk to lock in fossil fuels-based technologies, even though the government required the new infrastructure to be compatible with hydrogen fuels. Moreover, Germany has allowed the

restarting of coal-fired power plants, which were initially scheduled to close in 2022 and 2023, as long as the gas emergency plan's second "warning phase" remains in place (Chapter 1). According to the Federal Network Agency, if renewables are expanded as planned and the European electricity market continues to function well, Germany will not experience an electricity shortage from 2025 to 2031. This holds true even if electricity consumption rises due to the electrification of transport and heating, the nuclear power plants are shut down, and coal is phased out by 2030 (Bundesnetzagentur, 2023[23]). Energy security will be at lower costs if the expansion of renewables supply is combined with available measures to shift electricity use across time and reduce peak demand times on the grid (see the section on modernising the transmission network below). Ensuring that infrastructure investments in renewables progress fast is crucial to achieve both energy security and the ambitious mitigation targets.

Achieving carbon neutrality will require massive investment in technologies and infrastructure by both the private and the public sectors. According to KfW (the German state-owned investment and development bank), the total volume of necessary investments is estimated at EUR 5 trillion, including about EUR 0.5 trillion in emission removal technologies that could compensate for sectors, such as agriculture, that are more difficult to decarbonise. If this sum is spread out evenly until 2045, EUR 191 billion or 5.2% of Germany's 2021 GDP would need to be invested each year. This high amount includes investments that would be undertaken anyway but must be adjusted to include low-carbon technologies. The additional necessary climate action investment averages EUR 72 billion per year until 2045, about 2% of 2021 GDP. Other estimates range from EUR 52 to 97 billion (Brand, Römer and Schwarz, 2021[24]). Investment as a share of GDP was 20.3% on average in 2011-20, down from 22.5% in 2001-10. The increase in investment by 2 percentage points of GDP to above 22% of GDP seems feasible. A significant part of the additional investment is needed in industry and energy sectors to modernise the electricity grid or develop and scale up green technologies (Figure 2.8). The public investment share is projected at around 500 billion, 10% out of the total needed investment (Brand and Römer, 2022[25]).

Figure 2.8. Massive investment is needed to meet Germany's ambitious climate targets

Total investment needed to achieve the target of net-zero climate neutrality until 2045, EUR billion



Source: Prognos / Nextra / NKI (2021).

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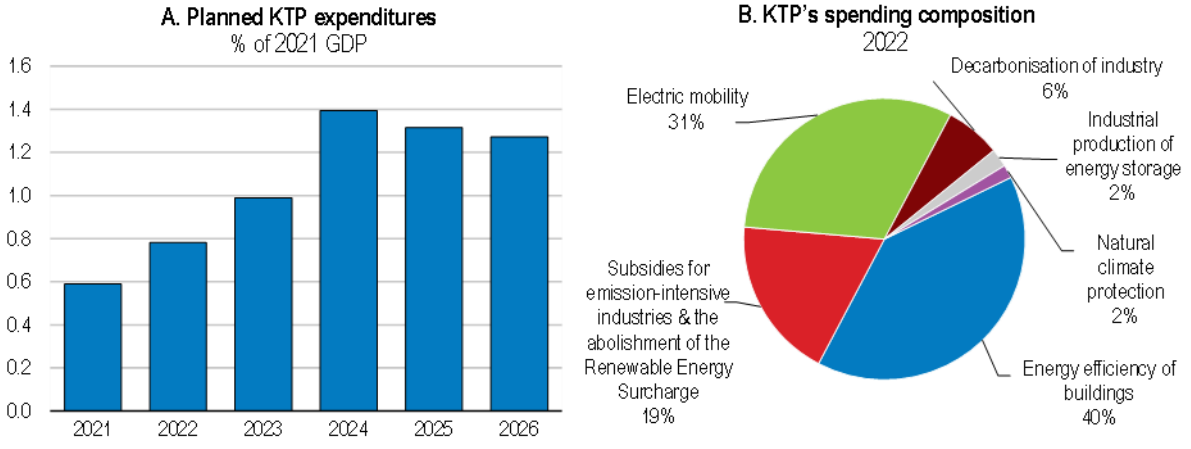
Substantial public support to increase investment is planned in the next few years. The federal government has adopted several comprehensive climate programmes before and during the COVID-19 crisis, totalling over EUR 80 billion (BMF, 2022[26]). For example, about 40% of the German Recovery and Resilience Plan (EUR 11.5 billion) was dedicated to climate policies and the energy transition. These programmes include a mix of direct investments and subsidies for firms and households that would mainly be financed by the Climate and Transformation Fund (KTP). This Fund receives revenues from three sources: the EU ETS, the national emission trading system, and direct transfers from the federal budget (expected to account for about 50% of total revenues in 2021-26). In 2020-22, the Fund received an additional EUR 100 billion in

credit allowances from the federal budget, as the national debt brake was suspended for three years due to the COVID-19 crisis and unused funds for pandemic related support programmes were redirected to the EKF to counter the pandemic-related reluctance to invest (Chapter 1). The Fund is expected to spend EUR 180 billion from 2022 to 2026, mainly for supporting the green transition in transport, building and industry sectors and abolishing the Renewable Energy Surcharge (Figure 2.9). Boosting public investment is timely as financing costs are still low, although skilled labour shortages in the construction and planning sector as well as material shortages will likely limit the speed of implementation of investment projects and increase their prices (Figure 2.10). Further promoting the transition between secondary education and VET positions in high demand, expanding VET and adult education opportunities for low-skilled and unemployed workers, and facilitating the migration of skilled workers from non-European countries, as envisioned under the *Fachkraeftestrategie*, are essential to ease labour shortages (see Chapter 1). Facilitating the ability of EU construction companies and material producers to operate in Germany by removing trade barriers, such as the additional testing requirement for construction products, and fostering digitalisation of the construction sector would increase market competition, lower prices and help boost investment (European Commission, 2018[27]).

Figure 2.9. Government support for green investment will expand substantially



Source: Ministry of Finance.

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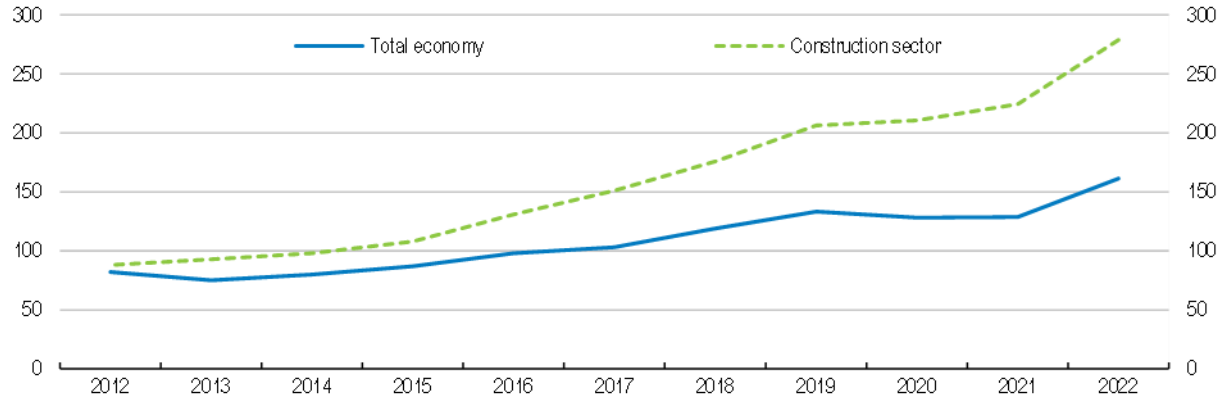
Figure 2.10. Labour shortages in the construction sector are mounting

Completed vacancy time, number of days



Note: The numbers refer to the values in November of each year.
Source: Federal Employment Agency.

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Germany has strengthened its institutional framework for climate mitigation policies

Two independent, interdisciplinary bodies advise the Federal Government on climate policies and contribute to evidence-based policy making. From 2022 onwards, the Council of Experts on Climate Issues will regularly present its assessment of climate policies to the Bundestag and the Federal Government. If the Council finds in its annual examinations that a sector has missed its emission targets, the relevant federal ministry must present an action programme within three months to ensure the sector will comply with its annual emission budget in the subsequent years. The Science Platform on Climate Policy, a body of scientific experts, supports the German Federal Government in evaluating climate protection measures and conduct policy analysis, including on the economic consequences of the mitigation efforts.

To better evaluate the efficiency of public spending, impact assessment studies should be an integral part of all existing and new policy programmes and plans, which requires better data collection and analysis (Chapter 1). Better data collection is also required to assess emissions from land use, land-use change, and forestry (LULUCF) in a timely way and define a sensible target, which is in line with other sectoral targets (Council of Experts on Climate Issues, 2021[12]). Furthermore, it is key to regularly monitor trade-related emissions. So far, the trend in total emission reduction after including emissions embodied in imports is broadly in line with the trend according to the production-based definition (Our World in Data, 2022[28]). Nevertheless, this could change, especially if carbon prices in Germany rise to levels required to reach ambitious emission reduction targets but remain low in other countries (see below).

Key policy instruments for a net-zero economy

Keep relying on pricing mechanisms to reduce emissions

The cost of cutting emissions differs between emission sources, abatement measures and over time. Setting a price on emissions helps to find the most cost-efficient solution. It encourages firms, households and the government to realise all opportunities to reduce emissions which cost less than the marginal emission price and allow activities where abatement costs are higher than the marginal emission price (de Serres, Murtin and Nicoletti, 2010[29]) (D'Arcangelo et al., 2022[30]; Pisany-Ferry, 2021[31]). Due to high uncertainty and information asymmetry about the heterogeneity of abatement costs across the economy, more directive approaches, such as regulations and standards, raise total abatement costs compared to emission pricing by missing opportunities for low-cost emission reductions. Nonetheless, these policy tools are still needed in specific cases to overcome market failures and coordination problems (see below). Emission pricing is also technology-neutral and a transparent policy that simplifies the decisions for the government and reduces the scope for lobbying influences, as the only information required is the measurement of emissions. Pricing mechanisms have been shown to substantially alter behaviour for GHG emissions (Andersson, 2019[32]) (Dechezleprêtre, Nachtigall and Venmans, 2018[33]). For example, the United Kingdom has substantially reduced emissions by adopting a carbon price floor on top of the EU-ETS price in 2013. This led the coal share in electricity production to fall from 40% to 5% by 2018, and to a shift to less-emission intensive gas power plants (Blanchard and Tirole, 2021[34]).

Emission pricing is well recognised in Germany as an efficient way to achieve the green transition (Ministry For Economic Affairs and Climate Action, 2022[35]). Germany participates in the EU ETS, a cap-and-trade system that sets a carbon price for obligated participants, namely power generators, large emission-intensive industrial facilities, and airlines for flights within the European Union. The cap declines over time, ensuring that the desired emission mitigation target in the EU ETS sectors is achieved cumulatively. Due to the high share of industry in GDP and the high coal share in electricity generation, around half of German emissions are covered by the scheme, compared with only 40% on average in the European Union. The permit price has increased substantially since 2019 and stood at around EUR 85 per tonne in 2022. Moreover, in 2021 Germany implemented a national trading system for emissions in the non-ETS sectors (i.e., buildings and transport), with a fixed price of EUR 30 per tonne in 2023 that will rise to EUR 45 in

2025. From 2026, allowances will be auctioned within a price corridor of EUR 55 to EUR 65. The price corridor beyond 2026 will be decided in 2024 after an evaluation of the first phase of the system and depending on policy developments at the EU level (Box 2.4). In 2022, revenues from carbon pricing stood at 0.3% of GDP (EUR 13.2 billion).

Meeting Germany's ambitious objective of reducing emissions by 65% in 2030 (compared to 1990 levels) will require higher carbon prices. Simulations conducted for this Survey show that raising carbon prices to reach the EU Fit for 55 targets for ETS and non-ETS sectors would reduce emissions in Germany by 67% in 2030, indicating that Germany's national targets and the Fit for 55 targets are aligned (Box 2.4, Box 2.5, Table 2.2). This requires a doubling of the ETS carbon price compared to a benchmark scenario, which is based on 2021 policies. In the benchmark scenario, the European Union and Germany reduce their emissions by 44% and 53% in 2030, respectively.

The carbon price in sectors covered by the Effort-Sharing-Regulation (ESR), which are not covered by the ETS, would need to increase to about USD 323 (EUR 273) in 2030 in Germany, which is much higher than in other EU countries. This is because Germany has pledged higher emission reductions in the ESR sectors than other EU countries and faces higher marginal abatement costs. Abatement costs are higher because GHG intensity in the ESR sectors (especially in transport) is lower, implying fewer emission savings potential compared to other EU countries (Box 2.4) (Bickmann et al., forthcoming[1]).

Box 2.4. The EU "Fit for 55" package

Fit for 55 is a set of policy proposals to reduce net greenhouse gas emissions by 55% in 2030 (compared to 1990 levels). The package aims to reduce emissions in the EU ETS by 62% compared to 2005 levels (a decrease of 19 percentage points compared to the current target), to include the maritime shipping sectors in the ETS, increase the share of renewables in electricity supply to 40% and create a new, separate emissions trading system for the buildings and road transport sector from 2027 (although in case the energy prices are "exceptionally high", it will be delayed to 2028).

The Commission also proposes to gradually remove free emission allowances from the EU ETS, which are currently allocated to non-power producers, and simultaneously introduce a carbon border adjustment mechanism (CBAM) to address the risk of carbon leakage. Currently, these free allowances are allocated based on an efficiency benchmark equal to the average emissions of the best-performing 10% of the installations producing the same product. Installations that meet the benchmarks and are, therefore, among the most efficient in the European Union receive the allowances they need to cover their emissions for free. According to the proposal, installations that will benefit from free allocations will need to comply with several additional requirements, including in the form of energy audits. The CBAM will initially apply to imports of certain goods and selected inputs whose production is carbon intensive and at most significant risk of carbon leakage: cement, iron and steel, aluminium, fertilisers, electricity and hydrogen. In these sectors, the free allowances will be phased out from 2026 until 2034.

Country-specific emission reduction targets in sectors that are not covered by the ETS are established for the year 2030 in the context of the EU's Effort Sharing Regulation (ESR). The target for Germany is a 50% reduction in 2030 compared to 2005 levels, which is higher than for other countries. For example, France is supposed to reduce ESR emissions by 47.5%, Italy by 43.7% and Poland by 17.7% in 2030. The carbon price in the new EU trading system for the buildings and road transport sectors is expected to be restricted in the first years. If the price of allowances exceeds EUR 45, additional allowances will be released, increasing the supply on the market. In addition, a new Social Climate Fund will help vulnerable households, micro-enterprises, and transport users cope with higher carbon prices. The fund would be part of the EU budget and be financed by assigned revenues of up to EUR 65 billion.

Source: European Commission.

Table 2.2. Economic effects of implementing the EU Fit for 55 targets for 2030

Main EU Fit for 55 scenario

	Germany	Rest of European Union
Total CO_2 emissions reduction vs 1990	-67%	-46%
CO_2 emissions reduction in the ETS sectors, compared to benchmark	-36%	-17%
CO_2 emissions reduction in the ESR sectors, compared to benchmark	-27%	-10%
Change in welfare (real consumption), compared to benchmark	-0.86%	-0.29%
Change in GDP, compared to benchmark	-1.22%	-0.34%
Renewables share in electricity generation (change in p.p compared to benchmark)	77% (+15)	60% (+3)
Coal share in electricity generation (change in p.p compared to benchmark)	5% (-15)	5% (-2)
Change in total electricity supply, compared to benchmark	-7.8%	-2.1%
Change in electricity generation, compared to benchmark	-9.9%	-2.4%
Change in electricity imports, compared to benchmark	+22.9%	+1.9%
Change in electricity price, compared to benchmark	+4.7%	+2.8%

Note: Simulations are conducted using a Computable General Equilibrium Model (CGE) (Box 2.5). The table shows results from a scenario implementing the EU Fit for 55 targets, which means that the EU as a whole reduces emissions by 55% in 2030. Results are shown relative to a benchmark scenario, which assumes based on 2021 policies that the EU and Germany reduce their emissions by 44% and 53% in 2030, respectively. Non-EU countries are assumed to reduce emissions as in the benchmark scenario. The results of the CGE simulations should not be interpreted as projections but can be used to analyse reallocation and distributional effects across regions, sectors and households. The welfare measure does not account for the beneficial environmental aspects of emission reduction.
Source: (Bickmann et al., forthcoming[1]).

Box 2.5. The economic and distributional consequences of reaching the EU Fit for 55 target – a Computable General Equilibrium analysis

This Survey applies a multi-sector, multi-region Computable General Equilibrium (CGE) model to analyse the economic and distributional effects of different policy scenarios of carbon emission abatement for Germany (Bickmann et al., forthcoming[1]). The model uses a standard top-down structure for representing production, consumption, and trade and includes a discrete representation of alternative power generation technologies. CO_2 emissions enter the model in two ways: First, they arise from the energy sector, where they are linked in fixed proportions to the use of fossil fuels, with CO_2 coefficients differentiated by the specific carbon content of different fuels. Second, the model also accounts for process-based CO_2 emissions. Constraints on the amount of emissions in each region are implemented through a cap-and-trade system and endogenous carbon price adjustments. Emission reductions take place by fuel switching, energy savings or output reductions.

The model relies on data from the global macroeconomic balances published by the EU Joint Research Centre (JRC) (Vandyck et al., 2021[36]). They include detailed macroeconomic accounts and information on physical energy flows and carbon emissions for 49 regions and 31 sectors in five-year intervals until 2070, which rely on nationally determined contributions (NDCs) to emission reductions. These data are used to establish a benchmark scenario for the year 2030, which is based on 2021 policies and against which all other model scenarios are compared. For the European Union, the benchmark presumes a GHG emission reduction of 44% below 1990 levels by 2030. Germany reduces its GHG emissions by 53% in the benchmark. In addition, the JRC data set assumes that the United States and other OECD countries reduce their emissions by 27% and 18% compared to 2005, whereas China increases emissions by 108% compared to 2005.

All simulations depart from the benchmark scenario and implement the EU Fit for 55 targets: A reduction of ETS emissions by 61% compared to 2005 levels and national emission reductions in ESR sectors, which in the case of Germany correspond to a 50% reduction compared to 2005. Overall, these targets lead to an EU-wide emission reduction of 55% in 2030 (compared to 1990 levels). Importantly, the model does not quantify the total effects of emission abatement from today's perspective, but rather the

impact of implementing these stricter climate targets for 2030 compared to the benchmark scenario. Relative to the benchmark scenario, the EU Fit for 55 targets correspond to an EU-wide ETS emission reduction of 22%. In the ESR sectors, Germany needs to reduce emissions by 27% compared to the benchmark, whereas the remaining European countries need to reduce emissions by 10%.

The **main EU Fit for 55 scenario** keeps the ETS and ESR cap-and-trade systems in the EU separated and allows for trade in emission rights across countries in the ETS, but not the ESR. Revenues from the ETS carbon price in non-power producing sectors are fully recycled back as output-based subsidies/rebates. These subsidies/rebates are a simplified representation of the free allowance allocation in the EU ETS, as they are exogenous from the perspective of the firm and keep marginal emission reduction incentives in place. The remaining revenues from power producers and the carbon tax on ESR (non-ETS) sectors are collected by the government, which recycles them to households as (net) transfers after ensuring that government spending remains constant in real terms. Non-EU regions do not reduce emissions compared to the benchmark. The remaining scenario analysis focuses on different policy options by changing assumptions compared to the main EU Fit for 55 scenario:

1.) Reforming the EU cap and trade system by including the ESR sectors in the ETS. One scenario with full integration and one scenario with only partial integration, i.e., all economic sectors are included in the ETS, but households remain outside of the scheme.

2.) Addressing carbon leakage and protecting the competitiveness of domestic industries. One scenario expands the output-based subsidies (at the expense of recycled revenues to households) to include automotive and machinery and equipment sectors, which are not part of the ETS and therefore do not receive full rebates from emission pricing in the main EU Fit for 55 scenario. In a second scenario, carbon tariffs equal to the carbon price difference between the import partner and the European Union are applied to the direct carbon content of imports. At the same time, output-based subsidies are set to zero.

3.) Multilateral abatement efforts. This scenario assumes that the United States and China reduce emissions according to their new NDCs. The United States pledged to cut emissions by 52% relative to 2005, whereas China committed to limit the increase in emission to 69% compared to 2005. Other OECD countries reduce emissions by the same proportion as the United States.

4.) Additional regulations for the German electricity market. One scenario models a complete coal exit in Germany by 2030. The second scenario introduces a subsidy scheme for renewable energy, which transfers all CO_2 pricing revenues that are not rebated to non-power producers in the ETS sectors to the renewable energy sector.

To analyse the distributional effects of mitigation across different types of households, the model links the CGE results to micro-simulations using detailed German survey data on household incomes and consumption expenditures and econometric estimates of behavioural parameters of the demand system. Using sectoral gross value-added shares at Laender level, the CGE simulation results are further disaggregated regionally.

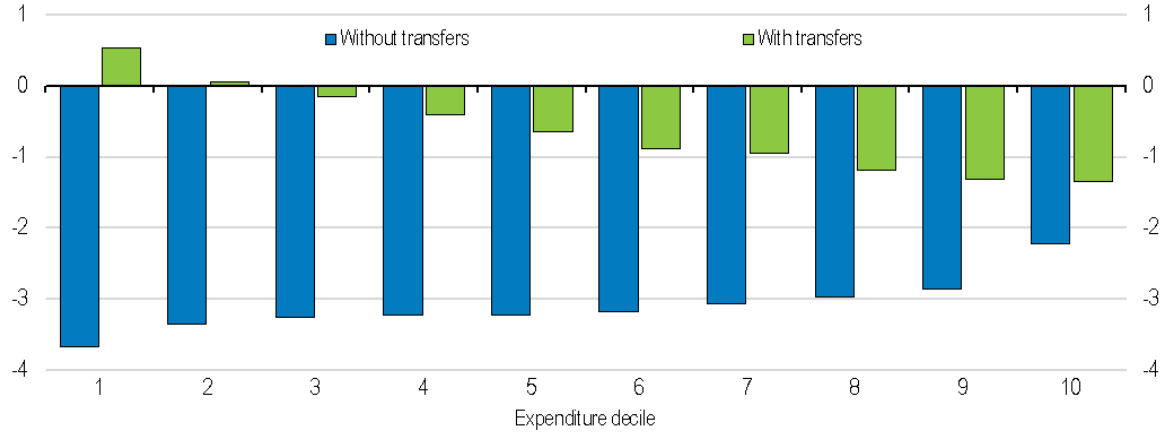
The Computable General Equilibrium model shows that reaching the EU Fit for 55 targets by increasing carbon prices would lead to a loss in GDP and welfare (measured as real purchasing power) by 2030 as production costs rise (Table 2.2). Still, these transition costs will help to avoid the much higher economic costs of missing global climate change mitigation targets, which are not considered in the simulations. GDP and welfare are expected to decline more in Germany than in other EU countries, due to higher carbon prices in ESR sectors, but also to higher emission reductions in the ETS sectors in Germany. With rising ETS prices, coal-based electricity generation becomes less profitable due to its high emission intensity. As Germany uses much more coal for electricity generation than the EU average, it will reduce emissions in the ETS sectors more strongly than other EU countries. The sharp drop in coal-based

electricity generation leads to a substantial increase in renewables supply, and its share in electricity production almost reaches the 2030 renewables target of 80% of electricity supply without any further regulation (Table 2.2). However, increased renewables supply and rising electricity imports cannot fully compensate for the exit of coal power plants. Therefore, total electricity supply falls and prices rise, which particularly hurts energy-intensive industries (see below).

Recycling revenues generated through carbon pricing strongly influences the distributional effects of more ambitious emission abatement (Figure 2.11). If revenues from carbon pricing are not recycled to households, poorer households lose a considerable share of their real income compared to the benchmark scenario because wages decline, and labour is their main income source. In addition, they spend a higher share of their income on electricity, transport and heating, which become more expensive relative to other goods due to carbon pricing. In the poorest household decile, expenditures on energy and transport amount to 18.9% of total expenditures, while the highest decile only spends 10.1%. However, if revenues from rising carbon prices are recycled as an equal lump sum to each household, real household income in the lower two deciles rises compared to the benchmark scenario. For other households, labour and capital income losses as well as increases in energy and transport prices outweigh the gains from transfers. Overall, lump-sum revenue recycling results in a progressive effect of emission abatement (Bickmann et al., forthcoming[1]).

Figure 2.11. If additional revenues are recycled as a lump sum, low-income households will benefit from the increase in carbon prices in the main EU Fit for 55 scenario

Real household income changes by expenditure decile, compared to the benchmark scenario (in %)



Note: Carbon price-related revenues are recycled, transferring the same amount to each household.
Source: (Bickmann et al., forthcoming[1]).

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The carbon price level needed to reach emission targets and its impact on GDP and welfare is highly sensitive to the institutional set-up. Harmonising carbon prices across sectors, enabling countries to trade emission allowances in the ESR sectors, increasing the predictability of future carbon prices, and phasing out fossil fuel subsidies and distorting tax exemptions would allow reaching the targets with lower prices and economic costs. Likewise, facilitating the expansion of renewable energy supply and better integrating the European electricity grid would mitigate electricity price rises and volatility and support energy-intensive industries (see below). The following sections discuss policies to improve the carbon pricing strategy and the institutional set-up.

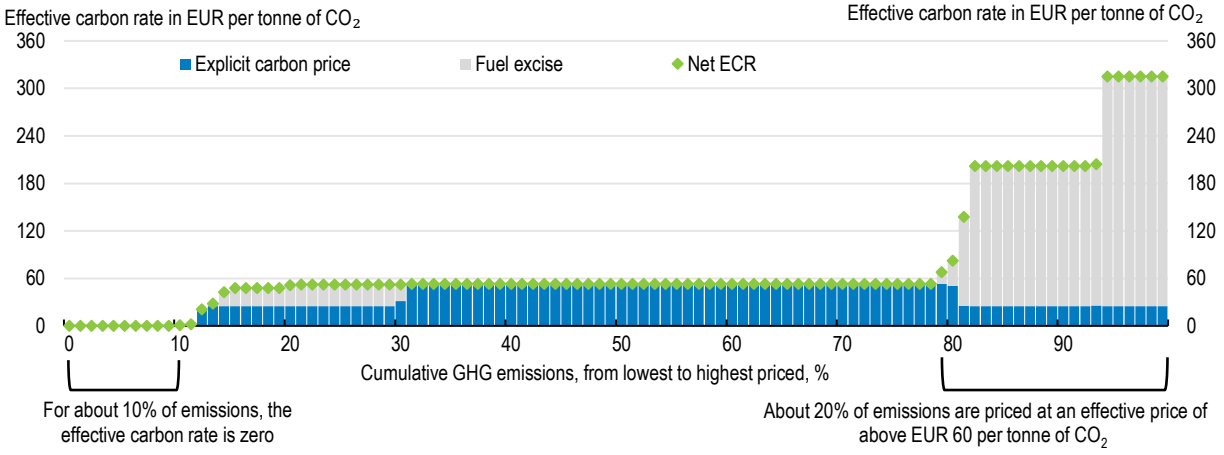
Carbon prices vary largely across sectors

In 2021, Germany priced 90% of its GHG emissions, explicitly or implicitly, with an average effective marginal carbon rate of EUR 81 (in 2021 prices), up by 46% since 2018. However, heterogeneity across sectors is large. Most unpriced emissions were from shipping and aviation fuels and from other GHG

emissions rather than CO_2 (like F-gases and methane). A small part of industrial CO_2 emissions, not covered by the EU ETS, were unpriced as well. Emissions from road transport, accounting for about 20% of total emissions, were priced at a relatively high marginal effective price due to fuel excise taxes, which implicitly tax GHG emissions (Figure 2.12).

Figure 2.12. Emission pricing coverage is significant, but levels are uneven

Share of CO_2 emissions subject to different levels of Net Effective Carbon Rates (Net ECR), 2021



Note: The explicit carbon price comprises the EU-ETS and the national emissions trading scheme. The Net Effective Carbon Rate measures the effective marginal price of an additionally emitted tonne of CO_2, which differs from the average emission price. For example, free allocations of emission rights in the EU ETS to non-power producers do not affect marginal prices and incentives to reduce emissions. Still, they affect the average carbon price (not presented in the chart) and may affect investment decisions. The Net Effective Carbon Rate measure does not include all subsidies or tax exemptions for fuel and electricity use, which considerably weaken carbon price incentives in Germany (Burger and Bretschneider, 2021[37]).

Source: OECD (2022), Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate Action, OECD Series on Carbon Pricing and Energy Taxation, OECD Publishing, Paris, https://doi.org/10.1787/e9778969-en.

StatLink https://stat.link/80efm5

Carbon prices across sectors are also further impacted by many fossil fuel and other harmful environmental subsidies and tax expenditures amounting up to EUR 65 billion (Burger and Bretschneider, 2021[37]). These subsidies and tax expenditures weaken and distort price signals, hamper the market breakthrough of environmentally-friendly products, and jeopardise climate goals (Table 2.3). Furthermore, energy-intensive industrial companies and airlines receive free allowances under the current EU ETS and other support, which hinders necessary resource reallocation and makes carbon prices less effective in changing consumption habits. For example, energy intensive companies are expected to receive EUR 27.5 billion until 2030 as partial refunds (up to 75%) to compensate them for higher electricity prices resulting from the EU ETS. Under current EU legislation, up to 43% of the emission cap can be distributed as free emission allowances to industrial installations.

Table 2.3. Main environmentally harmful subsidies and tax expenditures

Subsidy description	Estimated annual cost, 2018
Tax exemption for kerosene fuel in the aviation industry[1]	EUR 8.4 billion
Energy tax concession for diesel fuel	EUR 8.2 billion
Distance allowance – a tax deduction of traveling from home to work, regardless of means of transport[2]	EUR 6.0 billion
Lower VAT on meat and other animal products	EUR 5.2 billion
Lower concession electricity and gas charges for public spaces	EUR 3.6 billion
Favourable tax treatment for privately used company cars[2]	EUR 3.1 billion
Electricity and energy tax reductions for the manufacturing and agriculture sectors[3]	EUR 2.9 billion
Relief from electricity and energy taxes for certain energy-intensive processes and procedures	EUR 1.3 billion
Concessions for energy-intensive industry regarding electricity grid fees	EUR 610 million
Exemption of agricultural vehicles from the vehicle excise duty (agriculture diesel)	EUR 470 million
Tax concession for agricultural diesel fuel	EUR 470 million

Notes: (1) Including international flights taking off or landing in Germany. (2) This measure does not necessarily support fossil fuels (for example, electric cars can also benefit from the measure). However, most allowances end up supporting the usage of combustion-engine vehicles. (3) Including reimbursements of the peak equalisation charges for manufacturing companies.
Source: (Burger and Bretschneider, 2021[37])

Concerns about German firms' competitiveness and increased cost of living, especially for poor households, are the main reason for many of these subsidies and tax expenditures. For example, after introducing the national emissions trading system in 2021, the German government raised subsidies to emission-intensive trade-exposed industries under the provision that they undertake emission reduction measures. Although sometimes overstated, these concerns are valid. Simulations for this Survey show that higher carbon prices in the European Union would increase electricity prices and reduce output, employment and exports in Energy-Intensive Trade-Exposed (EITE) industries in Germany more than in other sectors (Box 2.5, Table 2.2, Table 2.4, Main EU Fit for 55 scenario). Nonetheless, not all sectors will lose competitiveness, even within the EITE industries. This is due to substantial market power in export markets, which allows to pass on part of the costs to consumers in other countries. Likewise, some industries are less carbon- and energy-intensive than others, which provides them with a comparative advantage and allows them to benefit from reduced factor demand in shrinking sectors and lower factor prices. In the CGE model, the expected output reduction is strongest for oil refineries, ferrous and non-ferrous metal industries as well as some ESR sectors such as consumer goods and transport services, while chemical, automobile and machinery and equipment increase output and exports (Table 2.4).

Table 2.4. Sectoral effects of reaching EU Fit for 55 targets under different policy designs for Germany

Change in production by sector, compared to benchmark scenario (in %)

Sector (share in employment)	**Main EU Fit for 55 scenario**	**ETS full integration**	**Extending output-based subsidies**	**Carbon tariffs**	**Multilateral abatement**	**Coal exit**	**Renewable subsidies**
EITE industries Total (6.6%)	**-1.7%**	**-1.7%**	**-1.8%**	**-2.9%**	**-0.1%**	**-1.9%**	**-0.6%**
Chemical products (3.5%)	0.4%	-0.8%	0.3%	0.6%	0.8%	0.2%	0.7%
Paper products (1.2%)	0.1%	-0.7%	0.0%	0.3%	0.4%	-0.2%	0.6%
Non-metallic minerals (0.9%)	-0.5%	-0.9%	-0.6%	0.4%	0.3%	-0.6%	-0.3%
Ferrous metals (0.7%)	-1.4%	-2.1%	-1.3%	-11.0%	0.7%	-1.6%	1.8%
Non-ferrous metals (0.4%)	-1.0%	-1.6%	-1.1%	-2.0%	1.2%	-1.3%	2.0%
Oil refinery (0.0%)	-18.8%	-8.9%	-18.8%	-18.5%	-16.9%	-18.7%	-15.0%
Other industries							
Machinery and equipment (8.1%)	0.6%	0.0%	0.8%	0.2%	0.1%	0.6%	-0.2%
Transport equipment goods (3.4%)	0.2%	-0.1%	0.5%	-0.3%	-0.6%	0.1%	-0.8%
Consumer good industries (3.2%)	-2.1%	-0.8%	-2.2%	-1.8%	-2.5%	-2.2%	-2.8%
Services							
Land transport (2.1%)	-9.4%	-2.0%	-9.4%	-9.3%	-7.8%	-9.3%	-10.2%
Air transport (0.3%)	1.4%	-0.2%	1.3%	-4.4%	13.1%	1.5%	1.0%
Water transport (0.1%)	-14.2%	0.5%	-14.2%	-13.9%	-11.4%	-14.1%	-16.2%
Market services (36.9%)	-0.1%	-0.2%	-0.1%	-0.1%	-0.4%	-0.1%	-1.2%
Non-market Services (27.9%)	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	-0.3%

Note: Please see Box 2.5 for a description of the methodology and simulation scenarios.
Source: (Bickmann et al., forthcoming[1]).

Existing subsidies and tax expenditures should be carefully evaluated and better targeted. Subsidies favouring EITE industries can help to address competitiveness concerns (see below) (Böhringer, Lange and Rutherford, 2014[38]). However, not all EITE industries will suffer from higher carbon prices, and many of the existing subsidies are not limited to companies exposed to international competition and should be abolished. Moreover, by hampering a stronger decline of output and emissions in EITE industries, these subsidies and ETS payment rebates lead to higher demand and prices for emission certificates in the ETS, causing higher emission reduction requirements and costs for other firms and sectors (Böhringer, Lange and Rutherford, 2014[38]).

Remaining firm support should be well targeted and incentivise emission reductions, for example by supporting the development of green technologies (see below). Providing high polluters with free allowances as part of a grandfathering scheme or using abatement subsidies to incentivise emission reductions below a pre-defined baseline are other options to reduce the effective tax burden of firms, while maintaining high marginal cost of CO_2 emissions (D'Arcangelo et al., 2022[30]). Nevertheless, it is crucial that all subsidies include sunset clauses, announced upfront, to strengthen abatement incentives and

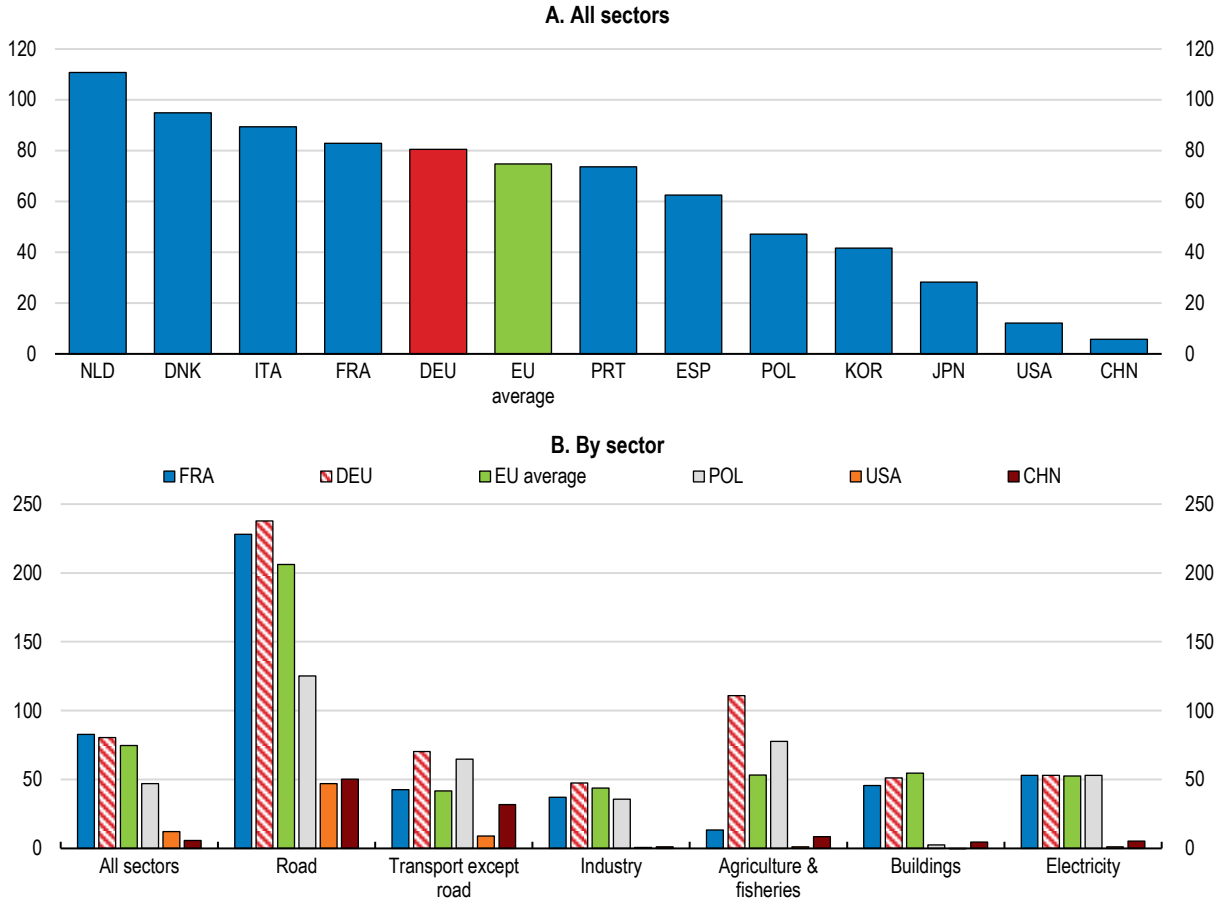
reduce future fiscal costs. Subsidies indirectly supporting households, such as the tax exemptions for diesel and kerosene fuel and reduced VAT rates for meat and other animal products, should be phased out and partly replaced by direct transfers to vulnerable households. The phase-out of subsidies could also support the financing of public investments and rising pension and health care costs (see Chapter 1). As energy prices are high, the phase-out could be linked to energy price levels: accelerating the phase-out in case the energy prices decline, and vice-versa.

Harmonising carbon prices across sectors would reduce the economic costs of the green transition

Carbon prices do not only differ strongly across sectors, but also across countries (Figure 2.13). In the European Union, many countries do not explicitly price emissions in non-ETS sectors and where emission pricing exists, emission allowances cannot be traded across countries or with the EU ETS, preventing the equalization of abatement cost across countries and sectors. In particular, the largest emitting sectors – electricity production and industry – faced relatively moderate effective carbon rates in 2021. Harmonising carbon prices across sectors and countries would help to reduce emissions where it is the least costly but imply higher carbon prices for emission-intensive industries (D'Arcangelo et al., 2022[30]).

Figure 2.13. Carbon prices differ substantially between sectors and countries

Net Effective Carbon Rates, EUR per tonne of CO_2, 2021



Note: The Net Effective Carbon Rate measures the effective marginal price of an additionally emitted tonne of CO_2.
Source: OECD (2022), Pricing Greenhouse Gas Emissions.

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According to simulations conducted for this Survey, Germany would benefit significantly from the expansion of the EU-ETS to all sectors in the EU economy (Box 2.5, Table 2.5). Including the ESR sectors

in the ETS would raise welfare as marginal abatement costs in ESR sectors are much higher compared to other EU countries and ETS sectors, and because Germany has pledged to reduce emissions in ESR sectors by much more. As a result of merging the two systems, German firms in ESR sectors can buy emission certificates from other EU countries and ETS sectors, allowing them to expand production and employment. Particularly, some emission-intensive ESR sectors such as land and water transport as well as consumer goods industries would raise output compared to the main EU Fit for 55 scenario (Table 2.4). However, the increased demand for ETS emission certificates would raise the ETS price and reduce-emission intensive electricity production, which in turn would raise electricity prices and lower output and emissions in many EITE industries in Germany (Table 2.5). Particularly, ferrous and non-ferrous metal and chemical industries but also automotive and machinery and equipment industries would shrink. In contrast, oil refinery would strongly expand due to higher fuel demand from ESR sectors. Overall, total emissions in Germany would decrease by only 64% in 2030, while emissions reductions in other EU countries would be larger than in the main EU Fit for 55 scenario.

Table 2.5. Reaching EU Fit for 55 targets under different policy designs – aggregated effects for Germany

	Main EU Fit for 55 scenario	ETS full integration	Extending output-based subsidies	Carbon tariffs	Multilateral abatement	Coal exit	Renewable subsidies
Total CO_2 emissions reduction vs 1990	-67%	-64%	-67%	-66%	-67%	-69%	-71%
CO_2 emissions reduction in the ETS sectors vs 2005	-64%	-66%	-64%	-63%	-67%	-68%	-74%
CO_2 emissions reduction in the ESR sectors vs 2005	-50%	-38%	-50%	-50%	-50%	-50%	-50%
The ETS CO_2 price, times higher than in the benchmark	1.84	1.95	1.84	1.75	2.00	1.66	1.35
The ESR CO_2 price, in USD (which equals 0 in the benchmark)	323	78	323	322	337	321	334
Change in welfare (real consumption), compared to Benchmark	-0.86%	-0.52%	-0.87%	-0.77%	-0.87%	-0.87%	-1.38%
Change in GDP, compared to Benchmark	-1.22%	-0.52%	-1.22%	-1.19%	-1.25%	-1.23%	-1.40%
Renewables share in electricity generation	77.2%	79.1%	77.2%	74.4%	80.7%	81.6%	100%
Coal share in electricity generation	5.3%	3.7%	5.3%	8.5%	1.4%	0.0%	0.0%
Change in total electricity supply, compared to benchmark	-7.8%	-6.0%	-7.8%	-7.4%	-8.7%	-8.6%	-3.0%
Change in electricity generation, compared to benchmark	-9.9%	-9.0%	-9.9%	-8.9%	-9.6%	-11.7%	10.4%
Change in electricity imports, compared to benchmark	+22.9%	+38.2%	+23.0%	+15.0%	+5.1%	+37.8%	-64.5%
Change in electricity price (consumer prices), compared to benchmark	+4.7%	+7.6%	+4.7%	+3.3%	+6.9%	+6.1%	-13.8%

Note: See Box 2.5 for a description of the methodology and simulation scenarios.
Source: (Bickmann et al., forthcoming[1]).

To mitigate the adverse effects of an expanded ETS on EITE and other industries, it is crucial to facilitate the expansion of renewable energy supply and better integrate the electricity grid with neighbouring countries (see below). This would mitigate electricity price increases in Germany when coal power plants exit the market due to higher ETS prices (Bickmann et al., forthcoming[1]). Moreover, as high energy prices

due to the war in Ukraine currently weigh on energy-intensive industries, a gradual phase in of carbon price harmonisation would be prudent. Introducing a separate cap-and-trade system for ESR sectors as currently discussed for the European Union, at least for residential heating and transportation fuels, would prevent ETS and electricity prices from rising too strongly, while allowing for harmonisation of carbon prices in ESR sectors due to emission rights trading across countries. If the carbon price in this scheme exceeds the ETS price by more than a certain threshold, a limited number of allowances could be traded between the two systems to mitigate price differences (Edenhofer et al., 2021[39]). The number of tradable allowances could increase gradually over time until the two systems are unified. Another option would be to expand the ETS to some more specific sectors. A partly integrated ETS system excluding households is not as efficient as a fully integrated ETS system, but still welfare improving (Bickmann et al., forthcoming[1]).

As mentioned above, Germany implemented a national trading system for emissions in the non-ETS sectors in 2021, with a growing fixed price until 2025. From 2026, allowances are to be auctioned. Until the European trading system for road transport and heating starts operating (Box 2.4), Germany should set the emissions cap in its national trading system according to its national targets and issue a quantity of tradable emission allowances consistent with this cap. In addition, Germany should expand its use of the existing EU mechanism that allows trading ESR emission reduction obligations with other EU countries to avoid the need to reduce emissions drastically in a very short period.

International agreements could help to address carbon leakage problems

A fundamental challenge in climate policy is that climate protection constitutes a global public good and each country has an incentive to free ride on the emissions abatement of other countries while contributing little itself. International agreements are trying to minimise this problem and following the 2015 Paris Agreement, many countries have announced ambitious national targets to reduce GHG emissions. Still, there are considerably differences in environmental stringency and effective carbon prices between countries, with increasing divergence in recent years (Figure 2.13) (OECD, 2021[40]). Countries with the highest effective (implicit and explicit) carbon rates in 2018, including Germany, saw carbon rates rise further, while there was little change in countries with low initial rates (OECD, 2022[41]). The war in Ukraine and the soaring energy prices in Europe are only amplifying those differences. Further mitigation actions risk the migration of economic activities abroad to enjoy lower costs in countries with lower environmental standards. This so-called carbon leakage increases global emissions and could hurt the competitiveness of the German economy in the domestic and export markets (OECD, 2021[42]; OECD, 2020[43]). Moreover, it is an obstacle to public support for the implementation of climate mitigation policies, especially in Germany, where economic growth in recent decades has been driven by a strong export-oriented manufacturing sector (D'Arcangelo et al., 2022[30]).

Simulations for this Survey show that implementing EU Fit for 55 targets without more ambitious mitigation action in non-EU countries would lead to reduced output and exports in many German EITE industries (see above). However, the simulations also show that output-based subsidies, which redistribute carbon tax revenues back to producers as lump sums at the industry level and keep emission reduction incentives for firms in place (Box 2.5), can mitigate these negative competitiveness effects from unilateral climate mitigation policies. In contrast, introducing a tariff that equilibrates carbon prices between domestic and imported products, while phasing out output-based subsidies, would hurt industries with a high share of imported and emission-intensive intermediate goods and – if not complemented by export rebates – would not address competitiveness concerns on export markets (Table 2.4). This would particularly hurt the ferrous and non-ferrous metal, automotive and the machinery and equipment industries, which are highly integrated in global value chains. A carbon tariff would only support a few industries by protecting them from emission-intensive imports, such as chemicals, paper products, non-metallic industries as well as consumer goods (Table 2.4). On the macro level, the simulations show that abolishing the output-based subsidies in favour of a carbon tariff would be slightly welfare-improving because it leads to a more efficient

labour and capital allocation and generates additional income that can be distributed to households, indicating that the design of a carbon price for imports should be carefully evaluated.

International agreements that enforce faster global emission reduction would limit the risk of carbon leakage and at the same time lower the risk of climate change (Nordhaus, 2015[44]) (G7, 2022[45]). Simulations conducted for this survey show that multilateral abatement, where the European Union reaches EU Fit for 55 targets and non-EU countries reach their NDCs in 2030, would significantly improve production and exports for EITE industries in Germany compared to the main EU Fit for 55 scenario of unilateral EU abatement (Table 2.4). Due to higher carbon prices in non-EU countries, the relative competitiveness of German EITE industries would increase in both export and domestic markets. However, stronger emission reductions in non-EU countries would lower demand for German products and increase prices of imported intermediate inputs. This would hurt other export-oriented manufacturing sectors in Germany, which are less emission intensive and highly integrated in global value chains, such as automotive and machinery and equipment, but also the services sectors (Table 2.4). The total effect on Germany's GDP and welfare compared to unilateral EU abatement would be minimal (excluding the long run gains from reducing global emissions).

Well-designed standards and regulations should be part of the policy mix

Even if carbon pricing is unified across sectors and carbon leakage issues are addressed, there are arguments for complementing carbon pricing with other mitigation policy tools. Market failures such as imperfect information and collective decision problems are hard to solve just by setting prices. Likewise, carbon pricing may be less effective for long-run investments of households, either because of liquidity constraints or because of a present bias. For example, some might not retrofit their homes even when it makes economic sense because savings will be realised far in the future (see the section on the building sector). High uncertainty, a lack of complete future markets, and technological path dependence reduce the effectiveness of carbon pricing to support innovation, which could lower the costs of replacing fossil fuels (Acemoglu et al., 2012[46]). Moreover, government commitment problems to carbon pricing can be severe. Carbon prices will have to reach high levels to meet net-zero emissions, which will cause strong reallocation and distributional effects hurting certain groups more than others (see the section on distributional consequences of emission reductions below). If distributional consequences are unaddressed, public opposition and lobbyism of interest groups can derail abatement efforts. If firms anticipate these commitment problems and expect prices to remain low, they might underinvest in innovative green technologies (Edenhofer et al., 2021[39]). Therefore, a mix of policy instruments is needed to reduce the economic and social costs of the green transition (D'Arcangelo et al., 2022[30]).

Well-designed regulations and standards can help overcome coordination failure and realise network effects, for example, by setting technical standards for electric vehicle charging stations or green hydrogen (D'Arcangelo et al., 2022[30]). Likewise, they can help to solve problems such as split incentives between homeowners and tenants, causing households to underinvest in energy efficiency measures (see the section on the building sector). Nevertheless, in a country like Germany, where carbon pricing mechanisms are already in place, the use of regulations should be done sparingly. Ill-designed and uncoordinated regulations risk to increase the cost of decarbonisation by complicating performance monitoring and blurring price signals. Regulations are also more open to lobby influence of special interest groups than a transparent carbon pricing scheme.

Accelerating the coal phase-out signals a higher government commitment to reducing emissions and expanding renewables. Nonetheless, simulations conducted for this Survey show that introducing additional regulation to mandate the exit of coal power plants by 2030 would raise electricity prices and hurt EITE and other industries compared to the main EU Fit for 55 scenario, where Fit for 55 targets are reached without additional regulation (Box 2.5, Table 2.4). Increasing electricity prices would incentivise the expansion of renewables to reach a share of 82% of electricity production, but supply increases are

insufficient to compensate for the coal exit and cover electricity demand, and electricity imports increase strongly (Table 2.5). Emissions in the German ETS sectors would fall strongly due to higher electricity prices allowing to reduce overall emissions by 69% in 2030. However, if total emission allowances in the EU ETS are not reduced, the shrinking demand for emission rights due to the coal exit and higher electricity prices would lower the ETS price and allow polluting firms in other EU countries to increase production and emissions, including to export electricity to Germany (the so-called waterbed effect). This problem is even more severe in the case of using carbon tax revenues to subsidise renewable energy supply (see below), where falling ETS prices strongly increase output in emission-intensive industries in other EU countries. The European Union introduced the Market stability reserve in 2019, among others, to reduce these waterbed effects. It makes automatic adjustments to the supply of certificates in the EU ETS based on the surplus in the market so that the price does not fall. The higher the surplus, the more certificates are withheld from auction. Germany could support initiatives to expand these kinds of mechanisms so that additional national regulations, such as the coal exit or other regulations concerning the expansion of renewables, would be more effective in reducing total emissions.

The amended version of the Federal Climate Change Act stipulates permissible annual emission volumes for each sector, which risk limiting the cost-effectiveness of mitigation policies. The breakdown of targets by sector increases liability and facilitates the design of specific mitigation strategies. However, it might also raise the cost of decarbonisation due to limited knowledge of sectoral abatement costs and their evolution over time. Having strict sectoral targets and regulations could create a substantial deadweight loss and lead to waterbed effects, especially in sectors covered by the EU ETS. In some contexts, overlapping regulations risk not only inducing substantial excess costs but even raising emissions (Knut et al., 2009[47]) (Böhringer and Rosendahl, 2010[48]). Moreover, relying on ad hoc criteria might increase compensation demands from polluting firms harmed by the regulation, for example in the case of the German coal phase out that included firm compensations of about EUR 5 billion (see the OECD 2020 Economic Survey of Germany). Regular ex-post performance reviews and evaluations help minimise these risks and should remain an integral part of policy planning and design. A welcome recent government decision to flexibilise the sectoral targets could strengthen the functioning of the existing emission pricing schemes by allowing sectors that have missed their sectoral emission reduction targets to compensate their underperformance with stronger emission reductions in other sectors, but a draft bill is still pending. A unified target for all sectors regulated under the National Trading System should be introduced when the system starts operating as a cap-and-trade system.

Boosting investment and innovation

Well-designed subsidies can effectively spur investment and innovation

Well-designed subsidies can spur innovation and accelerate the decarbonisation of infrastructure networks if they include transparent long-term incentives to abate emissions. Subsidising green research and development (R&D) as well as technologies which are still at prototype or demonstration stage will reduce future abatement costs and allow other mitigation policies to be less stringent. Subsidies to upgrade the infrastructure network are key to crowd in private investment, mainly in the transport and energy sectors. For example, the uptake of electric vehicles is constrained until charging infrastructure is available, while investments in infrastructure require more certainty about electric vehicle uptake (see the section on the transport sector). However, when subsidies are applied to scale up matured technologies, the risk of distorting competition and wasting public resources is higher. Moreover, many subsidies might be regressive and encounter public opposition, as they benefit more affluent households and are financed by the general budget (Blanchard and Tirole, 2021[34]). These risks need to be addressed appropriately in the policy design.

Higher carbon prices make solar and wind technologies attractive even without subsidies. Simulations conducted for this survey show that using carbon tax revenues to subsidise renewable energy expansion

instead of financing lump-sum transfers to households helps to mitigate the negative effects of unilateral emission reductions on the EITE industries, but comes at a significant economic and social cost (Box 2.5, Table 2.5). The strong expansion of renewables increases electricity supply and lowers electricity prices compared to the main EU Fit for 55 scenario, strongly supporting EITE industries, which increase production, employment, and exports. The renewables share in electricity production comes close to 100% and emissions fall by more than 71% in 2030 (compared to 1990). However, as carbon pricing revenues recycled to households strongly decrease to finance renewable energy subsidies, households' purchasing power and consumption decline despite the fall in electricity prices. Sectors with lower energy-intensity suffer from decreased demand and reduce output and employment, in particular market services, consumer goods, automotive and other equipment goods (Table 2.4). As these sectors are also more labour intensive than EITE industries, poorer households are more adversely affected compared to the main EU Fit for 55 scenario with full recycling of carbon tax revenues to households. Overall GDP and welfare decrease compared to the main scenario, as using scarce resources to subsidise the scale up of commercialised technologies such as wind and solar power reduces economic efficiency. To mitigate the effects of emission abatement on electricity prices, it is more efficient to further accelerate planning and approval procedures for energy related infrastructure and improve the integration of the electricity grid with neighbouring countries (Bickmann et al., forthcoming[1]). A gradual shift in support from renewable energy subsidies towards more targeted subsidies for green R&D (see below) and deploying near-zero-emission industrial technologies, especially those in pre- or initial steps of commercialisation, could be another way to support the EITE sectors and reduce future abatement costs (IEA, 2022[49]).

Predictable prices would reduce risks for investing in low-carbon projects

There is substantial uncertainty about the carbon price needed to reach net-zero and the price path that will materialise in a cap-and-trade system because of many unknowns, e.g., the effect of prices on emissions, the cost and speed of developing green technologies and the future political commitment to address climate change. The war in Ukraine only amplified these uncertainties. The high uncertainty makes it harder for firms, households, and entrepreneurs to plan their investments. Unsurprisingly, countries with higher environmental policy uncertainty have suffered from lower investment in the green transition (Dechezleprêtre, Kruse and Berestycki, Forthcoming[50]). Predictable prices are especially crucial for investment in sectors characterised by a long lifetime of capital goods, such as building and industry (Harthan et al., 2022[51]).

In Germany, high uncertainty about future carbon prices exists in both the ETS and the ESR sectors. The volatility of allowance prices in the EU ETS has been high (Figure 2.14). In the housing and transport sectors, the design for setting prices from 2026 on is still unclear, and recent changes to the price path until 2026 have weakened policy credibility. One way to credibly signal future carbon prices would be to incorporate an automatically escalating price floor in the national trading scheme (Black et al., 2021[52]). In the Netherlands, for example, a national carbon levy on industrial emissions was implemented in 2021 on top of the EU-ETS price, establishing a transparent price trajectory reaching EUR 125 per tonne of CO_2 in 2030, including the ETS price (D'Arcangelo et al., 2022[30]). In addition, a price floor would limit the risk that more ambitious mitigation policies in one sector would reduce carbon prices and thus allow for higher emissions in other sectors without changing total emissions (see above). Issuing securities that would compensate emission allowance holders if the future price of carbon fell relative to the announced path could secure the commitment to the price path (Blanchard and Tirole, 2021[34]).

Figure 2.14. Carbon prices are volatile

European Union Emissions Trading System (EU ETS) allowances, spot price, Euro per ton

Source: International Carbon Action Partnership (ICAP) based on EEX data.

StatLink https://stat.link/govnb5

Expanding the use of Carbon Contract for Difference (CCfD) schemes would be an efficient way to shield investors against regulatory risks, as a direct link between the level of subsidies and the carbon price is established (Edenhofer et al., 2021[39]). Based on a strike price for emissions reductions resulting from an auction, a CCfD guarantees investors a fixed revenue per tonne of non-emitted CO2. The government reimburses the difference if carbon prices are below the strike price. Conversely, investors return the difference if carbon prices exceed the strike price to avoid windfall profits. The auction design encourages competition and minimises the fiscal cost of reaching policy objectives, as the most cost-effective project is selected (Richstein et al., 2021[53]). In the United Kingdom, CCfDs have successfully mobilised the private sector to invest in renewables.

While this approach could be attractive for all mitigation projects, it is especially well suited to address challenges associated with emissions reductions in hard-to-abate sectors such as the steel and cement industries (Richstein, 2017[54]). Technological developments to reduce emissions in these sectors are often beyond the typical scope of R&D funding yet are not mature enough to be financed purely via the markets, even with high carbon prices (the so-called valley of death). However, applying CCfD auctions to specific sectors or technologies faces a dilemma: Increasing the scope of technologies to participate in the auctions risks crowding out technologies at a current cost disadvantage but with high potential to become competitive in the future. In contrast, excluding certain technologies may waste resources by lowering competition.

The government recently established a scheme based on the concept of Carbon Contract for Differences ("climate protection agreements"), which awards companies in energy-intensive industries 15-year subsidy arrangements in return for reducing emissions in their production. The government should carefully evaluate the impact of this scheme on investment and consider expanding the use of Carbon Contract for Differences schemes while, in principle, keeping the auctions as technology-neutral as possible. To promote experimentation and technological diversity, some auctions should allow for a higher strike price for less matured technologies or sectors with slower improvements (Richstein et al., 2021[53]). However, clear and widely accepted definitions should be used to guide support so that by 2030 only production that is already near zero emission, or has demonstrated a pathway to soon become near zero emission, is eligible for government finance (IEA, 2022[49]).

Crowding- in private investment to finance the green transition

Long-run public infrastructure planning that reduces regulatory risks as well as higher public investment in the transport and electricity networks can crowd-in private capital needed for the transition. For example, upgrading the electricity network is crucial to manage the increasing share of electricity produced by

intermittent energy sources and the increasing load to the grid as more activities are electrified. Emerging technologies, such as hydrogen and energy storage, may also require large investments in production, storage, and pipeline infrastructures (D'Arcangelo et al., 2022[30]). Streamlining the planning and approval procedures and providing agile and pro-active public services is highly needed for accelerating these investments (Chapter 1).

To encourage firms to prioritise investment in green (and ICT) infrastructure and accelerate the green transition, the government plans to temporarily increase the generosity of tax depreciation allowances ("super depreciation") for firms investing in climate protection for a two-year period. Accelerated depreciation would increase the expected return on investment, lower liquidity constraints and shift some proportion of the investment risk to the government. It could raise green investment spending by up to 10% in the first years after implementation (Funke and Terasa, 2022[55]) (House and Shapiro, 2008[56]). However, targeting the depreciation allowance only to green infrastructure introduces issues related to the definition of green infrastructure, increasing administrative burden, and complicating the tax system. Expanding existing targeted innovation support tools might be a better use of public resources (see below).

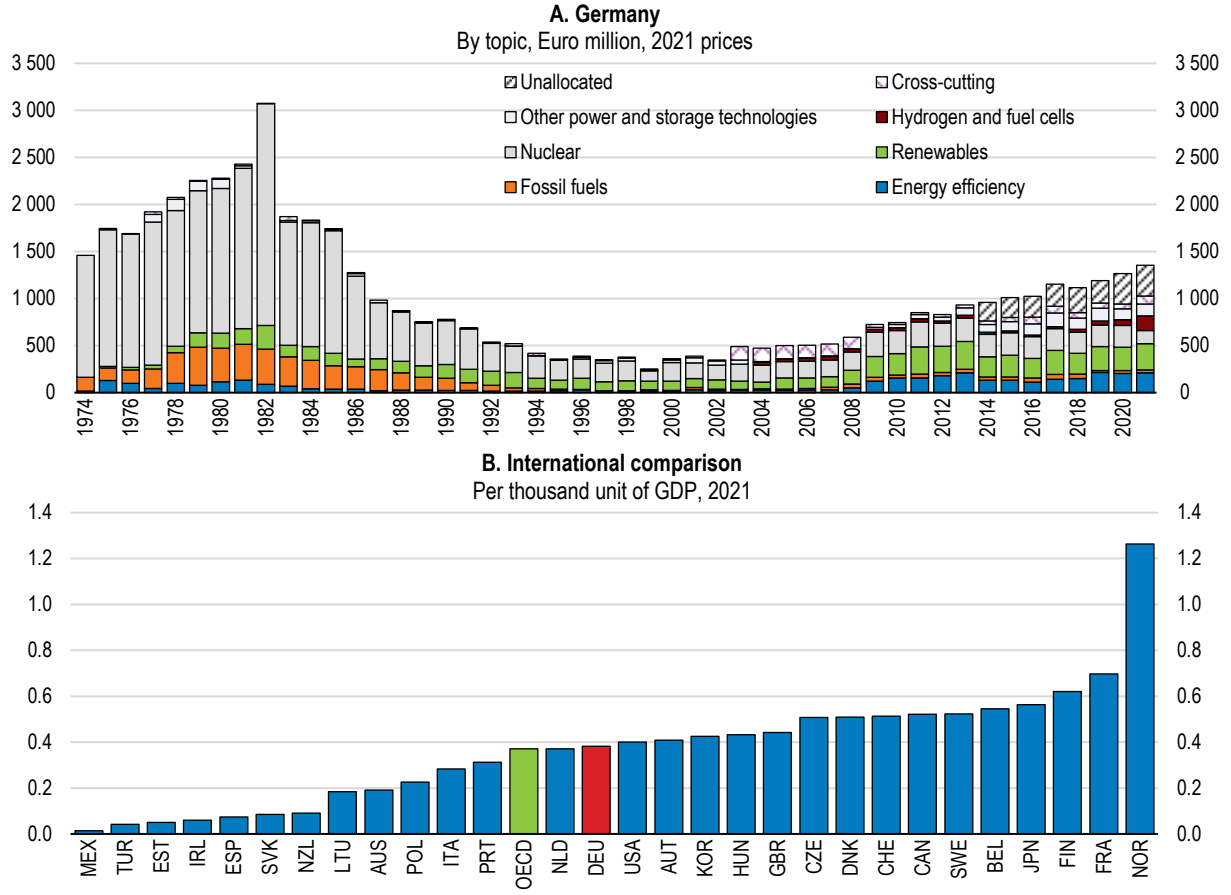
Innovation policy should support the development of new key technologies

Accelerating the deployment of existing technologies is key for reaching Germany's short-term targets, but not enough for reaching net-zero in 2045. Almost half of the reductions until 2050 will have to come from technologies that are currently at the demonstration or prototype phase (IEA, 2021[57]). Scaling up these technologies requires massive production cost reduction. For example, even with a high carbon price, green hydrogen is not yet competitive with fossil-based alternatives (Cammeraat, Dechezleprêtre and Lalanne, 2022[58]). Public support to green R&D can improve the overall cost-effectiveness of the policy mix by reducing future costs of low carbon technologies. Without government support, the level of research is likely to be inefficiently low because of positive knowledge externalities.

Public spending on R&D in the energy sector has been rising in real terms since the early 2000s, but it is still much below the 1970s levels (Figure 2.15, panel A). In 2021, it accounted for around 0.04% of GDP, which is lower than in many other European countries (Panel B). The government target to increase total R&D investment as a share of GDP to 3.5% by 2025 is an opportunity to raise support for breakthrough green technologies. As spending on green R&D is a global public good, this should be complemented by improved cooperation with other countries. Initiatives to set mutual clean energy R&D investment goals have not been successful so far (Cunliff, 2019[59]). A European green technology funding institution equivalent to the American ARPA-E, would support high-risk research in the private and public sectors (Blanchard and Tirole, 2021[34]). European Alliances for batteries (since 2017) and for green hydrogen (since 2020) are positive examples of public-private collaboration. A Global or European institution that uses funds to incentivise countries to expand their green R&D spending could be another option to foster innovation (Stern, 2022[60]).

Figure 2.15. Public spending on R&D in the energy sector is limited

Public energy research, development, and demonstration (RD&D) budgets



Source: IEA, Energy RD&D Budget/Expenditure Statistics.

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Germany has room to improve its innovation system. Its strengths are heavily intertwined with the needs of its existing industry, while the green and digital transitions require technological disruptions and significant breakthroughs. Innovation suffers from weak business-creation dynamics, lengthy and costly administrative procedures, weak access to finance for start-ups, and difficulties in marketing new ideas and technological solutions developed in public research institutions (see the 2020 Economic Survey of Germany). Moreover, strict and complex data privacy regulations, slow progress in improving digital infrastructure and a finance industry dominated by banks, which require traditional collateral for lending, particularly complicate digital innovations (see Chapter 1). Expanding the use of regulatory sandboxes and creating a public-private laboratory would support experimentation, implementation and monitoring of innovation policy tools. In addition, the government should promote open platforms and networks for data-based innovation and enhance university engagement with industry, including by better encouraging the development of funds for academic spin-offs (OECD, 2022[61]).

Green hydrogen can play an important role in hard-to-abate industries

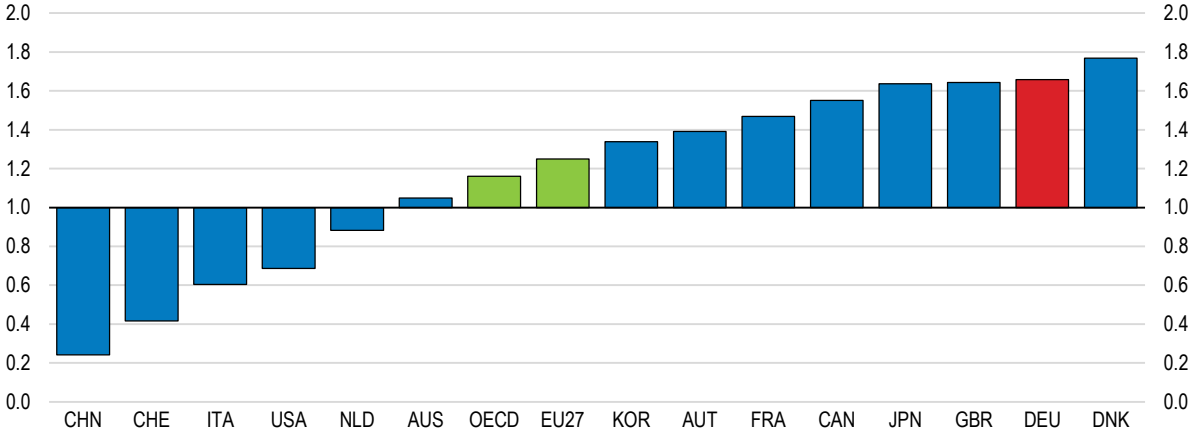
Production of hydrogen through electrolysis using water and electricity produced from renewables (green hydrogen) can play an important role in reducing greenhouse gas emissions. It has potential to replace fossil fuels in high-temperature industrial processes of hard-to-abate sectors such as steel production, in road freight traffic, and to store energy produced from intermittent sources. In most net-zero emission scenarios, green hydrogen plays a pivotal role, although the production of green hydrogen is still about three times more expensive than hydrogen made from natural gas (Cordonnier and Saygin, 2022[62]). Major

cost reductions will crucially depend on R&D and large-scale demonstration projects. Reducing uncertainties for investors through standardisation and infrastructure investments is also needed (Cammeraat, Dechezleprêtre and Lalanne, 2022[58]).

Germany is a world leader in hydrogen-related patents and trademarks, especially hydrogen production and hydrogen storage (Figure 2.16). It plans to develop 5 gigawatt of green hydrogen production capacity by 2030 and 10 gigawatts by 2040. The EU-ETS and the abolishment of the EEG surcharge incentivise the use of hydrogen in electricity storage and industry. The National Hydrogen Strategy supports the development of a domestic market and enhances international cooperation, as Germany will have to import large quantities of green hydrogen due the comparative advantage of other countries in renewable energy sources. An annual budget of more than EUR 300 million is dedicated to support green hydrogen by investing in R&D and establishing regulatory sandboxes (Cammeraat, Dechezleprêtre and Lalanne, 2022[58]). As some hydrogen technologies have matured, many support measures focus on implementation such as funding for electrolyser development and developing a hydrogen refuelling infrastructure. Although the strategy is well-designed, better evaluation mechanisms are needed. The strategy does not include sufficient evaluation mechanisms providing independent, systemic feedback that is not tied to the responsible ministries (OECD, 2022[61]). In addition, Germany should work towards better harmonising quality standards across countries and shared definitions of the different types of hydrogen (green, blue, turquoise etc.) to reduce uncertainty and facilitate coordination, including at the EU level (BMBF, 2022[63]).

Figure 2.16. Hydrogen-related innovation

Relative technology advantage (RTA) in green hydrogen innovation, index, 2015-19



Note: This index is obtained by dividing each country's share of hydrogen patents with the global share of hydrogen patents. The share of hydrogen patents is obtained as the number of PCT hydrogen patents divided by the total number of PCT patents filed by the same country or region. Data refer to PCT patents in hydrogen technologies. Patent counts are based on the filing date and the inventor's location, using fractional counts. Only economies featuring more than 50 hydrogen technology patent families over the period 2014-19 are included.
Source: Innovation and industrial policies for green hydrogen, OECD Science, Technology, and Industry Policy Papers February 2022 n. 125.

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Public procurement can help to strengthen innovation incentives

Until effective carbon prices are high enough and cover all sectors, including shadow prices for carbon emissions in public procurement decisions could help to create markets for innovative green products and services. Given that public procurement represents an estimated 15% of German GDP, this could have a substantial effect on emission reduction. Such a shadow price would be compatible with the concept of "economically most advantageous bid" inscribed in the European public procurement directives. A study conducted in Berlin found that purchasing 15 frequently procured product groups in an environmentally friendly way could result in a 47% reduction in CO_2 emissions compared to conventional procurement (Öko-Instituts e.V., 2015[64]). Nonetheless, many potential hurdles limit the attractiveness of using shadow prices in public procurement. Developing and administering a non-discriminatory and objective

measurement of shadow prices, which is defendable in courts against the claims of competing bidders, is a very complex and costly task for the public administration. This is particularly problematic for municipalities with financial difficulties, which suffer from staff shortages and weak IT infrastructure. It will also create high administrative burden for firms, and the additional legal complexity risks further delaying the implementation of infrastructure projects, jeopardising the green transition (Löschel and Schulze, 2022[65]).

Finding the right balance is therefore essential. The government should publish and use shadow carbon prices for procuring strategic products and services, such as the public vehicle fleets. In Baden Württemberg, for example, the local government uses a shadow price of EUR 180 per ton of CO_2 for public renovations projects. For the procurement of other products and services, minimum standards and negative lists of products and services should be used. The government could also enable contractors to apply for a CO_2 performance ladder certificate, like in the Netherlands. To receive the certificate, contractors in the Netherlands need to take steps towards reducing their carbon footprints that increases their chances of winning contracts (OECD, 2019[66]).

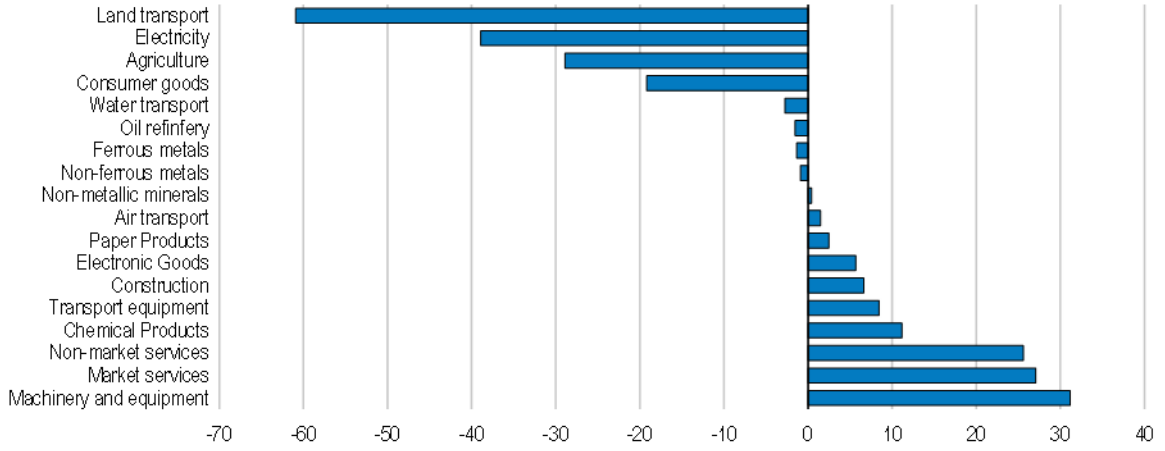
Protecting social cohesion and building strong public support for climate policy

Carbon abatement would lead to reallocation of labour across sectors and firms and increase income and regional inequality

Significant GHG emission cuts have not prevented strong economic and employment growth in the last three decades. Nonetheless, more stringent policies to reach ambitious emission reduction targets will have significant effects on the allocation of labour and capital across sectors and firms (Mohommad, 2021[67]). Some sectors and firms will strongly expand production and employment, others will need to shrink and shed labour or even exit the market (Dussaux, 2020[68]). For example, in the main EU Fit for 55 scenario, employment in land transport strongly declines (compared to the benchmark), while employment in machinery and equipment increases (Figure 2.17).

Figure 2.17. Reaching Fit for 55 targets would lead to labour reallocation

Contribution to the change in total employment until 2030, main EU Fit for 55 scenario (compared to the benchmark scenario), thousand



Note: See Box 2.5 for a description of the methodology and simulation scenarios.
Source: (Bickmann et al., forthcoming[1])

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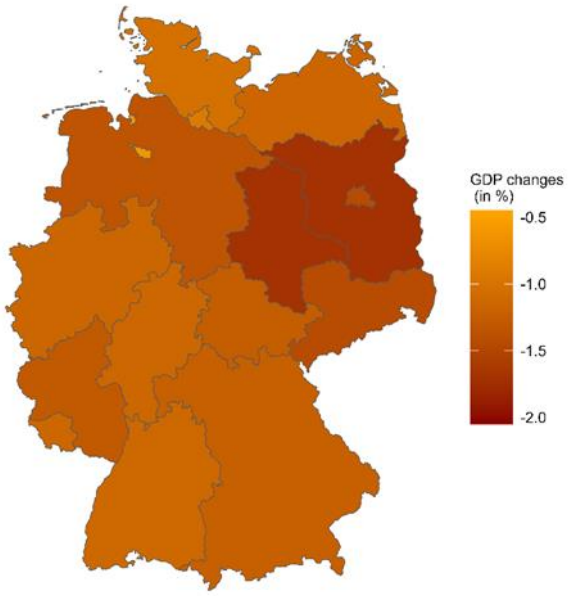
The economic effects of emission reductions will also vary across regions according to their economic structure (Figure 2.18). Simulation results for this Survey suggest that losses in regional GDP would be particularly strong in East Germany and noticeably weaker in the north, risking to increase regional

inequality, which is already pronounced (Immel and Peichl, 2020[69]). The East German states Brandenburg, Sachsen and Sachsen-Anhalt would be among the most affected Laender due to a higher share of fossil fuel-based energy supply and mining in regional gross value added. Fostering regional labour mobility through mobility subsidies and improved employment services is one important policy lever to reduce adjustment costs for affected workers (see below). Regional development policies are another important policy tool. While the potential to expand solar and wind power in some of the adversely affected areas is limited due to less suitable weather, some of these regions are less densely populated, which could facilitate renewables expansion (OECD, 2021[70]). Regional development policies could build on this latent relative comparative advantage and support the attraction of investments in green technologies and R&D. To mitigate the asymmetric regional effect of the coal exit, in 2020, the federal government pledged to support the affected coal mining regions, which include Brandenburg, Sachsen and Sachsen-Anhalt, with EUR 40 billion (1.1% of 2021 GDP) until 2038, focusing on improving infrastructure, innovation, and job markets.

Figure 2.18. Climate mitigation policies would have the strongest effect on East Germany



Note: Simulations are conducted using a Computable General Equilibrium Model (CGE) for Germany (Box 2.5). The graph shows changes in real GDP for the Main Fit for 55 scenario compared to the benchmark scenario.
Source: (Bickmann et al., forthcoming[1]).

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Reallocation would also occur across firms within sectors, with the most energy-intensive and the least productive firms tending to experience the most significant declines in employment. At the same time, less energy-intensive or more productive firms may benefit and increase employment (OECD, 2021[42]). For example, an OECD study that investigated the impact of energy prices on employment in French manufacturing found that rising carbon prices did not affect total manufacturing employment. However, employment declined in large firms with low energy-efficiency, while it increased in smaller and more energy-efficient firms (Dussaux, 2020[68]). Nonetheless, the overall job reallocation rates triggered by environmental policies will likely be relatively small compared to other major structural transformations, such as automation and globalisation, partially because employment in emission-intensive industries, which are most affected by higher carbon prices, is relatively low (OECD, 2021[42]; Grundke and Arnold, 2022[71]).

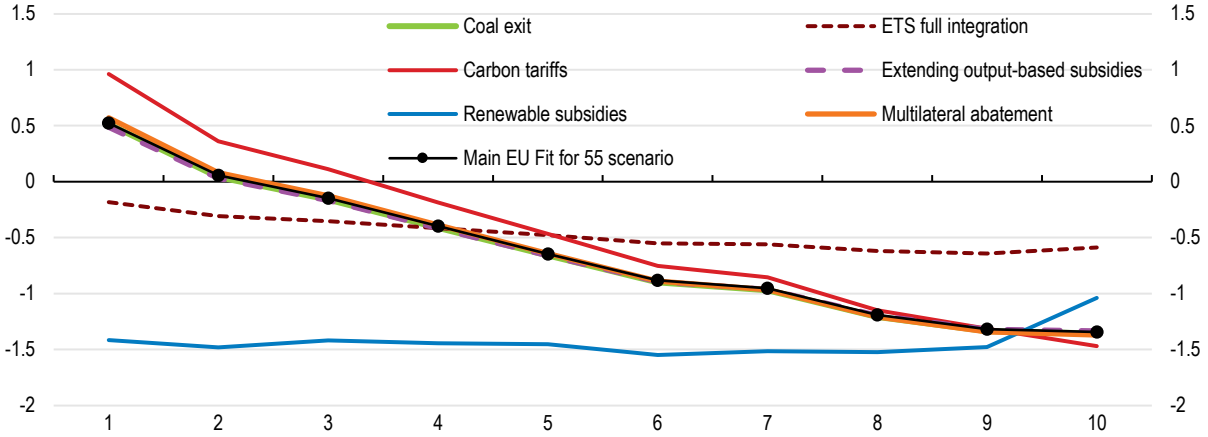
The reallocation of labour across sectors and firms will change relative factor prices, which has heterogenous effects on the incomes of households along the income distribution. It will also lead to significant adjustment costs for displaced workers (discussed below). Moreover, rising carbon prices will

significantly affect the relative consumer prices of goods and services depending on their carbon content. As poorer households spend a higher share of their income on carbon-intensive items, distributional effects on the consumption side are likely to be regressive (SVR, 2019[72]). The total effects of stronger emission reductions on inequality are highly dependent on the economic structure and can be significantly influenced by policy design. Lump-sum recycling of carbon price revenues mitigates adverse effects on low-income households and is efficient, as it has a limited effect on labour supply decisions of households (Figure 2.11). However, it requires accelerating the establishment of a central register and expanding the use of existing payment mechanisms (such as reimbursement of taxes and pension benefits) to transfer the money to households (Färber and Wieland, 2022[73]). More targeted transfers to vulnerable households could be preferred as they tend to be less expensive and more popular (see below), but they could also distort incentives to work (D'Arcangelo et al., 2022[30]). A broader compensation mechanism could seek to reduce the labour tax burden on lower-income households or second earners, which could positively affect labour supply and increase support for explicit carbon pricing (see below and Chapter 1). However, relying on carbon price revenues to finance major tax reforms would be problematic because carbon receipts will shrink as emissions are reduced. The government should also continue to use the fiscal space provided by the additional revenue (from carbon price receipts) to support green investments and R&D, which has high potential to reduce future abatement and transition costs and is also one of the policy designs that enjoys the highest public support (see below).

The distributional effects also strongly depend on the policy set-up (Figure 2.19). Low-income households would benefit from pricing the carbon content of imports, as this would generate additional revenues that can be redistributed (on top of carbon pricing receipts, see above). For higher-income groups, the negative effect of the carbon tariff on many manufacturing industries and shrinking capital and labour incomes outweigh the positive transfer effect. In contrast, expanding the EU ETS would reduce the negative effects for higher income groups, as the implied efficiency gains increase capital and labour income, whereas revenues from carbon pricing, and therefore also transfers to households, considerably decline. Lastly, using a larger share of carbon tax revenues for subsidising renewables leads to more regressive effects of carbon mitigation, as it strongly benefits capital-intensive EITE industries by lowering electricity prices at the expense of transfers to households.

Figure 2.19. Distributional effects of emission abatement differ across policy options

Household welfare changes by expenditure decile, compared to the benchmark scenario (in %)



Note: See Box 2.5 for a description of the methodology and simulation scenarios.
Source: (Bickmann et al., forthcoming[1]).

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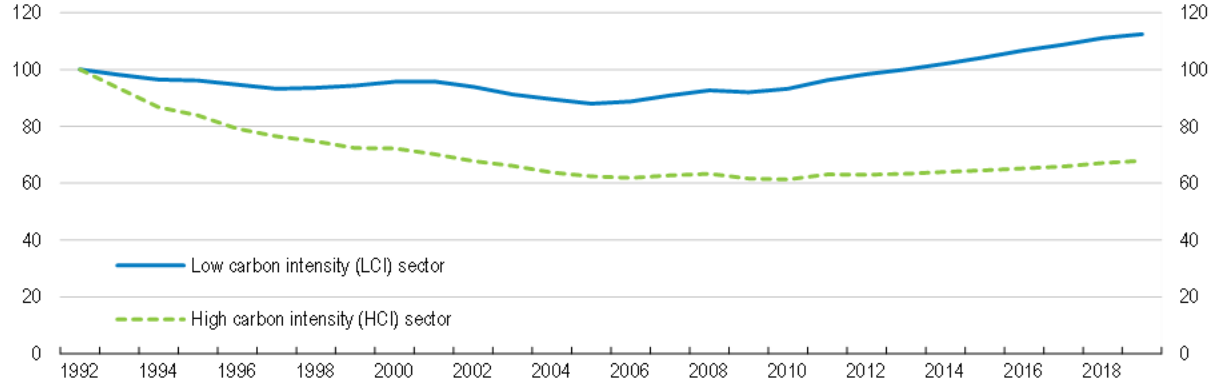
Reducing adjustment costs for displaced workers and facilitating the move to new jobs

Adjustment costs for displaced workers can be high

If they are well-designed, mitigation policies are likely to have only a moderate total negative net employment effect, reflecting the limited initial shares of employment in carbon-intensive sectors. A large part of the adjustment has already happened in Germany, as employment in carbon-intensive sectors has decreased by a third since 1992 (Figure 2.20).

Figure 2.20. Germany has already experienced significant employment losses in High Carbon-Intensity sectors

Employment in high carbon (HCI) and low carbon intensity (LCI) sectors, 1992 = 100



Source: (Barreto, Grundke and Krill, Forthcoming [79]) based on data from the IAB.

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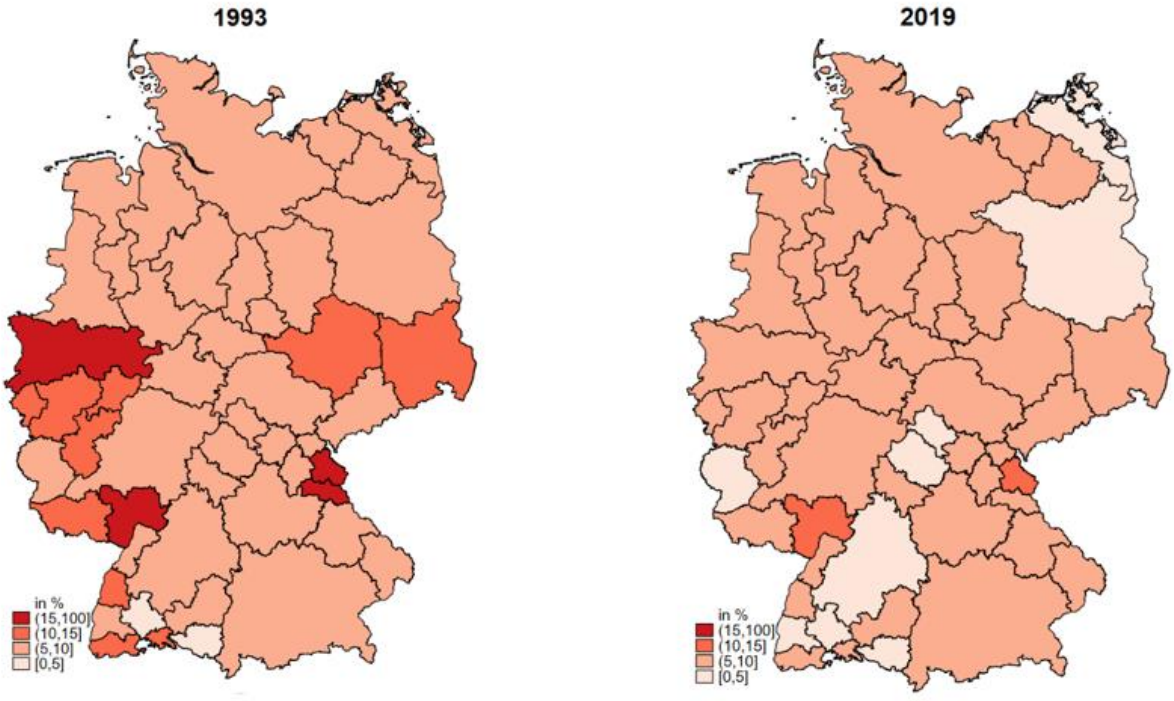
However, remaining workers in carbon-intensive sectors will likely face considerable adjustment costs due to the green transition. Displaced workers will lose their wage income; they have to search for a new job, learn new skills, and often have to bear, together with their families, the social costs of moving to other locations to find a new job (Grundke and Arnold, 2022[71]). Job creation in sectors that benefit from the green transition might happen in locations that are different from the locations suffering from the decline of carbon-intensive industries. Job-search and matching frictions, rigid labour market regulation, duration and costs of necessary training courses as well as low geographical mobility of workers can prolong unemployment spells and even lead older workers to exit the labour force (Hyman, 2018[74]). Moreover, workers who stay in their jobs also need to update their skills through on-the-job and formal training. As firms upgrade production processes through more advanced and greener technologies, the task content and skill requirements of existing jobs changes (Hummels et al., 2012[75]; Becker, Ekholm and Muendler, 2013[76]).

To better understand the adjustment costs and main obstacles to job mobility for workers in carbon-intensive industries, this chapter exploits the strong drop in employment in carbon-intensive industries since the 1990s to investigate employment transitions following mass-layoffs (Box 2.6, Figure 2.20). From 1993 to 2019, the share of workers in high carbon-intensity sectors (out of all workers) declined by a third: from about 9.7% to about 6.4%. As workers from high-carbon intensity sectors are concentrated in certain regions in the east and west of Germany, the employment drop has been particularly pronounced there, but layoffs have also affected other regions (Figure 2.21).

Figure 2.21. Employment losses in High Carbon Intensity sectors have been heterogenous across regions

Share of HCI workers in total employment (by labour market region)



Source: (Barreto, Grundke and Krill, Forthcoming [79])

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Involuntary job losses entail a lasting and significant reduction in employment and earnings for workers in all industries and services sectors (Jacobson, Lalonde and Sullivan, 1993[77]) (Schmieder et al., 2022[78]). However, analysis conducted for this survey finds that displaced workers from high carbon intensity (HCI) sectors experience (on average) even higher and more persistent losses compared to other displaced workers (Box 2.6). Five years after the job separation, displaced workers from HCI sectors have 23% lower earnings compared to individuals with similar characteristics that haven't been displaced, while the loss for workers in other economic sectors is only about 17% (Figure 2.22, Panel A). Earnings of workers in HCI sectors that remained employed after a mass layoff event were broadly stable. The more severe job loss effect is driven by a sharp decline in daily wages for workers in the High Carbon Intensity sectors, while the employment gap is less substantial. Displaced workers from HCI sectors are more likely to change occupation, sector, and workplace district after displacement than other workers (Figure 2.22, Panel B). Five years after displacement, 49% of displaced workers in HCI sectors had found a new job in other sectors, 31% moved to a new job within HCI sectors, 12% were still unemployed and 9% had left the labour market. However, switching occupations or sectors is, on average, associated with lower earnings compared to displaced workers that find a new job in the same occupation or sector. In contrast, switching workplace district seems to result in higher earnings compared to displaced workers who remained in the same district after displacement.

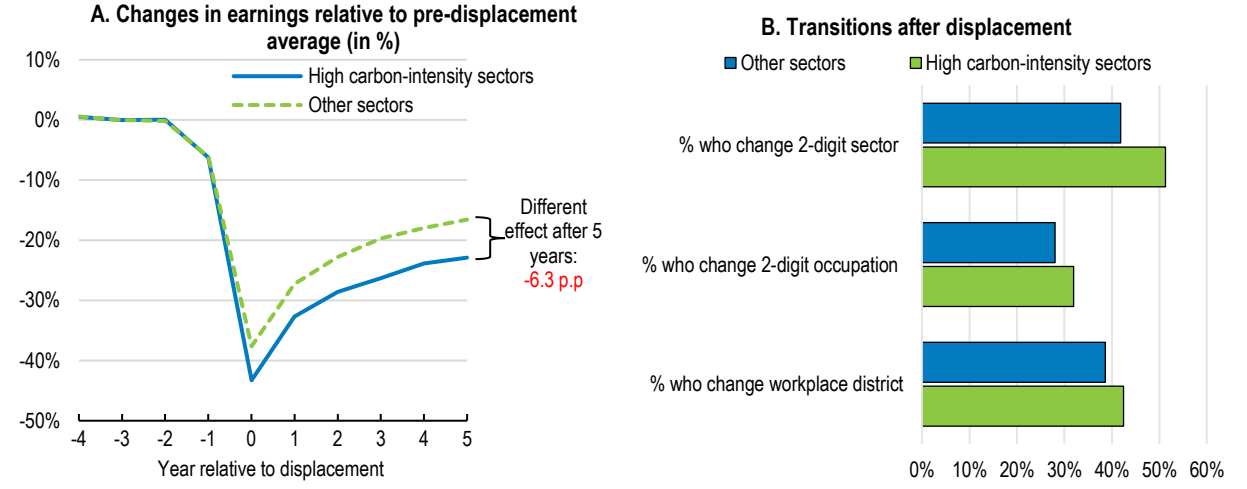
Box 2.6. Estimating the job loss effect for workers in high carbon-intensity sectors

This analysis is presented in a technical background paper prepared for this Survey (Barreto, Grundke and Krill, forthcoming[2]). It uses a random sample of 10% of workers from the Integrated Employment Biographies (IEB) dataset, which comprises all workers registered in German Social Security records and includes information on wages, employment status, economic sector, location and firm ID as well as a range of individual characteristics, such as education and age of the worker. The analysis focuses on the period of 1993-2020 to be able to include eastern Germany in the analysis. To identify workers in high-carbon intensity sectors (HCI), data from the World Input-Output Database Environmental Accounts is used to compute the average carbon intensity from 2000 to 2016. HCI sectors are defined as the top two deciles of the carbon intensity distribution, accounting for 81% of total CO_2 emissions during this period.

The administrative worker-level data is matched to the Establishment History Panel (BHP), which allows to identify workers that have been laid off during a mass layoff. Focusing on displacements during mass layoff events enables identifying the causal effects of involuntary job separations (Jacobson, Lalonde and Sullivan, 1993[77]) (Schmieder et al., 2022[78]). Mass layoff events are classified as a drop in employment of at least 30% among establishments with at least 50 employees. About 2% of establishments with more than 50 employees experienced a massive layoff event each year during the relevant period, and mass layoffs are dispersed across regions. Estimations include full-time employees aged 20-55 with at least two years of tenure. Overall, 8089 individuals in the sample were displaced from mass layoffs in high-carbon intensity sectors.

To control for different characteristics between displaced and non-displaced workers, the estimation uses a matching technique combining exact matching and Propensity Score Matching to pair each displaced worker with a non-displaced worker, separately in cells defined by high- and low-carbon intensity sectors, 1-digit economic sector, year, and gender (exact matching on all of these variables). Propensity scores are based on workers' wages before displacement, age, job tenure, education level, occupation, nationality, the establishment's size and indicator variables for East Germany and urban/rural area. This technique allowed to construct a control group with similar individual characteristics and pre-displacement trends in outcomes compared to displaced workers. This allows quantifying the effects of job displacement on labour market outcomes, such as hourly wages, employment status and job transitions, up to five years after the displacement event, and separately for workers in the high- and low-carbon intensity sectors.

Figure 2.22. Displaced high carbon intensity workers suffer lasting and significant reductions in earnings



Source: (Barreto, Grundke and Krill, forthcoming[2])

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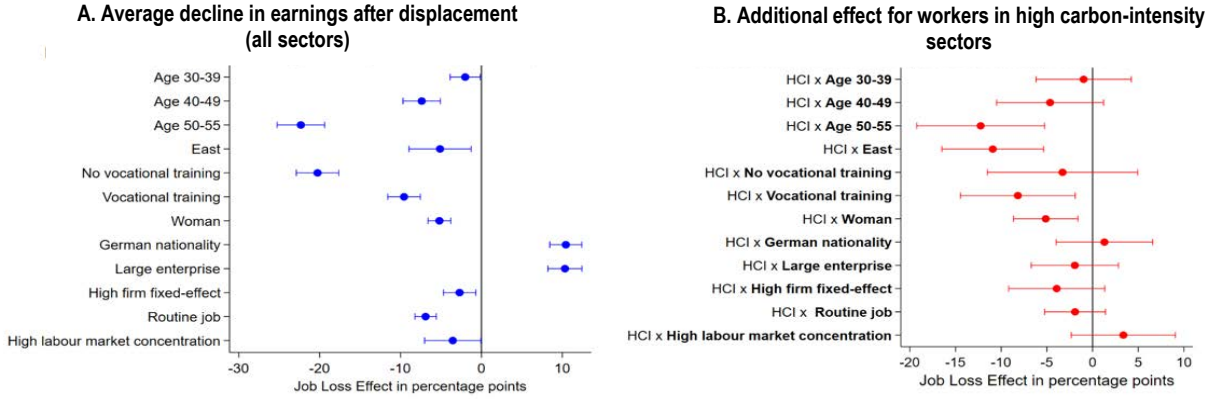
Displacement costs for workers in HCI sectors were higher than for other workers due to observable differences in worker, job and regional characteristics, which explain two-thirds of the earnings gap (Barreto, Grundke and Krill, forthcoming[2]). Workers in High Carbon Intensity sectors are (on average) older and have higher tenure, are more likely to have vocational education rather than more general tertiary education, and work in very specific occupations, which have a higher routine task content. Employees with these characteristics experienced higher earning losses after displacement (Figure 2.23). For example, chemical plant operators and mechanical workers were among the occupations with highest average displacement costs. The negative effects of these characteristics on earnings after displacement suggest that human capital specificity, particularly related to routine tasks, and lower basic skills, especially of older workers, play a major role in explaining the higher displacement costs for workers in HCI sectors (Utar, 2018[79]; Dauth, Findeisen and Suedekum, 2020[80]). If displaced workers in HCI sectors succeed to move to another occupation, the distance between the required skill set of the new and the old job is higher than for workers in Low Carbon Intensity sectors. This calls for more fundamental formal education courses to help displaced workers from HCI sectors to move into well-paid occupations in expanding sectors and firms (Hummels et al., 2012[75]; Hyman, 2018[74]; Autor et al., 2014[81]). Necessary improvements in general cognitive skills, such as literacy and numeracy, and new occupation-specific skills will require large investments in formal and vocational education courses for adults (Bechichi et al., 2018[82]; Bechichi et al., 2019[83]).

High concentration of HCI firms in specific regions, higher restrictions to regional mobility and high firm wage premia are other major explanations for higher displacement costs in HCI sectors (Barreto, Grundke and Krill, forthcoming[2]). Outside options in the most affected regions are more limited and employer concentration is higher, complicating employment transitions (Figure 2.23). These effects are more severe in eastern Germany (Barreto, Grundke and Krill, forthcoming[2]). Moreover, a mass layoff in a large firm could create a domino effect on the region as a whole, reducing employment and labour productivity, due to negative agglomeration effects and the decline in consumer demand (Gathmann, Helm and Schönberg, 2018[84]; Helm, 2019[85]; Dix-Carneiro and Kovak, 2017[86]). However, displaced workers that are more mobile and transition to a new job outside their local labour market have lower displacement costs. This calls for active labour market and other policies to facilitate the regional mobility of workers, while at the same time emphasising the role of well-designed regional development policies to counter negative agglomeration effects and improve employment opportunities in local labour markets.

Figure 2.23. Older, low-skilled, and female workers as well as those in East Germany experience steeper earning losses due to involuntary displacement



Note: Point estimates refer to changes in relative earnings in case of involuntary displacement. A negative effect indicates earning losses 5 years after displacement. Horizontal bars indicate the estimated 95% confidence interval based on standard errors clustered at the district level. The base groups are the age group 25-29 years, having an academic degree, being male, from West Germany and without the German nationality. Large enterprises are firms with more than 250 employees. Labour market concentration is calculated by 2-digit occupation as the number of employers that hire workers of the specific occupation within a commuting zone. The index ranges from 0, no market concentration, to 1 in the case of a single firm hiring all workers with the same occupation (2 digits) in the market. An HHI larger than 0.15 is considered as high.

Source: (Barreto, Grundke and Krill, Forthcoming [2])

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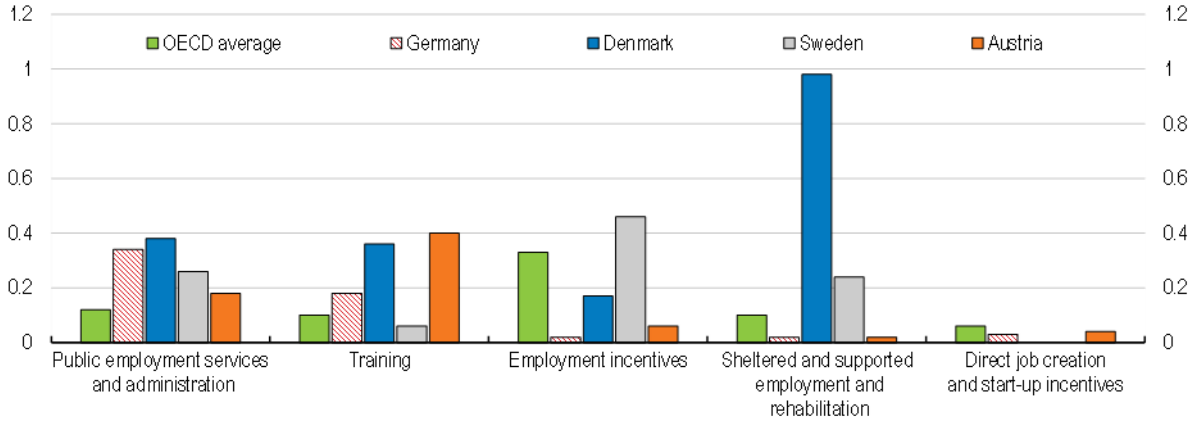
Policies to reduce adjustment costs and smooth the transition

Flexible labour market regulation and an effective social safety net focusing on the protection of workers and not of jobs combined with efficient job placement services would facilitate the transition of workers to new job opportunities in low carbon-intensity industries (Grundke and Arnold, 2022[71]). Germany has quite robust social safety nets, but has room to improve labour market flexibility: Employment protection against collective and individual dismissals is high, which might postpone necessary resource reallocation and increase adjustment costs. As discussed in the previous Economic Survey of Germany, many occupational entry regulations, limited housing supply in big cities, where job opportunities are more spread, and underfunded public transport (see below) hinder job mobility (OECD, 2020[87]). Improving policies in these areas is key for mastering the green transition, but also other structural transformations such as the globalisation of production processes, technological change and population ageing that affect relative prices and the reallocation of workers and capital across firms, sectors, and occupations (OECD, 2012[88]; OECD, 2005[89]).

Expanding the scope of Active Labour Market Programmes (ALMP) can help displaced workers find a good quality job. In countries with higher ALMP spending the average earnings loss due to displacement is lower (Bertheau et al., 2022[90]). Spending for ALMP was around 0.6% of GDP in Germany in 2019, slightly lower than the OECD average (0.7%) and much lower than in Sweden (1%) and Denmark (1.9%), two countries in which displaced workers experience modest earning losses. While spending on labour market services such as guidance, counselling and other forms of job-search assistance is relatively high, spending on training and start-up incentives is moderate (Figure 2.24). The proportion of jobseekers benefitting from participation in activation measures in Germany has declined since 2008 (Kristine, 2019[91]).

Figure 2.24. There is scope to increase spending on training

Public expenditure on active labour market policies, % of GDP, 2019



Source: OECD Labour Force Statistics.

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Undertaking more fundamental re-training and support for acquiring basic skills are essential to raising employability and life-time income for the unemployed and would help to reduce skilled labour shortages (van den Berg, Uhlendorff and Wolff, 2021[92]; Wolff, 2021[93]). In 2022, about 55% of the unemployed had no university or vocational degree (Bundesagentur für Arbeit, 2022[94]). The recent basic income support reform (*Bürgergeld*) is an important step to promote more reskilling and upskilling for registered job seekers, as it abolishes the prioritisation of job placement over additional training. Completing a VET degree will be possible within three instead of two years. Additionally, registered job seekers will receive support for acquiring basic skills and a monthly allowance of EUR 150 if they are enrolled in training measures leading to a professional degree. However, as low basic skills of many unemployed persons complicate the successful completion of a VET degree, adult education opportunities to update basic skills need to be further expanded and better linked with public employment services (OECD, 2021[95]; OECD, 2022[96]). This requires better cooperation across levels of government, as ALMP is a federal and adult education a Laender responsibility. In addition, mobility assistance programmes should be expanded. These programmes increase jobseekers' search radius, leading to higher employment probabilities and wages. While such programmes already exist in Germany, their provision varies substantially between Laender (Caliendo, Künn and Mahlstedt, 2017[97]).

About 15% of employed workers have low basic skills, which makes them particularly vulnerable to the green transition (OECD, 2022[96]). They are less likely than other workers to participate in Continued Vocational Education and Training (CVET) programs, which emphasises the need to better promote and target adult education programmes. One way to promote participation is to rely more on partial qualifications that allow individuals to complete single training modules on a step-by-step basis and combine this with better recognition of prior learning, particularly of knowledge accumulated on the job. This would reduce entry costs, provide more flexibility, shorten training time and encourage low-skilled workers to participate in CVET and eventually complete a VET degree (OECD, 2021[95]). So far, partial qualifications only exist in Germany for certain occupations, are not standardised across training providers, and not well linked to career guidance or the skill validation system. Implementing nationwide quality standards in career guidance, skill validation and partial qualifications and setting precise qualification requirements for career guidance counsellors in calls for tender would improve the services given to workers with low skills (OECD, 2022[96]). As the German CVET system is highly fragmented, introducing nationwide quality standards and certifications for CVET courses and better coordinating and marketing the existing supply across all regions, for example by introducing a common digital platform, is key for raising training participation (OECD, 2021[95]). Expanding support for acquiring basic skills and better

targeting them to low-skilled workers is also crucial, as many CVET courses require a minimum level of basic skills. In the context of rising skilled labour shortages, employers and employer associations should play a larger role in promoting adult education opportunities by providing workers with sufficient training time and supporting efforts to raise awareness and disseminate information on adult education opportunities among low-skilled workers.

Targeted hiring subsidies should complement improved training and education opportunities to strengthen the employability of the most vulnerable groups (Brown, 2015[98]) (Card, Kluve and Weber, 2018[99]). The Participation Opportunities Act, which has been in force since 2019, provides targeted wage subsidies as well as coaching and training and helps long-term unemployed to find a stable job, but these services are exclusively available for individuals who have been unemployed for at least two years (German Council of Economic Experts, 2022[100]). This programme could be expanded to vulnerable groups already in early stages of their unemployment spell to improve their re-employment chances. To better identify these groups and to limit cream-skimming effects, whereby public employment agencies could prioritise individuals with higher re-employment chances to maximise their performance outcomes, profiling tools that rely on statistical models to predict jobseekers' likelihood of becoming long-term unemployed should be used to select participants. Well-known examples are the *Work Profiler* in the Netherlands, the *Job Seeker Classification Instrument* in Australia and the *Worker Profiling and Reemployment Services* (WPRS) initiative in the United States (Desiere, Langenbucher and Struyven, 2019[101]) (Box 2.7).

Box 2.7. Data-driven employment services for displaced workers

Statistical profiling of jobseekers draws on both the characteristics of the jobseeker to be profiled and on observations of previous jobseekers with similar characteristics. It is used in several OECD countries to identify early on those jobseekers who have a high risk of becoming long-term unemployed. This allows concentrating the efforts of the public employment service on high-risk jobseekers, as well as providing leaner services to jobseekers who do not need help with finding employment.

As a result of profiling, the interaction with jobseekers can vary strongly. In the Netherlands, for example, initially only high-risk jobseekers are invited for an interview with a caseworker, while the interaction with low-risk jobseekers is typically limited to online services unless their unemployment duration approaches six months. Similarly, an individual action plan (IAP) is concluded early on for high-risk jobseekers in Ireland, but only after 6 months for low-risk jobseekers. Along these lines, the interaction with jobseekers in Germany could be targeted more strongly at those profiled as having a high risk of long-term unemployment or likely to experience a significant decline in earnings.

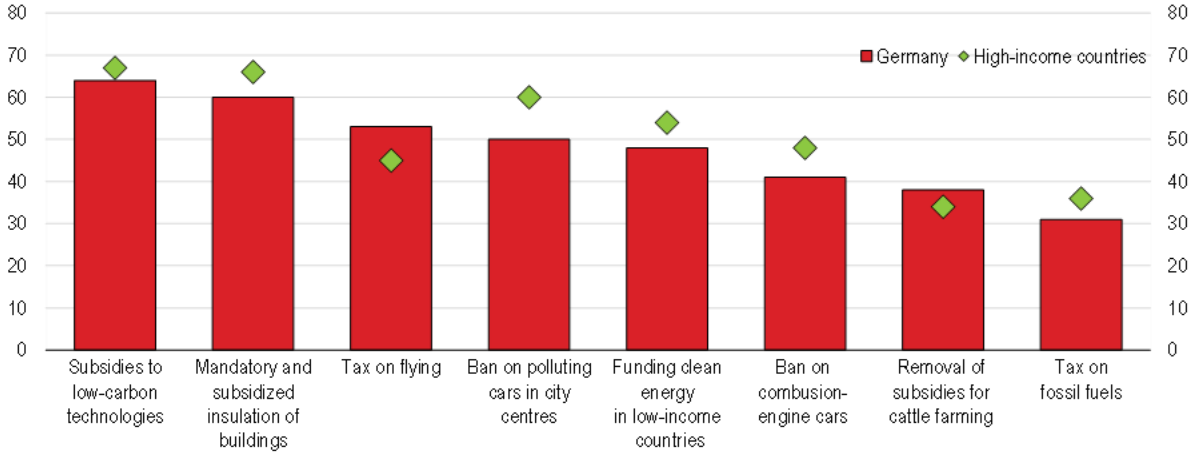
Source: (Desiere, Langenbucher and Struyven, 2019[101]).

Designing climate policies to build strong public support

A cross-country OECD survey found that 80% of German respondents agree that "climate change is an important problem" and that Germany "should take measures to fight climate change", in par with results in other high-income countries. Yet, attitudes about different mitigation measures vary significantly. The most popular policies are subsidies for low-carbon technologies, investment in thermal renovations for buildings and taxes on flying (Figure 2.25). Germans are less prone to accept measures such as a tax on fossil fuels (without earmarking of revenues), bans on combustion engines or removing subsidies for cattle farming. Car users are less supportive of climate policies, especially regarding bans on combustion engine cars, and so are individuals who live in small cities and rural areas. However, public transport availability increases support significantly and it is a stronger predictor of support than city size (Dechezleprêtre et al., 2022[102]).

Figure 2.25. Policies to tackle climate change receive unequal support

Share of respondents who somewhat or strongly support climate change policies, %



Source : Dechezleprêtre, A., et al. (2022), "Fighting climate change: International attitudes toward climate policies", OECD Economics Department Working Papers, No. 1714, OECD Publishing, Paris, https://doi.org/10.1787/3406f29a-en.

Note: High-income countries include Australia, Canada, Denmark, France, Germany, Italy, Japan, Poland, South Korea, Spain, UK and the US.

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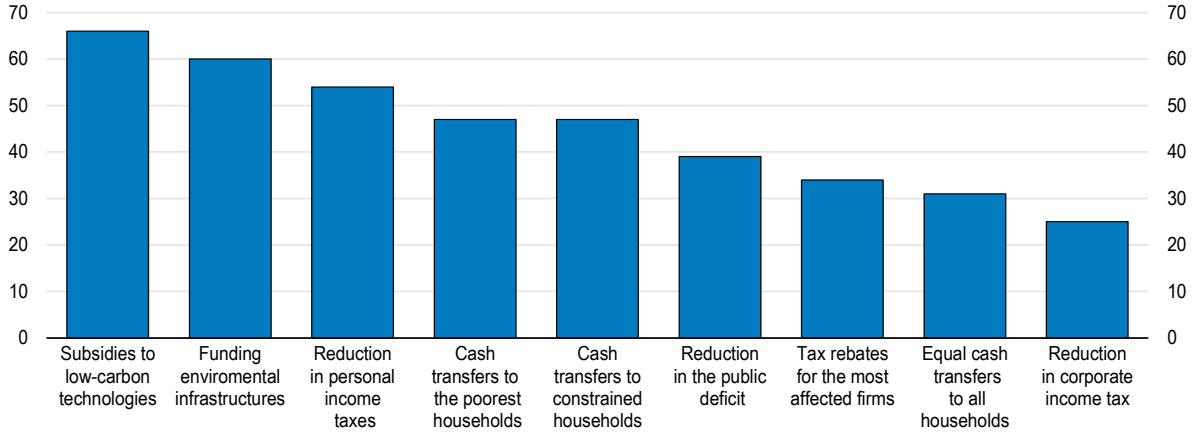
Carbon pricing by itself is not a popular measure but it can receive majority support when the revenues are used to fund green infrastructure and clean technology adoption or to reduce personal income taxes (Figure 2.26). Using carbon price-related revenues for targeted support to poor households could also increase support for carbon pricing. In contrast, using revenues to lower corporate income taxes or distributing revenues equally via lump-sum cash transfers are unpopular, although the latter is still supported by a relative majority when excluding “indifferent” respondents from the sample.

Information about climate policies, how they work and about how revenues are distributed can increase support for pricing policies (Dechezleprêtre et al., 2022[102]) (Douenne and Fabre, 2022[103]). For example, only a minority of Germans believes a carbon tax would encourage people to drive less. However, explaining (using pedagogical videos) how higher taxes on fossil fuels contribute to reducing emissions and explaining their distributional effects were found to increase support significantly. Public information and education campaigns should be an important part of climate policy implementation and need to be introduced before pricing is fully phased in. Nevertheless, high quality information requires better ex-ante evaluation of economic and social effects of mitigation polices.

Figure 2.26. Support for carbon pricing strongly depends on revenue use

Share of respondents who somewhat or strongly support policy combination (with carbon tax), %



Source: Dechezleprêtre, A. et al. (2022), "Fighting climate change: International attitudes toward climate policies", OECD Economics Department Working Papers, No. 1714, OECD Publishing, Paris, https://doi.org/10.1787/3406f29a-en.

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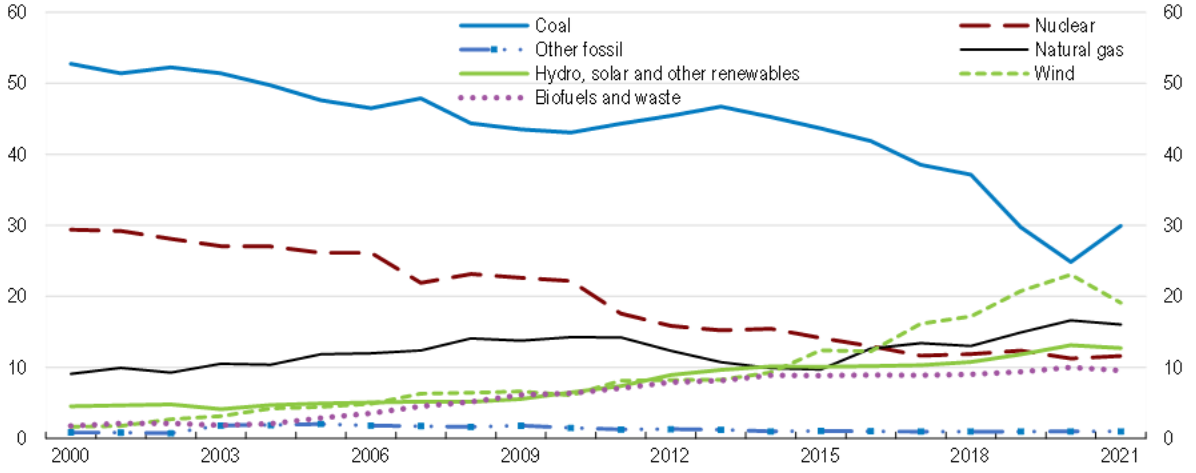
Targeting policies to the sectoral context

Removing barriers to expanding renewables

The electricity sector is Germany's largest source of GHG emissions, contributing 29% of total emissions. In 2021, more than half of the electricity in Germany was still generated by fossil sources. Nonetheless, use of renewables has expanded significantly, and coal usage trend has been declining rapidly (Figure 2.27). Germany led the G20 in deploying wind and solar energy with a share of 29% in 2021, ahead of the United Kingdom (25%) and Australia (22%). Even so, many windless days in the first half of 2021 reduced their share in the total electricity generation mix. Along with the expansion of renewables, the reliability of the electrical grid improved. In 2020, the average power outage duration was 0.25 hours, amongst the lowest in Europe and the world (World Bank, 2020[104]).

Figure 2.27. Coal uses for electricity generation steadily declined until 2020

Electricity generation by source, %



Source: IEA Electricity Information 2022.

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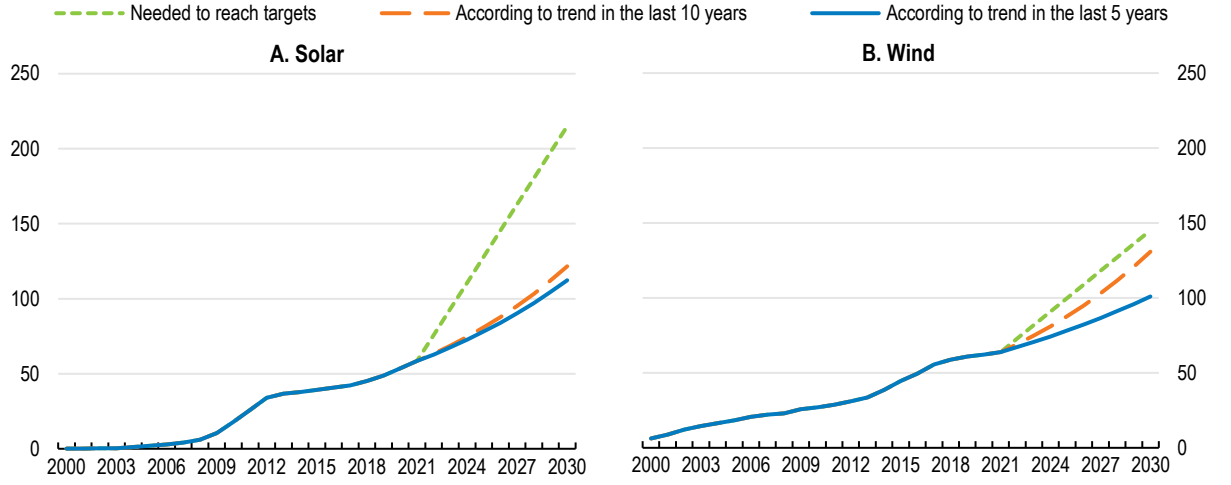
Germany will have to expand renewables even faster to replace coal-fired and nuclear power capacity being taken off the grid and to cover the future rise in demand due to the shift to electric transport and heating. The government aims to reach 80% of electricity generation from renewables by 2030, which requires accelerating the installed capacity dramatically: The annual growth in installed capacity of solar energy should be about three times higher compared to the average progress between 2016 to 2021, and of wind 2.2 times higher (Figure 2.28). In addition, it phased out nuclear power in April 2023 and aims to phase out coal (ideally) by 2030. Although costly in the short run, the renewables installations could benefit German consumers in the long run. New wind and solar installations deliver decentralized electricity at a cost of between four and five cents per kilowatt-hour – roughly half of the 2021 level of electricity prices on the exchanges. Accelerating the installations will also help to reduce energy imports from foreign countries and improve energy security (BMWK, 2022[105]).

Figure 2.28. Faster deployment of renewables is needed

Renewable's capacity, terawatt hours



Source: Ember, https://ember-climate.org

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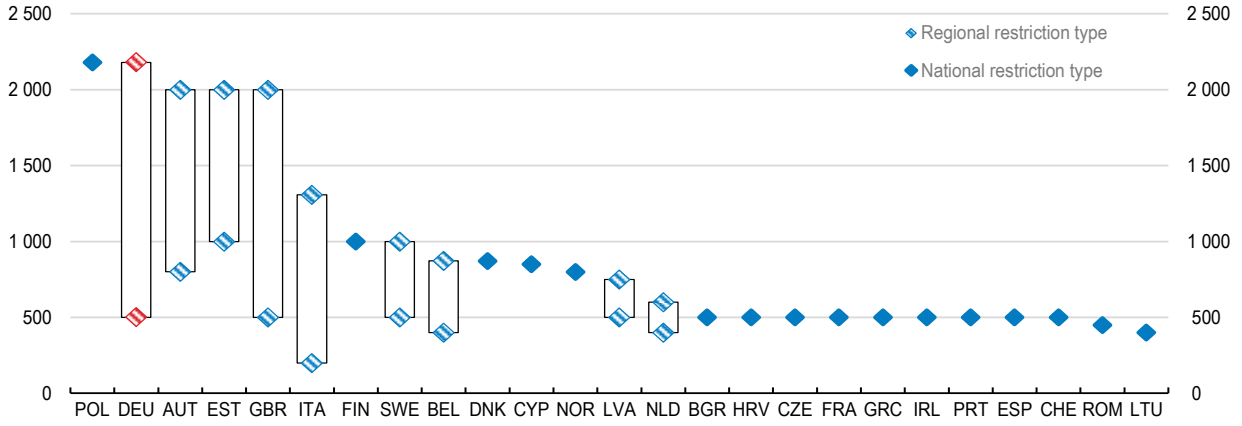
Public opposition, conflicts with nature protection objectives and lengthy planning and approval procedures are the main barriers to expanding renewables. This is especially true for onshore wind power. From 2019 to 2021, Germany added, on average, only 5 gigawatts of wind capacity, compared to 14 in the previous three years. The slowdown is partially due to strong resistance in some Laender that, among others, have imposed restrictive minimum distance regulations for onshore wind turbines (Figure 2.29). In Bavaria, for example, the introduction of minimum distance rules decreased the number of construction permits for wind turbines by 90% (Stede and May, 2020[106]). The new Onshore Wind Energy Act tackles this challenge by limiting the ability of Laender to set overly restrictive rules. According to the Act, Germany's 13 larger Laender must designate 1.8% to 2.2% of their surface area to onshore wind power by 2032, depending on their wind conditions and the size of their nature protection areas, while the three city states need to dedicate 0.5% of their respective surface areas. Laender will keep relying on their own planning capabilities and can, in principle, stick to individual distance rules. However, if they don't manage to assign enough space to wind turbines, wind power investors will be automatically allowed to build turbines in restricted areas. According to the law, states are allowed to exchange up to 50% of their designated sites with overachieving Laender to fulfil their obligations.

Figure 2.29. Strict regulations slow down the deployment of renewables

Minimum distance of wind turbine from settlements, meter



Note: A Vestas V136 turbine with 218m tip height is assumed.
Source: Ember, https://ember-climate.org

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The German government took essential steps to streamline permitting procedures but the ambitious targets demand reducing administrative and legal burdens further. The government adopted an amendment to the Renewable Energy Act, which emphasises that the use of renewable energies is of "overriding public interest" and will be given priority over conservation concerns until net-zero is achieved. It also enables the building of wind turbines closer to air traffic control and meteorological systems and sets uniform federal standards for species protection assessments. Setting a single contact point for all permitting procedures, being transparent on deadlines, roles and responsibilities of the different authorities and applying silence-is-consent rules could lower the administrative burden. Raising capacity and allowing for more specialisation of administrative and court staff, in accordance with the expected increase in tenders, and adopting a population-based approach to biodiversity protection (i.e., protecting species numbers instead of individual creatures) could help as well (Wind Europe, 2022[107]). Collaborative planning approaches and public campaigns that emphasise the positive effects of expanding renewables to rural areas due to the creation of new jobs could help lessen local resistance (Wolsink, 2000[108]) (Brunner and Schwegman, 2022[109]). Nonetheless, the impact of accelerated and streamlined permitting processes on biodiversity goals should be carefully analysed to inform future policy design.

Simplifying permitting and improving planning procedures is also crucial for the expansion of solar energy. Over the last decade, the number of solar panels deployed has increased massively while their costs have declined drastically. In 2021, Germany added almost 5 gigawatts of solar power capacity, 9% more than in 2020 (but still much less than around 2010). Rising energy prices since Russia's invasion of Ukraine have boosted demand for solar installation further (BSW solar, 2022[110]). Nonetheless, massive expansion of free-standing plants, especially big solar farms, could lead to conflicts and acceptance problems. Integrating solar panels into existing built-up areas, mainly on buildings, agricultural lands, and roads can be a solution (Fraunhofer ISE, 2022[111]). The government opens more agricultural areas to solar panel installations, allows community solar parks to be built without participating in tenders, makes installing solar roofs mandatory for all new commercial buildings and has suspended the feed-in tariff payment reductions until the beginning of 2024. Upgrading the capacity of municipal planning offices and streamlining administrative procedures could help accelerate deployment.

Modernise the transmission network

A rapid expansion of wind and solar energy poses challenges for the transmission network: Electricity generation from renewables is less stable over time and the electricity generated by wind turbines in the north must be transported to the major power consumption regions in the west and south. Therefore,

considerable expansion of the electricity network and a better balance of supply to variations in demand are needed. However, the expansion and restructuring speed is lagging far behind what is needed, mainly due to lengthy planning procedures (BMWK, 2022[105]). The government intends to simplify the permit procedures by partially dispensing with the spatial planning and approval procedures and replacing them with federal sectoral planning.

Nevertheless, little progress has been made in changing grid charge incentives to better balance electricity demand and supply. Overall, price signals on the consumer side are weak due to static levies, taxes, and grid charges. In addition, the grid charges – that account for about 28% of industrial consumer electricity price – incentivise stable consumption of electricity. For instance, the Electricity Network Fee Ordinance grants large energy-intensive industrial consumers reduced grid charges for keeping their electricity consumption constant over time (Hanny et al., 2022[112]). Moreover, grid charges are higher in the north and east than elsewhere, lowering incentives to establish energy-intensive plants (such as electrolysis plants to produce green hydrogen), despite a large amount of wind power. Encouraging the establishment of new plants where energy is more abundant should be combined with abolishing the concessions for energy-intensive industries and introducing time-variable electricity charges as well as peak pricing to ensure that the costs of grid utilisations are based on the actual state of the grid (Fritz, Maurer and Jahn - Projektleitung, 2021[113]). This would incentivise the use of available technologies, such as smart thermostats and water heating, to shift electricity use across time and reduce peak demand times on the grid (raise load flexibility), thereby minimising generation and transmission costs. Therefore, the government's plan to require all electricity suppliers to offer dynamic tariffs from 2025 is welcome.

As electricity generation from renewable energy sources fluctuates, a better communication network is needed to link generation, consumption, and the grid. Smart meters and contracts together with better storage units can help households optimise their electricity consumption and even feed the grid in times of high demand. Likewise, they can provide decision makers with a more precise picture of energy consumption patterns and save resources by eliminating the need to visit the traditional meter readers. Nonetheless, the rollout of smart meters in Germany is lagging considerably, mainly due to data protection issues and the fear of cyber-attacks (European Commission, 2020[114]). In 2021, the Federal Office for Information Security (BSI) withdrew its target for the roll-out of 10% of the measuring points with smart meters until 2023 due to a lawsuit by municipal utilities. By contrast, in Sweden, Finland and Estonia, 100% of households now have smart meters and in Italy a second round of deployment is already taking place. The Government agreed on a bill that should accelerate the rollout of smart meters by setting a roadmap for their deployment, reducing unnecessary regulations and facilitating the installation of smart meters' secure communication unit at the grid connection points. The proposed bill also seeks to cap the annual costs of the meters for consumers (EUR 20) so the grid operators will have to bear a more significant share of the cost. This measure may reduce the incentives of the grid operators to accelerate the deployment of smart meters and should be evaluated carefully. Dedicating more investment to strengthening data protection and cyber security could help to increase public acceptance for the deployment of smart meters.

Rising electricity demand and the coal and nuclear phase-out limit the amount of flexible capacity in the electricity market, creating a risk that producers will raise electricity prices by withholding capacity. In 2021, RWE – the largest electricity supplier in Germany, accounting for 25% of the market – was indispensable for meeting the electricity demand in a significantly higher number of hours, which means it has substantial market power (The Monopolies Commission, 2022[115]). Promoting competition in the market is crucial for keeping electricity affordable. The regulatory set-up in Germany's electricity sector is competition-friendly, but the share of consumers who switch suppliers is lower than in other EU countries (OECD, 2018[116]). Upgrading grid connections with neighbouring countries and improving transparency and data access for investigating anti-competitive behaviour could help to strengthen competition as well as energy security. Fostering competition in the cross-zonal intraday market by expanding trading times is also key. It could boost competition between electricity exchanges, which in turn will promote innovation and investment in the intraday market (The Monopolies Commission, 2021[117]).

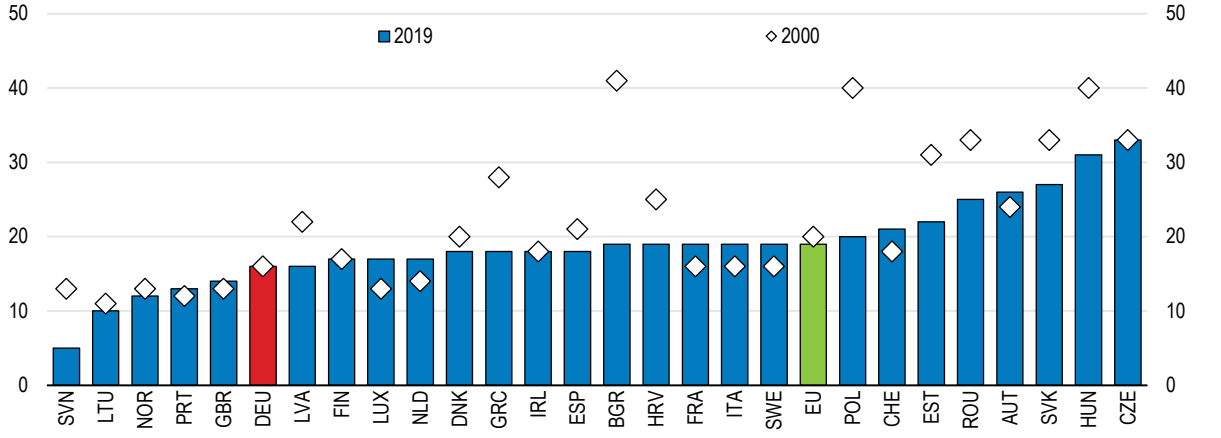
Decarbonising transport and shifting to more sustainable transport modes

Transport is the second largest source of GHG emissions in Germany, contributing 20% of total emissions. The actual share is likely higher because international aviation, shipping, and emissions from electricity consumption in transport are not included in the data. Greening transport is challenging. For some forms of transport – notably maritime and aviation – economically viable solutions are not yet available (IEA, 2021[57]). Nonetheless, most emissions from transport arise on land for which mature technological solutions, such as electric vehicles or rail are available.

The decarbonisation of Germany's transport sector is not on track: emissions from transport in Germany were broadly stable in the last two decades. Emissions per kilometre of Germany's car fleet have decreased by 9% since 1995, but heavier cars and rising mileage in passenger transport cancelled out the positive effect of improved engine efficiency. Furthermore, the shift to public transport has been limited (Figure 2.30). Simultaneously, emissions in domestic freight transport increased by about 75% from 1990, with a twofold increase in road freight and slower growth in rail (Federal Ministry for the Environment, 2021[118]). Travel and freight movements are projected to rise over the coming years due to rising living standards and trade. Considering the increase in travel movements and all mitigation measures adopted until 2022, emissions in transport are projected to reach 126 million tonnes of CO_2 by 2030, which is 40 million tonnes above the sectoral target (UmweltBundesamt, 2022[119]). Thus, major policy changes are needed. Focusing only on either greening road transport or improving public transport would fall short of bringing Germany close to net-zero.

Figure 2.30. Public transport remains limited

Ratio between passengers of public transport (bus, train, metro, tram) and total traffic of road and rail passengers, %



Source: Odyssee-Mure database.

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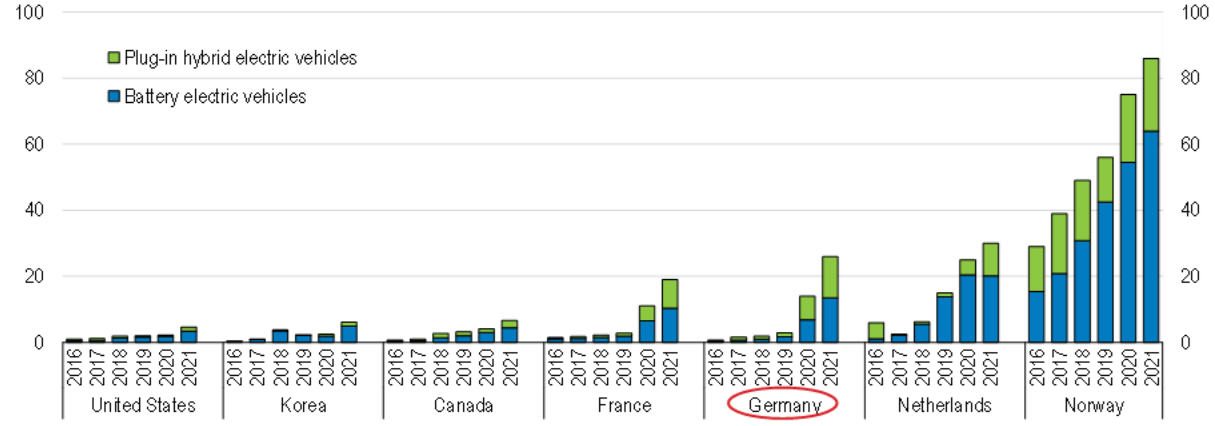
Cutting emissions per kilometre travelled on the road

The share of low-emissions vehicles in new car registrations (26% in 2021) is among the highest in the OECD and EU countries and has been growing rapidly since mid-2020 (Figure 2.31). This is related to tightening European CO_2 standards, restricting access of fossil-fuel cars to dense areas and subsidies for the purchase and maintenance of electric cars. To reach the government's target of at least 15 million passenger cars to be fully electric by 2030, which would allow closing about half of the gap between current transport emissions and the 2030 climate target, the share of electric cars among new registrations should reach at least 50% by 2025 and 85% in 2030 (Federal Ministry of Economic Affairs and Climate A, 2022[120]). This is only feasible with a much quicker expansion of charging infrastructure. Moreover, the efforts to electrify the car fleet should be better coordinated with other national targets, such as increasing the share of alternative modes of transport (like walking and cycling) and reducing congestion and car accidents (European Commission, 2019[121]).

Figure 2.31. The share of low-emissions vehicles is growing rapidly

Electric car sales, share in new registrations, %



Source: IEA, Global EV Data Explorer

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Government subsidies strongly incentivise the purchase of electric and hybrid cars and operating expenses are already around 40% lower for electric vehicles than for fossil fuel-powered cars (Table 2.6). For example, consumers receive a subsidy of up to EUR 4 500 for purchasing an electric car, which is expected to decline to EUR 3 000 in 2024, and EUR 900 for purchasing a home charging station. Additionally, the government supports the deployment of fast-charging infrastructure along the countries' highways and has eliminated the renewable energy surcharge. Due to these subsidies and the high oil prices in 2022, driving a median electric car has become cheaper than driving a median conventional car (Table 2.6) (Miotti et al., 2016[122]),(Agora Verkehrswende, 2022[123]). In the executive and luxury vehicle classes, battery-electric vehicles are already cheaper than their combustion-engine counterparts even without subsidies, as other equipment features are more important price determinants compared to engine parts (Agora Verkehrswende, 2022[123]).

Table 2.6. Government subsidies strongly incentivise the purchase of electric cars

Breakdown of the costs for different cars, per 100 kilometres, in euros

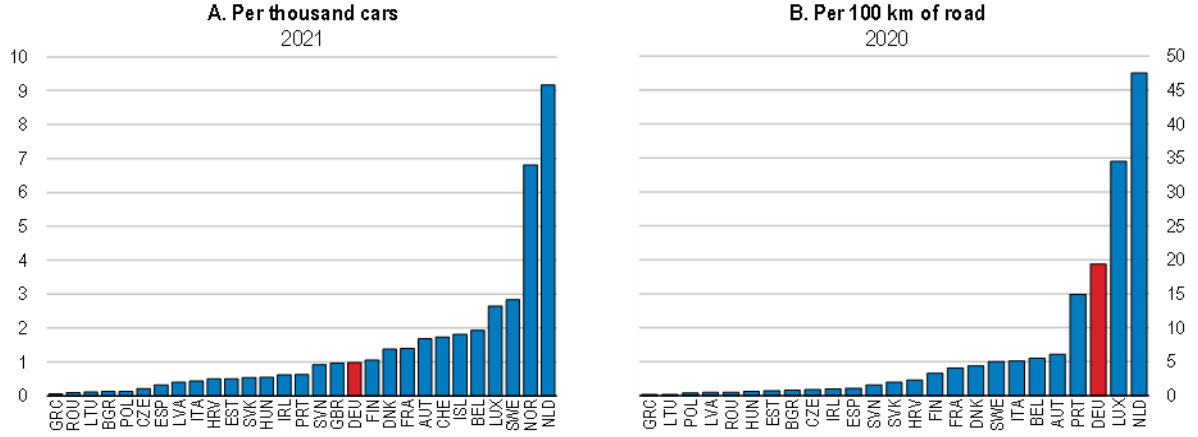
	Battery Electric Vehicle (BEV)	Plug-in hybrid	Petrol car	Diesel car
Capital Costs				
Purchase cost (Incl. VAT)	28.43	24.27	18.48	19.56
Subsidies (-)	4.31	3.38	-	-
Operational Costs				
Fuel/charging cost	5.08	8.40	9.99	7.96
Maintenance cost	4.91	5.76	6.62	6.62
Insurance	3.05	3.66	4.28	4.33
Yearly car tax	Exempt	0,53	0.75	1.72
Total, excluding subsidies	**41.45**	**42.63**	**40.12**	**40.20**
Total, including subsidies	**37.16**	**39.25**	**40.12**	**40.20**

Note: The analysis is based on 2022's data. The expenses are calculated for an average driver. Capital costs include the purchase expenses of a car and a home-charging station. Operating costs are calculated as the annual and lifetime mileage of 13,700 and 160,000 km, respectively. The car models were picked within the same classification according to the "Europe-wide safety assessment programme". For the electric vehicle, the Volkswagen ID.3. is chosen. It was the third most sold electric vehicle in Germany in 2021 and is classified in the "small-family car" segment by Euro NCAP. The counterpart within the same category (small-family car) in the petrol and diesel variation is the Volkswagen Golf. For the plug-in hybrid, the Volkswagen GTE is chosen. There are several possibilities to charge electric car's battery: Charging publicly at a slow-charging station (AC), charging publicly at a fast-charging station (DC) and charging at home. Since no driver would use solely one option, the simulation assumed that alternative powertrains "refuel" energy for 66.6% of the time at home and 33.3% at public charging points. For internal combustion engine vehicles, average fuel prices are based on data from June 2022. Average figures for car-insurance premiums in 2020 are used, assuming the vehicle owners opt for mandatory vehicle insurance and additional full-coverage insurance.
Source: Author's calculations based on data from Euro NCAP, the Central Association of the German Motor Trade, EnBW, and Institut der Automobilwirtschaft.

Besides myopia, high uncertainty regarding future fuel prices and a lack of reliable information on cost differences, a main reason for not purchasing an electric vehicle is concerns about practicability, such as range and the availability of charging stations (IEA, 2022[124]). Vehicle uptake will be constrained until sufficient charging infrastructure is available, but private investments in infrastructure require more certainty about vehicle uptake. Thus, the government has a pivotal role in developing this market to make electric vehicle charging at least as easy as filling a conventional vehicle tank. In Germany, public charging points per 1 000 vehicles are below the EU average, with wide variation between Laender (Figure 2.32, Panel A) (ACEA, 2021[125]). When charging points are related to roads length, performance looks slightly better (Panel B). The government plans to install 1 million public charging points with non-discriminatory access by 2030, focusing on developing fast-charging infrastructure. In November 2022, only 72 000 charging points were in operation, of which 11 850 were fast charging points. Thus, more than 9 000 new charging points need to be deployed every month until 2030 to reach the government's target. However, a smaller number of public charging points might be enough to supply services for 15 million electric cars, particularly if the deployment of fast charging points is accelerated. In that case, fewer charging points will be needed overall (PwC, 2022[126]).

Alongside the deployment of infrastructure, fostering competition in the charging infrastructure market is crucial. Individual operators in the market often control a high proportion of the charging points in particular regions (Monopolies Commission, 2021[127]). Customers often cannot access information about operators' prices when charging directly without preliminary registration. Subsidies should be targeted at small players in the charging point market (those who own less than 40% of all charging points in a local area) and support the diversity of operators. Standardizing market access and pricing, such as per kilowatt of energy, and linking public tenders and support measures to performance targets could help to ensure access to reliable information and quality service as well as to ease cross-border mobility (IEA, 2022[124]).

Figure 2.32. Germany lags top performers in the number of charging points



Source: German Association of the Automotive Industry; European Automobile Manufacturers' Association (ACEA).

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The purchase subsidies for electric cars should gradually abolished to create fiscal space for other support measures, including the scale up of charging infrastructure. Purchase subsidies are costly, amounting to EUR 2.1 billion in 2022, and should be confined to the initial marketing step of a new technology (Federal Ministry of Finance, 2021[128]). They are regressive, as most electric car buyers are richer than the average household, and they have supported the purchase of heavier cars, lowering energy efficiency and driving up demand for critical minerals. The speed of the subsidy phase-out should consider the decline in battery costs, the expected rise in carbon prices and developments in the oil market to prevent a strong drop in incentives to buy electric cars. Simulations conducted for this survey show that the incentives to buy an electric car are highly sensitive to changes in battery and fuel prices (Figure 2.33, Box 2.8). To enable consumers to conduct more accurate cost comparisons, the government can require car dealers to prominently display the total typical cost of vehicle ownership for consumers (Agora Verkehrswende, 2022[123]). Currently, the purchase price tends to be a prominent and more salient factor in consumer purchase decisions.

Box 2.8. What determines the attractiveness of buying an electric vehicle?

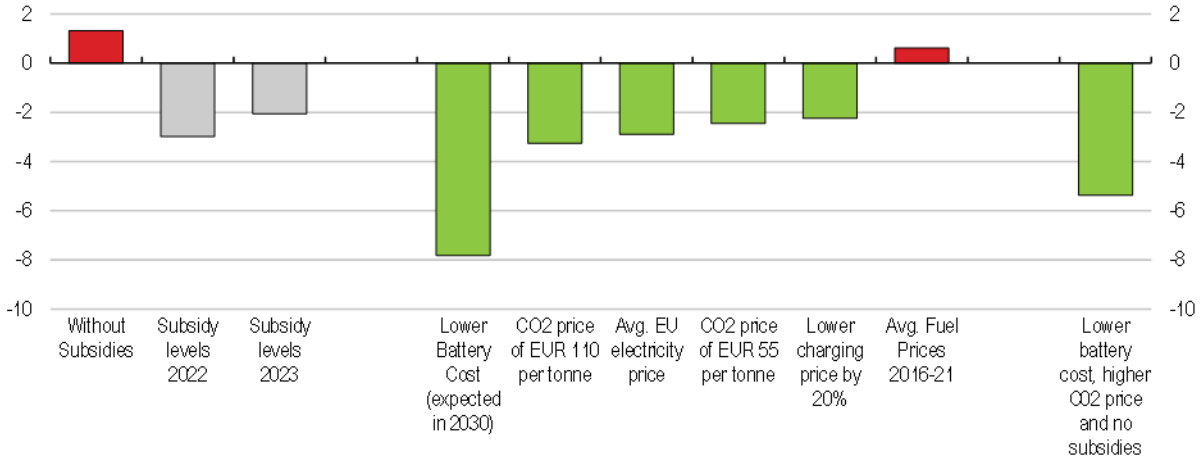
To better understand how changes in the relevant costs influence the motivation to shift to low-emissions vehicles, simulations considering several scenarios were conducted for this Survey (Figure 2.33). In each scenario, only one cost variable is changed, while the others remain constant (Table 2.7). Costs to buy an electric car are compared to the costs of buying a similar petrol car (see Note to Table 2.6).

Table 2.7. Main parameters affecting the decision to shift to driving low-carbon vehicles

Scenario	Description
A further decrease in battery cost	Over the last decade, the cost of a lithium-ion battery declined by around 85%. Rising material prices and soaring inflation have halted the decline in 2022. However, prices are expected to decline further from 2024 (BloombergNEF, 2022[129]). The battery cost of an electric vehicle can decrease by 50% until 2030, which corresponds to an estimated 21% decrease in car purchase costs (König et al., 2021[130]).
A lower household electricity price	Electricity prices are higher in Germany than in most European countries. In the second half of 2021, the EU average electricity price was 23.7 cents per kWh compared to 32.3 cents per kWh in Germany. A decrease in electricity prices to the EU average is considered in this case.
Higher carbon prices	In the beginning of 2021, Germany implemented a CO_2 price on transport fuels of EUR 25 per tonne, implying an increase of 7 cents per litre of petrol and around 8 cents per litre of diesel. In 2026, the CO_2 price will be EUR 55.A further increase in the carbon price to EUR 110 per tonne is considered.
Fuel prices return to their long-term average	Given the volatility of fuel prices, consumer expectations might be based on the long-term average rather than the current prices. The additional cost related to driving an electric vehicle is calculated according to the average fuel prices from 2016 to 2021 in that case.
Lower public charging prices	A reduction of 20% in both the slow- and fast-charging possibilities due to economies of scale, potential subsidies from the government, higher competitiveness in the market and technological developments is considered.

Figure 2.33. Incentives to buy an electric car are highly sensitive to changes in battery and fuel prices

Additional cost related to driving an electric vehicle (compared to a combustion engine car) under different policy scenarios, per 100 kilometres, in EUR



Source: Author's calculations.

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A more sustainable and socially equitable way to incentivize the shift to low-emission vehicles, especially in case carbon prices remain too low, would be to impose a registration tax for new cars, with tax levels varying based on CO_2 emissions. Germany is one of the only OECD countries that does not tax vehicle purchase or registration (see below). Along with the EU fleet-wide CO_2 emission reduction targets for new passenger cars and vans and the ban on the registration of new internal combustion cars by 2035, the introduction of a registration tax for petrol- and diesel-based vehicles would maintain a strong signal regarding the need to accelerate the shift to low-emission passenger cars. Speed limits on motorways would be another way to cut emissions per kilometre travelled on the road. According to the German Environment Agency, it would allow reductions of GHG emissions ranging between 1.9 and 5.4 million tonnes annually, depending on the limit imposed (UmweltBundesamt, 2020[131]).

Though freight vehicles represent a relatively small percentage of on-road vehicles, they account for 36% of transport emissions. The technological pathway towards zero-emission heavy goods vehicles is uncertain, but some mix of electric vehicles, technology that would allow vehicles to draw power from the grid while in use (route electrification) and fuel cell electric vehicles powered by hydrogen have the potential to eliminate emissions by the middle of the century (Lyons, Curry and Rohr, 2021[132]). Given technological uncertainties, the focus in the short term should be on supporting research and development by increasing funding dedicated to this field. This should be complemented by reducing the highway toll for low-emissions large goods vehicles for a limited period and supporting EU efforts in tightening the EU's CO_2 fleet target values for heavy vehicles.

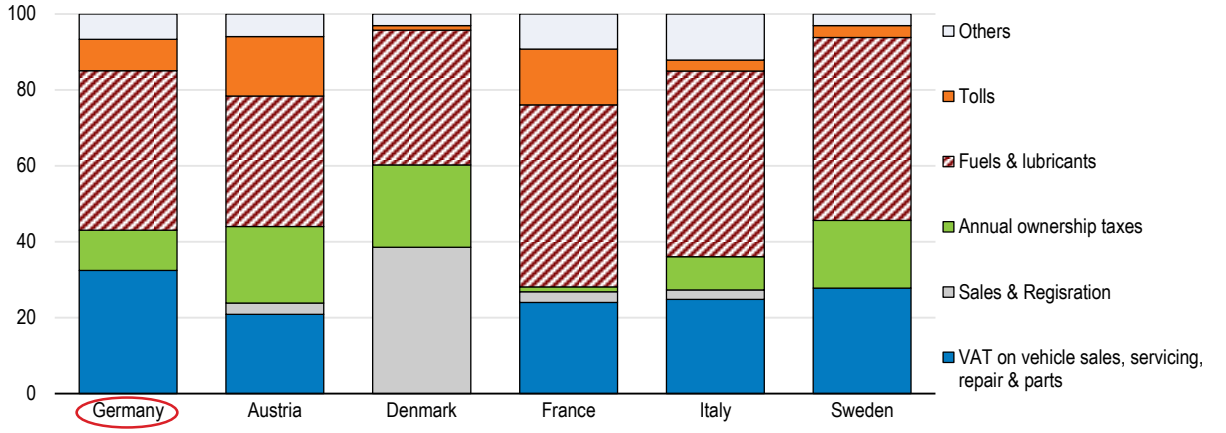
Cutting emissions by moving transport off the road

Public support for emission reductions is an opportunity to change the way people travel. The share of distance travelled by walking and cycling in cities in the Netherlands is more than twice higher than in Germany, for example, and the share of travel by car is eight percentage points lower (Eurostat, 2021[133]). Reducing private car use can help to lower emissions, but also improve health outcomes by reducing air pollution, congestion, and noise in urban areas. Strengthening urban planning, improving the quantity and quality of public transport, and modernising the tax system – e.g., abolishing environmentally harmful subsidies and tax expenditures and relying more on distance-based taxes – should be the main priorities.

The rising electrification of the vehicle fleet will undermine the tax base for fuel taxes and risks to increase negative externalities related to driving, such as congestion, which are currently not priced. Relying more heavily on tolls, consistent with the polluter-pays principle, would contribute to making mobility more sustainable and provide resources for investing in transport infrastructure and other needs (Frey et al., 2015[134]). Distance-based tolls for private vehicles that make it possible to set differentiated charges for infrastructure and internalise other external costs due to road traffic should be promoted as soon as possible to avoid increasing resistance as electric vehicles become more widespread. The collection mechanism could rely on lessons learned from the HGV tolling scheme that applies to heavy goods vehicles on motorways and federal roads, first introduced in 2005. An initial toll rate of about one cent per kilometre driven would yield a revenue of 6.6 billion euros, while a toll rate of 4.3 cents/km would fully finance the road infrastructure costs (based on 2018 car mileage in each case) (German Environment Agency, 2021[135]). Such revenues could largely offset the decline in energy tax revenues from 2030 on. Local externalities (such as noise and congestion) could be more effectively addressed through local measures such as congestion charges. In the short run, Germany has room to increase truck charges using existing charge mechanisms as well as purchase taxes, which are below the levels in France and Denmark (Figure 2.34). A recent government decision to raise truck charges is, therefore, welcome. However, instead of making the charges more dependent on carbon emissions, which would further increase heterogeneity in carbon pricing across sectors, the planned cap-and-trade system for Non-ETS sectors should be phased in earlier and its cap should be aligned with national emission reduction targets to harmonise carbon prices across sectors and reach emission targets more cost-effectively.

Figure 2.34. There is room to increase highway tolls and truck charges

Structure of tax revenues from car ownership and use (in%), 2020



Source: ACEA tax guide.

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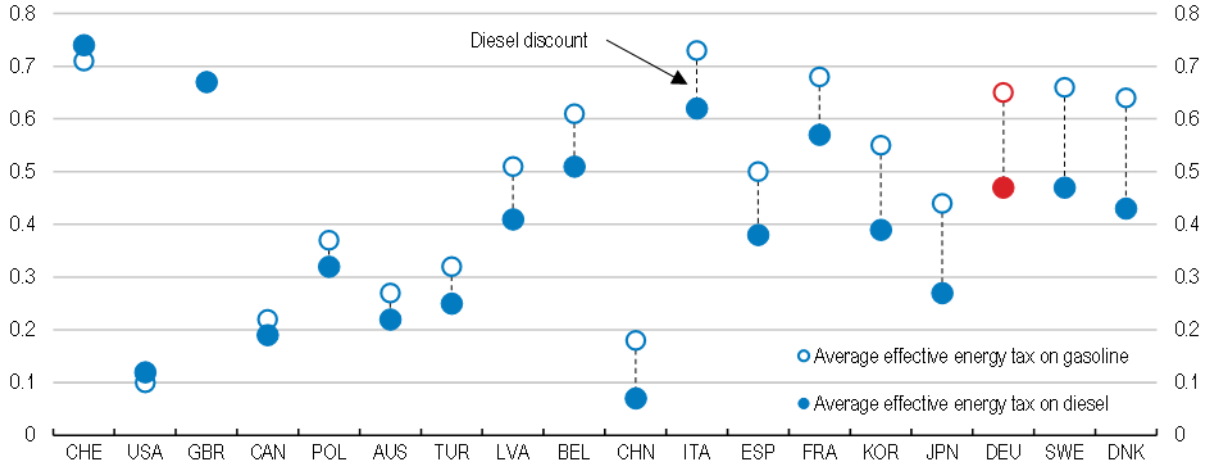
The current tax allowance for commuters – a tax deduction of EUR 30 cents per kilometre of traveling from home to work, regardless of means of transport, and 38 cents for distances of 21 kilometre or more – offers incentives to travel larger distances than necessary, jeopardising climate goals and encouraging urban sprawl and land use. Moreover, this EUR 6 billion tax allowance is regressive: high-income earners commute larger distances and pay higher marginal taxes, therefore enjoying a more substantial deduction. In several OECD countries (such as Australia, Italy, and the United Kingdom), commuting expenses are considered a personal non-deductible decision. In the OECD countries where the commuting deduction does exist, the deductible rate per kilometre is lower (Harding, 2014[136]). Abolishing the distance allowance is estimated to lower greenhouse gas emission by about 2 million tonnes in 2030, about 0.5% of the needed reduction according to the government's targets (Burger and Bretschneider, 2021[37]). Replacing this tax expenditure with a targeted support for employees who have high travel costs as a share of their income or to those who must accept long distance work for social or professional reasons could reduce emissions and inequalities.

Fossil fuel subsidies and tax expenditures weaken price incentives to reduce transport emissions. Diesel is taxed at significantly lower effective rates than gasoline, even though CO_2 emissions per litre of diesel are higher (Figure 2.35). Meant to encourage commercial road traffic, this tax expenditure was introduced when the share of diesel cars was low. Currently, diesel cars account for about 32% of all cars in Germany. As diesel vehicles are used especially by companies – which react more to change in prices – phasing out the lower taxation of diesel could have a substantial effect on behaviour and emissions (Zimmer and Koch, 2016[137]). It could reduce emissions by 3.7 million tonnes in 2030 (Burger and Bretschneider, 2021[37]). Other harmful tax expenditures include the exemption of agricultural vehicles from the vehicle road tax and the tax rebates farmers receive for their diesel consumption.

Furthermore, generous tax breaks for the private use of company cars – which represent about 60% of all new passenger cars in Germany – blur the price signals for those who get the benefit. This increases the number of cars in the economy and overall transport demand, incentivises buying larger and heavier cars as well as discourages energy-efficient driving (Metzler, Humpe and Gössling, 2019[138]). Where a vehicle is provided to an employee, the employer typically pays the annual registration and insurance costs as well as fuel and other operating expenses, regardless of whether they relate to personal or business use. Currently, the value of this fringe benefit, which is treated as taxable income, is mainly assessed based on the 1% rule, i.e., each month, 1% of the list price of the car (lower for cars with low CO_2 rating) is taxed according to the employee's income. In addition, there is a variable component based on the number of kilometres between the employee's home and workplace. Consequently, the tax benefits increase with the value of the car due to the untaxed capital component as well as the distances travelled privately, given the fixed level of taxation. Other countries use values above 1% of the list price to tax the fringe benefit. Thus, the tax benefit in Germany is high (Harding, 2014[136]). Unsurprisingly, company cars are driven almost twice as much as private cars, while company owners – who have higher incentives to save energy – drive less than employees (Metzler, Humpe and Gössling, 2019[138]). Companies favour car benefits as compensation because they only pay social security contributions on the 1% list price taxed, saving on costs that would arise should the full value of the company car be taxed. As for other fossil fuels subsidies, this beneficial tax treatment should be abolished. However, in the short run, reducing the generosity of the tax benefit only for cars with high CO_2 emissions could accelerate the shift to low-emissions vehicles.

Figure 2.35. Many fossil fuel subsidies jeopardise climate goals

Average effective energy tax on diesel and gasoline (road transport), EUR per litre



Source: OECD (2022), Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate Action, OECD Series on Carbon Pricing and Energy Taxation, OECD Publishing, Paris, https://doi.org/10.1787/e9778969-en.

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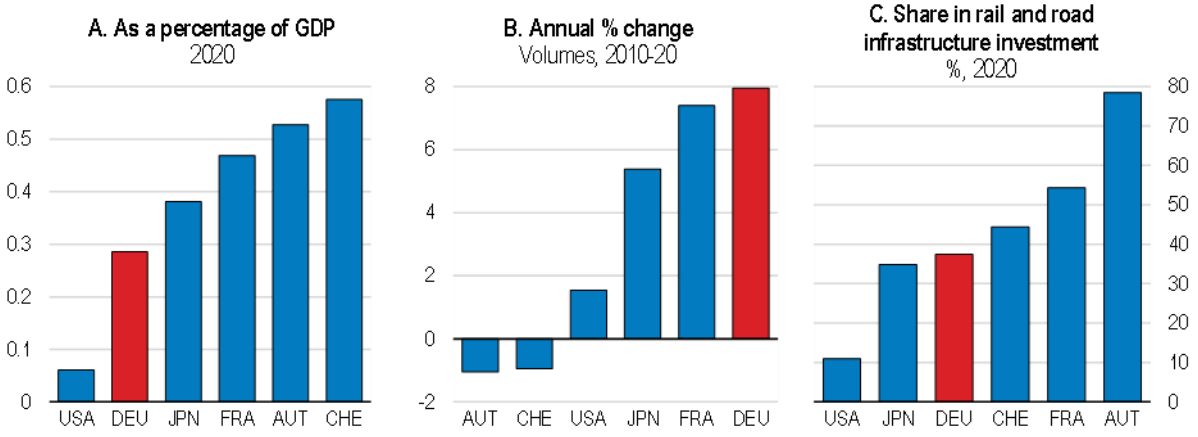
Rail accounts for only 9% of passenger traffic in Germany and 19% of freight transport (Bundesnetzagentur, 2021[139]). The quality of the rail services deteriorated in the last decade, with an increasing share of delayed trains and a shrinking network infrastructure. Consumer's satisfaction is lower than in the EU average, especially regarding punctuality, availability of Wi-Fi on trains and accessibility for persons with disabilities (European Commission, 2018[140]). Likewise, the electrification of the rail network has barely increased since 2015. The federal government aims to double rail passenger transport and increase the market share of rail freight transport to 25% by 2030, among others, to reduce the number of flights which have a high carbon footprint. It also aims to electrify 75% of the rail network by 2030 from a level of 62% in 2021. To reach these targets, investment in rail infrastructure needs to be prioritised and rise considerably. Rail investment has increased since 2010, but it is still far lower as a percentage of GDP than in leading countries like France and Switzerland, and lower than road infrastructure investment (Figure 2.36). In 2019, Bardt et al. (2020[141]) estimated that EUR 60 billion are needed over the following 10 years to overcome the investment backlog and improve supraregional rail infrastructure. This also requires simplifying and speeding up planning and approval procedures for rail infrastructure projects and addressing capacity constraints in the construction sector (see above) (BMDV, 2022[142]). A recent government decision to define key railway projects as an objective of national interest and, therefore, facilitate planning and approval procedures, has the potential to significantly accelerate rail infrastructure investments.

Figure 2.36. Investment in rail should increase further

Investment in rail infrastructure



Note: For the United States, 2019 data are used.
Source: The International Transport Forum (ITF) database.

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Digitalisation can improve the quality of these investments and the attractiveness of the railway system. Accelerating the digitalisation of the control and signalling systems could improve safety and train connections, while helping rail companies to cope with scarce human resources (BMDV, 2022[142]). Lack of staff for operating the old signalling systems has recently restricted train services. Further simplifying the train ticketing system and reducing train tariffs proved to have a significant impact on public transport attractiveness (Box 2.9). Providing sales platforms with a non-discriminatory access to data would be necessary to protect competition in the market (Monopolies Commission, 2021[143]). Improving recruitment of specialists for planning and construction of rail infrastructure, e.g. through more flexibility in pay schedules, is key.

Box 2.9. Early lessons from the EUR 9 public transport ticket experiment

Simplifying the train ticketing system and reducing tariffs significantly impact public transport attractiveness, but the impact on environmental goals seems more limited. As part of the measures taken to mitigate the increase in energy prices due to Russia's war against Ukraine, the government introduced a EUR 9 ticket from June to August 2022: Citizens in Germany could travel nationwide on all local and regional buses and trains by using a monthly single ticket. About half of Germany's population (40 million people) purchased the ticket. Rail travel has grown considerably in the first month after the introduction. In June 2022, movements in rail transport were 42% higher than in June 2019, while in May 2022, they were only 3% higher than in May 2019. The change during weekends was significantly greater (Federal Statistical Office, 2022[144]). Nonetheless, the cost of this measure was high: The federal government provided the states with an additional 2.5 EUR billion (0.26% of the quarterly GDP) to compensate for the loss of ticket sales, excluding funds for added person capacity.

Research on the impacts of the reform is still ongoing. Initial findings show that shifting away from cars was limited: Around a quarter of the journeys made in public transport would not have been made without the ticket, and only about 3% of the users took public transport instead of driving. Nonetheless, a decrease in traffic jams was evidenced in 23 out of Germany's 26 major cities, and about 22% of the users said they used public transport for the first time due to the scheme (VOX, 2022[145]). However, a better balance between measures to improve service quality – in particular through more infrastructure investments – and reducing fares is needed. For enhancing public transport usage, quality-of-service improvements are at least as important as lowering fares (Graham, Crotte and Anderson, 2009[146]).

Following the popularity of the 9-euro ticket, a similar ticket at a monthly cost of 49 EUR will be available from spring 2023. Expenses are estimated to stand at EUR 3 billion annually and to be shared evenly between the federal government and the Laender.

Fostering competition in the railway market would improve the quality of rail services and lower prices. Although smaller competitors continued to gain market shares in recent years (mainly in freight transport), 96% of long-distance rail transport and 72% of regional and short-distance transport in 2019 were still conducted by the national rail company, Deutsche Bahn (DB), which is both a rail operator and infrastructure manager that provides services to other rail operators (Bundesnetzagentur, 2021[139]). A substantial equity injection in favour of DB during the COVID-19 crisis risks distorting competition in the market further as increasing borrowing costs for private firms hamper their ability to compete. To strengthen competition in the market, the federal government should demand more transparency regarding DB's investment decisions and set quality indicators to ensure investments are used sustainably (Monopolies Commission, 2021[143]). Likewise, the government can share some of the risks of new competitors by, for example, introducing a limited reimbursement mechanism for lost ticket sales. A vertical separation of the infrastructure from the operations within the DB group would be the first best solution to enhance competition in the long run (Monopolies Commission, 2021[143]). Currently, both the operation and infrastructure companies within DB group share management functions such as legal advisory, financial management, and corporate development. In addition, profits and losses are transferred between companies (within DB).

Coordinating policies on housing and transport can accelerate the transition

Households' use of private transport also depends on housing and work locations (OECD, 2021[147]). Since 1990, urban sprawl has considerably increased. About 20% of the urban population in 2014 resided in areas of very low population density, which the OECD defines as a density of 150-1 500 per km^2. This share rose by about three percentage points since 1990. It is difficult and costly to provide high quality public transport to low-density areas, explaining why public transport use is usually lower for residents in

remote regions. Therefore, integrating land-use and transport planning, promoting densification, and encouraging public transport, cycling and walking is key to reduce distances travelled and emissions.

Local authorities play a crucial role in densification through their responsibility for transport system planning and regulation on land use and zoning. More compact urban development patterns and higher density combined with public transport planning would help to improve the competitiveness of sustainable modes of transport. However, this requires a shift in planning from the traditional "predict and provide" approach that expands transport infrastructures to meet inferred latent demand towards management of available road space according to strategic planning. To promote cycling, local authorities could set a standard speed of 30 km/h in certain built-up areas. In addition, planning procedures for cycling infrastructure (such as cycling lanes and parking) could be streamlined. The federal government can help by subsidising bicycles instead of cars. Sweden, for example, launched a subsidy for electric bikes of up to USD 1100 in 2017. About 100 000 people used the subsidy to purchase an electronic bike, and about two thirds of them would not have done this without the support. Each bicycle is estimated to have reduced lifetime carbon emissions by 1.3 tonnes (Anderson and Hong, 2022[148]). In the United Kingdom, a cycle-to-work scheme allows employers to buy or lease bicycles and related equipment for their employees and supports them with deductions of income tax and social security contributions. Employees can save up to 40% of the cost of a new bicycle. Over the past ten years, more than 1.6 million people participated in the scheme, including nearly 200 000 during the COVID-19 pandemic between March and September 2020 (OECD, 2022[149]).

Decarbonising buildings through energy efficiency improvements and renewable energy use

A combination of high per capita energy use and extensive reliance on fossil fuels puts Germany among the OECD countries with the highest emissions per capita from the residential sector (OECD, forthcoming[150]). Only 19% of the final energy use in the building sector is supplied by district heating and renewables; a share that is rising only slowly (Ministry For Economic Affairs and Climate Action, 2022[35]). The government now aims to reduce emissions in the sector by 42% until 2030, although a more flexible and decentralised approach relying on unified carbon pricing and allowing faster emission reductions in sectors with lower abatement costs would be preferable (see above).

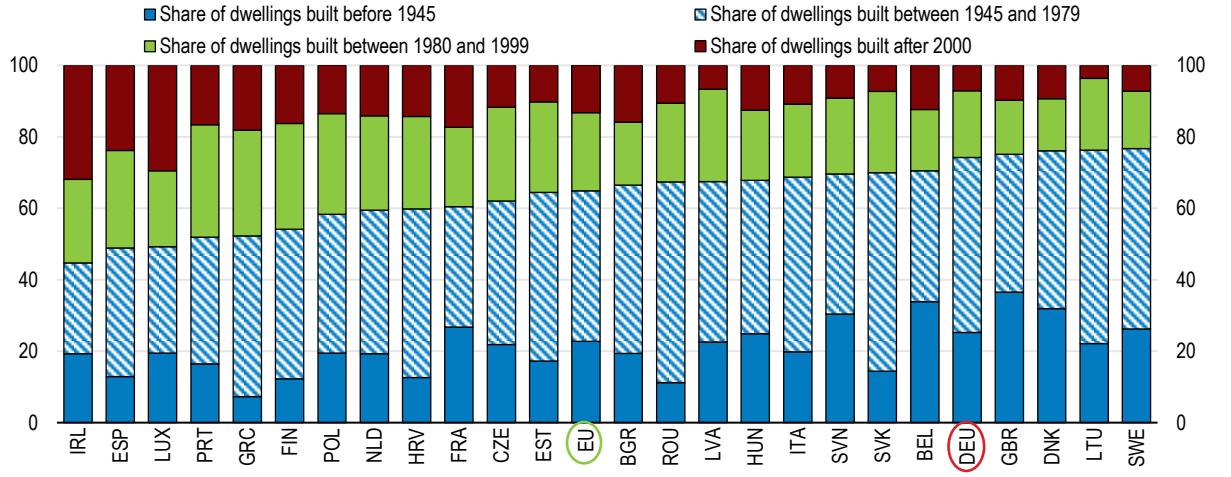
Accelerating building renovations and at the same time increasing energy efficiency standards are key priorities for faster decarbonisation. Fully refurbished buildings in Germany consume, on average, 22% less energy than un-refurbished buildings while new buildings have 39% lower energy consumption (Federal Ministry for the Environment, 2021[151]). However, only 12% of the building stock is classified as new (4%) or fully refurbished (8%). The main challenge is that the building stock is old and characterised by low annual renovation rates (Figure 2.37). Roofs in Germany, for instance, are replaced every 50 to 55 years (German Council of Economic Experts, 2021[10]).

The introduction of the national emissions trading scheme and the abolishment of the EEG surcharge (see above) as well as the higher energy prices due to the war in Ukraine create strong incentives for renovation and shifting to lower-emission heating systems. This is particularly true for industrial heat pumps, which additionally benefit from generous subsidies (IEA, 2022[152]). Nonetheless, the high abatement costs in the sector call for continued investments in innovative technologies and infrastructures, such as the expansion of the electricity distribution grid to support heat pumps in residential buildings (IEA, 2022[152]). Moreover, homeowners who are willing to renovate often struggle to find contractors (German Council of Economic Experts, 2021[10]). Already in 2018 it was estimated that around 100,000 additional skilled crafts workers were needed to achieve the climate targets set for the buildings sector (German Council of Economic Experts, 2021[10]). Since then, the targets have been raised and labour shortages have become more severe. Addressing skilled labour shortages requires raising productivity in the construction sector, for example by reducing occupational entry regulations and allowing for more competition from firms in other EU countries, and raising labour supply, for example by encouraging immigration of skilled workers (see

Chapter 1 and the 2020 Economic Survey of Germany). It also calls for careful prioritisation of government support programmes and better synchronising them with ambitious targets to increase the supply of new buildings.

Figure 2.37. The housing stock is old

Share of residential building by construction year, %



Source: European Commission, EU Building Stock Observatory database.

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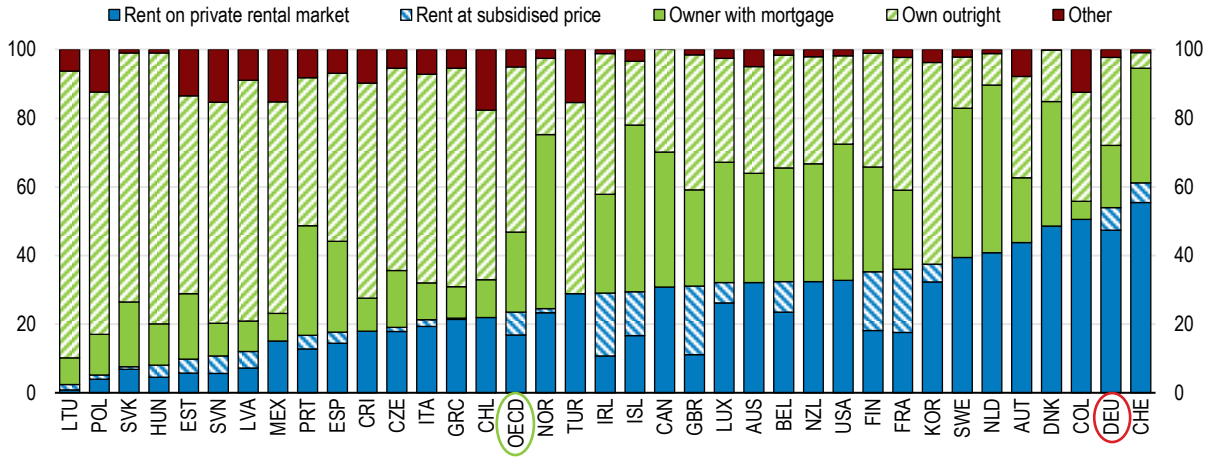
The effect of lower electricity and higher CO_2 prices on building renovations and emission reductions is hindered by market failures. For instance, current tenants and property owners do not necessarily know how poorly insulated their homes are, as energy certificates are only mandatory when renting or selling a property and the quality of many older certificates is weak (OECD, forthcoming[150]). A particular problem in the rental sector is the split incentives problem: Tenants usually have limited options to react to higher energy costs, while property owners who have opportunities to invest in energy efficiency solutions have weak incentives to do so because they typically do not pay the energy bills. In Germany, about half of the households live in rented dwellings, amongst the highest shares in the OECD (Figure 2.38). To tackle this, the government decided to split the payment to the National Emission Trading System between tenants and landlords, depending on the building's emissions performance. Tenants in low-emission housing will bear most of the carbon price, while landlords will be liable for most of the additional price for carbon-intensive rental dwellings. Coordination issues also exist for buildings with several apartments, including those built and managed by non-profit housing associations. Changes to collective decision-making procedures might help, as two thirds of the owners currently need to approve retrofitting of multi-owner properties to enable full cost sharing among owners. Some OECD countries – like Belgium and Austria – have recently eased the voting rules for renovations of multi-owner properties (OECD, forthcoming[150]). Home-level market failures are only compounded at the city level due to the need to coordinate between an even more significant number of actors. Therefore, fast decarbonisation of the building sector requires a mix of regulations, subsidies, and consultancy services to tackle these coordination issues and complement the increase in energy and carbon prices.

Figure 2.38. A high share of Germans rent

Share of households in different tenure types, %, 2020 or latest available year



Source: OECD, Affordable Housing Database, https://www.oecd.org/housing/data/affordable-housing-database/

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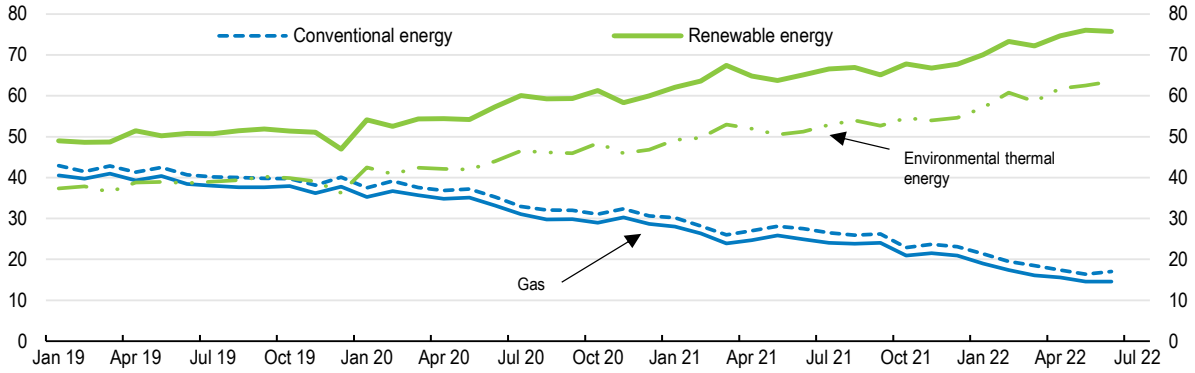
A variety of policy instruments to support the transition of the buildings sector are already in place: Germany has a long tradition in providing low interest loans and government support for new buildings and for the renovation of existing buildings and heating systems. Independent consultancy services are provided by the National Consumer Agency and minimum energy efficiency standards for new buildings became stricter over time. These policy measures seem to bear fruits, with more and more Germans choosing to use renewables for heating their new homes (Figure 2.39). Nonetheless, until recently, the policy measures may have focused too much on new buildings rather than reducing energy consumption of the existing housing stock, which has the highest energy savings potential (Environmental Action Germany, 2021[153]). Moreover, subsidies to raise energy efficiency of new and old buildings have not been targeted at households, which face binding credit constraints for investing in energy-efficiency renovations, but also benefitted many large institutional investors. This has considerably reduced spending efficiency, as many retrofitting projects would have been undertaken without subsidies, due to rising energy prices and technology improvements (Egner, Klöckner and Pellegrini-Masini, 2021[154]).

Non-targeted building subsidies should be phased-out quickly, as high energy prices provide sufficient incentives for renovations, and should be replaced by subsidies targeting vulnerable and credit-constrained households. At the same time, energy-efficiency standards should be strengthened faster than planned. The efficiency standards in existing buildings have not been raised since 2009 and monitoring is weak (Environmental Action Germany, 2021[155]). In Scotland, for example, a sufficient level of energy performance is required for rented homes from 2022, when a tenancy contract changes, and for all properties from 2025 (Sunderland and Jahn, 2021[156]). Energy performance certification has become mandatory for all properties in the Netherlands recently and will become mandatory in France for multi-family properties (OECD, forthcoming[150]). The draft bill specifying that newly installed heating systems, whether in new or existing buildings, must be operated with at least 65% renewable energy from January 2024 is a step in the right direction. Still, the specific threshold should be reviewed regularly to make sure it stays relevant, given the fast increase in renewable use (Figure 2.39). Better targeting government subsidies to credit-constrained households living in the worst-performing buildings could accelerate decarbonisation and energy poverty alleviation. There is also a scope to support pilot projects to boost energy efficiency innovation in buildings.

Figure 2.39. More and more Germans use renewables to heat their new homes

Approved residential buildings to be newly constructed by primary heating energy, %



Source: Statistical Federal Office.

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Main findings	Recommendations
Implementing efficient mitigation policies across the economy	
Germany prices 90% of its GHG emissions, explicitly or implicitly, but levels are too low and differ substantially across sectors.	**Set an emissions cap for all sectors not covered by the EU ETS, which is in line with the national targets, until the European trading system for road transport and heating starts operating.**
Many fossil fuel subsidies and tax expenditures weaken price signals and can jeopardise climate goals.	**Gradually phase out fossil fuel subsidies and tax expenditures, replacing them with abatement subsidies or direct transfers to households if needed.**
Boosting green investment and innovation	
Carbon pricing makes solar and wind technologies price competitive. Renewable energy subsidies can help to reduce electricity prices, but they are costly and can lead to higher emissions in other EU countries.	**Gradually shift support from renewable energy subsidies towards more targeted subsidies for green R&D and the deployment of near-zero emission industrial technologies to reduce future abatement costs.**
There is substantial uncertainty about the future carbon prices in both ETS and non-ETS sectors, weighing on green investments, particularly in hard to abate sectors.	Set a floor for prices in the National Emissions Trading System from 2026. Gradually expand the use of Carbon Contract for Difference and allow for a higher strike price for less matured technologies.
Low carbon prices used in public procurement contradict the "economically most advantageous bid" concept, as negative external effects on emissions are not priced in. However, the administrative burden of including carbon shadow prices in procurement is high.	Until carbon prices are sufficiently high, use shadow carbon prices for procuring strategic products and services and negative lists for other items. Enable contractors to apply for a CO_2 performance ladder certificate, and consider this ladder in procurement decisions.
Protecting social cohesion and building strong public support for climate policy	
Displacement costs for workers in carbon-intensive sectors are high, in particular because their human capital is very specific. Many unemployed but also employed workers lack basic skills necessary for attending initial and continuing VET courses.	Expand the scope of Active Labour Market Programmes, focusing on re-training and basic skills acquisition, while improving adult education by introducing nationwide quality standards and better coordination and marketing of training supply across regions.
Negative employment effects of emission reductions are regionally concentrated making it more difficult to find a new job. Moving to other local labour markets helps to find better paid-jobs.	Facilitate job mobility by expanding mobility subsidies to the unemployed, improving coordination between public placement services and employers across regions, and lowering general barriers such as stringent occupational entry regulations.
Low-skilled workers are most exposed to changing skill requirements due to the green and digital transition, but participate less in training. Partial qualifications combined with recognition of informal prior-learning can facilitate training up take.	Make standardised partial qualifications available nationwide and better link them with recognition of prior-learning and career guidance services.
Germans are conscious of the need to act strongly to tackle climate change, but support for effective policies such as carbon taxes depend on understanding their impact and the use of carbon tax revenues.	Expand public information and education campaigns to explain how policies reduce emissions and clarify their distributional effects.
Addressing sector-specific context and challenges	
Solar and wind capacity installation needs to accelerate significantly but is hindered by conflicts with nature conservation objectives, and lengthy planning and approval procedures.	Streamline the permitting process by setting a single contact point for procedures, applying silence-is-consent rules where appropriate, improving capacity and specialisation of administrative and court staff, and adopting animal population-based approach to biodiversity protection.
Electricity generation from renewables is less stable over time. Price signals on the consumer side are weak due to static levies, taxes, and grid charges.	Introduce time-variable grid charges.
Smart meters can help to match electricity supply and demand, but their rollout is lagging considerably, mainly due to data protection issues.	Accelerate the deployment of smart meters, while strengthening data protection and cyber security.
Government subsidies strongly incentivise the purchase of electric and hybrid cars. But they encourage car-dependency, are regressive and have high fiscal costs. In contrast with most OECD countries, there is no purchase or registration tax on new vehicles.	End purchase subsidies for electric cars after 2024 and introduce a purchase tax for cars with high CO_2 emissions.
The limited supply of publicly available charging stations is slowing electric vehicles' uptake.	**Expand the deployment of charging capacity, while enhancing competition in and access to the market by targeting support at small players, standardizing pricing, and setting performance requirements.**

The electrification of the vehicle fleet will undermine the tax base for the fuel excise duty and risk to increase car-dependency and negative externalities related to driving, which are currently not taxed.	Introduce highway tolls for passenger vehicles and increase truck charges. Consider congestion charging at the local level.
A tax allowance for commuters and a favourable tax treatment for privately used company cars encourage urban sprawl and offer incentives to travel larger distances than necessary.	Abolish the tax allowance for commuters and the favourable tax treatment for privately used company cars, while considering targeted support for employees who must accept long distance work and have high travel costs as a share of their income.
The quality of the rail services deteriorated in the pre-pandemic years. Investment in rail is lower than in leading countries.	**Increase public investment in rail, subject to cost-benefit analysis, and accelerate the digitalisation of the control and signaling systems.**
The temporary introduction of a flat rate nationwide public transport ticket (the EUR 9 ticket) significantly raised public transport attractiveness.	Continue to simplify the train ticketing system and provide a sales platform with non-discriminatory access to data for all market participants.
96% of long-distance rail transport and 72% of regional and short-distance transport in 2019 were made by the national rail company Deutsche Bahn, which is both a rail operator and infrastructure manager that provides services to all other rail operators.	Demand more transparency regarding Deutsche Bahn's investment decisions and set quality indicators for its investment. Consider a vertical separation between Deutsche Bahn's infrastructure management and operations.
Higher energy and carbon prices as well as the abolishment of the EEG surcharge create strong incentives for renovation and shifting to lower-emission heating systems. Many large institutional investors benefited from subsidies for increasing energy efficiency of new and existing buildings.	Phase out non-targeted building subsidies and replace them by subsidies targeting vulnerable and credit constrained households.
Landlords have limited incentives to invest in energy-saving measures as tenants pay for energy costs. The efficiency standards in existing buildings have not been raised since 2009.	**Increase minimum efficiency standards and apply energy performance certification to all existing buildings.**

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After a decade of strong export-led growth, decreasing unemployment and fiscal surpluses, the COVID-19 pandemic and the energy crisis have revealed structural vulnerabilities and emphasised the need for accelerating the green and digital transitions. At the same time, rapid population ageing increases public spending pressures and exacerbates skilled labour shortages. Reducing labour taxes, particularly for low-skilled workers and second earners, facilitating skilled migration, and improving education and training are key to raise labour supply. Modernising the public administration to lower the administrative burden and improve public services would help to foster business dynamism and innovation. Addressing large investment needs while safeguarding fiscal sustainability will require reducing tax expenditures, which are often distortive, regressive or environmentally harmful, and strengthening tax enforcement, but also increasing public spending efficiency and better prioritising spending. Reaching climate neutrality in 2045 while safeguarding competitiveness and social cohesion will require cost-effective mitigation policies. Germany should strengthen carbon pricing, but complement this with well-designed sectoral regulations and subsidies, especially for boosting green R&D, expanding sustainable transport and electricity network infrastructure, and decarbonising the housing sector. Using carbon pricing receipts to support vulnerable households and improve the quality of active labour market policies would help to protect social cohesion.

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