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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.

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Basic statistics of Germany, 2017

(Numbers in parentheses refer to the OECD average)[1]

LAND, PEOPLE AND ELECTORAL CYCLE					
Population (million)	81.5		Population density per km²[2]	230.9	(37.2)
Under 15 (%)	13.0	(17.9)	Life expectancy (years, 2015)	80.7	(80.5)
Over 65 (%)	21.6	(17.0)	Men	78.3	(77.9)
Foreign-born (%, 2015)	14.1		Women	83.1	(83.1)
Latest 5-year average growth (%)	0.3	(0.6)	Latest general election	September 2017	
ECONOMY					
Gross domestic product (GDP)			Value added shares (%)		
In current prices (billion USD)	3,677.4		Primary sector	0.7	(2.4)
In current prices (billion EUR)	3 267.3		Industry including construction	30.6	(26.9)
Latest 5-year average real growth (%)	1.7	(2.1)	Services	68.7	(70.7)
Per capita (000 USD PPP)	50.7	(43.8)			
GENERAL GOVERNMENT					
Per cent of GDP					
Expenditure[2]	43.9	(40.6)	Gross financial debt[2]	71.7	(110.2)
Revenue[2]	45.1	(37.7)	Net financial debt[2]	36.6	(71.2)
EXTERNAL ACCOUNTS					
Exchange rate (EUR per USD)	0.885		Main exports (% of total merchandise exports)		
PPP exchange rate (USA = 1)	0.785		Machinery and transport equipment	48.4	
In per cent of GDP			Chemicals and related products, n.e.s.	15.3	
Exports of goods and services	47.3	(55.0)	Manufactured goods	11.9	
Imports of goods and services	39.7	(50.5)	Main imports (% of total merchandise imports)		
Current account balance	8.1	(0.4)	Machinery and transport equipment	36.3	
Net international investment position	62.9		Chemicals and related products, n.e.s.	13.6	
			Miscellaneous manufactured articles	12.8	
LABOUR MARKET, SKILLS AND INNOVATION					
Employment rate for 15-64 year-olds (%)	75.3	(67.7)	Unemployment rate, Labour Force Survey (age 15 and over) (%)	3.7	(5.8)
Men	78.9	(75.4)	Youth (age 15-24, %)	6.8	(11.9)
Women	71.5	(60.1)	Long-term unemployed (1 year and over, %, 2016)	1.7	(2.0)
Participation rate for 15-64 year-olds (%, 2016)	78.0	(71.7)	Tertiary educational attainment 25-64 year-olds (%, 2016)	28.3	(35.7)
Average hours worked per year (2016)	1 363	(1 763)	Gross domestic expenditure on R&D (% of GDP, 2016)	2.9	(2.3)
ENVIRONMENT					
Total primary energy supply per capita (toe, 2015)	3.8	(4.1)	CO_2 emissions from fuel combustion per capita (tonnes, 2015)	9.0	(9.2)
Renewables (%, 2015)	12.5	(9.6)	Water abstractions per capita (1 000 m3, 2013)	0.3	
Exposure to air pollution (more than 10 g/m³ of PM2.5, % of population, 2015)	99.4	(75.2)	Municipal waste per capita (tonnes, 2016[3])	0.6	(0.5)
SOCIETY					
Income inequality (Gini coefficient, 2014)	0.289	(0.311)	Education outcomes (PISA score, 2015)		
Relative poverty rate (%, 2014)	9.5	(11.3)	Reading	509	(493)
Median disposable household income (000 USD PPP, 2014)	26.2	(22.9)	Mathematics	506	(490)
Public and private spending (% of GDP)			Science	509	(493)
Health care (2016)	11.3	(9.0)	Share of women in parliament (%, 2016)	36.5	(28.7)
Pensions (2013)	10.1	(9.1)	Net official development assistance (% of GNI)	0.66	(0.38)
Education (primary, secondary, post sec. non tertiary, 2014)	3.1	(3.7)			

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 29 member countries.
2. 2016 for the OECD aggregate.
3. 2015 for the OECD aggregate.
Source: Calculations based on data from the OECD, IEA, IMF, Inter-Parliamentary Union and World Bank.

Executive summary

Economic growth is robust and wellbeing is high

- *Strong domestic demand and exports are driving growth.*
- *Wages are growing moderately.*
- *Economic growth will slow somewhat, due to capacity constraints.*
- *The current account surplus remains large.*
- *Germans enjoy high living standards.*

Using fiscal policy to address structural challenges lying ahead

- *The strong fiscal position provides room in the near term to fund spending priorities.*

Productivity growth is held back by slow technology diffusion

- *Labour productivity growth in recent years has been subdued.*
- *Entrepreneurship is key to faster technology diffusion and higher productivity among SMEs.*
- *Government ownership in business sector activities holds back reallocation.*
- *Improving competition and boosting investment in digital networks would allow to better harness new technologies.*

Preparing for the future of work with new and changing skills

- *Automation, digital platforms, and other technological changes are altering the nature of work.*
- *Technological change increases the demand for cognitive and non-cognitive skills.*

Policies to improve skills and better skills use boost inclusive growth

- *Impressive progress has been made in reducing the impact of socio-economic background on education outcomes.*
- *Better opportunities for women to develop their careers would boost productivity and reduce poverty risk.*

Transport policy reform can contribute to green growth and boost wellbeing.

- *Emissions from transport have increased despite substantial gains in efficiency, leaving a weak spot in the overall climate policy mix.*

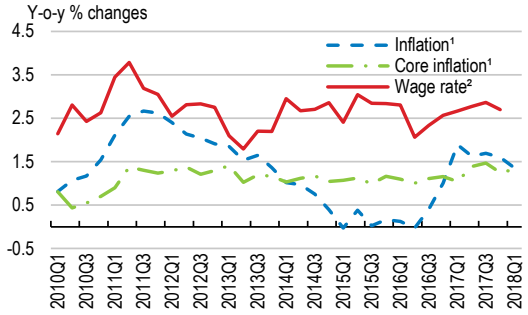
Economic growth is robust and wellbeing is high

Strong domestic demand and exports are driving growth. Record-low unemployment and real wage gains have underpinned consumption. Low interest rates and immigration boost residential construction. Exports benefit from a goods mix suited to investment needs in high-growth emerging economies and the recovery of the euro area economy. Business investment is picking up with the strong exports. Credit growth remains modest.

Wages are growing moderately. Recent collective bargaining outcomes points to some acceleration in wage growth. Unions have increasingly negotiated non-wage benefits to ensure a better work life balance. However, rising inflation, primarily due to higher oil prices, is eroding real wage gains to some extent (Figure A).

Figure A. Wage growth is moderate

Seasonally adjusted



1. Harmonised consumer price index (HICP). Core HICP excludes energy, food, alcohol and tobacco.
2. Average nominal wage per employee.
Source: OECD (2018), *OECD Economic Outlook: Statistics and Projections* (database).

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Economic growth will slow somewhat, due to capacity constraints (Table A). The recovery in the euro area will sustain exports and investment in equipment, while private consumption and housing investment may decelerate somewhat due to slower employment and real wage growth. Consumer price inflation may rise modestly, as firms can absorb the impact of higher wages in profit margins. The fiscal stance is projected to be somewhat expansionary, as the new government plans tax reductions and higher spending on education, digital infrastructure and social transfers. Nonetheless, strong tax revenue growth and low interest rates are projected to raise the budget surplus to 1.5% of GDP.

Table A. Economic growth will remain robust

	2017	2018	2019
Gross domestic product [1]	2.5	2.1	2.1
Private consumption	2.1	1.0	1.6
Gross fixed capital formation	3.9	3.5	3.9
Exports	5.3	4.5	4.5
Imports	5.6	4.3	5.1
Unemployment rate	3.7	3.4	3.3
Consumer Prices	1.7	1.7	2.0
Core Consumer prices	1.3	1.3	2.0
Current account (% of GDP)	8.1	8.3	7.9
General government fiscal balance	1.3	1.5	1.5

1. Working-day adjusted.
Source: OECD (2018), *OECD Economic Outlook: Statistics and Projections* (database).

The current account surplus remains large. Saving exceeds investment in the public and private sectors, notably in the corporate sector, where domestic investment has not kept pace with profitability. Exchange rate and energy price movements also mattered. Structural reforms to boost long-term, inclusive green growth and the use of fiscal space to support such reforms could reduce the current account surplus, by strengthening investment and reducing household saving.

Germans enjoy high living standards, especially in areas like jobs and earnings, and work-life balance. Disposable household income is more equally distributed than in other large OECD economies. However, inequality in wealth and market income is relatively high. Relative poverty risks relate to a high incidence of low-wage employment among low and middle-skilled workers as well as part-time working women.

Using fiscal policy to address structural challenges lying ahead

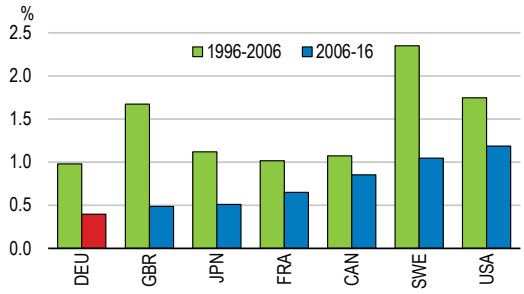
The strong fiscal position provides room in the near term to fund spending priorities, such as increasing provision of high-quality childcare and full-day schooling, adult skills, or investing in infrastructure and new technologies, as argued below. Fiscal leeway should be used in a prudent manner, taking capacity constraints into account. In the medium term, higher interest rates and ageing-related spending will reduce fiscal space. Additional structural reforms will be needed to maintain sustainability in the long run. Further room for prioritising spending can be identified by more extensive use of spending reviews.

Productivity growth is held back by slow technology diffusion

Labour productivity growth in recent years has been subdued (Figure B), which poses challenges in raising incomes and wellbeing. Slower productivity growth partly reflects strong employment performance, subdued investment, rising skill shortages and slower adoption of new technologies, including in the public sector. Productivity growth has been weaker among small and medium sized firms. Productivity can be boosted by encouraging more firms and individuals to seize opportunities new technologies provide, improving also inclusiveness.

Figure B. Labour productivity growth has slowed down

Average annual rate of trend labour productivity growth



Source: OECD (2018), *OECD Economic Outlook: Statistics and Projections* (database).

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Entrepreneurship is key to faster technology diffusion and higher productivity among SMEs. Firm creation has been declining partly due to strong employment growth. The lower income security associated with self-employment could hold back entrepreneurship. The period during which failed entrepreneurs must repay debt can last up to six years, discouraging firm creation. Women are under-represented among entrepreneurs, especially in technology-intensive sectors. R&D tax incentives may boost innovation if designed carefully to benefit fully young firms which have not generated profit. Well-developed e-government services can reduce the administrative burdens on start-ups.

Government ownership in business sector activities holds back reallocation of resources and the development of new business models. Privatising government stakes in businesses, including in the *Landesbanken*, could reduce risk of incumbent bias, for example in lending.

Improving competition and boosting investment in digital networks would allow to better harness new technologies. A larger number of mobile communication operators would result in more innovative services at lower prices. The upcoming radio spectrum auction for 5G networks should be used to promote competition in the mobile market. This would also stimulate demand for highest-speed broadband services, boosting roll-out. More investment is needed to expand high-speed broadband in rural areas where unsubsidised provision is unlikely.

Preparing for the future of work with new and changing skills

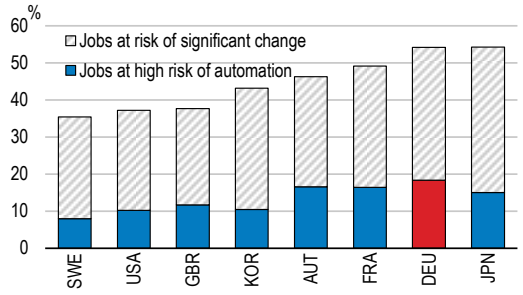
Automation, digital platforms, and other technological changes are altering the nature of work. Jobs with routine tasks are at risk of automation. They are concentrated in middle-skill occupations. The share of jobs with high risk of being automated or of undergoing substantial changes is high (Figure C).

New forms of work, such as digital platforms, involve more workers in flexible arrangements

such as "solo" self-employment. This reinforces the case for extending social safety nets to the self-employed.

Figure C. Many jobs will undergo significant change

The share of jobs at high risk of automation and significant change



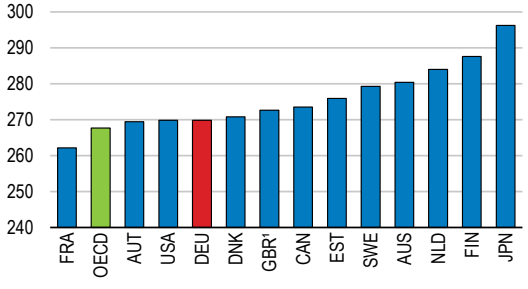
Note: Jobs are at high risk of automation if the likelihood of their job being automated is at least 70%. Jobs are at risk of significant change if the likelihood is between 50 and 70%.
Source: Nedelkoska, L. and G. Quintini (2018), "Automation, skills use and training", *OECD Social, Employment and Migration Working Papers*, No. 202, OECD Publishing, Paris.

StatLink http://dx.doi.org/10.1787/888933737134

Technological change increases the demand for cognitive and non-cognitive skills. Cognitive and digital skills of German adults are above the OECD average, but fall short of leading countries (Figure D). The vocational education and training system ensures excellent integration of young people in the labour market (Figure E).

Figure D. Adult skills are above OECD average

Mean proficiency scores in literacy, 15-65 year-olds



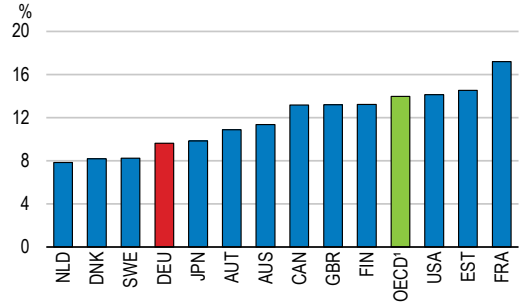
1. Data refer to England.
Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

StatLink http://dx.doi.org/10.1787/888933737153

More than a quarter of vocational graduates earn more than academic graduates. However, their earnings increase little with experience. Strengthening general education within the vocational education system and stronger incentives to participate in life-long learning could enhance adaptability of German workers to technological change.

Figure E. Most German youth are either in employment, education or in training

Youth not in employment, education or training (NEET), per cent of 15-29, 2016 or latest year



1. Unweighted average.
Source: OECD (2017), *OECD Education Statistics* (database).

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More modular training offers, combined with opportunities to formally recognise skills acquired on-the-job, can boost life-long learning, as experience in Denmark and Portugal suggests.

Policies to improve skills and better skills use boost inclusive growth

Impressive progress has been made in reducing the impact of socio-economic background on education outcomes, as improved PISA scores and a steep rise in childcare enrolment show. There is scope to further improve education outcomes among children with weakest socio-economic background. Ensuring high-quality childcare and early childhood education as well as that high-quality full-day primary schooling is available everywhere would allow making progress in this direction.

Better opportunities for women to develop their careers would boost productivity and reduce poverty risk. Women are overall as highly educated as men but their skills are used less, in part because they often work fewer hours, limiting professional choice and career prospects. Further developing full-day childcare and reducing the tax and social security disincentives for second earners, mostly women, to work longer hours and further strengthening fathers' incentives to take care of their children would improve gender equity.

Transport policy reform can contribute to green growth and boost wellbeing

Emissions from transport have increased despite substantial gains in efficiency, leaving a weak spot in the overall climate policy mix. Transport infrastructure plans needs to be made consistent with CO_2 emission reduction targets, including by expanding the electric charging infrastructure for automobiles. Policies to deploy ICT-based ride sharing, coupled with congestion charging, facilitate the low-carbon transport transition, help deploy effective public transport at lower cost, and can boost competitiveness of cities by reducing congestion.

MAIN FINDINGS	KEY RECOMMENDATIONS
Supporting steady inclusive growth with financial and budgetary policies	
The budget balance is above the medium-term deficit objective of 0.5% of GDP. Additional government spending is needed to expand full-day primary schooling, high-quality childcare, life-long learning and roll out high-speed fibre broadband infrastructure.	Use fiscal leeway in a prudent manner, taking capacity constraints into account, to lower the taxation of low wage earnings and to raise priority spending on childcare, education and life-long learning as well as for low-emission transport infrastructure.
Rising life expectancy will raise pension spending.	Index the legal pension age to life expectancy.
Performance-related budgeting can free room for priority spending.	Introduce spending reviews more broadly at the federal and *Länder* level and use them to reallocate funding across broad spending fields.
Strengthen productivity and prepare for the future of work	
Self-employed workers are less well covered by social safety nets than dependent workers. This can increase precarious employment and poverty risk while discouraging some potential entrepreneurs.	Make enrolment in public old-age pension mandatory for the self-employed who are not covered by old-age pension insurance. Open access to public health insurance to all self-employed.
Failed entrepreneurs must stand ready to pay back debt for up to 6 years, depending on how much debt they have paid back. This discourages entrepreneurship.	Ease the conditions for bankrupt entrepreneurs to be discharged of debt after three years, while maintaining adequate safeguards for creditors.
E-government services are underdeveloped, raising administrative costs of entrepreneurs. The scope of available services differs across municipalities and information is scarce.	Create a one stop shop to process all procedures for starting up a company online.
Regulation barriers, such as rules on exclusive activities, hamper competition in some services.	Reduce restrictive regulation in the professional services, safeguarding quality standards and consumer interests.
Government ownership in business sector activities holds back the reallocation of resources.	Privatise government stakes in the *Landesbanken*, car manufacturing, telecommunications and postal services.
The limited number of infrastructure suppliers in mobile networks limits competition and innovation which keeps prices high.	Use the upcoming radio spectrum auction to promote competition in the mobile market.
Boosting skills and skills use	
The earnings gap between men and women is large, especially for the well-educated. Joint income taxation lowers incentives for second earners in couples, women in most cases, to work full time. Second parents, mostly fathers, take little parental leave. If both fathers and mothers share parental leave more equally, gender norms about child-raising and household responsibilities rebalance.	Lower the tax burden on the wage income of second earners. Increase the minimum amount of time the second parent has to take parental leave, from the current two months, for the couple to receive the maximum leave entitlement.
The impact of socio-economic background on educational attainment and cognitive skills is still strong. Children with weak socio-economic background are less likely to attend high-quality childcare institutions. Most children attend half-day primary education.	Raise quality standards in childcare and early childhood education. Expand primary education to high-quality full-day education programmes.
Literacy skills are relatively low among young people in vocational education coming from lower secondary schools.	Strengthen general education within vocational schools, and maintain the strong labour market orientation of vocational education and training.
Participation in life-long learning is lower than in leading countries. There is little validation of informal skills acquired on the job. This reduces incentives to participate in life-long learning, especially for unskilled and older workers. Unskilled adults face low-pay and unemployment risks.	Offer more training programmes for the modular acquisition of qualifications in life-long learning and foster the recognition of skills acquired on-the-job. Strengthen support for unskilled adults to obtain professional qualifications.
Boosting green growth	
The CO_2 emissions from the transport sector are high and have not fallen. The federal transport infrastructure plan is inconsistent with CO_2 emission reduction targets. Pollution from transport has high costs to human health especially in cities, while road congestion reduces productivity.	Extend charging station infrastructure to promote electrification of road transport. Develop congestion pricing. Remove regulatory hurdles to ride sharing services and allow them to serve public transport.

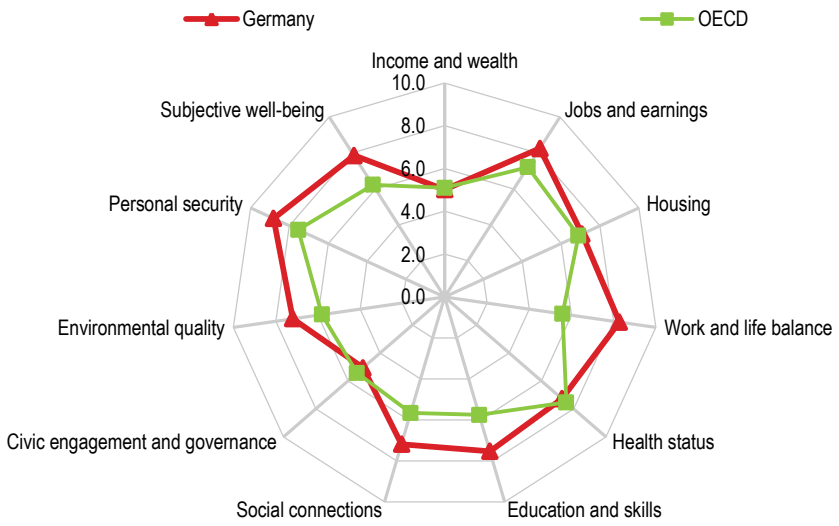
Key policy insights

Economic and social wellbeing are strong

Germany has been enjoying strong economic performance in recent years, building on strengthened domestic demand, good social outcomes and export performance. Exports have benefited from a large, productive and innovative manufacturing sector which has reinforced its position in sectors of long-standing comparative advantage, notably cars, chemical products and machine tools. Record-low unemployment, employment growth and real wage gains have underpinned private household demand. Business investment is picking up.

Figure 1. How's life in Germany?

Better Life Index, 2017



Note: Each well-being dimension is measured by one to four indicators from the OECD Better Life Index set. Normalised indicators are averaged with equal weights. Indicators are normalised to range between 10 (best) and 0 (worst) according to the following formula: (indicator value - minimum value) / (maximum value - minimum value) x 10.
Source: OECD (2017), OECD Better Life Index, *www.oecdbetterlifeindex.org*.

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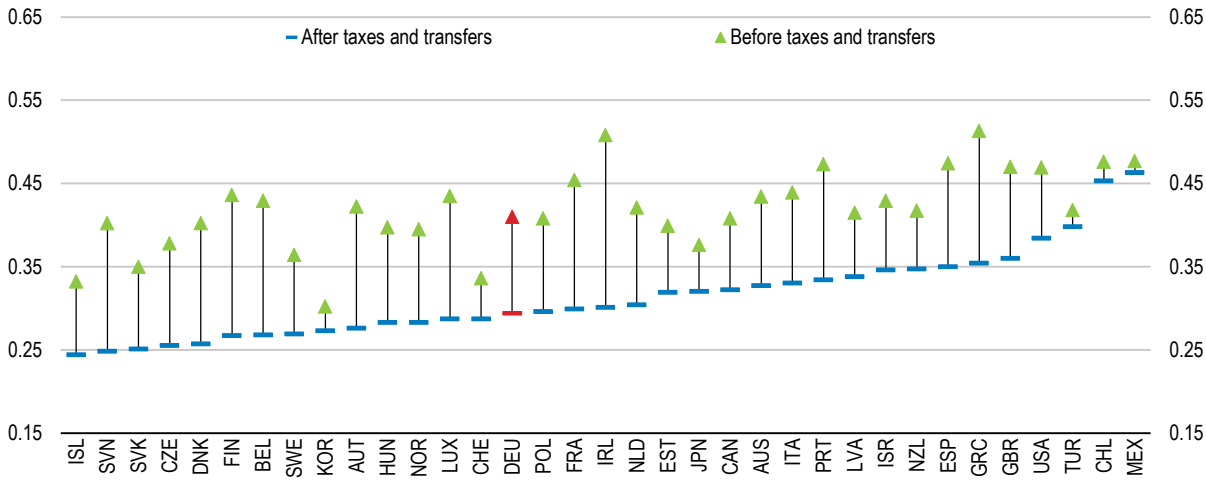
On aggregate, the population enjoys a high standard of living, as reflected in broad measures of well-being (Figure 1). Personal security, work-life balance, jobs and earnings as well as subjective wellbeing are particularly good. Almost the entire population is educated to upper secondary level and PISA scores are in the upper range of OECD countries, though still at some distance from best-performing countries. While health

outcomes are relatively good overall, self-assessed health among adults with low education is poor (OECD, 2017[1]). Median household wealth is modest, in part reflecting a highly unequal distribution of wealth across households, low housing wealth, and a relatively short period of prosperity in Eastern Germany, where incomes are still lower. While wealth and market incomes are concentrated, disposable household income among the working age population is more equally distributed than in other large OECD economies (Figure 2). The share of population in relative income poverty is lower than in most OECD countries (Figure 3). Poverty is strongly concentrated in some regions. A high incidence of low pay employment, especially among low and middle-skill workers and among women, is a major driving force (Figure 4). Housing costs have risen in major urban centres and are now high, damping housing well-being indicators.

Figure 2. Income inequality among the working population is lower than in most OECD countries after taxes

Gini coefficient, scale from 0 (perfect equality) to 1 (perfect inequality), 18-65 year-olds, 2015 or latest year



Note: After taxes and before transfers for Hungary, Mexico and Turkey.
Source: OECD (2018), *OECD Social and Welfare Statistics* (database).

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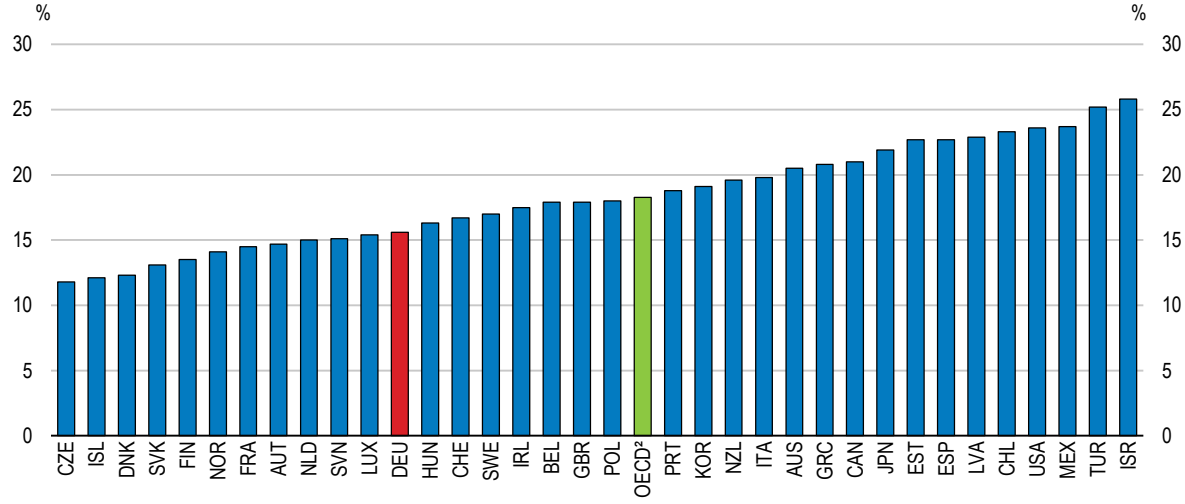
In this context, the main concern for policy makers is to make sure strong social and economic outcomes are sustained in the future, in the face of several challenges. As elsewhere, trend productivity growth has diminished (Figure 5), partly reflecting weakening technology diffusion. Past labour market reforms (the *Hartz* reforms), while having boosted employment, may have contributed by raising the share of workers with low qualifications. Productivity convergence in Eastern Germany has also slowed. However trend productivity growth has also been low in international comparison in recent years. Productivity growth is key to rising incomes, especially in the context of demographic ageing, which will reduce labour supply.

Figure 3. Relative poverty is lower than in most OECD countries

Share of population with disposable income below the poverty line[1], total population, 2015 or latest year



1. The poverty line is 60% of median household income. Household income is adjusted to take into account household size.
2. Unweighted average.
Source: OECD (2018), *OECD Social and Welfare Statistics* (database).

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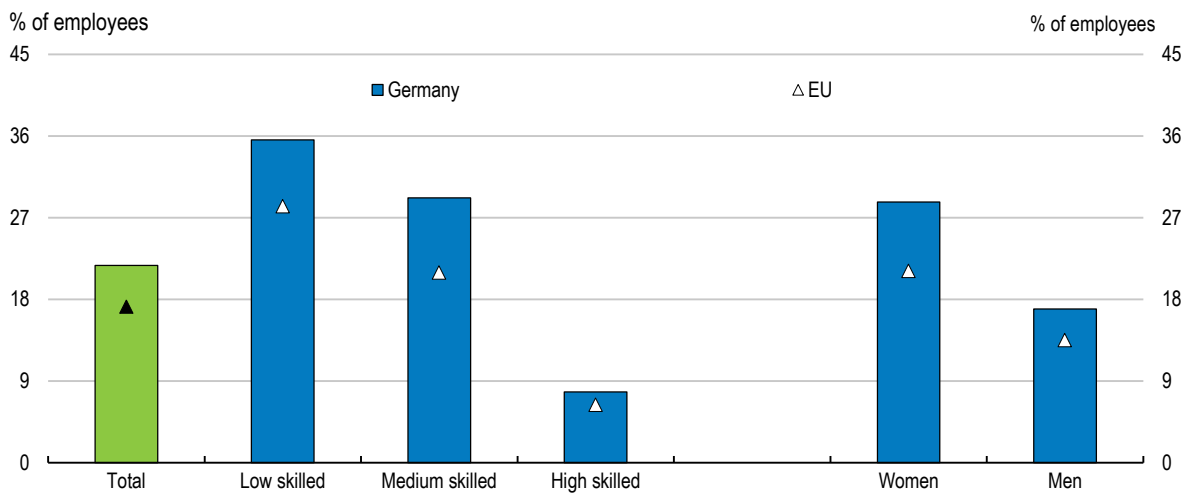
Figure 4. The incidence of low-pay employment is high

Low-wage earners by education and gender, 2014



Note: Low-wage earners are defined as those employees earning less than two thirds of the median gross hourly earnings. Low skilled, medium skilled and high skilled are defined respectively as educational attainments of below upper secondary (ISCED 0-2), upper and post-secondary (ISCED 3-4) and tertiary (ISCED 5-8). All employees excluding apprentices working in enterprises with 10 or more than 10 employees and which operate in all sectors of the economy except: agriculture, forestry and fishing (NACE Rev. 2, section A); and public administration, defence and compulsory social security (NACE Rev. 2, sections O).
Source: Eurostat (2018), *Employment and working conditions* (database).

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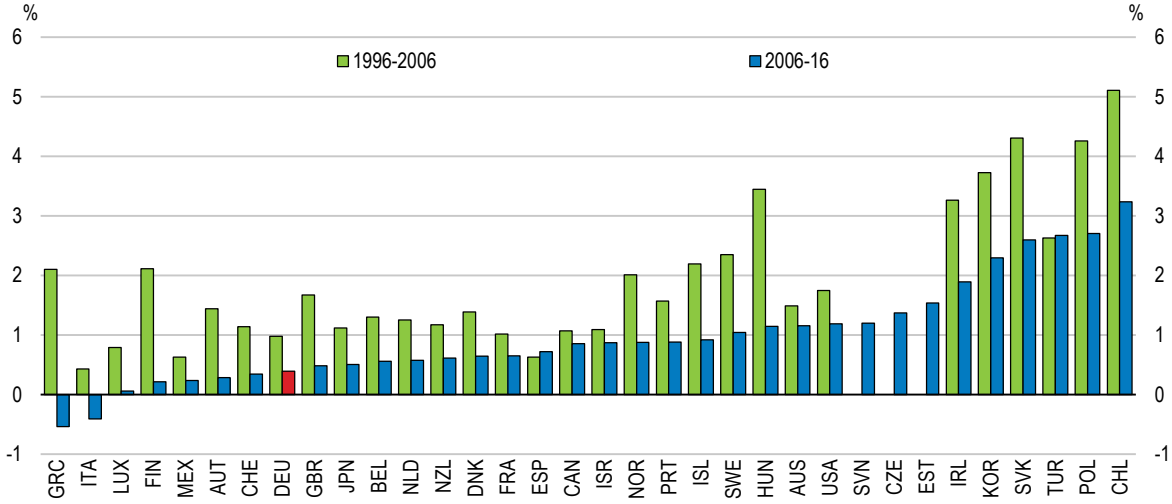
Figure 5. Trend productivity growth has diminished and is low in Germany

Average annual rate of trend labour productivity growth



Source: OECD (2018), *OECD Economic Outlook: Statistics and Projections* (database).

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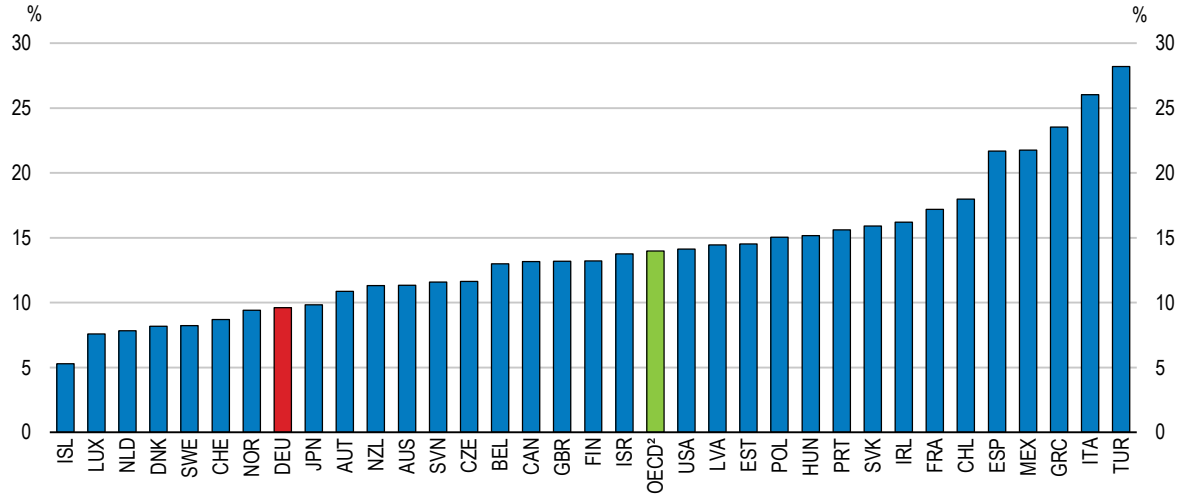
Skills are becoming more important as technological change and globalisation are advancing. A skilled workforce, reflecting in part Germany's renowned vocational education and training system and strong science and engineering skills, have delivered high labour productivity, especially in the manufacturing sector, good job quality (OECD, 2017[2]) and an excellent integration of young people in the labour market (Figure 6). However, cognitive and digital skills among the adult population are weaker and more dispersed than in leading OECD countries. Germany has undertaken impressive education reforms which have improved outcomes for disadvantaged youth, but scope remains to reduce the impact of socio-economic and immigration background further. Efforts are undertaken but need to be stepped up to reduce inequality of market incomes and poverty risk, improve upward social mobility and boost economic growth overall (OECD, 2015[3]).

Figure 6. Most German youth are either in employment, education or in training

Youth not in employment, education or training (NEET), per cent of 15-29, 2016 or latest year[1]



1. 2015 for Ireland and Chile. 2014 for Japan.
2. Unweighted average.
Source: OECD (2017), "Education at a glance: Educational attainment and labour-force status", *OECD Education Statistics* (database).

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Against this backdrop, the main messages of this Economic Survey to increase living standards for all are:

- New technologies must be exploited more extensively to boost wellbeing and productivity, with benefits for the whole society. Boosting entrepreneurship especially among women, wider access to high-speed Internet and strengthening digital skills would allow faster and more sustainable adoption of new technologies.
- Accelerated skill-biased technological change requires workers to be ready to adapt throughout their life time, including through strong skills and life-long learning. Better use of workers' skills, especially among women, can also boost productivity.
- Enhancing education opportunities for people with weak socio-economic background would help ensure that technological change brings better access to economic opportunities to all. Labour market regulations and social safety nets need to adapt to the changes new technologies bring to the labour market, so their benefits can be broadly shared.

The coalition agreement of the new German government (Box 1) addresses some of these challenges and includes some steps towards the recommendations developed below, notably by proposing to strengthen education and skills, lowering the taxation of low wage incomes, strengthening innovation and entrepreneurship, and addressing environmental challenges in transport. As recommended in this *Survey* it also aims at using fiscal space for this purpose.

Box 1. Key features of the programme of the new government

The coalition agreement between the two conservative parties (CDU and its Bavarian ally CSU) and the Social Democrats (SPD) includes a comprehensive overview of planned measures and additional government spending for these purposes.

- **Government spending:** The political objective of a balanced headline budget is kept. Budgetary space in the federal government's budget is estimated at EUR 46 billion (1.5 % of GDP; envisaged to be spent almost entirely in the three year period of 2019-2021). Of it 8 billion are planned to be given as support to the *Länder* to relieve them for the costs of integrating refugees. Priority spending areas are education, family benefits and pensions. In addition, revenues from auctioning 5G licences will be used for investment in high-speed broadband infrastructure and digital equipment of schools. Surpluses in the social security system will be reduced to lower social security contributions.
- **Tax policy:** The government intends to reduce the unemployment insurance contribution rate by 0.3 percentage points, shift about 0.5 percentage points of health insurance contributions from employees to employers, and to reduce employee-paid social security contributions for low-paid workers above the *mini-job* income threshold of EUR 450 (*midi-jobs*). Steps to raise the taxation of interest income received by households to the standard income tax rate are envisaged. From 2021, income tax reductions worth EUR 10 billion, mostly for middle-income households, are planned.
- **Labour market policy:** The government plans to reduce the scope for fixed-term contracts. A legal right for temporary limited part-time work, with the right to return to the previous working hours in companies employing more than 45 employees, will be introduced. In order to reduce long-term unemployment the government aims to strengthen active labour market policies. The government plans to introduce an immigration law to facilitate immigration of skilled workers. The agreement proposes to strengthen participation of women in executive positions in the private and public sector. The government plans to subsidise domestic services in private households to promote reconciliation of work and family life, and to foster regular employment in this sector.
- **Pension reform:** The government intends to keep the pension benefit replacement rate constant at 48% until 2025 while limiting pension contributions to 20%. This may have little effect on pension spending before 2025. For the time after 2025 a pension reform commission will be set up to investigate how to stabilise pension contributions and benefits. Furthermore a new basic pension will be introduced for people with long contribution records. They will receive a retirement income exceeding social assistance benefits by 10%, subject to a means test. Disability pension entitlements and pension entitlements for mothers who have raised 3 or more children will be increased. The government plans to introduce compulsory pension insurance for the self-employed,

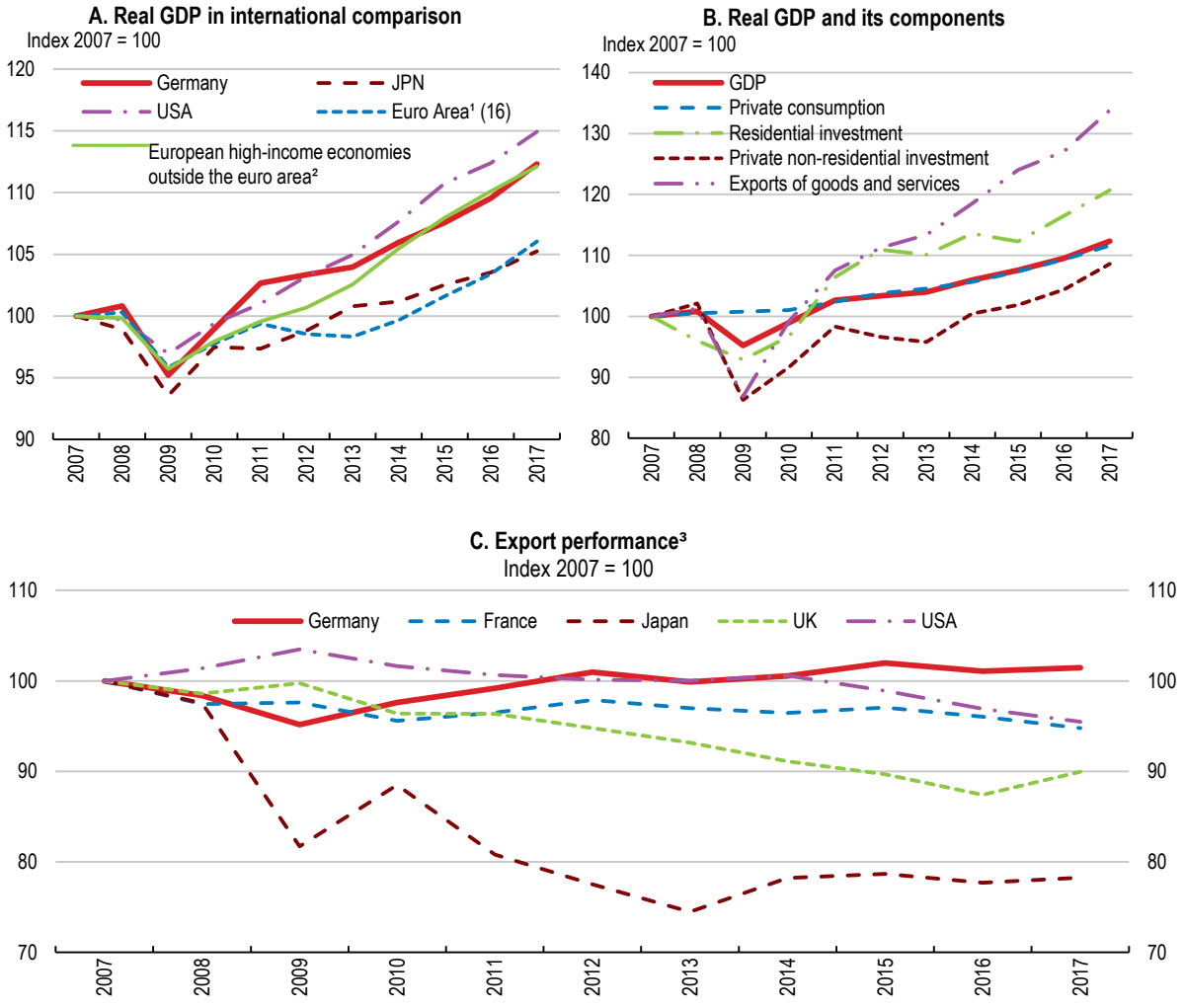
eventually including them in the public pay-as-you-go pension scheme with an opt-out possibility.

- **Innovation and entrepreneurship:** The government plans to raise R&D spending from currently below 3.0% to 3.5% of GDP by 2025. The High Tech Strategy will be further developed and focus on digitalisation and artificial intelligence (AI). In order to incentivise private R&D spending, especially within SMEs, the introduction of tax incentives will be considered. To facilitate start-ups, the government plans to introduce a "One-Stop-Shop" and a VAT exemption for the first years after starting a business. It will also examine further tax incentives for venture capital. Public health care insurance contributions for low-income self-employed workers will be reduced.
- **Child care, education and skills:** The government plans to improve child care and school education, including full-day care and schooling. By 2025, a legal right to primary full-day school places will be introduced. Schools will be better digitally equipped. To address needs due to technological change and strengthen ICT skills, a national life-long learning strategy with social partners will be put in place. Furthermore programmes will be introduced to upgrade skills in vocational education and address challenges from digitalisation, including a "digital pact for schools" (*Digitalpakt Schule*), the "vocational education and training pact" (*Berufsbildungspakt*) and an updated "Alliance for Initial and Further Training" (*Allianz für Aus- und Weiterbildung*). In addition the government plans to increase grants for adults in life-long learning. It also envisages introducing minimum apprenticeship pay. Challenges related to digitalisation and the upgrading of skills for the future of work are widely recognised in Germany`s coalition agreement where these challenges are addressed accordingly.
- **Family benefits:** The agreement proposes to raise family benefits (child benefits, child benefit supplements for low income households and child tax allowances as well as better in-kind benefits for low-income families e.g. for school lunch). The government plans to target additional education support to pupils from low-income households. Furthermore it plans to introduce substantial tax incentives and grants for private home purchases for families with children (EUR 1 200 per child per year for maximum of ten years).
- **Climate policy:** The government intends to implement additional measures to reduce the gap in greenhouse gas (GHG) emissions with respect to the 2020 climate goal. To meet the 2030 GHG emission target, it envisages reducing coal-fired energy generation while supporting structural change in the affected regions. Low emission transport policy will be strengthened (rail, public transport, low- and zero emission mobility, support for car sharing). Measures to improve air quality especially in cities will be implemented. Among other things, the government wants to increase the purchase bonus (*Umweltbonus*) for low-emission light commercial vehicles and taxis and to expand the charging infrastructure for cars to facilitate electric transport. The government also plans to introduce digital test fields for autonomous driving and open transport regulation for new shared mobility services.

Economic growth has been robust

Germany's recovery from the global financial and economic crisis has been stronger than in the euro area as a whole (Figure 7, Panel A). Past structural reforms have increased the resilience of the German economy. Germany has benefited from its status as a safe heaven, which results in capital inflows when other euro area countries experience financial or fiscal difficulties. Residential investment has expanded strongly. Exports have gained momentum and business investment is accelerating in the context of the euro area recovery (Figure 7, Panel B). Unusually among high-income countries, German exporters have maintained market shares (Figure 7, Panel C). However the euro exchange rate has also strengthened somewhat recently.

Figure 7. Growth has been strong



1. Euro area countries which are OECD members.
2. Includes Denmark, Sweden, Switzerland and the United Kingdom. The weighted sum of growth rates of their GDP in volume is used for the aggregate.
3. Export performance is measured as the ratio of actual export volume to the country's export market size.
Source: OECD (2018), *OECD Economic Outlook: Statistics and Projections* (database).

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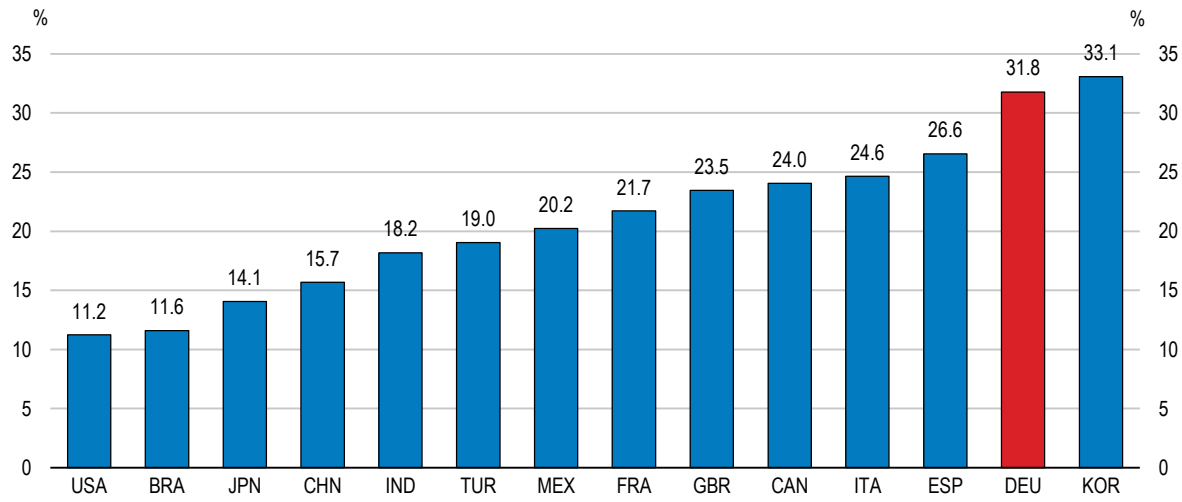
The strong export performance relies on the highly innovative manufacturing sector that is deeply integrated in global value chains (GVCs). For a large economy, Germany earns an unusually high share of value added from foreign final demand (Figure 8). German firms supply high value added goods, with a marked specialisation on capital goods. Global demand for capital goods has strengthened over the past 15 years, in the context of the increasing weight of emerging economies. German firms specialise in highly complex, technology-intensive goods which compete less with exports in emerging economies, such as China (Figure 9). Large German manufacturing firms have expanded their global production networks, incorporating more foreign value added (Figure 10). This has helped retain competitiveness and penetrate dynamic emerging markets.

Figure 8. Germany draws high value added from participation in global value chains

Share of domestic value added embodied in foreign final demand, % of total domestic value added, 2014



Note: Domestic value added embodied in foreign final demand captures the value added that industries export both directly, through exports of final goods or services, and indirectly via exports of intermediates that reach foreign final consumers (households, government, and as investment) through other countries.
Source: OECD (2018), "TiVA Nowcast Estimates" in *OECD International Trade and Balance of Payments Statistics* (database).

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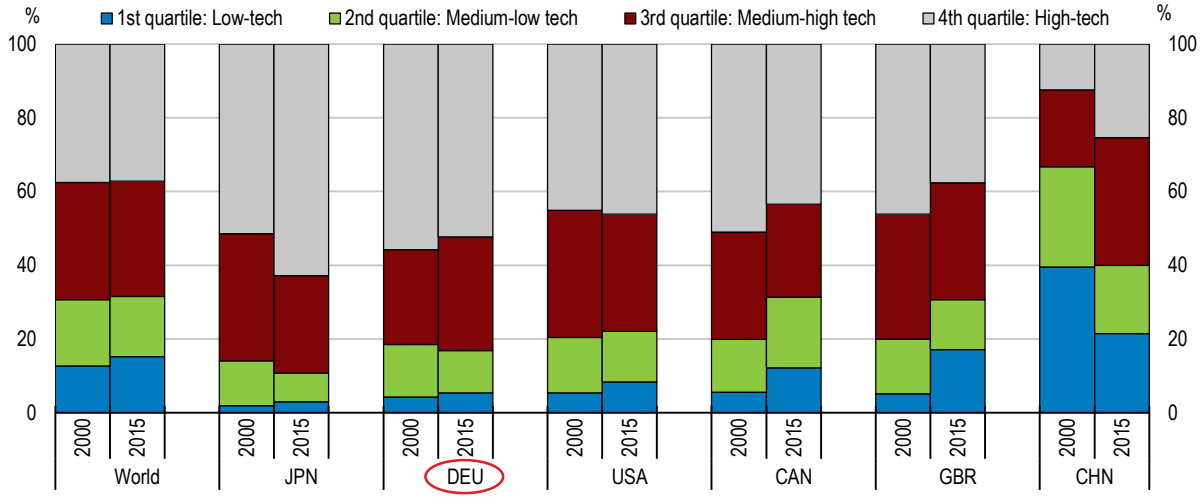
Figure 9. Germany's exports are strong in high-tech goods

Share of export by complexity quartile, 2000 and 2015



Note: Complexity is defined by the implied productivity of the product (PRODY) using the methodology of Hausmann, R., J. Hwang and D. Rodrik (2007), "What you export matters", Journal of Economic Growth, Springer, vol. 12(1). PRODY is calculated by taking a weighted average of the per capita GDPs of the countries that export the product. The weights are the revealed comparative advantage of each country in that product. The products are then ranked according to their PRODY level. An example of product in the 4th (highest) quartile is magnetic imaging resonance (MRI) machines used in scans in hospitals which ranked 18th in 2015, out of 4989 products listed in the Harmonized System 6 classification. A product in the 1st (lowest) quartile is crayons ranked 4218th in 2015. The analysis is carried out using a high level of product disaggregation to try to capture specialisation at different stages of the production chain.
Source: OECD (2018), "*OECD Economic Outlook* No. 102 (Edition 2017/2)".

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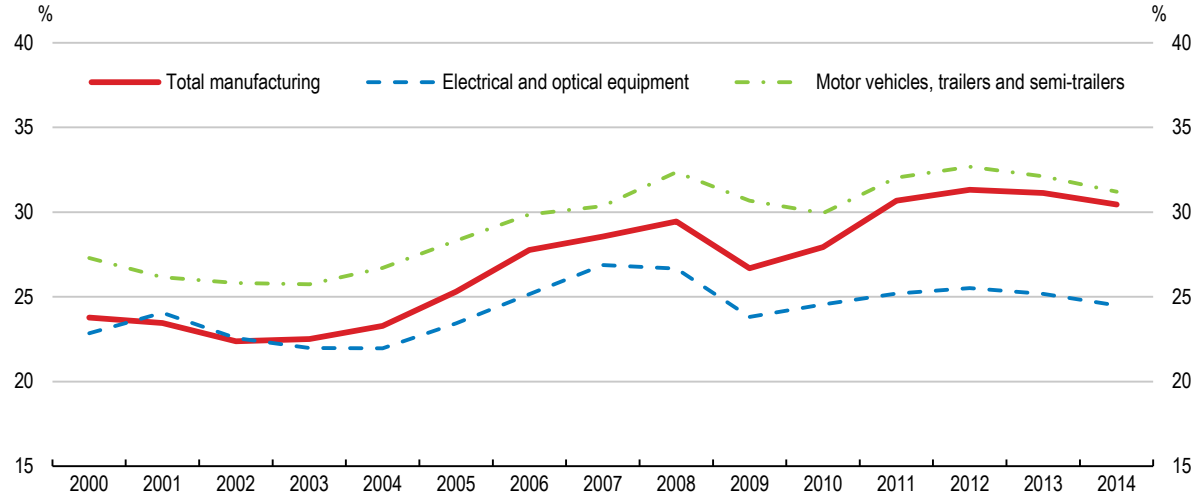
Figure 10. The manufacturing sector has increased its global sourcing

The share of foreign value added embodied in gross exports



Note: Data from 2012 to 2014 are TiVA nowcast estimates, which are extended estimates of the "Trade in Value Added (TiVA)" database based on more recent trade flow data.
Source: OECD (2018), "Trade in Value Added - December 2016" and "TiVA Nowcast Estimates" in *OECD International Trade and Balance of Payments Statistics* (database).

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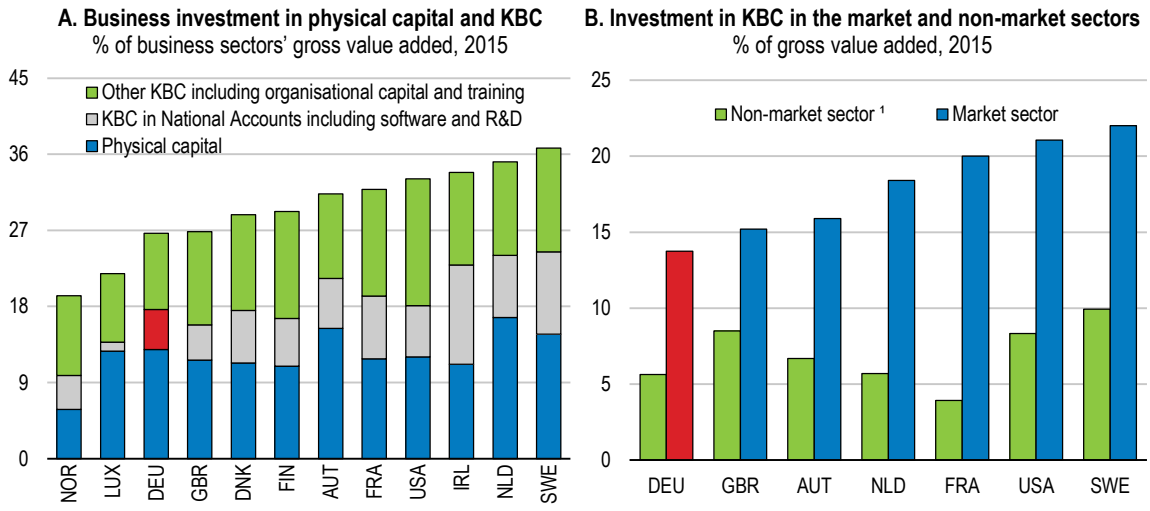
Business investment is picking up as capacity utilisation is above long-term average. Also confidence and demand in the euro area have strengthened, contributing positively to growth in Germany. But business expenditure on knowledge-based capital (KBC), including software and databases or firm-sponsored training, remains lower than in leading OECD countries (Figure 11). Spending on these intangible assets has become an increasingly important driver of productivity (OECD, 2015[4]).

Vigorous employment growth has pushed the unemployment rate to a record low, while the number of vacant jobs is rising strongly (Figure 12, Panel A). Jobs in long-term care and jobs related to construction have recorded the longest vacancy durations. Employment growth, low unemployment and real wage growth underpin household consumption. Residential construction has picked up markedly, boosted by the housing needs of immigrants, higher household incomes and low interest rates.

Figure 11. Investment in knowledge-based capital (KBC) is lower than in leading economies



Note: The non-market sector consists of the following NACE Rev. 2 sections: (1) public administration and defence; (2) education; and (3) human health and social work activities, (4) scientific research and development and (5) arts, entertainment and recreation.
Source: OECD (2017), OECD Science, Technology and Industry Scoreboard 2017: The digital transformation.
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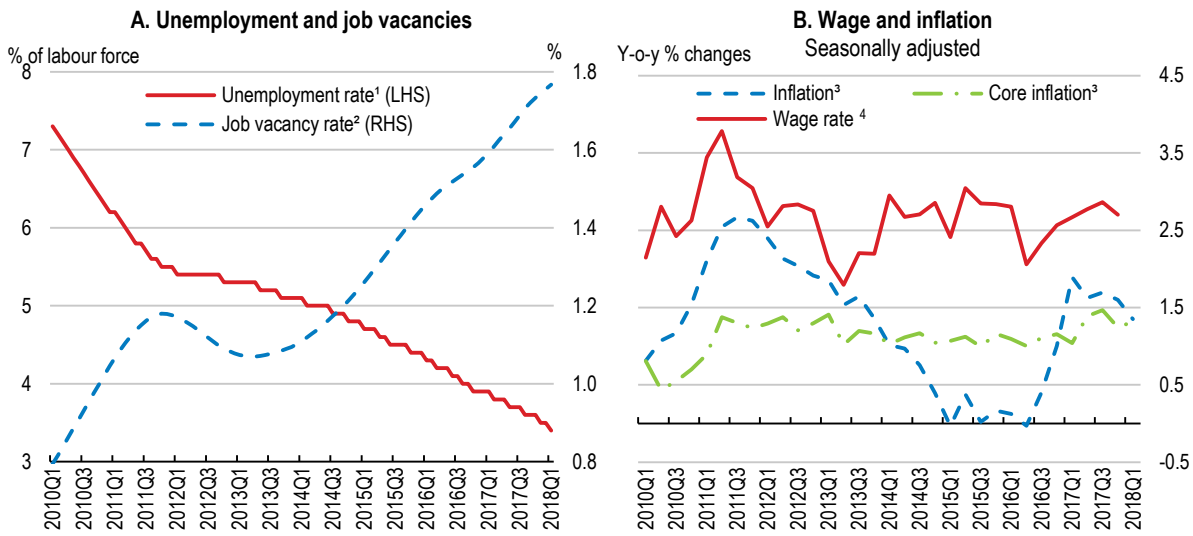
Rising wages, especially at the bottom of the wage distribution, are welcome as this will reduce worker poverty and further strengthen domestic demand. While wages are growing above inflation and productivity, they have not grown as much as could be expected on the basis of historic norms, given low unemployment (Deutsche Bundesbank, 2016[5]). This could be explained by declining collective bargaining coverage. It may have reduced wage growth by about 0.2 percentage points annually (Deutsche Bundesbank, 2016[5]). In some sectors, wage growth is still influenced by more modest collective agreements negotiated some years ago.

Recent collective bargaining outcomes suggest a modest acceleration of wages. In the metal industry, where unions remain relatively strong, negotiated wages will rise by about 3% on an annual basis. In sectors where collective bargaining is still ongoing, unions have demanded around 6% higher wages, somewhat more than in earlier years (Deutsche Bundesbank, 2018[6]). Unions have increasingly negotiated non-wage benefits, such as better work-life balance, by giving workers more leeway to reduce working time (with a

proportional cut in pay), for example, to look after children. Immigration may have reduced the extent to which wage growth responds to domestic unemployment. The trend increase in the dispersion of wages in past decades has not continued in recent years. Low-pay workers have benefited from the gradual introduction of the minimum wage in all sectors since 2015, and a tight labour market has diminished competition for jobs with low skill requirements.

Real wage gains diminished as consumer price inflation rose in 2017 (Figure 12, Panel B) mostly reflecting higher oil prices. Core inflation also rose to 1.5%, reflecting spillovers from oil prices, notably in transport services, as well as higher capacity utilisation (Deutsche Bundesbank, 2018[6]). In recent months inflation has not risen further. Credit growth also remains modest. However, capacity utilisation in industry has climbed well above historic averages. Capacity constraints appear most binding in construction where prices have risen significantly. Immigration is allowing employment to expand despite low unemployment. On aggregate, despite a tight labour market and supportive fiscal and monetary policy conditions, there is so far little sign of overheating.

Figure 12. The labour market is tight but nominal wage growth has remained broadly stable



1. Population aged 15-74 years. Based on the German labour force survey.
2. Percentage of unfilled job vacancies relative to total employment.
3. Harmonised consumer price index (HICP). Core HICP excludes energy, food, alcohol and tobacco.
4. Average nominal wage per employee.

Source: OECD (2018), *OECD Economic Outlook: Statistics and Projections* (database) and Statistisches Bundesamt.

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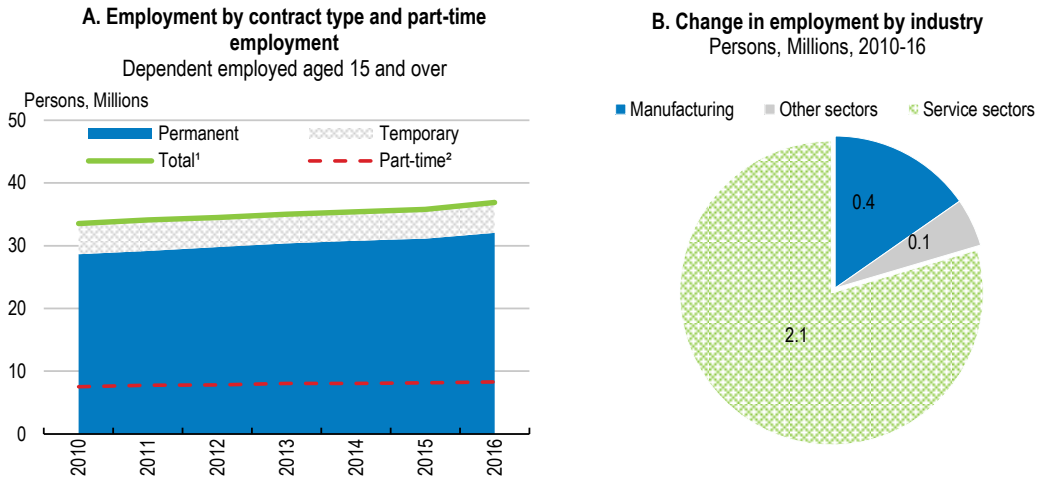
Most new jobs are full-time permanent contracts (Figure 13), which is welcome, as non-regular forms of employment are typically less productive and raise in-work poverty risks. Expanding labour supply has fed most of the employment gains, notably immigration. Hours worked among women have risen, in part reflecting expanding childcare, but most employed women continue to work part-time. Employment has mostly grown in services. Health services, professional services and support services have contributed strongly (Figure 14 panel A). Data shows that professional services provide high value-added activity and highly paid jobs, while health and support services provide many low value-added and low-paid jobs, for example, in long-term care, cleaning, security. Employment

growth has been strongest for jobs with the high skill demands (experts and specialists) as well as with the lowest skill demands (Figure 14, Panel B). The impact of skill-biased technological change may have contributed (see below). Employment of immigrants and formerly unemployed workers may also have made it easier to fill vacancies for low-skill jobs.

Immigration, mostly from other EU countries, remains strong and includes many highly skilled young workers. By contrast, most of the about 1 million refugees, mostly from the middle-east and Africa, who arrived in 2015 and 2016, have no recognised qualifications.

Germany has taken strong measures to facilitate labour market entry for refugees (2016 *Economic Survey of Germany*). In general, refugees may start working three months after registration. They also have access to preparatory courses to enter the vocational education and training system. Incentives to obtain qualifications have also been improved by offering guarantees to stay at least two years following completion of a vocational qualification to refugees with otherwise uncertain perspectives to stay. German language classes, support for integration in schools and counselling services have been stepped up. Language programmes integrate general and job-related language learning. Skills assessment has been reinforced (OECD, 2017[7]). Efforts continued in 2017 to help young refugees and migrants enter and complete vocational training, for example with programmes to support all youth with weak socio-economic background, including mentoring and coaching. In addition refugee recruitment advisors (“*Willkommenslotsen”*) help companies to find trainees among the refugees. Further steps could however be taken to open labour markets more generally, including by facilitating business creation, notably in the construction-related crafts, which can attract many immigrants and where there are capacity constraints (see below and the 2016 *Economic Survey of Germany*). The inflow of refugees diminished sharply in 2017.

Figure 13. Most jobs created are full-time permanent jobs and are in the service sector



Note: Based on labour force surveys.

1. Total employment is calculated as the sum of permanent and temporary employment and it is slightly different to the sum of full-time and part-time employment. The difference is 0.1%.

2. Part-time employment is defined as people in employment who usually work less than 30 hours per week in their main job

Source: OECD (2018), *OECD Employment and Labour Market Statistics* (database) and *OECD National Accounts Statistics* (database).

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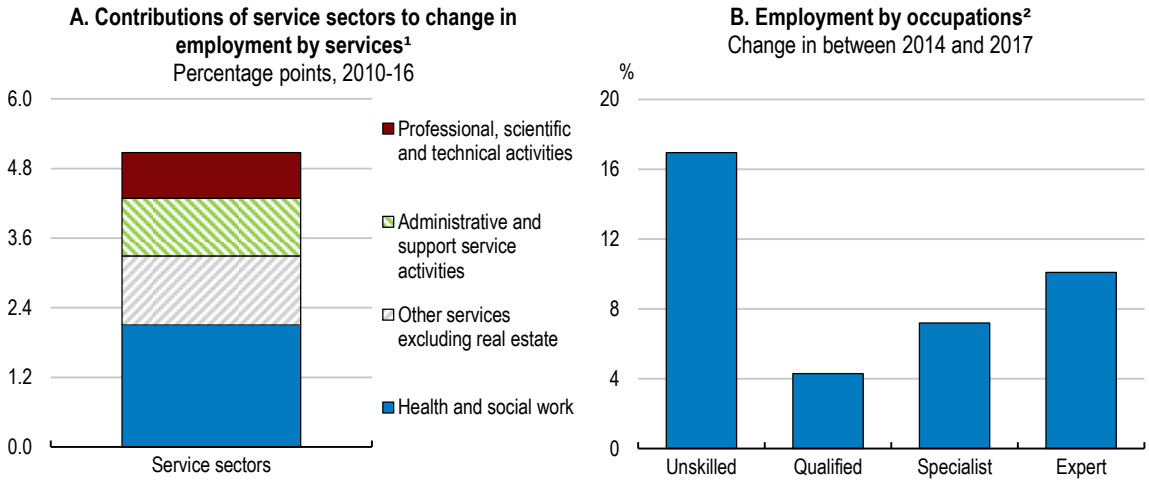
Figure 14. Jobs with the highest and the lowest skill demands have grown strongly



1. Based on labour force surveys for Panel A.
2. Unskilled jobs include simple tasks requiring little skill. Qualified jobs contain more complex tasks requiring intermediate vocational skills. Specialist jobs include highly complex and managerial tasks, typically requiring higher vocational skills. Expert jobs include the most knowledge-intensive tasks, typically requiring an advanced university degree.
Source: OECD (2018), *OECD National Accounts Statistics* (database) and the Federal Employment Agency of Germany.

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Economic growth is expected to slow somewhat, as capacity constraints have been reached, including in the labour market (Table 1). Strengthening world trade and the recovery in the euro area are projected to sustain exports. The tight labour market will continue to boost private consumption. Wage growth is projected to pick up, although the response to tight labour market conditions will be damped by lower collective bargaining coverage in the services, immigration and the expansion of low-skill jobs. Consumer price inflation may rise modestly as higher wages can be absorbed in comfortable business profit margins. Remaining slack in some trading partners, notably in the euro area, may also damp inflation. A deterioration of exports, for example, as a result of protectionism affecting world trade or lower demand from China, could weaken economic prospects (Table 2). There are also downside risks related to the impact of the exit of the United Kingdom from the European Union, as it may disrupt the value chains in key German industries, including automotive production and chemicals. On the other hand, some businesses have announced they will transfer activity to Germany.

Table 1. Macroeconomic indicators and projections

Annual percentage change, volume (2010 prices)

	2014	2015	2016	2017	2018[1]	2019[1]
	Current prices (billion EUR)					
Working-day adjusted GDP	**2,937.0**	**1.5**	**1.9**	**2.5**	**2.1**	**2.1**
Private consumption	1,595.5	1.6	1.9	2.1	1.0	1.6
Government consumption	563.9	2.9	3.7	1.6	1.3	2.0
Gross fixed capital formation	588.4	1.0	2.9	3.9	3.5	3.9
Housing	172.7	-1.1	3.8	3.6	2.6	3.1
Business	355.1	1.4	2.5	4.0	4.5	4.4
Government	60.6	4.5	2.6	4.6	0.6	3.1
Final domestic demand	2,747.9	1.7	2.5	2.4	1.6	2.2
Stockbuilding[2]	-15.3	-0.3	-0.1	0.0	0.2	0.0
Total domestic demand	2,732.6	1.5	2.4	2.4	1.8	2.2
Exports of goods and services	1,344.2	4.7	2.4	5.3	4.5	4.5
Imports of goods and services	1,139.9	5.2	3.8	5.6	4.3	5.1
Net exports[2]	204.4	0.1	-0.3	0.3	0.4	0.1
Other indicators (growth rates, unless specified)						
GDP without working day adjustment	2,932.5	1.7	1.9	2.2	2.1	2.1
Potential GDP	. .	1.5	1.7	1.6	1.6	1.7
Output gap[3]	. .	0.2	0.4	1.3	1.8	2.2
Employment	. .	0.8	2.4	1.1	1.1	0.9
Unemployment rate[4]	. .	4.6	4.2	3.7	3.4	3.3
GDP deflator	. .	2.0	1.3	1.5	1.6	2.1
Consumer price index (harmonised)	. .	0.1	0.4	1.7	1.7	2.0
Core consumer prices (harmonised)	. .	1.1	1.1	1.3	1.3	2.0
Household saving ratio, net[5]	. .	9.6	9.7	9.9	9.9	10.0
Current account balance[6]	. .	9.0	8.5	8.1	8.3	7.9
Government primary balance[6]	. .	1.8	1.8	2.0	2.1	2.0
General government fiscal balance[6]	. .	0.8	1.0	1.3	1.5	1.5
Underlying general government fiscal balance[3,7]	. .	0.5	0.7	0.6	0.6	0.4
Underlying government primary fiscal balance[3,7]	. .	1.4	1.5	1.4	1.2	1.0
General government gross debt (Maastricht)[6]	. .	71.1	68.4	64.0	60.7	57.9
General government gross debt (national accounts definition)[6]	. .	79.2	76.5	71.7	68.4	65.6
General government net debt[6]	. .	43.0	41.1	36.6	33.8	30.9
Three-month money market rate, average	. .	0.0	-0.3	-0.3	-0.3	-0.2
Ten-year government bond yield, average	. .	0.5	0.1	0.3	0.6	0.8

1. Projections
2. Contribution to changes in real GDP.
3. As a percentage of potential GDP.
4. Survey-based unemployment rate following the definition of the the International Labour Office.
5. As a percentage of household disposable income.
6. As a percentage of GDP.
7. The underlying balances are adjusted for the cycle and for one-offs.

Source: OECD (2018), *OECD Economic Outlook: Statistics and Projections* (database), May.

Table 2. Possible shocks and their economic impact

Shock	Possible outcome
Rising protectionism in trade and investment.	Lower world trade would hit German exports and investment, which could feed to lower private consumption and employment. Global value chains, in which Germany is closely integrated, would be disrupted. Exports to key trading partners outside the euro area (United States, China) could be particularly affected.
Demand for German products in China could weaken markedly in the context of a financial crisis in China.	Exports and the value of the stock of German foreign direct investment would fall, with a negative impact on investment, employment and private consumption.

The current account surplus remains large

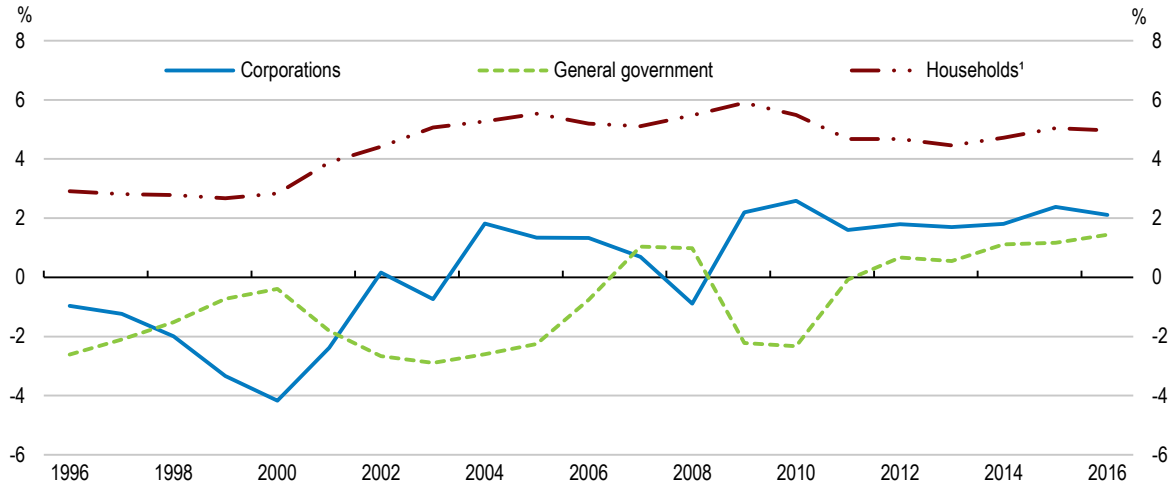
Germany's current account surplus remains large. It correlates strongly with global demand for capital goods (Grömling, 2014[8]). The large external imbalance reflects excess saving by households, corporations and government (Figure 15). The saving-investment balance has risen in the government sector and in the corporate sector, where retained earnings have risen more than investment. Investment has fallen among large corporations quoted in the stock market (OECD, 2016[9]). German firms increased their equity to strengthen resilience to external shocks. One important factor contributing to boosting corporate savings has been the deep integration of German firms into global value chains through foreign direct investment and the associated profits of foreign affiliates. Excess saving by non-financial corporations is also observed in many other high-income countries.

A large part of the current account surplus can be attributed to structural factors like demographics, a competitive industry and the specific composition of German exports. In 2017, about 25% of the German current account surplus can be attributed to a surplus in the primary income balance, reflecting the income earned on Germany's large net international investment position. At the same time, the 2016 *Economic Survey* identified barriers to the reallocation of resources, restrictive regulation in some services, skills shortages and uncertainty about prospects in the euro area as factors holding back domestic investment in Germany, including investment in knowledge-based capital.

Several policies recommended below that boost productivity and inclusiveness can reduce the current account surplus by stimulating investment and consumption. Policies which promote investment, entrepreneurship, the diffusion of new technologies, and skills, as recommended further below and in previous *OECD Economic Surveys*, would increase investment, as would using fiscal space to increase public investment in key infrastructure. However, such steps could also boost competitiveness in the long-term. Tax reductions on low wage earnings would boost private consumption. Policies that increase labour market participation and reduce poverty risks can also reduce precautionary savings. In particular, reforms that remove barriers to women's full time employment and to better careers would protect households better against poverty risk. Policies to improve income prospects at older age would also reduce the need for households to save to prepare for old-age. This includes better opportunities for upskilling, stronger incentives to work at higher age, better insurance against income risks from disability and better access to low-cost pension annuities (see below).

Figure 15. Excess savings in the corporate and government sector increased

Saving-investment balances by sector as % of GDP



1. Includes non-profit institutions serving households.
Source: OECD calculations based on OECD (2018), *OECD National Accounts Statistics* (database).

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Low interest rates and high leverage are potential risks to the financial market

Lending to non-financial corporations and to households has picked up (Figure 16) but growth remains broadly in line with nominal GDP. The share of nonperforming loans is low. Banks have stepped up precautions against sudden changes in interest rates (Deutsche Bundesbank, 2017[10]).

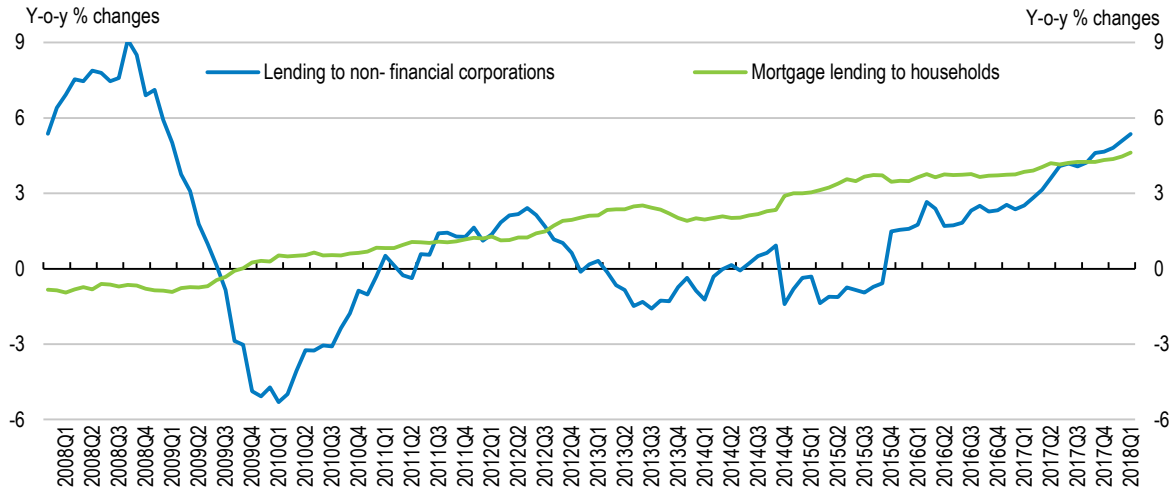
House prices have risen fast, especially in major cities (Figure 17, Panel A). So far, overall increases are primarily driven by fundamental market forces, notably housing demand and lower interest rates (Deutsche Bundesbank, 2017[10]). Only in the major cities are prices higher than implied by fundamental market forces. The ratio of house price to household income is still lower than the long-run average (Figure 17, Panel B). Banks have not eased credit standards for housing loans (Deutsche Bundesbank, 2017[10]).

The Federal Financial Supervisory Authority (*BaFin*) has been given powers to take macroprudential measures such as ceilings on loan-to-value ratios. This is timely as risks related to the housing markets may arise in the future. However, imposing a ceiling on the loan-to-value ratio may not always be effective to halt a credit-driven price bubble, as a stable loan-to-value ratio may be consistent with high growth of both lending and house prices (Deutsche Bundesbank, 2017[10]). The macroprudential toolkit can be strengthened by including a cap on the ratio of a borrower's debt servicing relative to income. Such a cap was recently introduced in Denmark and Norway and is envisaged in Sweden.

The Bundesbank provides analysis to prepare macroprudential decisions. Its analysis must prove that banks' lending practices pose macroprudential risks. However, it cannot conduct surveys of financial institutions on individual banks' housing-related lending practices on a regular basis. It is important that the Bundesbank be able to collect such data regularly.

Figure 16. Credit growth is picking up

Growth of lending to non-financial corporations and mortgage lending to households



Source: Deutsche Bundesbank.

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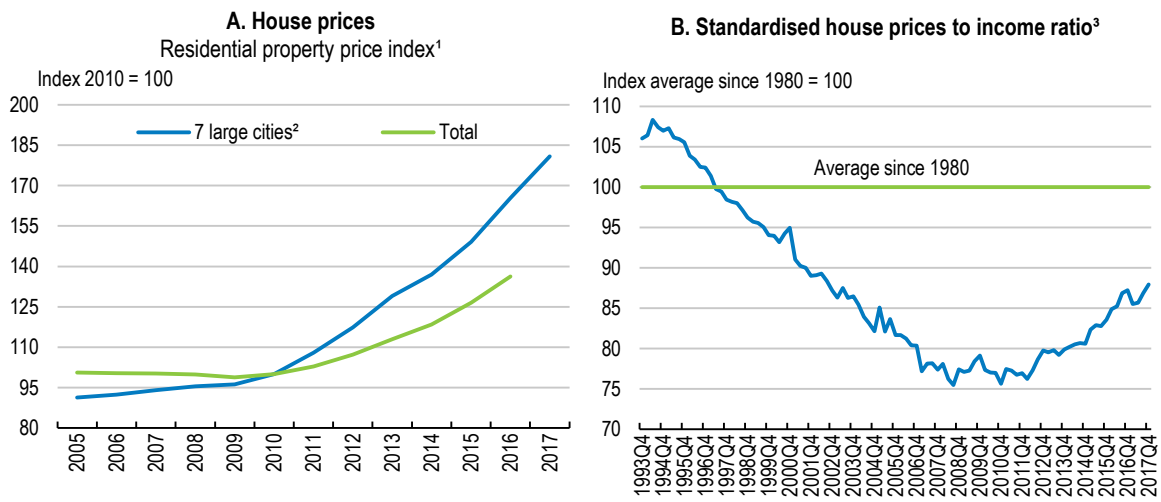
Figure 17. House prices are rising but remain broadly in line with income growth



1. Bundesbank calculations based on price data provided by Bulwiengesa AG.
2. Berlin, Düsseldorf, Frankfurt, Hamburg, Cologne, Munich and Stuttgart.
3. The nominal house price is divided by the nominal disposable income per head. It is standardised by being divided by the long-term average as a reference value over post-1980.
Source: OECD (2018), *OECD Analytical House Price Statistics* (database) and Deutsche Bundesbank.

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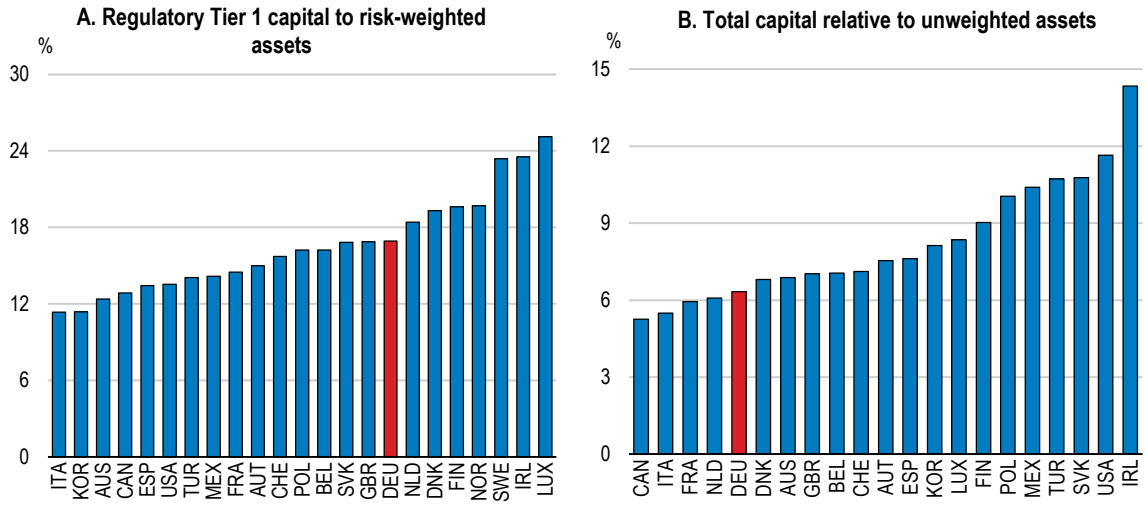
Bank capital relative to risk-weighted assets has increased. It is still lower than in some countries, but most of these have had to take macroprudential steps to prevent excessive housing-related lending (Figure 18, Panel A). Large banks calculate the risk weights of their assets with internal models, which may result in excessively good capital ratios (e.g. the (German Council of Economic Experts, 2016[11]). The rules concerning risk weights in internal risk models have recently been tightened somewhat in the context of the Basel III agreement.

Banks are still highly leveraged. The unweighted capital ratio of banks in Germany remains lower than in many OECD countries (Figure 18, Panel B). Leverage is particularly high in the largest banks. The seven largest banks' leverage ratio (following the definition in the capital requirements regulation which banks have to fully implement by 2022) amounted to 3.7% mid-2017. Since the new tools to resolve globally active systemically-important banks in financial distress are still untested, the low capacity of equity to absorb losses exacerbates the distorting impact of implicit government guarantees. The perception that too-big-to-fail banks may be rescued by the government in case of distress can lead to excessive risk-taking by the banks, impair the quality of their lending, put taxpayers' wealth at risk and aggravate the destabilising macro financial effects of asset price fluctuations. The authorities should induce banks to further strengthen capital buffers where necessary.

Figure 18. The capital to asset ratio is low

2017 or latest year[1]



1. 2016 for Italy, France, Switzerland, Belgium, the United Kingdom and Norway and 2014 for Korea.
Source: IMF (2018), *IMF Financial Soundness Indicators Database*.

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The exposures to derivatives can be a factor in propagating systemic risks, as they raise interconnectedness between institutions, especially to the extent that the derivatives are not centrally cleared. The rapid growth in derivatives trade in the past has been motivated not only by the need to hedge risks but by tax and regulatory arbitrage and speculation (OECD, 2014[12]). Derivative positions are concentrated in large banks, aggravating the risks associated with high leverage. The weight of derivatives in their assets has declined but still amounts to around 20%. Germany has introduced legislation to separate retail banking from investment banking, but the separation requirements could be more effective, as argued in the 2014 *Economic Survey*. Steps by the German government would be particularly timely as the European Commission has abandoned plans to legislate separation requirements at the EU level. Such steps may help change the strategic relation between the supervisory authorities and the banks, with the supervisor being less under pressure to stand behind a systemically important bank when it faces problems, as relatively smaller and less complex banks tend to be easier to resolve if in distress.

As the 2014 *Economic Survey* pointed out, the regional *Landesbanken*, which are mostly owned by *Länder* governments, have had a poor track record in efficiency and vulnerability

to solvency risk. Profitability has remained substantially weaker than in other banks since 2012 (Deutsche Bundesbank, 2017[13]). Their balance sheets have shrunk by 40%, but they remain important banks, with assets worth about 30% of GDP. Owing to their strong financial links with other banks, notably the savings banks, and their role in interbank lending, they have a substantial systemic weight. One *Landesbank* merged. Another *Landesbank* is in the process of privatisation, after it failed to meet requirements by the European Commission. The two *Länder* governments owning this *Landesbank* will make losses on account of the support they provided over the past ten years. These losses may amount to about 5% of the GDP of the two *Länder's* GDP.

Regional government ownership of the *Landesbanken* has caused a governance problem due to the international nature of their business. *Landesbanken* have supported shipping in Northern Germany, holding back the reallocation of resources. Further progress in their privatisation could also reduce risks and facilitate the exit of banks with poor profitability (OECD, 2016[9]; OECD, 2014[12]).

Fiscal policy can help address structural challenges

Germany's budgets are governed by top-down and multi-year budgeting. They are bound by a structural general government medium term deficit objective of 0.5% of GDP agreed with the European Union. According to national constitutional rules, a structural deficit limit (0.35% of GDP) applies to the federal government and, from 2020 onwards, balanced budget rules to the *Länder*. The Stability Council (*Stabilitätsrat*), a joint body representing the German federal government and the *Länder*, monitors their budgets and the social security system. It is tasked with making sure that these, taken together, comply with the medium-term objective and, if necessary, issues recommendations. The Stability Council is assisted by an independent advisory board. A panel of independent experts provides revenue projections which guide government budgeting.

Tax revenues relative to GDP amount to 38% of GDP, more than in the OECD on average (34%). This ratio has increased in recent years, partly reflecting bracket creep. The fiscal position is sound and the general government budget has been in surplus since 2014. According to OECD projections, government gross debt (Maastricht definition) is expected to fall below 60% of GDP in 2019 and net debt close to 30%. According to government estimates the general government structural budget balance may amount to a surplus of 0.75% of GDP in 2019, though without incorporating the budgetary measures foreseen by the new government. Structural surpluses are also expected in the federal government budget and in the social security system. The OECD estimates the new measures to reduce the general government surplus by 0.25% of GDP in 2018 and 2019. Although the timing of the measures is uncertain, social security contributions are likely to be reduced and subsidies for families purchasing owner-occupied housing are likely to be introduced in the near term. In addition spending to improve childcare provision, full-day primary schooling and schools' digital equipment is expected to rise in 2018 and 2019. Income tax allowances and child benefits will also rise. Nonetheless, tax revenue growth is likely to increase the government surplus to 1.5% of GDP by 2019. Additional budget space consistent with meeting Germany's budget rules could amount to 0.4% of GDP.

The strong fiscal position provides some room to fund additional priority spending in the near term. However, fiscal leeway should be used in a prudent manner, taking capacity constraints into account. Enrolling more young children from disadvantaged socio-economic backgrounds in high-quality childcare and providing more full-day primary schooling are welcome spending priorities of the new government. A policy package which

includes the budgetary and tax policies in Table 5 below and key growth-enhancing structural reforms (Box 2) would imply structural government deficits in the medium term, which would still be consistent with budgetary rules. The policy package would raise the ratio of government debt to GDP modestly in the medium term, and even reduce it in the long-term, reflecting the impact of the indexation of the statutory retirement age to life expectancy, which would lower pension spending (Figure 25 below). The baseline and reform scenario assume that commitments to budget rules are kept and do not assume that higher ageing-related spending increases the government deficit. Stronger support for young children is particularly effective to strengthen skills in the long term. Simulations suggest that investment in childcare, early childhood education and full-day schools could improve the sustainability of government finances in the medium and long-term, by boosting GDP growth and reducing the risk of benefit dependency when the children reach adulthood (Krebs and Scheffel, 2016[14]). These steps would also make it easier, especially for women, to reconcile family life and full-time employment. Policies to boost skills and gender equity have large potential to boost long-term growth (Box 2). By improving the earnings potential among individuals at the lower end of the skill distribution, boosting support for very young children may, in the long-term, help reduce the need for cash transfers to prevent poverty.

Spending on childcare and early childhood education is substantially lower than in Denmark or Sweden for example. Primary education spending is relatively low in comparison to other high-income countries (Figure 19). It is welcome that the government plans to address these priority spending areas.

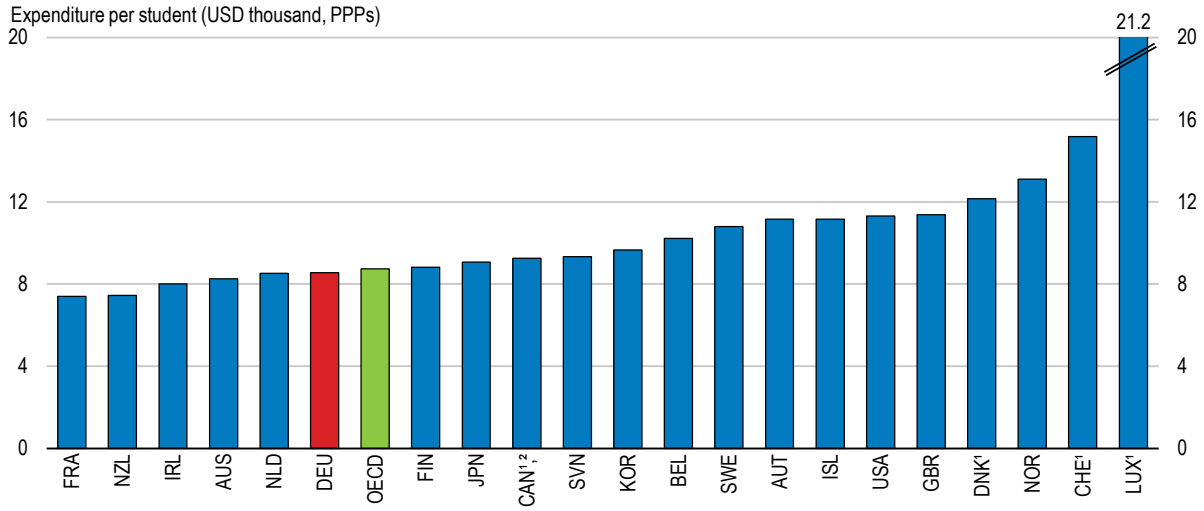
Further improvements could in part be funded by remaining fiscal space and reducing tax breaks for households with children, while maintaining child cash benefits. As argued in the 2016 *Economic Survey* (OECD, 2016[9]), these tax breaks do not increase labour supply because they widen the gap in the taxation between first and second earner in a household. They do not reduce poverty significantly because they provide the most relief to high-income households. By contrast, better childcare and early childhood education reduce poverty and raise the labour supply of women the most. Child cash benefits have also proven effective in reducing poverty, especially the supplementary benefit for low income households (OECD, 2016[9]).

There is also scope to improve the efficiency of government funding for childcare and early childhood education. Most government funding is provided by *Länder* and municipalities. Some *Länder* and their municipalities reimburse individual institutions for their operating costs without consideration to the number of children attending. In others, funding of individual institutions includes a demand-based add-on (for example, Saxony, Saxony-Anhalt and *Schleswig-Holstein*). Indeed, allowing the money to follow the children could strengthen incentives to offer formal childcare in locations and at times which suit parents, improving efficiency.

Other spending priorities include the rollout of high-speed fibre broadband infrastructure, which is poor, especially in rural regions, as foreseen in the coalition agreement. Accelerating rollout could improve economic development of rural regions which has fallen behind and boost GDP (Box 2). Spending on life-long learning and on low-emission transport infrastructure also needs to be stepped up (see below). The coalition agreement foresees subsidies for acquiring owner-occupied housing and higher pensions for mothers having raised three or more children in the past. These measures are not targeted to low-income households. This will limit the budgetary space available for spending that would support growth-enhancing structural reform.

Figure 19. Primary education spending is low

Annual public expenditure per student by educational institutions for all services, in primary education, 2014



1. Public institutions only.
2. Primary education includes data from pre-primary and lower secondary education.
Source: OECD (2017), *Education at a Glance 2017: OECD Indicators*.

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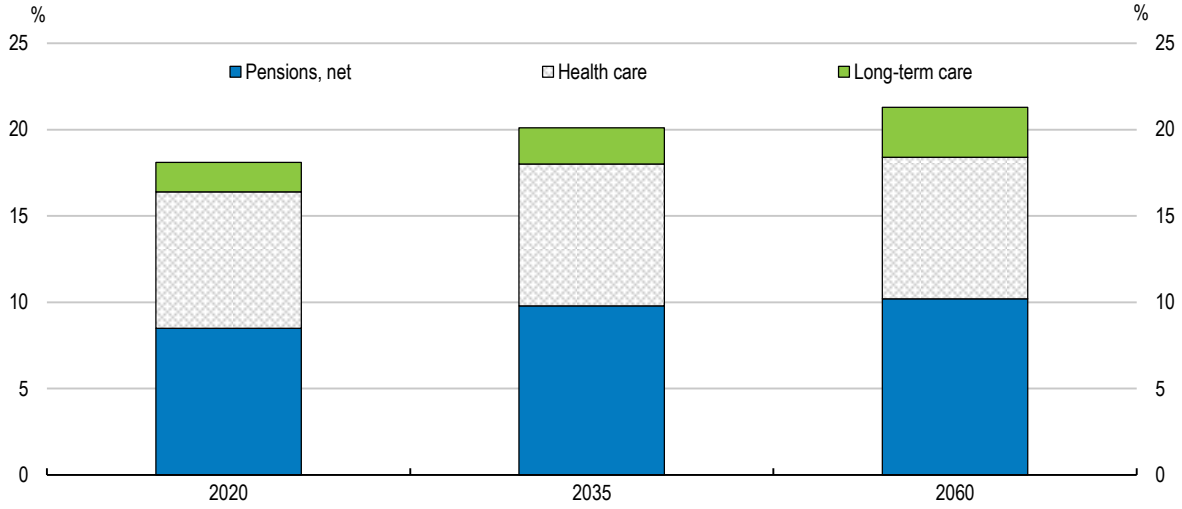
Ageing-related spending will increase, requiring better spending prioritisation

Looking further ahead, demographic change will increase the old-age dependency ratio and drive up public spending on old-age pensions, health and long-term care. The baseline scenario of the 2015 Ageing Report by the European Commission projects that spending could increase by almost 4% of GDP by 2060 (Figure 20), mostly driven by spending on pensions (net of taxes paid on pensions), and long-term care. These baseline scenarios broadly fall within the range of scenario projections by the German government. These also point to considerable uncertainty around projected spending beyond 2035. The temporary inflow of refugees in 2015-16 may reduce the increase of ageing-related spending only slightly, under the assumption that they are well-integrated into the labour market and stay in Germany durably (Federal Ministry of Finance, 2016[15]). By contrast, pension plans in the coalition agreement would further increase spending. Higher pension spending should be limited to reducing poverty risks.

Most of the increase in ageing related spending is projected to occur between 2025 and 2035, as the "baby boom" cohorts retire. However, in the long-term, the increase in ageing-related spending is mostly caused by gains in life expectancy. Since these gains are an ongoing process, resulting higher ageing related spending should not be prefunded with higher government surpluses today. Instead, structural reforms are necessary to provide workers with incentives and the capacity to extend working lives. Skills policies are critical in this regard (see below) and require higher government investment.

Figure 20. Ageing-related spending will increase

Projections on pensions, public health and long-term care spending as % of GDP



Source: European Commission (2015), "The 2015 ageing report: Economic and budgetary projections for the 28 EU Member States (2013-2060)". Based on the reference scenario.

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The statutory pension age will increase from age 65 in 2012 to age 67 by 2029 (meaning that people born in 1964 will only be able to retire with an unreduced pension in 2031). However, indexation of the retirement age to life expectancy, as recommended in the 2016 *Economic Survey of Germany* has not yet been introduced. It could reduce spending by 0.6% of GDP by 2060. Moreover incentives to work for longer still need to be strengthened by raising the pension premium for later retirement. According to OECD estimates postponing retirement still results in a loss of net pension wealth (OECD, 2017[16]). In many OECD countries, the premium for later retirement is large enough so retiring later increases net pension wealth. Germany could adopt a similar approach, as working for longer has social benefits, in addition to the private benefits for the worker who decides to postpone retirement. For example, longer working lives raise more tax revenue. Moving in this direction in Germany would therefore help raise income at high age while improving sustainability of government finances. It would also be inclusive as earlier retirement is often taken up by high-income individuals.

These steps need to be complemented by measures to lower income risks for workers who lose earnings capacity on account of disability before reaching retirement age, as the ageing process is unequal across socio-economic and professional backgrounds. Some progress has been made (Table 3). Indeed, poor health and low skills are important factors pushing older workers with weaker socio-economic status into early retirement. In addition, individuals with low lifetime income tend to have lower life expectancy, and Germany's pension system does not redistribute except through taxation. Reflecting the increase in income inequality in past decades, inequality in health outcomes by socio-economic status is widening, and these differences are relatively large in Germany, according to an OECD assessment (OECD, 2017[17]). Old-age poverty is low, but the number of pensioners in relative poverty risk is expected to rise by 25% until 2035 (DIW/ZEW, 2017[18]). These points reinforce the case for limiting any increases in pension spending to steps which prevent old-age poverty, as recommended in the 2016 *Economic Survey of Germany*.

Länder governments bear part of the cost of pension spending, as they pay the pensions of their former civil servants. Most of Germany's civil servants are employed by the *Länder*. To make sure the *Länder* take into account the financial burdens when they arise, they are required to build up reserves to cover pension commitments. However, the *Länder* have discretion as to how they calculate these reserves (Sachverständigenrat, 2017[19]). Since some high-debt *Länder* have benefited from bailouts by the central government in the past, incomplete budgeting of future pension commitments could result in moral hazard.

Table 3. Past recommendations and actions taken on pension reform

Recommendations	Action taken
Index the legal pension age to life expectancy.	No action taken.
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. Allow working old-age pensioners to accrue benefits on social security contributions employers pay on their behalf.	The pension premium remains unchanged. Since 2017, a partial pension and wage earnings can be combined in a more flexible and individual way. Wage earnings now reduce pensions by 40% only above a threshold of EUR 6 300 annually (previously the threshold was EUR 450 per month). Since 2017, individuals who continue to work after the statutory retirement age can choose to pay pension contributions and thereby accrue full benefits on all their pension contributions.
Focus additional pension entitlements on reducing future old age poverty risks, for example, by phasing out subsistence benefit entitlements more slowly as pension entitlements rise. Fund such additional spending from general tax revenue instead of higher payroll taxes.	From 2018, individual and occupational private pension savings will not be deducted from means-tested minimum pensions, up to a limit.
Strengthen insurance against disability, for example by making it easier to claim legitimate private disability insurance benefits. Consider eliminating the discount from public disability benefits for claiming the benefit before the age of 63 years and ten months. Reconsider the cuts of these benefits as other income rises.	Legislation in 2017 improved the benefits in case of reduced earnings capacity in the statutory pension insurance. A more flexible combination of partial pension and supplementary earnings also applies for disability benefits.
Remove barriers to the portability of civil servant pensions.	No action taken.
Enroll all individuals in occupational pensions by default, allowing them to opt out.	From 2018, social partners can agree enrolment by default in businesses covered by collective bargaining.
Strengthen supervision of direct pension commitments of employers. Make contributions to the risk-pooling scheme dependent on risk indicators.	No action taken.
Reduce operating costs of subsidised, individual pension plans by improving comparability among providers.	Since 2017, providers of subsidised individual pension plans are obliged to disclose costs and the implied reduction in the yield in a standardised fashion.
Strengthen experience-rating in employer contributions to work accident and disability insurance.	No action taken.

Better prioritising public spending would help boost growth and wellbeing

Spending reviews provide evaluations of spending programmes with the objective to identify savings, improve efficiency by allowing to reallocate spending and create fiscal space (OECD, 2016[20]; 2011[21]). Systematic scrutiny improves prioritisation. Spending reductions, if needed, can be made sustainable (Robinson, 2014[22]). Spending reviews reconsider programme objectives and the impact of the resources devoted to them. The OECD regularly gathers expertise on spending reviews to develop best practice (OECD, 2017[23]; 2017[24]; 2016[25]).

Following the 2014 OECD Budget Review (OECD, 2015[26]), Germany introduced spending reviews in 2015 (Federal Ministry of Finance, 2017[27]). They are performed in inter-ministerial working groups and include external experts. They are coordinated by a steering committee headed by the Ministry of Finance. However, results are only used to

prioritise spending within narrowly-defined policy areas, not to shift funds between broad policy fields, as is done in the United Kingdom for example (Federal Ministry of Finance, 2017[27]).

Germany can broaden the scope of spending reviews in various ways (Shaw, 2016[28]; OECD, 2016[25]). The Netherlands applies them comprehensively to wide policy areas (such as transport or health) while Canada and Denmark apply them to all the spending programmes conducted by selected departments. Canada also applies a horizontal approach across departments on selected policy areas (e.g. innovation in the public sector). At an earlier stage Canada reviewed spending ministry-by-ministry to redirect funding (Shaw, 2016[28]). Some countries, such as Ireland and United Kingdom, do comprehensive spending reviews across all government policy areas, covering established programmes as well as new programme proposals (European Commission, 2017[29]), usually at the beginning of a new government.

Spending reviews should draw on systematic ex-ante and ex-post evaluation. Canada for example has introduced a central registry of evaluation results. Ireland conducts evaluations every three years for all major blocks of spending. To be useful for spending reviews, evaluation requires defining clear programme objectives and introducing standards for the analysis of efficiency (Shaw, 2016[28]).

To ensure their systematic use, spending reviews can be integrated in budgeting procedures. In the United Kingdom, for example, comprehensive spending reviews were explicitly linked to the setting of departmental expenditure limits (OECD, 2011[30]). In Chile it is a requirement to incorporate recommendations from broad evaluations in the preparation of the budget. Defining cycles of recurrent spending reviews, such as in Denmark, the Netherlands and the United Kingdom, also helps ensure their continued application.

Strengthening spending reviews would foster performance-oriented budgeting, which is less developed in Germany than in many OECD countries, such as Austria (Downes, Moretti and Nicol, 2017[31]), Canada and Ireland (Shaw, 2016[28]). Performance-oriented budgeting improves decision-making and public scrutiny (OECD, 2017[24]), thereby strengthening civic engagement and governance, a key wellbeing dimension (Figure 1 above). It can also improve the evaluation of whole-of-government policies, such as gender equity. Spending reviews could be legally required and to allow the review of priorities across broad policy areas (OECD, 2015[26]). The implementation of recommendations in spending reviews needs to be tracked closely (OECD, 2017[24]). They could also help set priorities within *Länder* budgets.

The tax system could be made more growth and equity friendly

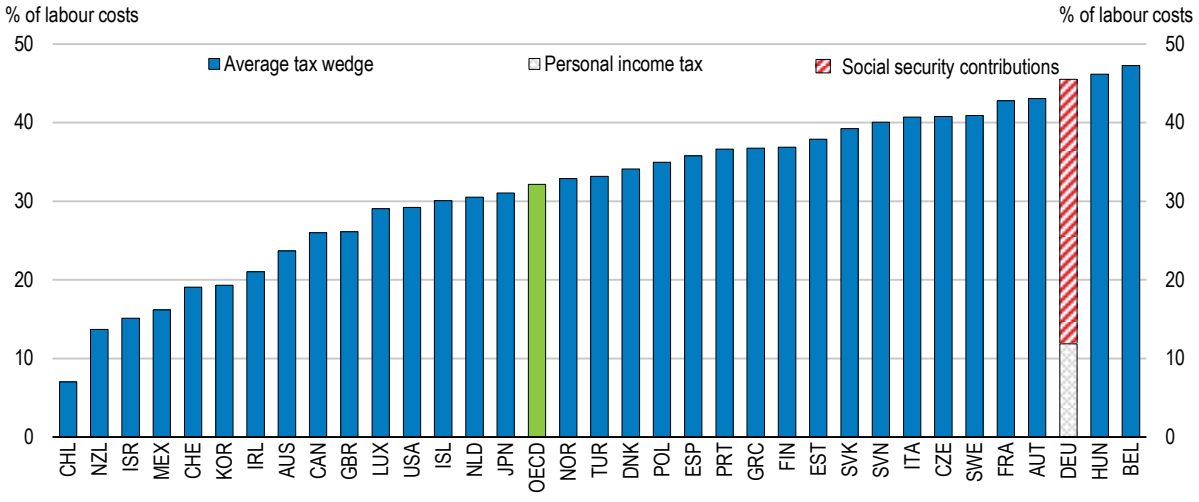
The taxation of low labour incomes is high (Figure 21), mostly on account of social security contributions, and has fallen little below the level in 2016. Moreover, the increase in ageing-related spending is expected to entail an increase in ear-marked social security contributions, which fund pension, health and long-term care spending. Steps to reduce this tax burden and prevent future increases should therefore be a priority. It would also help workers maintain employability in the face of technological change (see below). The coalition agreement foresees reducing the unemployment insurance contribution rate by 0.3 percentage points. It also proposes to shift some social security contributions from employees to employers and to lower taxes and social security contributions paid by low-wage earners above the *mini-job* income threshold of EUR 450. Another option would be to phase out means-tested social assistance more slowly as wage earnings rise.

Second earners (often women) in households are taxed particularly highly which discourages full-time employment of women (Figure 22). Lower taxation of second earners would improve incentives to work longer hours and therefore give women better access to good professional carriers and reduce the gender earnings gap. Non-working spouses are ensured in public health insurance free of charge. Relating health insurance premiums to the number of adults in a household and introducing a separate tax-free allowance which can only be deducted from the earnings of the second earner would reduce the tax wedge on second earners. In some OECD countries, spouses' incomes are assessed fully separately for income taxation. However, this would be inconsistent with the German constitution. Removing barriers to gender balance has a large potential for boosting long-term growth (Box 2).

The taxation of corporate profits is higher than in other high-income OECD countries (Figure 23). However business investment has been subdued despite strong corporate profitability in recent years, suggesting that corporate income taxes may not constrain investment much at present. In recent years, several high-income OECD countries reduced corporate income taxes, including Spain, Italy, Norway, Luxemburg, the United Kingdom, Japan and the United States. Recently, France and Australia announced reductions. In the United Kingdom a further reduction is envisaged for 2020. This may put pressure on Germany to reduce its corporate income taxes.

Figure 21. Labour taxes on low incomes are high

Income tax plus employee and employer contributions less cash benefits for single person, no child, 67% of average earnings[1], 2017



1. 67% of the average wage earnings of a full-time worker in the private sector.
Source: OECD (2018), *Taxing Wages Statistics* (database).

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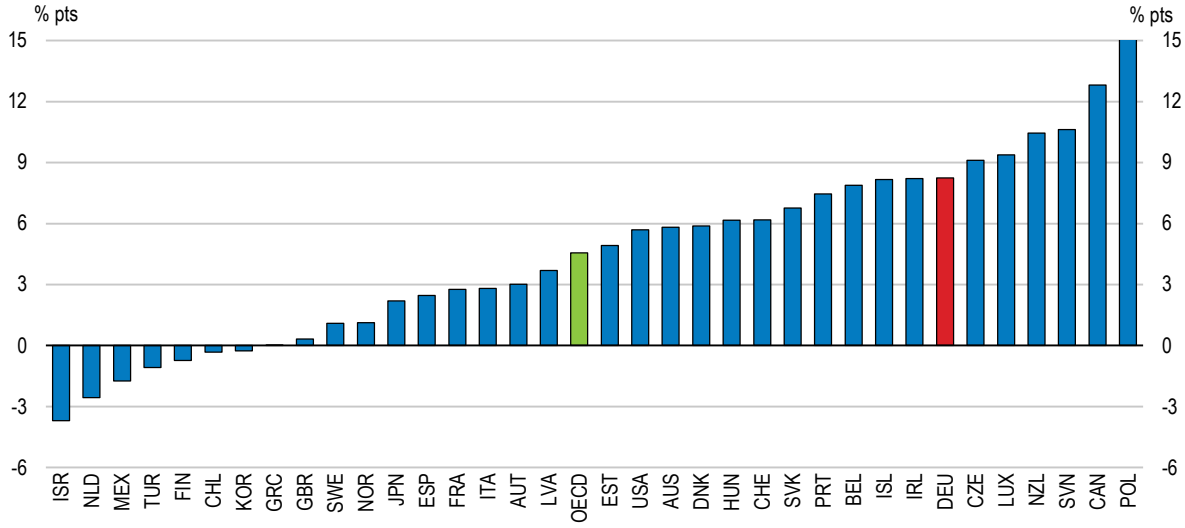
Figure 22. Taxes on second earners are high

Difference in the average tax wedge between two- and one-earner family, 2017



Note: The bars show the difference between the tax wedge of a two- and a one-earner family. The main earner earns the average earnings and the secondary earner earns 67% of the average earnings of a full-time worker in a family of a married couple with two children. The tax wedge is the sum of personal income tax, employee plus employer social security contributions, minus benefits as a percentage of labour costs.
Source: OECD (2018), *Taxing Wages Statistics* (database).

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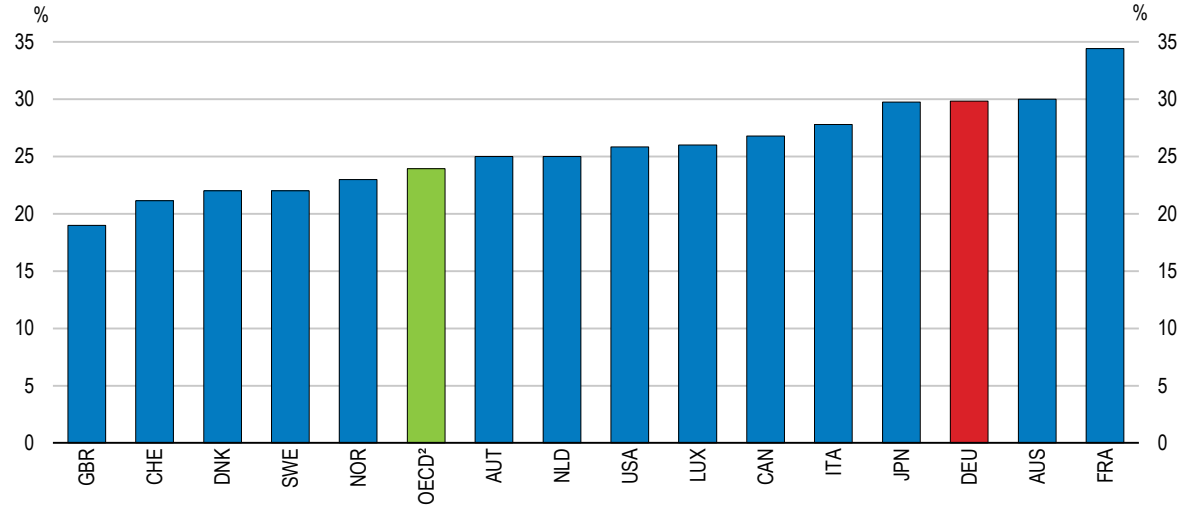
Figure 23. Corporate taxes are higher than in most high-income OECD countries

Statutory corporate income tax rate[1], 2018



1. Basic combined central government and sub-central government corporate income tax rate.
2. Unweighted average of 35 OECD countries.
Source: OECD (2018), *OECD Tax Statistics* (database).

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Fiscal space could be used to reduce the taxation of low earnings further. More room for a reduction of taxes, in particular social security contributions, on wage income could be made by changing the tax mix. Consumption, environmental externalities, real estate and household capital income could be taxed more consistently, eliminating reduced rates and exemptions. Reduced VAT rates could be raised to the standard VAT rate. Shifting the tax system away from labour towards consumption, real estate and environmental taxes is growth-friendly (Johansson et al., 2008[32]). Little progress has been made on tax reform recommendations in previous Economic Surveys (Table 4). In part, this is because revenues from different taxes flow to different government levels. For example, social security contributions fund pensions, public health insurance institutions and unemployment insurance. Real estate taxes accrue to local governments. Broader tax reform would therefore need to be accompanied by reforms to the financial relationships between government levels.

The revenue from environmentally related taxes accounts for 2% of GDP, only about half of what is raised in Denmark according to OECD data (Figure 24). Charges electricity consumers pay to finance subsidised feed-in tariffs for renewable energy are not included in environmental taxes, in Germany and elsewhere. The structure of Germany's energy taxation sends inconsistent carbon abatement signals across fuels, as argued in previous *Economic Surveys*. Carbon intensive fuels are often taxed at lower rates per tonne of CO_2 compared to low-carbon fuels. For example, diesel is taxed at a lower rate than gasoline on a per litre basis. However, burning diesel emits higher levels of CO_2 per litre. Tax rates differ widely across energy users and fuels. Coal use is taxed at lower rates than natural gas use. Certain energy-intensive production processes are partially or fully exempt from energy taxes. In addition, tax expenditures for environmental harmful activities could be gradually phased out, energy tax rates could be aligned with carbon intensity and taxation of nitrogen oxide emissions could be introduced, as recommended in the 2016 *Economic Survey*.

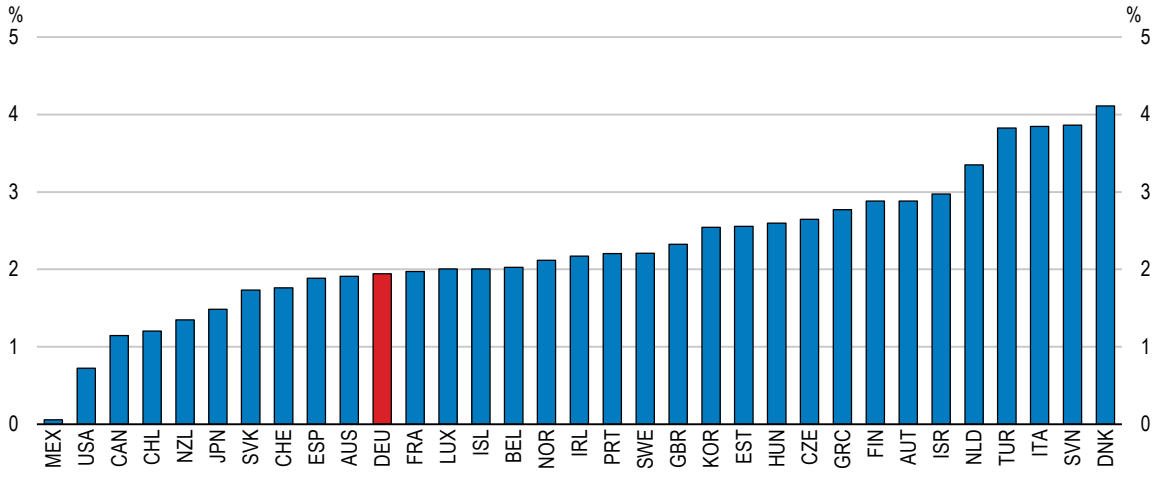
Reforming the taxation of immovable property would be particularly timely in view of rising house prices. Valuations for the purpose of real estate taxation date back to 1964 (in Western Germany) and 1935 (in Eastern Germany). The constitutional court has recently required a reform to update valuations by 2024. Updating could be used to raise more revenues with relatively little economic distortion. Extending the taxation of capital gains to residential real estate which is not owner-occupied (i.e. owned by households for investment purposes only) would be particularly timely in view of house price developments and would also benefit inclusiveness, as the richest 20% of German households own 75% of the housing stock (Clamor and Henger, 2013[33]). It would also do away with a distortion which biases investment away from more productive investment.

Taxes on household capital income could be better aligned with taxation of other household income. Interest income, dividends and capital gains are taxed at a flat rate, which is in most cases lower than the personal income tax rate. Aligning tax rates on household capital income more closely with personal income tax rates would strengthen the tax system's progressivity, as capital income is concentrated among wealthy households. It is welcome that the coalition agreement proposes to do so for interest income. In view of the international mobility of capital, which disconnects domestic saving from domestic investment decisions, taxing households' capital income in line with the taxation of other household income need not hamper investment. Inheritance tax exemptions with respect to family firms lock in capital in these firms, harming reallocation and inclusiveness in view of the strong concentration of wealth. Steps to give more time for family-owned businesses

to pay inheritance tax liabilities and to treat the inheritance tax liability as subordinate debt in the balance sheet can help avoid unwanted liquidations.

Figure 24. Environmental tax revenue could be higher

Environmental tax revenue as % of GDP, 2014



Source: OECD (2018), "OECD Instruments used for environmental policy", *OECD Environment Statistics* (database).

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Table 4. Past recommendations and actions taken on tax reform

Recommendations	Action taken
Reduce social security contributions, notably for low income workers.	Public pension contributions were lowered by 0.1 percentage points in 2018.
Update real estate tax valuations while protecting low income households.	No action taken.
Extend capital gains taxes on residential real estate except for owner-occupied housing.	No action taken.
Raise the tax rates applying to household capital income towards marginal income tax rates applying to other household income.	No action taken.

A policy package which includes the budgetary and tax policies in Table 5 and key growth-enhancing structural reforms (Box 2) would imply structural government deficits in the medium term, which would still be consistent with budgetary rules. Nevertheless they would allow the debt-to-GDP ratio to fall substantially (Figure 25). The baseline and reform scenario assume that commitments to budget rules are kept and that higher ageing-related spending is offset by increased revenues or lower spending.

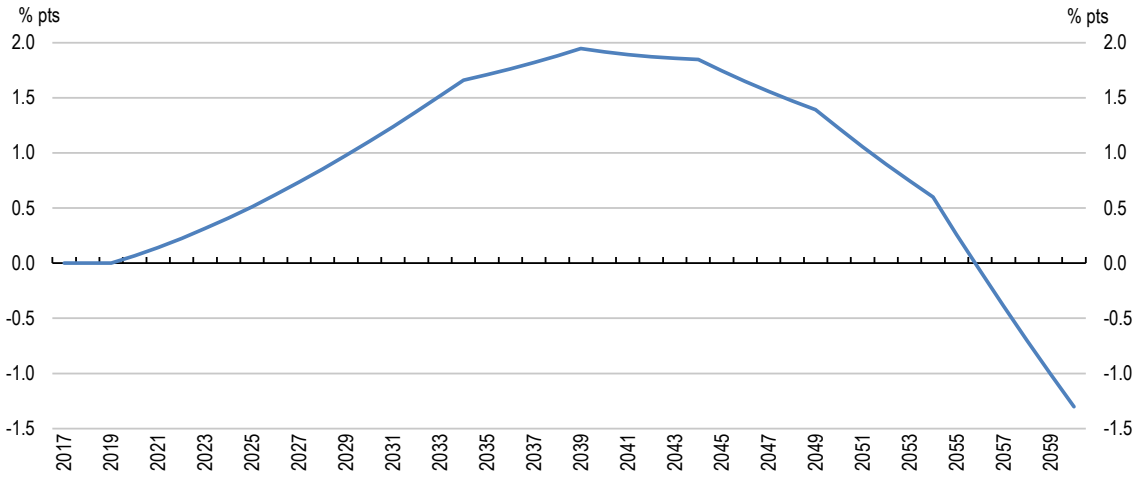
Table 5. OECD reform proposals on budgetary and tax policy

	Budgetary impact (annually, % of GDP)	
Estimated impact on government financial balance	**Short-term**	**Long-term**
Increase spending on primary education per pupil to the level of Denmark or Sweden, in purchasing power terms of GDP	-0.1%[1]	- 0.1%
Increase government spending on early childhood education and childcare to the level of Sweden or Denmark, while reducing family tax breaks.	-0.2%[2]	-0.2%
Reduce taxation of wage earnings, while strengthening the taxation of environmental taxation, real estate taxes, the taxation of capital income received by households and raising reduced VAT tax rates to the standard rate	- 0.1%	-0.1%
Index the statutory retirement age to life expectancy	0	+0.6%[3]

Note: The short-term budgetary impact is 0.4% of GDP, equal to the OECD estimate of near-term budgetary space. The spending increases are constant shares of GDP.
1. Increase in government spending in Germany towards the level of spending per pupil observed in Denmark.
2. Raising government spending on childcare and early childhood education towards the level observed in Denmark and Sweden (% of GDP), while assuming that tax breaks for families with children in Germany are abolished and savings used to pay for childcare and childhood education.
3. Estimates by (European Commission, 2015[34]).

Figure 25. Policies which raise inclusive growth can be deficit financed in the short and medium term

Difference in government debt (% of GDP) between reform scenario and baseline scenario



Note: The baseline scenario assumes real GDP growth of 1% and an inflation rate of 1.5% after 2019. The primary balance is assumed to remain constant at its 2019 level (0.65% of GDP). The reform scenario assumes real GDP growth of 1.6%, which includes the annual average impact of structural reforms quantified in Box 2, as well as the budgetary measures in Table 5. The interest rate on government debt is assumed to converge to 1.8%.
Source: Calculations based on OECD (2018), *OECD Economic Outlook: Statistics and Projections* (database).
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Boosting productivity and preparing for the future of work are key medium-term challenges

As other OECD countries, Germany faces the challenge of making the most of technological changes, including through appropriate skills policies. This needs to include policies to remove barriers for women to good careers and to make better use of their skills. The GDP gain from structural reforms in these policy areas would be particularly large (Box 2).

Box 2. Simulations of the potential impact of structural reforms

This table gauges the potential impact of some of the key structural reforms proposed in this *Economic Survey*, based on OECD studies on relationships between reforms and growth and other studies. The simulation results are based on cross-country estimates that do not reflect the unique institutional settings in Germany. These estimates should be seen as purely illustrative.

Table 6. Potential impact of structural reforms on GDP per capita

Structural policy reform	Change in GDP per capita		Scenario
	After 10 years	Long run	
Product market regulation			
(1) Upgrading e-government	0.13%	0.25%	Creation of an online single contact point, where all notifications and licenses be issued or accepted via the Internet.
(2) Reducing entry barriers to professional services	2%	2%	Making regulations as competition-friendly as in the United Kingdom.
Infrastructure investment			
(3) Investment in high speed broadband	3%	3%	Germany's average connection speeds (15.3Mbts/s) catches up to the average of ten best performing OECD countries (21Mbts/s) (37% increase in connection speed) by 2025
Skills			
(4) Boosting cognitive skills, including by improving the quality of childcare, expanding high-quality full-day primary education, improving general education within vocational education, strengthening life-long learning.	-	15% (75 years)	Cognitive skills as measured by PISA or PIAAC move from an upper-middle to a top position among OECD countries. The improvement of cognitive skills takes place over a 20-year period.
Labour market policies			
(5) Remove barriers to women's full-time employment and access to good careers, including by reducing the gap in the taxation of main and second earners, improving full-day childcare and primary education, improving gender balance in parental leave and encouraging firms to increase women's presence in the highest decision making bodies.	4.1%	20% (45 years)	Women's labour participation rate and hours worked are assumed to converge to men's. Women's productivity per worker is assumed to converge to men, to the extent the earnings gap with respect to men's earnings reflects differences in experience and hours worked. As women's labour supply decisions and earnings depend on their experience, convergence is assumed to be gradual. Men's participation rate, hours worked and earnings are assumed not to diminish in response, so the estimates are an upper bound.
(6) Reduce taxation of labour income	0.45%	0.47%	2.28 percentage point reduction in average tax wedge (the average size of reform observed across OECD countries), while increasing indirect taxes to keep tax revenue constant.
(7) Indexation of the retirement age to life expectancy	0.13%	0.14%	Proxied by the rise in statutory retirement age of 0.57 years (the average size of reform observed across OECD countries).
Total	**10%**	**41%**	
	Welfare gain (monetary equivalent, % of GDP)		
(8) Introducing pricing of congestion and removal of regulatory hurdles to car-sharing. Electrification of car transport.	6.76%		Welfare gains from reforming urban transport, including reduction of congestion cost to zero. Reduction of pollution-related mortality and morbidity costs to zero.

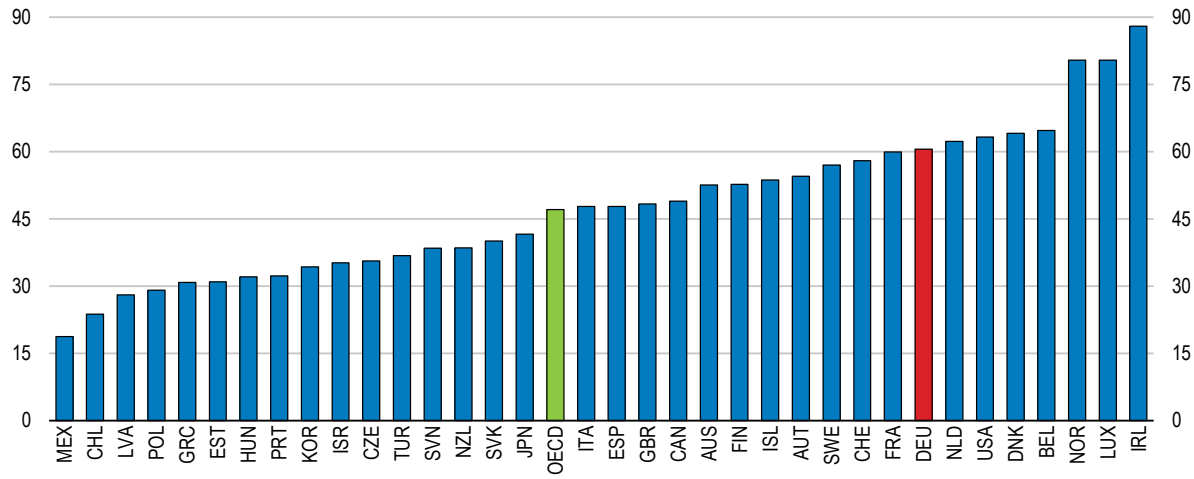
Note: Reforms are quantified using the framework of (Égert and Gal, 2017[35]) (1, 6, 7); (Arentz et al., 2016[36]) (2); (Kongaut and Bohlin, 2014[37]) (3); (Hanushek and Woessmann, 2008[38]) (4); (OECD, 2016[9]) (5); (INRIX, 2016[39]) (INRIX, 2017[40]) (8). Investment in high speed broadband is included in the coalition agreement.
Source: OECD calculations.

Productivity growth has slowed and new technology is adopted only slowly

Germany enjoys high labour productivity (Figure 26). However, it is held back by weak capital deepening and slower diffusion of new technology (Chapter 1). Technology diffusion can be accelerated by reinvigorating entrepreneurship and strengthening high-speed digital infrastructure.

Figure 26. Labour productivity is relatively high

Real GDP in constant USD PPP per total hours worked, 2016



Source: OECD (2018), *OECD Productivity Statistics* (database).

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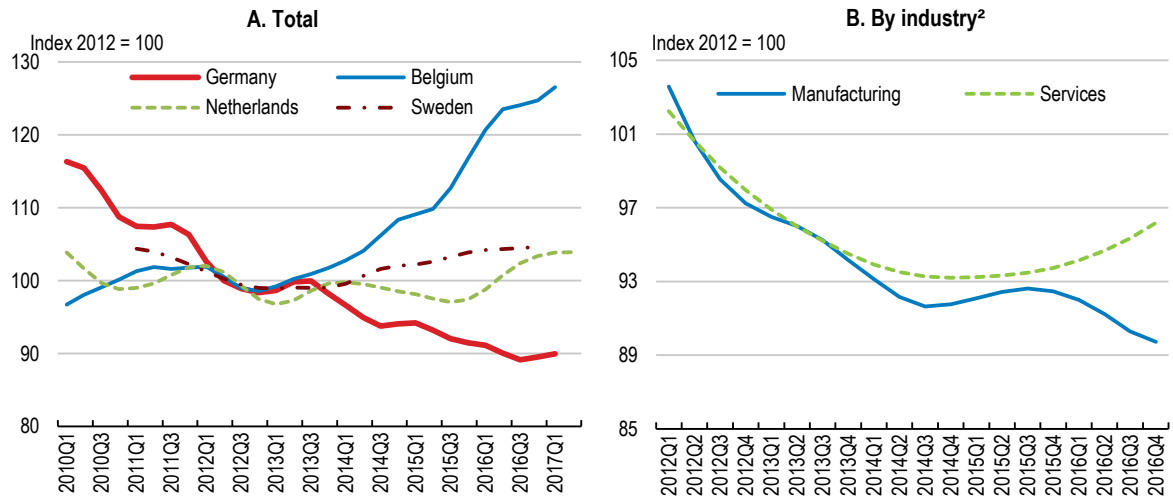
Boosting entrepreneurship would accelerate technology diffusion

New firm creation, which often helps introduce new technologies into the market, has been declining (Figure 27). In Germany, talented individuals are less willing to choose entrepreneurship, partly because it is associated with higher income risk, especially in view of the abundant job offers (KfW, 2017[41]). Including the self-employed more effectively in some social safety nets could protect them better against risks, which may encourage some individuals to become self-employed (see below). Germany's insolvency regime is among the most efficient in OECD countries (Figure 28). However, failed entrepreneurs must wait up to six years to be discharged from pre-bankruptcy debt, which is longer than on average in OECD countries (2.9 years) (Adalet McGowan, Andrews and Millot, 2017[42]). The period can be shortened to three years if 35% of debt is repaid. However, this repayment condition can be too demanding in some cases and in such cases could undermine the fresh start of entrepreneurs (Fossen and König, 2015[43]). Easing the requirements to qualify for the three-year discharge period while maintaining adequate safeguards for creditors could encourage entrepreneurship.

Figure 27. New enterprise creation is weak

Number of new enterprises, by industry, trend-cycle[1]



1. The trend-cycle component is extracted from quarterly data by applying seasonal adjustment to quarterly series. Refer to the source for more details.
2. Manufacturing refers to ISIC Rev.4 Divisions 10 to 33. Services refer to Divisions 45 to 82 excluding 64 to 66.
Source: OECD (2017), *Entrepreneurship at a Glance 2017*.

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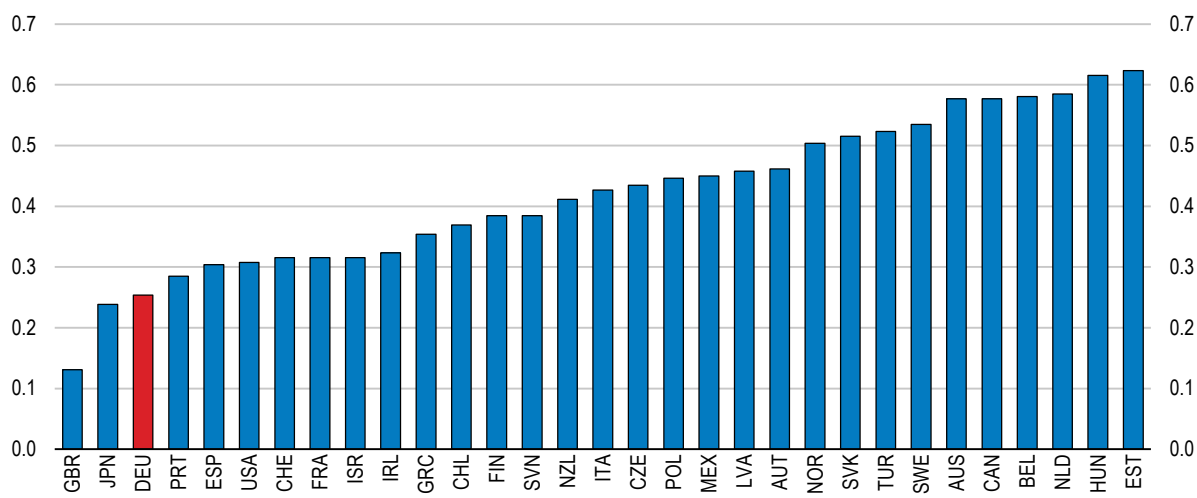
Figure 28. The insolvency regime is among the most efficient in OECD countries

OECD indicator of insolvency regime, composite indicator based on 13 components, 2016



Note: The OECD insolvency regime indicator captures (1) personal costs to failed entrepreneurs that include the time to discharge, (2) lack of prevention and streamlining and (3) barriers to restructuring. Higher values of the composite indicator correspond to more inefficiency.
Source: Adalet McGowan, M., D. Andrews and V. Millot (2017), "Insolvency regimes, zombie firms and capital reallocation", *OECD Economics Department Working Papers*, No. 1399.

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Few women are entrepreneurs. Only 8% of all active female workers are self-employed, less than in the average of European Union countries (13%), although this share is rising (OECD, 2017[44]). Women's self-employment is concentrated in personal and business services. Only 13% of high tech start-ups are led by women (OECD, 2017[44]).

Women's entrepreneurship could be encouraged by making it more compatible with giving birth. Maternity benefit coverage depends on the women's choice of health insurance package. Self-employed women on maternity leave receive a benefit of about 70% of their previous income if they are covered by statutory insurance and have opted for sickness benefits. Alternatively, if they have purchased private health insurance with an option for a daily sickness allowance, they receive a sickness allowance during the maternity protection period if they do not work or if they work only a limited time during this period. By contrast, in the Netherlands, all self-employed women can receive a benefit equal to the full-time minimum wage for 16 weeks, paid from general tax revenue (Conen, Schippers and Schulze Buschoff, 2016[45]).

Setting up a company in Germany takes more procedures and time than in other advanced OECD economies (The World Bank, 2018[46]). Administrative burdens can be reduced by a well-developed e-government service that allows all procedures to be processed online. The use of online services for administrative procedures is low in Germany (OECD, 2017[47]). The scope of available services differs across municipalities and information is scarce (Commission of Experts for Research and Innovation, 2017[48]). Steps were taken to require the central and local governments to offer their services online and make them accessible via central portals. Also, the federal government can prescribe electronic access to the administrative services of regional authorities. These rules should be implemented swiftly.

Some legal transactions for creating new businesses require notary services at a high regulated price (OECD, 2016[9]). Entrepreneurship in professional services is also subject to regulatory barriers to entry. No progress has been made in reforming exclusivity rules or entry regulations (Table 7).

Price and entry regulation in different forms have been accumulating over time to meet different objectives, like consumer protection or non-discriminatory access of consumers to public goods. However, previous *Economic Surveys* highlighted that self-regulation by sector-specific business chambers risks protecting the status quo against reforms and that consumer protection should be pursued with fewer entry barriers (OECD, 2016[9]; 2014[12]). To remove regulatory bias in favour of incumbents, Germany could benefit from an independent standing capacity to regularly undertake comprehensive in-depth reviews of policy areas in the light of their economy-wide effects. For example, the benefits of regulatory reform in the professional services would largely accrue to downstream sectors, which use such services as intermediate products.

Fast technological diffusion requires swift resource allocation to innovative firms that experiment with new technologies (Andrews, Criscuolo and Menon, 2014[49]). Privatisation of government ownership in the business sector would help remove barriers to resource reallocation and boost competition. Privatising government shares in telecommunications and postal services, could help remove potential conflicts of interest between the government's role as owner of these businesses and its role as the regulator of the relevant markets, boosting market entry. In addition to the *Landesbanken*, *Land* ownership includes just above 20% of one of the biggest car manufacturers.

Table 7. Past recommendations and actions taken on professional service regulation

Recommendations	Action taken
Reduce exclusive rights in the professional services. For example, allow new companies to register in the commercial registry without notary services and open the provision of auxiliary services in property conveyancing to other professions. Reduce exclusive rights of lawyers in providing legal advice and representation in court.	No action taken.
Abandon price regulation in some professional services. Abolish the price regulation for architects and engineers and consider liberalising price regulation for notaries. Give lawyers more options to deviate from the principle of effort-based remuneration, e.g. allow all-inclusive fees for certain tasks and extend outcome-based payments.	No action taken.
Ease requirements to hold a tertiary level vocational degree or alternatively to have job experience in a leading position, for self-employment in some crafts.	No action taken.
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.
Give consideration to abolishing restrictions on shareholders for limited liability companies of lawyers, tax consultants, architects and engineers.	No action taken.

Strengthening high-speed broadband networks

High-speed Internet is a prerequisite for the adoption of many data-intensive new technologies (OECD, 2017[47]). However, the average Internet connection speed is considerably slower in Germany than in peer countries (Figure 29), which holds back technology diffusion (Federal Ministry of Economic Affairs and Energy, 2017[50]). The government has set an ambitious goal to roll out gigabit fixed broadband networks throughout the country by 2025. A faster pace of investment is needed to reach this goal. It is welcome that the coalition agreement foresees this. Private investment in gigabit networks should be accelerated while strengthening competition. Decisions to pay government subsidies should be based on cost-benefit analysis.

Competition in the provision of next generation mobile networks would also boost communication and data transmission. Better mobile services would raise the demand for gigabit fixed broadband networks, facilitating their deployment and reducing access prices, on the back of scale economies. Germany has three mobile services operators in mobile networks. Increasing the number to four would make a substantial difference for service prices and innovation (OECD, 2014[51]). The government should use the upcoming radio spectrum auction to promote competition in the mobile market.

The impact of technological change on the labour market will be large

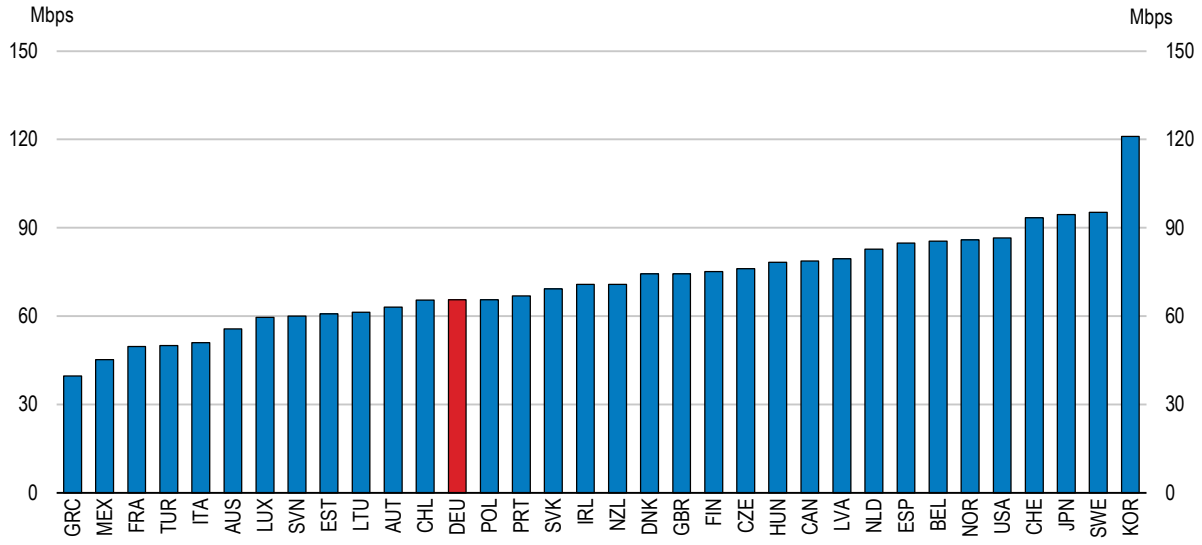
Intensive use of digital technologies is considered to displace a large number of workers engaging in routine tasks that can be automated. Those workers will have to shift to jobs that may not necessarily match their original skills.

The share of mid-level skilled jobs that largely involves routine tasks has declined in Germany, although not to the same extent as in Nordic countries and the United Kingdom (Figure 30). However, the share of jobs at risk of automation or undergoing radical changes is high (Figure 31). Middle-skilled workers may suffer wage losses if they move to new jobs or tasks where they cannot apply their skills. Boosting opportunities for them to

develop their skills is therefore important, especially in Germany, where the share of middle-skilled production workers is particularly large.

Figure 29. The internet connection speed is slow

Akamai's average peak connection speed, Q1 2017



Source: Akamai (2017), "Akamai's state of the Internet report: Q1 2017 report", *https://www.akamai.com*.

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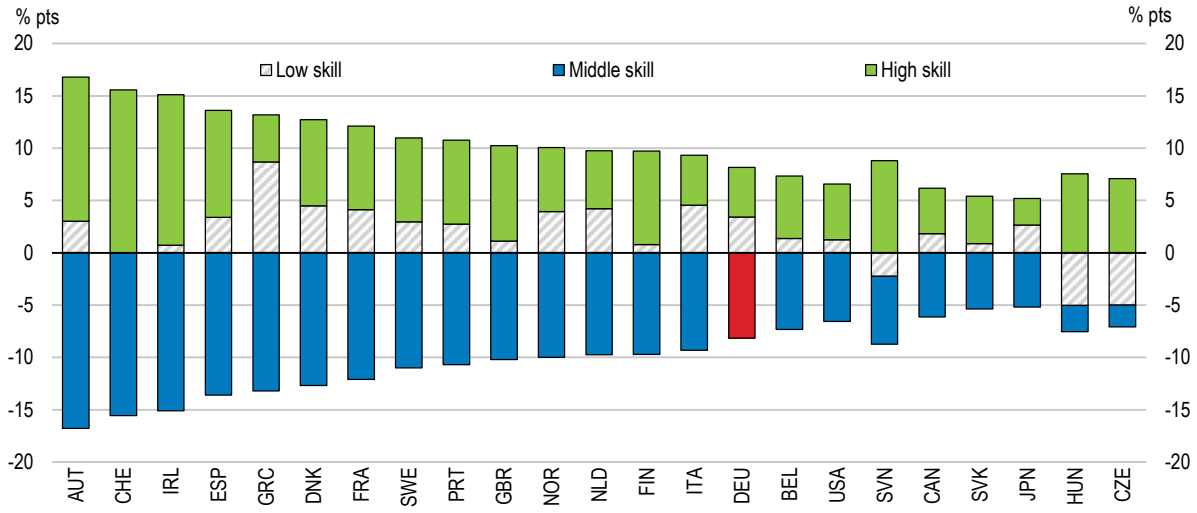
Wider use of digital technologies increases the demand for reading, numeracy and problem solving skills (OECD, 2016[52]). Workers endowed with such skills will be increasingly better remunerated. Some low-skilled workers engage in manual non-routine jobs that cannot be automated easily (Autor, Levy and Murnane, 2003[53]). Yet, overall the demand for low-skilled workers is also foreseen to decrease in Germany, although not as much as for middle-skilled workers (Warning and Weber, 2017[54]). Low-skilled workers are also likely to suffer wage losses as they compete with displaced middle-skilled workers for low-skilled jobs. Policies that sustain workers' employability and allow them to upgrade their skills need to be stepped up (see below).

Self-employment in highly flexible work arrangements is likely to increase with digital platforms. These self-employed are not generally covered by all social safety nets, including old age pension and unemployment insurance. They are required to enrol in health insurance but are not generally eligible to public health insurance. Private health insurance can be costlier than public insurance and increase income risks as contributions do not depend on income. As a result risks of poverty following sickness, workplace accidents, or unemployment may be higher. Inclusion in the public pension system appears to be the most effective way to include the self-employed in pension insurance, for example to cover disability risks, ensure integration with the means-tested minimum pension and avoid mobility barriers.

Figure 30. The share of middle-skilled jobs in employment has declined

Percentage point change in the share in total employment between1995 and 2015



Note: High-skilled occupations include jobs classified under the ISCO-88 major groups 1, 2, and 3. These are legislators, senior officials, and managers (group 1), professionals (group 2), and technicians and associate professionals (group 3). Middle-skilled occupations include jobs classified under the ISCO-88 major groups 4, 7, and 8. These are clerks (group 4), craft and related trades workers (group 7), and plant and machine operators and assemblers (group 8). Low-skilled occupations include jobs classified under the ISCO-88 major groups 5 and 9. These are service workers, shop and market sales workers (group 5), and elementary occupations (group 9).
Source: OECD (2017), *OECD Employment Outlook 2017*.

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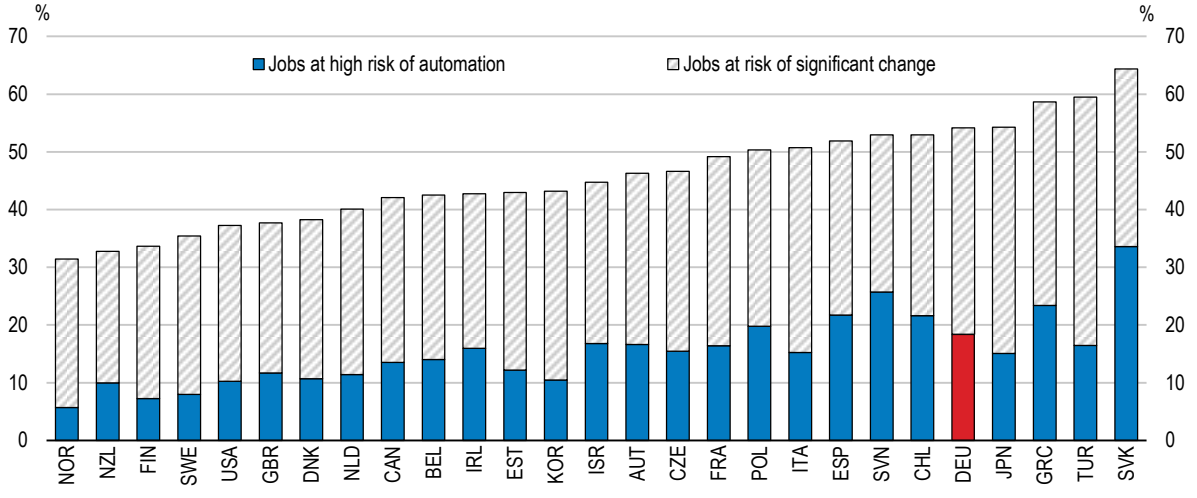
Figure 31. Many jobs are at risks of significant change

The share of jobs at high risk of automation and significant change



Note: Jobs are at high risk of automation if the likelihood of their job being automated is at least 70%. Jobs are at risk of significant change if the likelihood is between 50 and 70%.
Source: Nedelkoska, L. and G. Quintini (2018), "Automation, skills use and training", *OECD Social, Employment and Migration Working Papers*, No. 202, OECD Publishing, Paris.

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Adult skills are a major determinant of long-term growth and well-being

Skills are a strong determinant of economic growth, wages and employment (Hanushek and Woessmann, 2008[38]), as argued in Box 2.1 in Chapter 2. Across OECD countries the impact of skills on economic growth, income and wellbeing is reinforced by skill-biased technological change (Hanushek et al., 2017[55]). In Germany, this is for example reflected in rapid and regular updating of vocational education and training programmes, including in response to digitalisation. How much workers use their skills at the workplace has an even stronger impact on wages than skills themselves (OECD, 2016[56]). Policies thus need to support skills as well as skills use.

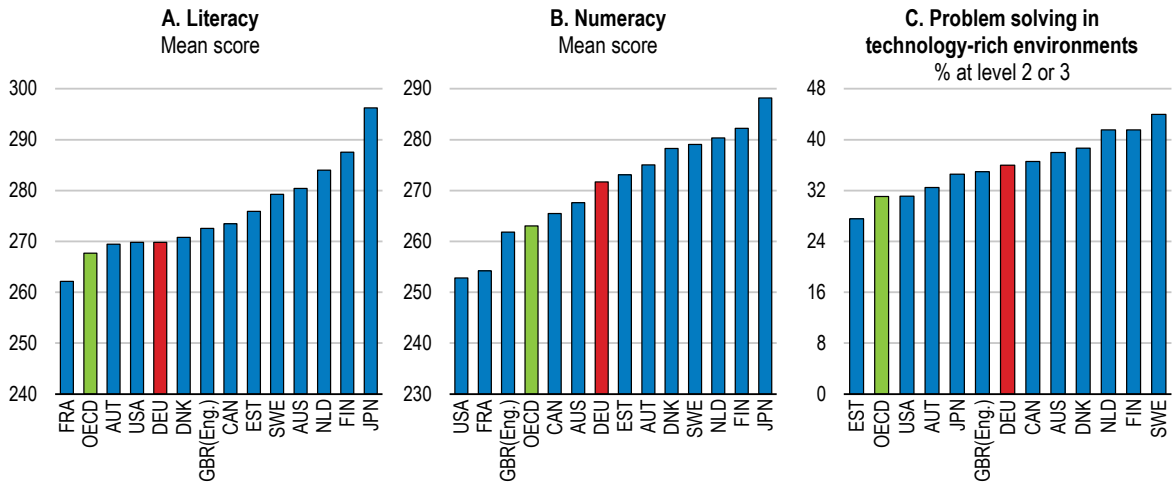
Cognitive and non-cognitive skills, and their use, are powerful predictors of important life outcomes beyond income, such as job satisfaction, health and civic engagement as well as participation in life-long learning (OECD, 2016[56]; Kosse et al., 2016[57]). The important role of access to education and acquired skills in upward social mobility has also been well documented.

Adult cognitive skills still have some way to catch up with leading countries

Adult proficiency in literacy, numeracy and problem-solving skills in technology-rich environments, as measured in the OECD PIAAC Study, is above OECD average but lags behind leading countries (Figure 32). Literacy proficiency is below OECD average for adults with low (below upper secondary) and close to the average for middle (upper secondary) education (Figure 33). In Germany, upper secondary educated workers have mostly gone through the vocational education system.

Figure 32. Adult skills are above OECD average, but lower than in leading OECD countries, especially in literacy

Mean proficiency scores in literacy and numeracy, and the percentage of adults scoring at level 2 or 3 in problem solving in technology-rich environments, 15-65 year-olds, 2012



Note: France did not participate in the problem solving in technology-rich environments assessment.
Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

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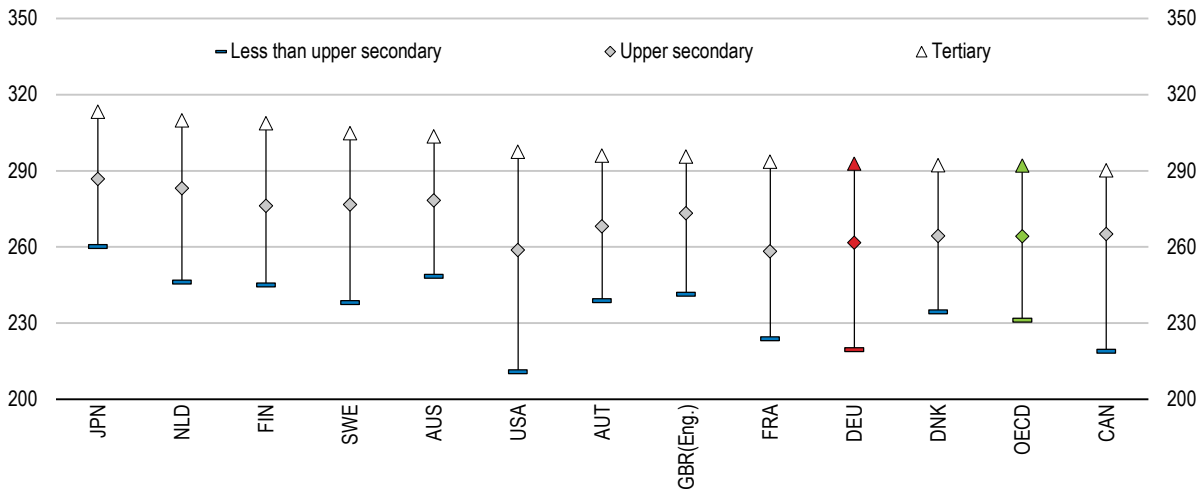
Figure 33. Performance gaps with respect to leading countries are larger for adults with low and intermediate educational attainment

Mean proficiency scores in literacy, by educational attainment, 25-65 year-olds, 2012



Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

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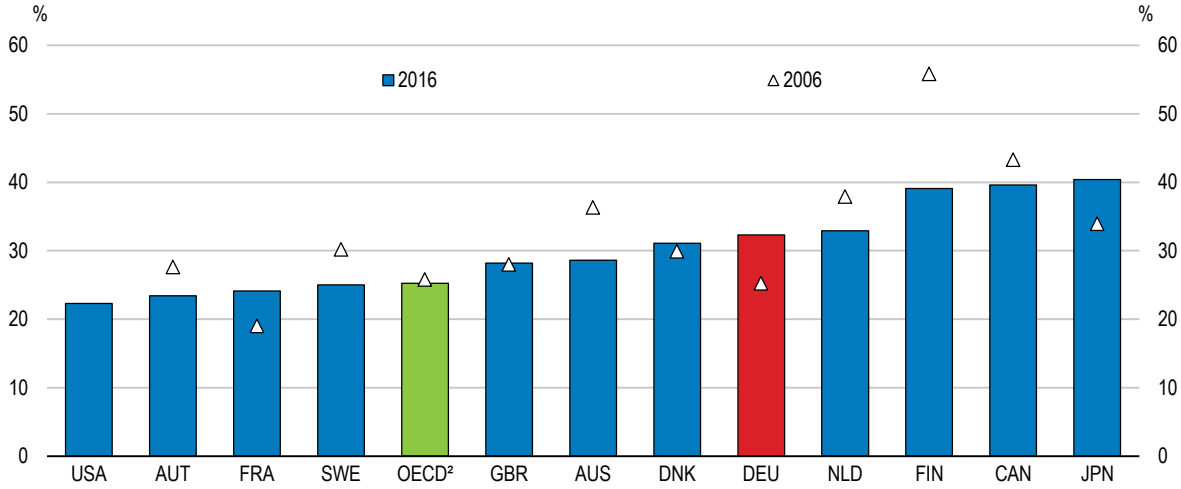
Progress has been made in improving education outcomes of youth with weak socio-economic background

Over the past ten years the share of 15-year-old pupils with weak socio-economic background who reached median performance in reading, mathematics and science, rose strongly, more so than in most OECD countries (Figure 34). Fostering cultural activities, through extracurricular activities is one successful strategy (Borgonovi and Pál, 2016[58]), as in the programme *"Kultur macht stark"* (Prognos AG, 2016[59]). Nonetheless, the strength of the impact of socio-economic background on student performance in science remains above the OECD average (OECD, 2016[60]). Upward mobility through education pathways has improved only slowly (OECD, 2017[61]). Only 14% of 30-44 year-olds whose parents did not attain tertiary education have attained an academic tertiary qualification themselves, little more than among older adults. Another 11% have attained a vocational tertiary qualification. The impact of socio-economic background on education outcomes is a key transmission mechanism through which inequality can have a negative impact on economic growth and thereby reduce living standards for all (OECD, 2015[62]).

Investing at an early stage in children's development and education can produce high returns since this lays the foundation for future learning, especially for youth with weak socio-economic background (OECD, 2017[61]). Germany has made much progress over the past decade in boosting enrolment of young children in childcare, which has risen above OECD average. The effect of attendance in early childhood education and care on subsequent education outcomes depends on the quality of the interactions and learning environment in these institutions (Stahl, Schober and Spiess, 2017[63]).

Figure 34. The share of resilient students has increased strongly over the past 9 years

Percentage of resilient students among disadvantaged students[1], PISA 2006 and 2015



1. Resilient students are the 25% most disadvantaged students in their country according to the PISA index of economic, social and cultural status but are able to achieve at or above level 3 in all three PISA domains – reading, mathematics and science. Level 3 corresponds to the median proficiency level across all OECD countries on average.
2. Unweighted average of available countries. PISA 2006 results in reading are not available for the United States.
Source: Agasisti, T., et al. (2018), "Academic resilience: What schools and countries do to help disadvantaged students succeed in PISA", *OECD Education Working Papers*, No. 167.

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The federal and *Länder* governments have taken strong initiatives to improve quality of early childhood education and childcare, especially for children with disadvantaged socio-economic background. For example, programmes have been introduced to improve language development. Nonetheless, the quality of childcare is uneven. The federal government and the *Länder* have developed instruments to improve quality so all *Länder* can raise the quality in all early childhood education and care (ECEC) institutions according to their priorities. However, many young children from disadvantaged socio-economic backgrounds are enrolled in lower-quality institutions (Stahl, Schober and Spiess, 2017[63]). It is particularly important to improve quality in institutions attended by young children who need the most support. In addition, incentives need to be developed to encourage parents with disadvantaged socio-economic background to enrol their children, for example, with conditional cash benefits, in addition to free enrolment.

About 66% of primary schools provide full-day schooling and 40% of the pupils attend. Differences between the *Länder* are marked. The quality of programmes is key for obtaining benefits from full-day schools. Many full-day schools provide mostly childcare in the afternoon, rather than education (StEG, 2016[64]).

Vocational education ensures excellent integration of young people

The German vocational education and training system ensures excellent integration of young people in the labour market. Germany's NEET (not in education, employment or training) rate among young people is among the lowest in the OECD. The integration of young people with a migration background will remain a key challenge in vocational education and training. Assistance for young refugees is a particularly complex task in

many cases. Language programmes have been introduced, integrating general and job-related language learning.

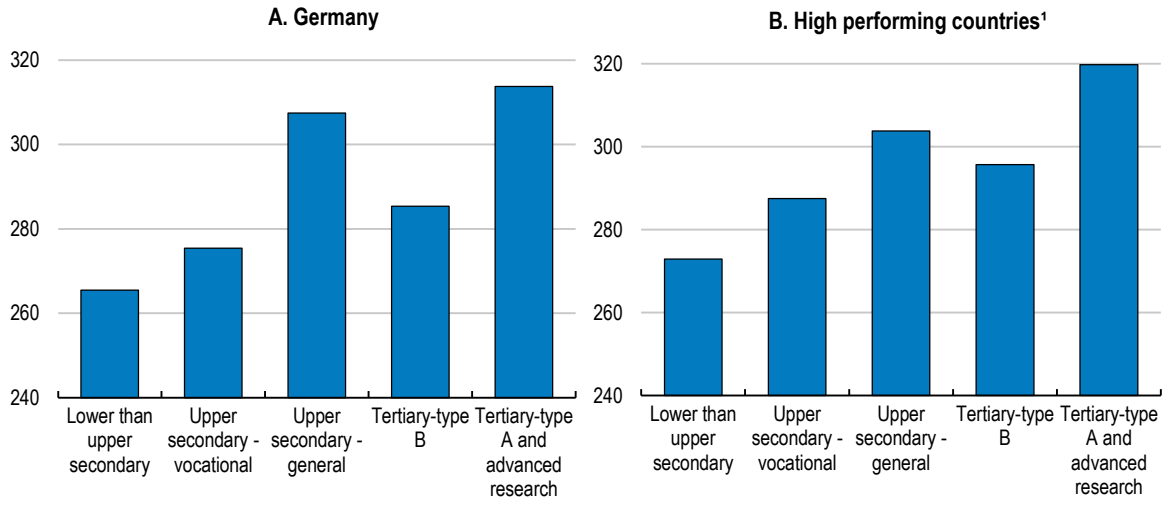
Wage and employment prospects of vocational education graduates may be exposed to risks as a result of technological change at higher age. Vocational education graduates are often middle-skilled workers whose tasks are most likely to change substantially as a result of automation (see above). While occupation-specific vocational education and training helps with school-to-work transitions, especially in countries with strong apprenticeship systems, it appears to be linked with lower employment prospects later in life, relative to general education pathways (Hampf and Woessmann, 2016[65]), discussed also in Chapter 2. The government supports vocational education graduates in their efforts to obtain further qualifications, such as *Meister* courses or technical schools. It is welcome that the coalition agreement proposes to increase this support.

Literacy skills are relatively low among young people in vocational education coming from lower secondary schools , notably compared to countries with strong PIAAC results (Japan, Finland and Australia, Figure 35). Since the PIAAC Survey of adult skills was undertaken in 2012, it is likely that test scores would today be higher, reflecting reforms which have boosted PISA scores for 15 year-olds since the first OECD PISA study was undertaken, especially among those with weak socio-economic background. Many of these youth have entered upper secondary vocational education subsequently. However, PIAAC scores among upper secondary vocational students also appear little higher than among young people with no upper secondary degree.

Only 37% of students in upper secondary vocational education learn English, far fewer than in most European OECD countries (Eurostat, 2018[66]). In 2015, the *Länder* adopted a framework agreement to be able to better react to the requirements of a globalised world. This includes the extension and deepening of foreign language competence according to its significance in each vocational qualification.

Figure 35. Literacy skills improve modestly in upper secondary vocational education

Mean literacy scores by educational attainment, 16-29 year-olds, 2012



1. Unweighted average of Australia, Austria, Finland and Japan. The estimate for Tertiary-type B for Finland is based on a sample size close to 30 and thus is not included.
2. Only a sample of countries is shown as an example.
Source: OECD (2013), *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills*.

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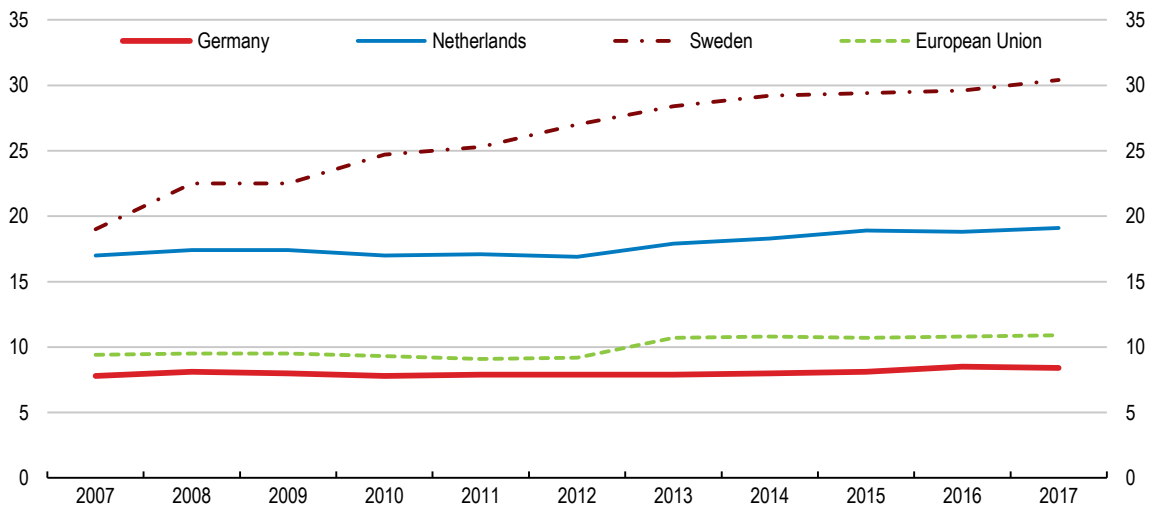
Participation in life-long learning is around EU average but lower than in leading countries

Adult participation in general and vocational education has risen little and is well behind best-performing high income countries, such as Denmark, Finland and Sweden, according to Labour Force Survey data (Figure 36) and the Adult Education Survey (AES). The latest results of the Adult Education Survey show that one in two adult Germans participated in at least one adult education measure in 2016 while in the best-performing countries nearly three out of four participated. Participation in formal and non-formal education and training is relatively low also according to the 2012 OECD PIAAC Survey. Germany is among the few countries with lower participation by women than by men. Women above the age of 35 are particularly unlikely to participate in life-long learning likely reflecting family responsibilities. It is welcome that the new government aims at strengthening support for life-long learning as well as information and counselling services.

Modular training offers, combined with opportunities to formally recognise skills acquired on-the-job, have boosted adult learning in Denmark and Portugal, especially among the unqualified (Desjardins, 2017[67]). They can boost incentives to participate in adult education and learning by allowing individuals to focus learning on skills they need in order to acquire formal qualifications. Modular life-long learning offers need not result in lower standards for the qualifications required for specific professions but widens access to such qualifications, notably among adults with poor formal qualifications, including immigrants. (Kis and Windisch, forthcoming[68]).

Figure 36. Participation in life-long learning can be raised further

Participation in life-long learning[1], % of population aged 26-64, 2017



1. Includes formal as well as non-formal education and training. The reference period for the participation is the four weeks prior to the interview.
Source: Eurostat (2018), *Education and training* (database).

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Modular training offers combined with formal skills recognition can make it easier for workers to adapt to technological change, helping to maintain employability. It is welcome that in the White Paper "Work 4.0" the government has recognised that modularisation needs to be strengthened. Germany could do so by further developing existing projects (e.g. *Kölner Bildungsmodell, Perspektive Berufsabschluss, TrialNet*) and initiatives to recognise

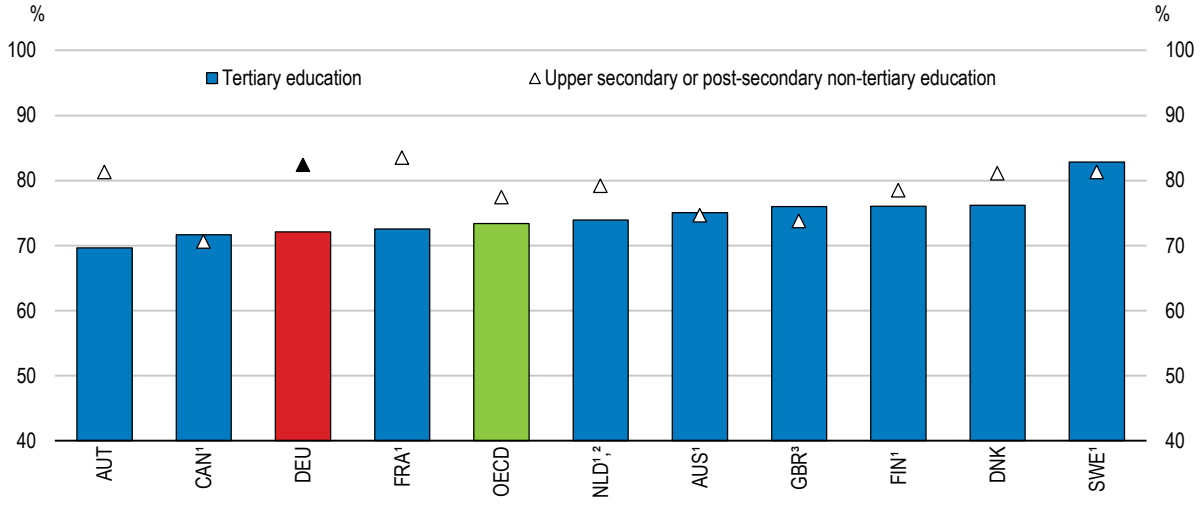
skills of formally unqualified workers (e.g. *ValiKom*) or immigrants (e.g. *Recognition Finder*). Government support for adult learning, including grants, loans and educational leave, generally requires participants to complete a full programme leading to a professional qualification. In order to allow for more flexibility, these policies could be adapted to support modular programmes.

Gender inequality contributes to underutilisation of skills

While education attainment among women is broadly as high as among men, and even higher among young women, the full-time earnings gap is large, particularly so between highly educated men and women (Figure 37). The earnings gap is even bigger when hours worked are taken into account. In 2015, 47% of all women in employment were working part-time, while this was the case for only 9% of men.

Figure 37. The earnings gap between men and women is particularly large among highly educated workers

Women's earnings as a percentage of men's earnings, by educational attainment, 25-64 year-olds with income from full-time employment, 2014



1. 2010 for the Netherlands. 2012 for Australia, France and Sweden. 2013 for Canada and Finland.
2. Educational attainment levels are based on the ISCED-97 classification.
3. Data for upper secondary attainment include completion of a sufficient volume and standard of programmes that would be classified individually as completion of intermediate upper secondary programmes (18% of the adults are under this group).
Source: OECD (2016), *Education at a Glance 2016: OECD Indicators*.

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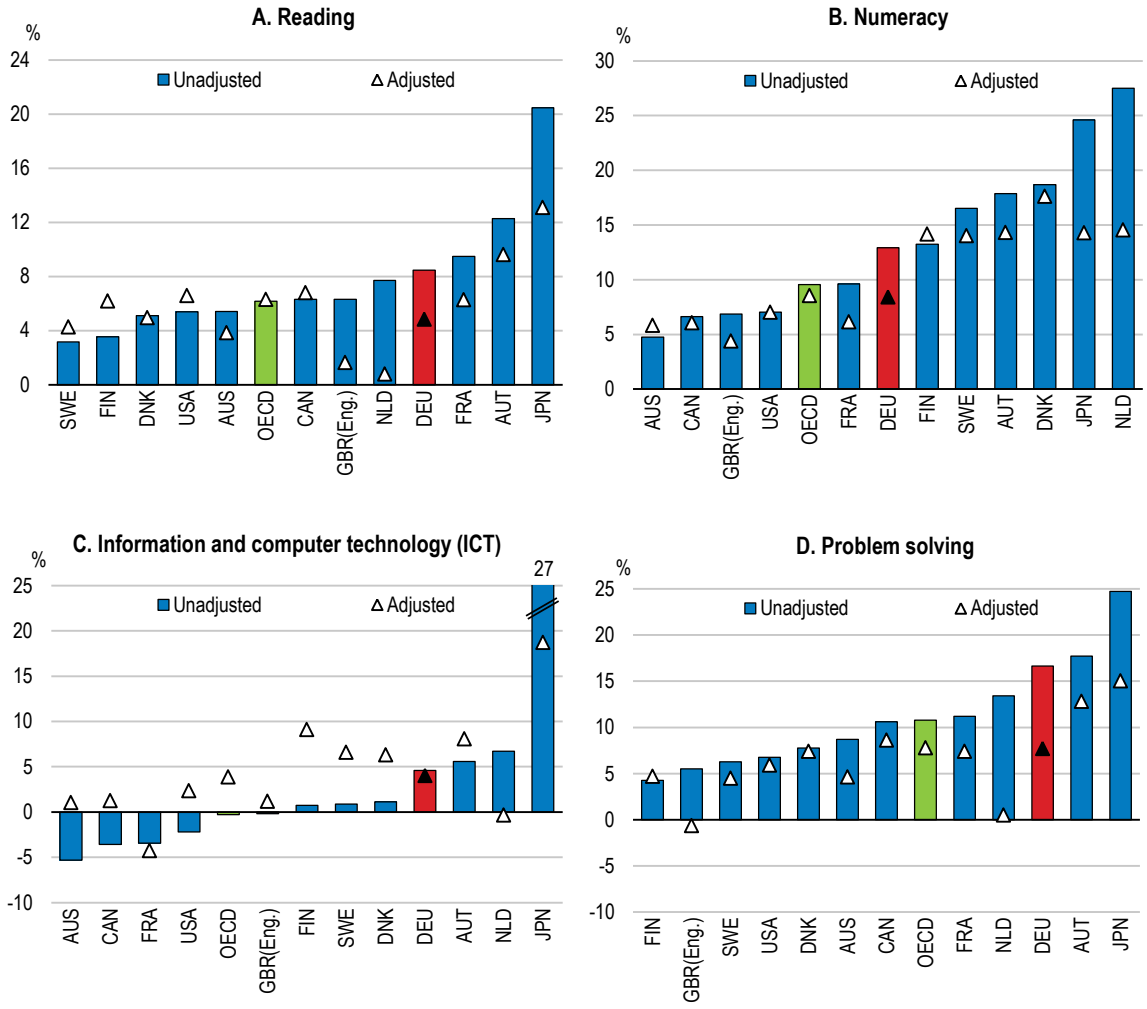
Women's skills are used less then men's, and this difference is more marked than in other high-income countries with strong PIAAC results (Figure 38, unadjusted results). A large part of this difference can be attributed to the incidence of part-time work and occupational choice (Figure 38, adjusted results). Indeed, part-time workers are 25% more likely to be overqualified than full-time workers in Germany (OECD, 2016[56]). This makes part-time employment among women a major cause of overqualification, resulting in substantial productivity loss. Most women state that they work part-time voluntarily. However, their decisions are influenced by the incentives in the tax system and the availability of childcare and full-day schooling. Steps to lower the taxation of second earners, who are often women, would boost their incentives to work longer hours, while better provision of full-day

primary education and childcare would make it easier for them to do so, as family and responsibilities are still mostly left to women.

Figure 38. Women's skills are used less than men's

Gender differences in the mean use of information-processing skills at work (men minus women), % of the mean use of skills by women, 2012



Note: Adjusted estimates are based on ordinary least squares (OLS) regressions including controls for literacy and numeracy proficiency scores, hours worked, and occupation dummies based on the International Standard Classification of Occupations (ISCO, 1-digit).
Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

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Parental leave benefits can currently be taken up either by the father or the mother for a maximum of 12 months, if they temporarily stop working to look after their children. If the second parent takes at least 2 further months off work to look after a child, the total duration for the couple is 14 months. Requiring fathers to take more parental leave for the couple to benefit from the maximum joint allowance would result in further benefits in terms of reducing gender stereotypes, stronger labour market participation by women, and better skills use.

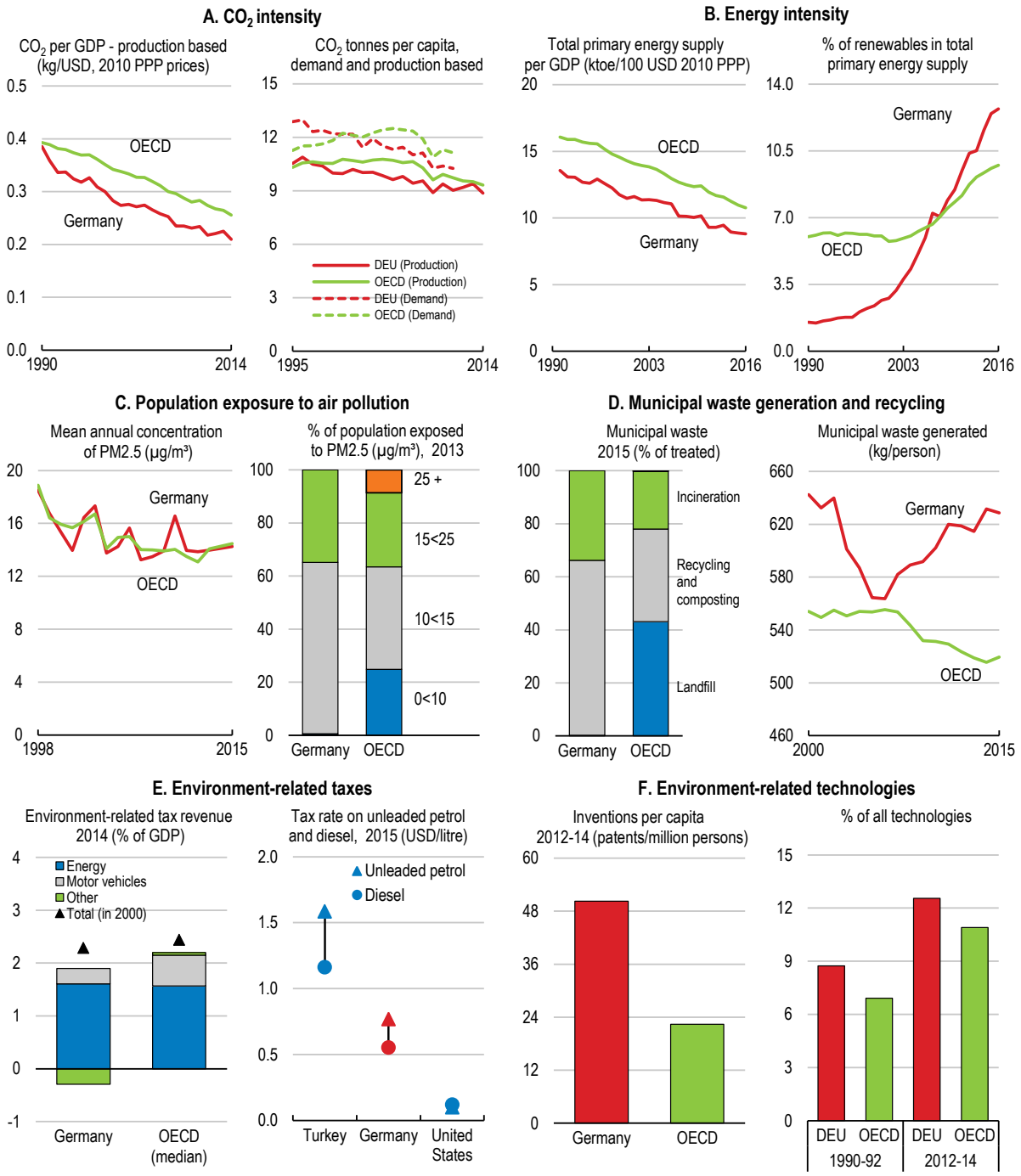
Meeting climate objectives requires more action

Germany has committed to reducing greenhouse gas (GHG) emissions by at least 40% by 2020 and by at least 55% until 2030, compared to 1990 levels. For 2020 Germany has chosen an ambitious national target consistent with the EU burden sharing agreement. Germany intends to reduce emissions by 80% to 95% in 2050 compared to 1990 levels, consistent with the need to achieve close to zero net greenhouse gas emissions in the second half of the century to keep the climate goals from the Paris agreement.

Additional policies are needed to meet even the near-term targets. Per capita CO_2 emissions have not fallen in recent years, unlike the OECD average, as economic growth has offset falling CO_2 intensity (Figure 39). The coalition agreement has softened the commitment to when the national 2020 target will be met. It is important to meet targets on time as the credibility of climate policy is critical in view of the long-term nature of the climate challenge.

Phasing out coal-fired energy generation has among the lowest CO_2 emission abatement costs and would enable Germany to meet its 2020 target (Sachverständigenrat für Umweltfragen, 2017[69]). Moreover, it would reduce electricity supply and raise wholesale prices, making low-emission gas-fired power plants more profitable and allowing to integrate renewable energies with a lower subsidy cost (Agora Energiewende, 2016[70]). Higher wholesale prices also imply an increase in household and firm electricity prices. Therefore the transition path needs to be chosen under consideration of other relevant energy policy goals like affordability and security of energy supply. However, as a recent OECD report has pointed out (OECD, 2017[71]) the low-carbon transition is consistent with achieving higher and more inclusive economic growth and stronger wellbeing, if it is accompanied by structural reforms to support the reallocation of resources and the deployment of low-carbon infrastructure. The low-carbon transition also has benefits for security of energy supply. Additional scope for GHG emissions reduction comes from aligning energy taxation better with environmental externalities (see above and the 2016 *Economic Survey*).

Figure 39. Green growth indicators: Germany



Source: OECD (2018), Green Growth Indicators (database).

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Forward-looking transport policy helps achieve climate goals, boosts wellbeing and cities' competitiveness

Transport represents around one fifth of Germany's GHG emissions. While total GHG emissions have fallen by more than 30% since 1990, transport emissions have increased as

rising traffic more than offset efficiency gains. The 2016 Climate Action Plan for 2050 envisages a reduction of emissions from the transport sector by 40-42% by 2030. Some 96% of transport emissions are caused by road transport (Federal Ministry of Transport and Digital Infrastructure, 2017[72]), of which passenger transport contributes 64% (Statistisches Bundesamt, 2017[73]).

The transportation sector lacks an overarching policy strategy. Recent research proposes four most important policy directions that need stronger support at national level: 1) shift to public transport; 2) low-carbon freight logistics; 3) new mobility services, including internet-based car sharing, 4) non-motorised transport, including walking and cycling (Hochfeld et al., 2017[74]; Vieweg et al., 2017[75]; Umweltbundesamt, 2017[76]). Better transport management and a stronger focus on combining transport modes could make better use of rail and water transport capacities (Umweltbundesamt, 2014[77]). To allow for better and more evidence-based decisions data on the costs and benefits of different transport modes is needed. Fees and taxes on transport modes need to be based on such cost-benefit-analysis (Monopolkommission, 2017[78]). Better pricing of the externalities of transport modes, especially of individual car use (including congestion, pollution and CO_2 emissions) is essential to guide transport policy.

The federal government has a role to play in identifying good practice. The multiplicity of transport policy actors, including subnational governments, reinforces the need for alignment of priorities and investment. For example, Switzerland developed a nationwide concept ("*Sachplan Verkehr*") which combines the targets of spatial and transport development and therefore could serve as an example for Germany. The Norwegian National Transport Plan envisages achieving zero emissions economic growth. It conditions central-government funding for urban infrastructure on "urban environment agreements" between central and subnational government authorities. The plan specifies that land-use plans for the larger urban areas must be aligned with the zero-growth objective. (OECD, 2016[79]).

Aligning infrastructure policies are key to achieve GHG emission reduction objectives (OECD, 2017[71]). The 2030 Federal Transport Infrastructure Plan is expected to generate emission reductions less than 8% of the needed reductions (Hochfeld et al., 2017[74]).

Electrification and ICT-based car sharing are key elements of a low carbon transport strategy

Using electricity to meet primary energy needs while expanding renewable electricity generation is key for preparing economies to operate in a carbon-neutral way (OECD, 2017[71]). Germany needs to extend its charging infrastructure to promote electrification of road transport. Full electrification of the currently 45 million cars would be costly, given the limits of the expansion of renewable energies and the challenges for the electricity grid (Federal Ministry for the Environment, Nature Consservation and Nuclear Safety, 2016[80]; Umweltbundesamt, 2017[76]). To minimize the additionally needed electricity, the transport transition needs to include a mobility transition leading to fewer cars in the streets. OECD research has shown that public car sharing modes may have the potential to reduce the car fleet size dramatically. For example, a simulation for Helsinki shows that only a car fleet size equivalent to 4% to 7% of the current private car stock would be required (ITF, 2017[81]). To develop car sharing services the German authorities need to review regulation restricting development of new shared transport services. For example, the testing of transport modes which are not included in current regulation is limited to 4 years (Sachverständigenrat für Umweltfragen, 2017[82]; Hochfeld et al., 2017[74]).

Ride sharing also reduces the cost of using electric cars below the cost of using cars with internal combustion engines. Operating costs of electric car use are relatively low, so more intensive use helps to amortise investment in electric cars and associated infrastructure. In addition accelerated fleet replacement would make quicker penetration of newer, cleaner technologies possible (ITF, 2016[83]).

Cities are important actors for green growth policies

The transition towards more shared transport also offers the potential to boost wellbeing and competitiveness of cities, thanks to lower pollution and reduced congestion. About 80% of Germans live in metropolitan areas with more than 500 000 inhabitants (OECD, 2015[3]) and urbanisation is expected to grow further (Deschermeier, 2017[84]; Bertelsmannstiftung, n.d.[85]). According to an OECD study, there are about 50 000 premature deaths annually as a result of air pollution in Germany (OECD, 2016[9]).

Cities are key contributors to national socio-economic and environmental performance (OECD, 2015[86]; Ahrend and Schumann, 2014[87]). This is due to several factors, such as greater competition and deeper labour markets, a faster spread of ideas and a more diverse intellectual and entrepreneurial environment (OECD, 2015[86]). The time cost of congestion and looking for parking have been estimated at EUR 110 billion annually (INRIX, 2016[39]; 2017[40]), about 4% of GDP. Since transport is an intermediate service to other sectors, substantial additional productivity losses in downstream sectors are likely.

Shared mobility services can provide citizens with more flexible, comfortable and easily available transport and encourage the shift away from individual car use. Modelling of urban transport flows for some OECD cities has shown that ICT-based Taxi-Bus and Shared Taxi services can reduce emissions, congestion and the need for parking space sharply (ITF, 2017[88]; 2017[89]). Shared private transport works particularly effectively in tandem with public transport, for which they can act as feeders (ITF, 2017[89]), especially in areas further from the city centre (ITF, 2017[81]).

Ride sharing systems can produce transport service at lower cost than conventional public transport or private car use. Costs may be a third of current public transport cost (ITF, 2016[83]). It also reduces travel time (ITF, 2017[81]). By contrast, autonomous cars, if used individually, could increase sprawl and congestion (OECD, 2015[3]). The authorities must carefully reflect on regulation and supervision of shared urban transport systems to ensure efficient outcomes (ITF, 2016[83]). One promising approach would be to charge a single entity with matching demand and supply (ITF, 2017[88]).

Congestion charges often face fierce political resistance but have nevertheless been successfully introduced in several major cities (such as London, Singapore, Milan and Stockholm) in recent years. A congestion charge close to the level currently applied in London, with receipts being used to improve public transport in less well-served areas would lead to a reduction in car traffic by roughly 8%, with reductions in particulate matter and carbon emissions in the order of 6% (OECD, 2015[3]). This highlights that pricing policies are not sufficient but need to be accompanied by policies facilitating the development of new transport modes.

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Annex. Progress in structural reforms

This annex summarises recommendations made in previous Surveys and main actions taken since the OECD Economic Survey on Germany was published in April 2016.

Recommendations in previous Surveys	Action taken
Improving efficiency and stability in financial markets	
Micro- and macroprudential regulation should address remaining risks emanating from the *Landesbanken*. Continue restructuring the *Landesbanken*, including through privatisation, consolidation or focusing on core activities according to a viable business model.	One *Landesbank* is being privatised, as required by the EU Commission under state aid rules.
Improve corporate governance in the *Landesbanken* and savings banks, for example, by requiring members of the board to be more independent from elected regional and local governments.	No action taken.
Consider ways to improve the effectiveness of requirements to separate investment banking activities from retail banking. For example, give consideration to including securities held for market-making purposes in separation requirements and to focusing such requirements on derivatives exposures.	No action taken.
Improving efficiency in public finance	
Strengthen public investment in childcare, early childhood education (ECEC) and primary education. Invest more in full-day schooling,	The federal government has launched an investment program until 2020 that supports expansion of childcare services. It also supports the operating costs of childcare services borne by *Länder*. Also, measures have been taken to improve access to ECEC and quality of ECEC such as the qualification of child minders.
Provide more support for good municipal investment projects, including by strengthening administrative capacity, especially in municipalities burdened with high spending mandates (such as cash transfers).	In 2017, the federal government increased funding for school infrastructure. It also grants financial relief to municipalities with high federally-mandated social benefit spending.
Improve priority setting in budgeting, for example by enhancing the analytical capacity of parliament and by making poor performance of budget programmes public.	The federal government introduced yearly rolling spending reviews on selective narrowly-defined policy fields in order to improve expenditure prioritisation. Some performance information is included in the budget review.
Introduce regional advisory units in all *Länder* to provide technical support for local governments in carrying out investment.	The federal government has launched a service to provide organisational and technical support and it has supported more than 100 projects.
Promote e-procurement by improving skills of procurement officials. Involve the public more effectively in investment projects through electronic communication tools.	Since 2016 all federal administration authorities have to publish notices and provide procurement documents online and accept submission of electronic bids. The government is promoting awareness on the training of procurement officials at all levels of public administration.
Improve assessment and disclosure of long-term financial risks of public-private partnerships (PPPs) of subnational governments. Share experience across levels of government and national borders and harmonise procedures.	A special working group was launched in 2017 to improve transparency of PPP projects including their financial risks, chaired by the Federal Ministry of Finance and involving federal line ministries, *Länder* and other local authorities.
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.
Consider introducing usage-dependent and congestion-dependent road tolls for cars.	The infrastructure charge for the use of federal trunk roads is expected to be collected from 2019.
Include private insurers in the financing system based on the central health fund.	No action taken.
Reforming the tax system	
Phase out reduced VAT tax rates.	No action taken.
Reduce social security contributions, notably for low income workers.	The contribution rate to the statutory pension insurance was reduced slightly in 2018.
Cut statutory corporate tax rates. Consider lowering or abolishing the local trade tax.	No action taken.
Update real estate tax valuations while protecting low income households.	No action taken.
Extend capital gains taxes on residential real estate except for owner-occupied housing.	No action taken.
Raise the tax rates applying to household capital income towards marginal income tax rates applying to other household income.	No action taken.
Equalise the inheritance tax burden for different forms of wealth. Remove exemptions for family businesses.	No action taken.

Recommendations in previous Surveys	Action taken
Broaden the contribution base for the funding of health and long term care beyond wage income to all household income.	Since 2015, the transfer from the federal government budget to public health insurance has been increased somewhat.
Reforming the pension system and improving wellbeing at old age	
Index the legal pension age to life expectancy.	No action taken.
Raise the pension premium for starting to draw old-age pensions later in life.	The pension premium remains unchanged.
Do not reduce pensions for old-age pensioners who work. Allow working old-age pensioners to accrue benefits on social security contributions employers pay on their behalf.	Since 2017, a partial pension and wage earnings can be combined in a more flexible and individual way. Labour market earnings now reduce pensions by 40% only above a threshold of EUR 6 300 annually (previously the threshold was EUR 450 per month). Since 2017, individuals who continue to work after the statutory retirement age can choose to pay pension contributions and thereby accrue full benefits on all their pension contributions.
Focus additional pension entitlements on reducing future old age poverty risks, for example, by phasing out subsistence benefit entitlements more slowly as public pension entitlements rise. Fund such additional spending from general tax revenue instead of higher payroll taxes.	A lump-sum allowance for private old-age provision was introduced in subsistence benefits in January 2018. The additional income within the threshold will not be deducted from the benefits.
Strengthen insurance against disability, for example by making it easier to claim legitimate private disability insurance benefits. Consider eliminating the discount from public disability benefits for claiming the benefit before the age of 63 years and ten months. Reconsider the cuts of these benefits as other income rises.	Legislation in 2017 improved the benefits in case of reduced earnings capacity in the statutory pension insurance.. A more flexible combination of partial pension and supplementary earnings also applies for disability benefits.
Remove barriers to the portability of civil servant pensions.	No action taken.
Enrol all individuals in occupational pensions by default, allowing them to opt out.	As of 1st January 2018, social partners can establish enrolment by default in firms covered by collective bargaining.
Strengthen supervision of direct pension commitments of employers. Make contributions to the risk-pooling scheme dependent on risk indicators.	No action taken.
Reduce operating costs of subsidised, individual pension plans by improving comparability among providers.	Since 2017, providers of subsidised individual pension plans are obliged to disclose the operating costs and how much it reduces yield.
Promote workplace health by improving monitoring and the collaboration between authorities and employers.	No action taken.
Strengthen enforcement of workplace regulation for workers on non-standard contracts.	No action taken.
Strengthen experience-rating in employer contributions to work accident and disability insurance.	No action taken.
Encourage healthy life-styles by raising taxes on alcohol and tobacco and reviewing regulation.	The EU directive on advertising of tobacco has been implemented. The minimum tax rate on cigarettes was increased in 2016.
Improving labour market performance	
Lower the tax burden on the second earner in personal income taxation for example by introducing a separate tax-free allowance for second earners. Relate health insurance premiums to the number of adults in a household.	No action taken.
Continue to expand formal childcare provision, notably for full-day care. Consider introducing a voucher system for childcare. Lower regulations for the set-up of childcare facilities to encourage more private supply.	A new investment program for expanding and improving childcare worth EUR 1.1 billion was launched in 2017.
Reduce the gap in employment protection between permanent and temporary workers by moving towards a unified job contract with the degree of protection rising with tenure. Ease employment protection legislation for regular job contracts by shortening the notification procedure, by reducing the notice period for workers with long tenure and, in case of dismissals for economic reasons, by giving employers the right to choose between a severance payment or paying a higher unfair dismissal compensation which would replace the court route. Limit the use of multiple successive fixed term contracts with the same employee.	Since 2017, the duration of employment on jobs filled by temporary work agency workers is limited to 18 months.
Target the preferential tax treatment of minijobs towards low-wage workers.	No action taken.

Recommendations in previous Surveys	Action taken
Continue to review in-work benefits (means-tested benefits which low-pay workers may be able to receive in employment) to ensure that the most vulnerable receive sufficient support while minimising disincentives to work. For instance, phase out more slowly means-tested subsistence benefits for particularly vulnerable individuals earning more than EUR 100. Phase out additional child benefits paid to parents receiving a housing allowance more slowly.	No action taken.
Integrating immigrants better in the labour market	
Ease labour market testing requirements for asylum seekers who are judged likely to stay and include them in active labour market programmes.	Labour market tests have been suspended for asylum seekers since 2016. Since 2016, refugees with good prospects of staying can participate in a job opportunity programme financed by the Federal Government. They also have access to preparatory courses for on-the-job vocational training after three months of staying in Germany.
Improve access of immigrants to public sector jobs.	No action taken
Improve training and the recognition of immigrants' skills.	Monitoring through common statistics across the *Länder* is in preparation and will be available in the course of 2018. Between 2012 and 2016, the government received 86.000 applications filed according to the Federal Recognition Act. Most of the applicants received full recognition. Others were offered trainings by several organisations. Furthermore, the Federal Employment Agency provides qualification programmes and counselling (see above). A new program was launched in 2016 to lower the costs of application for skills recognition for low income immigrants. Programs aimed at the integration of asylum seekers into the labour market are in place. They include German classes, (re)-enrolling in school, and counselling services.
Decide quickly who will be allowed to stay and reunite families quickly, especially those with young children.	No action taken.
Integrate migrant children in mainstream schooling while providing specific language support. Provide financial incentives and advice to parents to encourage refugees to make use of childcare and early childhood education.	Children without any knowledge of German are usually first taught German in preparatory courses. At the same time, they also attend some regular classes to prepare the transition into the regular system. Some *Länder* boosted language support to accelerate integration. Access to school education is guaranteed for all children of asylum seekers. The funding for the migration counselling service for adult immigrants (Migrationsberatung für erwachsene Zuwanderer) was updated in 2016.
Take stock of all available integration measures and evaluate their effectiveness.	The review of the government strategy for German courses and integration of refugees was published in 2017.
Consider establishing an institution tasked with designing, assessing and coordinating labour migration policy.	No action taken.
Enhancing competition in product markets	
Liberalise the issuance of SIM cards in mobile communication. Sell the remaining government shares of Deutsche Telekom.	Since 2016, the use of foreign International Mobile Subscriber Identities (IMSIs) in Germany and the use of German IMSIs abroad are allowed for Machine-to-Machine (M2M) communication.
Raise competition in the railway sector, for example by fully privatising the transport service subsidiaries while retaining state ownership of the tracks, and by eliminating exemptions from tendering of regional railway services. Facilitate access of market entrants to rolling stock. Strengthen the role of the regulator by improving its investigative and interventional competences. Move to full ex ante regulation of access conditions.	The investigative and interventional competences of the regulator will be strengthened by transposing the 4th EU railway package into national law.
Provide equal treatment in value added taxation for all postal service providers. Sell the remaining government shares of Deutsche Post.	No action taken.

Recommendations in previous Surveys	Action taken
Ease requirements to hold a tertiary level vocational degree or alternatively to have job experience in a leading position, for self-employment in some crafts.	No action taken.
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.
Abandon price regulation in some professional services. Abolish the price regulation for architects and engineers and consider liberalising price regulation for notaries. Give lawyers more options to deviate from the principle of effort-based remuneration, e.g. allow all-inclusive fees for certain tasks and extend outcome-based payments.	No action taken.
Reduce exclusive rights in the professional services. For example, allow new companies to register in the commercial registry without notary services and open the provision of auxiliary services in property conveyancing to other professions. Reduce exclusive rights of lawyers in providing legal advice and representation in court.	No action taken.
Review restrictions on business conduct in the professional services. Abolish all remaining restrictions on advertising for lawyers. Give consideration to abolishing restrictions on shareholders for limited liability companies of lawyers, tax consultants, architects and engineers.	No action taken.
Relax the requirement that pharmacies can only be owned by a pharmacist who has to work personally in one out of a maximum of four branches he/she is allowed to own.	No action taken.
Strengthen the analysis of the economy-wide impact of regulation. Establish an advisory body tasked with identifying and reviewing regulatory hurdles to higher productivity.	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, such as the potential beneficiary and the targeted government action.	No action taken.
Remove limitations on the carrying forward of losses when a start-up firm is sold while taking measures to prevent tax evasion.	A legislation expanding the options for carrying forward tax losses was adopted in 2016.
Improving educational outcomes	
Remove constitutional barriers to federal government co-funding of education expenditure by subnational governments.	In 2017, the constitution allowed the federal government to provide funding to financially weak municipalities for important investment in local education infrastructure.
Ensure equal access of the most vulnerable to affordable high-quality childcare.	A program reaching out to families advocating the benefits of early childhood education and care system was launched in April 2017.
Improve the quality of early childhood education and care, including by improving the staff-child ratio in accredited facilities; by better integrating education and care; and by ensuring early childhood professionals have better qualifications, more professional development opportunities and better working conditions.	No action taken.
Increase the availability of full-day schooling.	The proportion of full-day schools has reached more than 50%.
Continue to reduce the stratification in the school system, notably by delaying the tracking decision beyond age ten and reducing the number of school tracks across all *Länder*. Reduce grade repetition.	Many *Länder* are merging Haupt- and Realschulen.
Continue reducing the assignment of pupils to special needs schools (Sonderschulen) and make sure assignment to such schools does not reflect the socio-economic background of pupils.	No action taken.
Provide more financial resources to schools with a comparatively high share of pupils with weak socio-economic background in particular at lower secondary level.	No action taken.

Recommendations in previous Surveys	Action taken
Further reform the VET system by considering reducing the variety of VET qualifications and providing continuing education offers of general skills (mathematics, German, foreign languages, computer skills) according to labour market needs. Let vocational schools and chambers jointly prepare and carry out the final examination of dual VET programmes.	Some courses on general skills are offered since 2015 as response to large enrolment of refugees.
Ensure sufficient and diverse financing of higher education and overcome the free-rider problem between *Länder* in the financing of university education.	No action taken.
Strengthen life-long learning. 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 counselling hot line for continuing education was launched in 2015.
Fostering green growth	
Gradually adjust energy tax rates according to carbon intensity. Eliminate exemptions and reduced energy tax rates, except if they are designed to avoid double taxation, notably in sectors covered by the EU ETS.	No action taken.
Introduce taxation of NOx emissions of large emitters. Tax cars according to their NOx emissions.	No action taken.
Phase out tax expenditures for activities that damage the environment without harming international competitiveness, and better align environmental taxation with negative externalities. For example, raise taxes on diesel.	No action taken.
Make feed-in tariffs of renewable energy more cost-effective by linking them to market developments. Consider reforms to move the current support scheme to a competitive auction system.	Competitive auctions were introduced in 2017 to determine the funding for renewable installations.
Provide adequate incentives for the transmission systems operators to invest in the most efficient technologies while extending the grid.	No action taken.

Chapter 1. Boosting productivity and preparing for the future of work

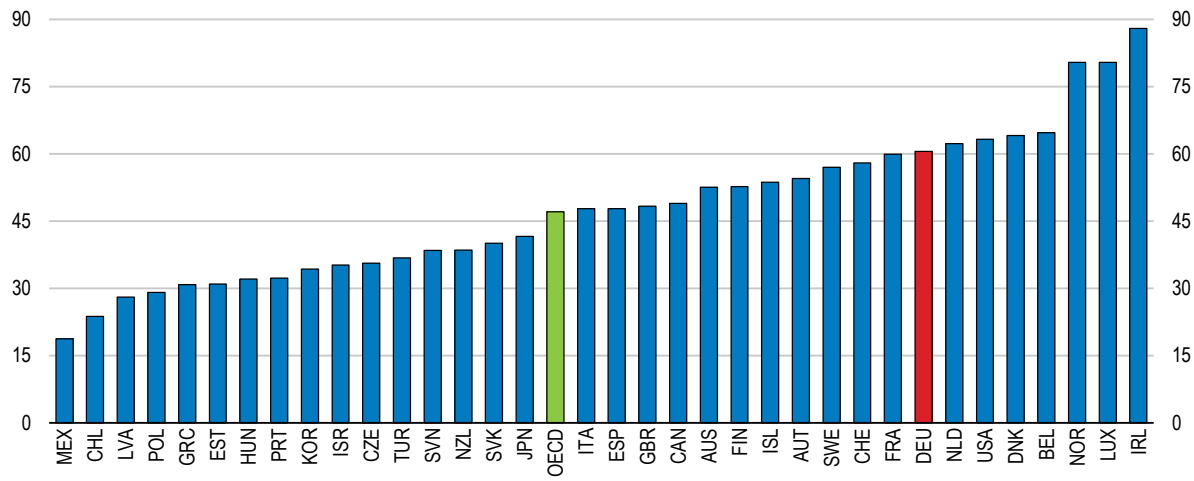
This chapter reviews policies to strengthen Germany's productivity growth and prepare for changes in labour markets brought about by new technologies. The chapter also discusses how social protection and the bargaining framework should be reformed for the future of work. Germany enjoys a relatively high labour productivity level but productivity growth has been modest in recent years. There is room to boost productivity growth by accelerating the diffusion of new technologies throughout the economy. Vigorous entrepreneurship and innovation by small and medium enterprises are key for such technology diffusion while strong broadband and mobile networks widen the scope of data-intensive technologies that can be exploited to increase productivity. Widespread use of new technologies will bring about significant changes in skill demand and work arrangements. As in many countries, Germany saw a decline in the share of middle-skilled jobs in employment. A relatively high share of jobs is expected to be automated or undergo significant changes in task contents as a result of technological change. New technologies are also likely to increase individuals engaging in new forms of work, such as gig work intermediated by digital platforms. Such workers are less covered by public social safety nets such as unemployment insurance than regular employment.

Productivity growth is held back by slow adoption of new technologies

Germany enjoys relatively high labour productivity among OECD countries (Figure 1.1). However, labour productivity growth in recent years was subdued compared to the pre-crisis period, as in many other OECD countries,(Figure 1.2 Panel A) (OECD, 2016[90]). The contribution of capital per worker to labour productivity growth was very small, due to weak business investment (Figure 1.2 Panel B). Multifactor productivity (MFP) growth improved significantly during the swift economic recovery after the crisis, but it has slowed down since.

Figure 1.1. Labour productivity is relatively high

Real GDP in constant USD PPP per total hours worked, 2016



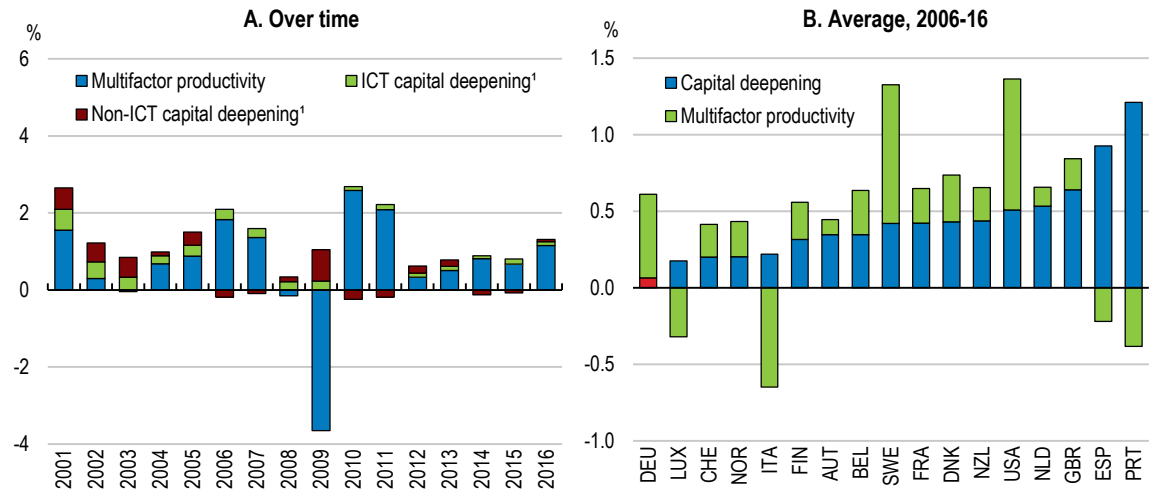
Source: OECD (2018), *OECD Productivity Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933737647

Slower MFP growth reflects several factors. For instance, Germany's strong employment performance, particularly employment gains among low skilled workers, may have weighed on productivity growth (Boulhol and Turner, 2009[91]). Rising skill shortages are also likely to be holding back more productive firms from growing in size (Adalet McGowan and Andrews, 2015[92]). A recent OECD study emphasizes the role of increasing divergence in productivity between firms at the productivity frontier and the rest (Andrews, Criscuolo and Gal, 2016[93]). Indeed, the average MFP level of the most productive German firms (considered as firms at the productivity frontier) and that of other German firms diverged after the crisis, especially in the service sector (Figure 1.3). The divergence points to a slower diffusion of new technologies and knowledge from frontier firms to the rest of firms in the economy. It also implies substantial room to boost productivity growth by increasing the adoption of new technologies like digital technologies among lagging firms.

Figure 1.2. Labour productivity growth has been subdued

Contribution of capital deepening and multifactor productivity to labour productivity growth



Note: ICT (Non-ICT) capital deepening refers to the annual rate of change in ICT (Non-ICT) capital intensity that is defined as the ratio of ICT (non-ICT) capital services per hour worked.
Source: OECD (2018), OECD Productivity Statistics (database) and OECD (2018), OECD Economic Outlook: Statistics and Projections (database).

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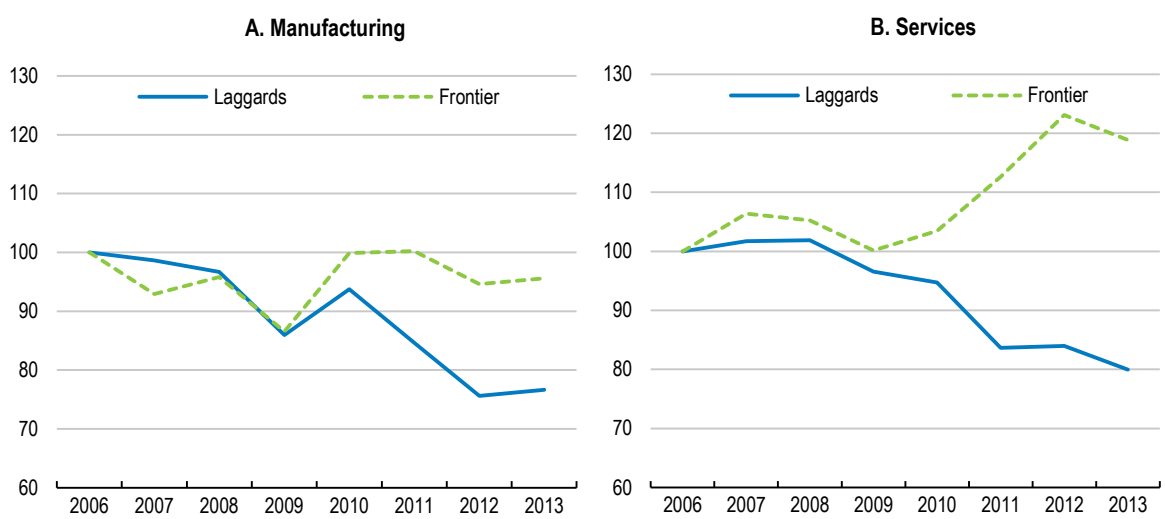
Figure 1.3. The productivity gap between frontier firms and the rest has widened

Multifactor productivity level, indexed as 2006=100



Note: The charts show the evolution of multifactor productivity of the top 5% of German firms with highest productivity within each 2-digit sector (frontier firms) and the rest of firms (laggards). The productivity levels are normalised to 2006 = 100, and the indices are approximated by changes in log-productivity.
Source: Estimation by the OECD secretariat based on ORBIS dataset.

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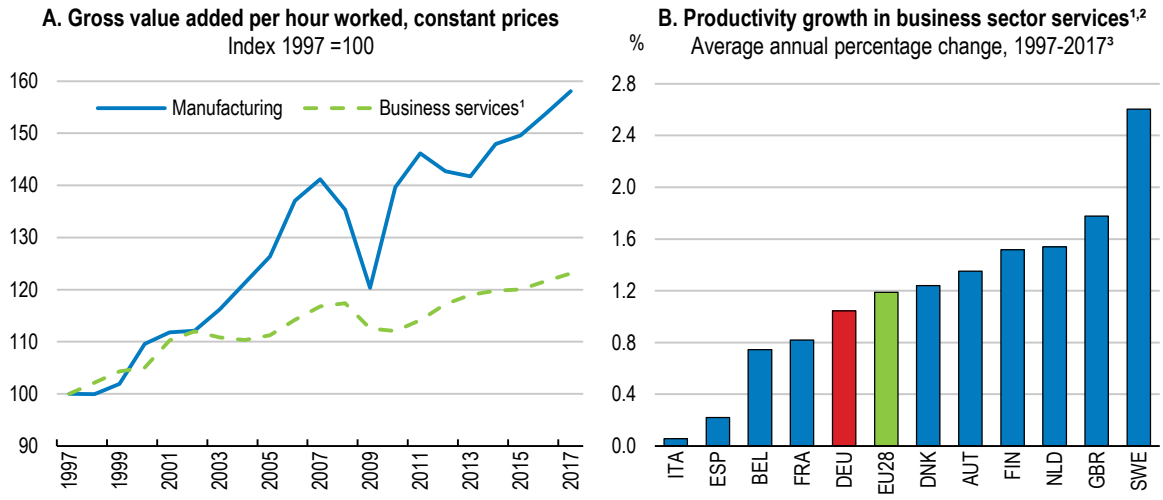
Faster technology diffusion can boost productivity in the service sector and among SMEs

Labour productivity growth has been slower in the service sector compared to the manufacturing sector (Figure 1.4, Panel A) or to the service sector in several other advanced European economies (Figure 1.4, Panel B).

Figure 1.4. Productivity growth in the service sector is low



1. Excludes real estate.
2. Labour productivity growth is defined as the annual change in gross value added (in volume terms) per hour worked.
3. 1999-2016 for Belgium.
Source: OECD (2018), *OECD Productivity Statistics* (database).

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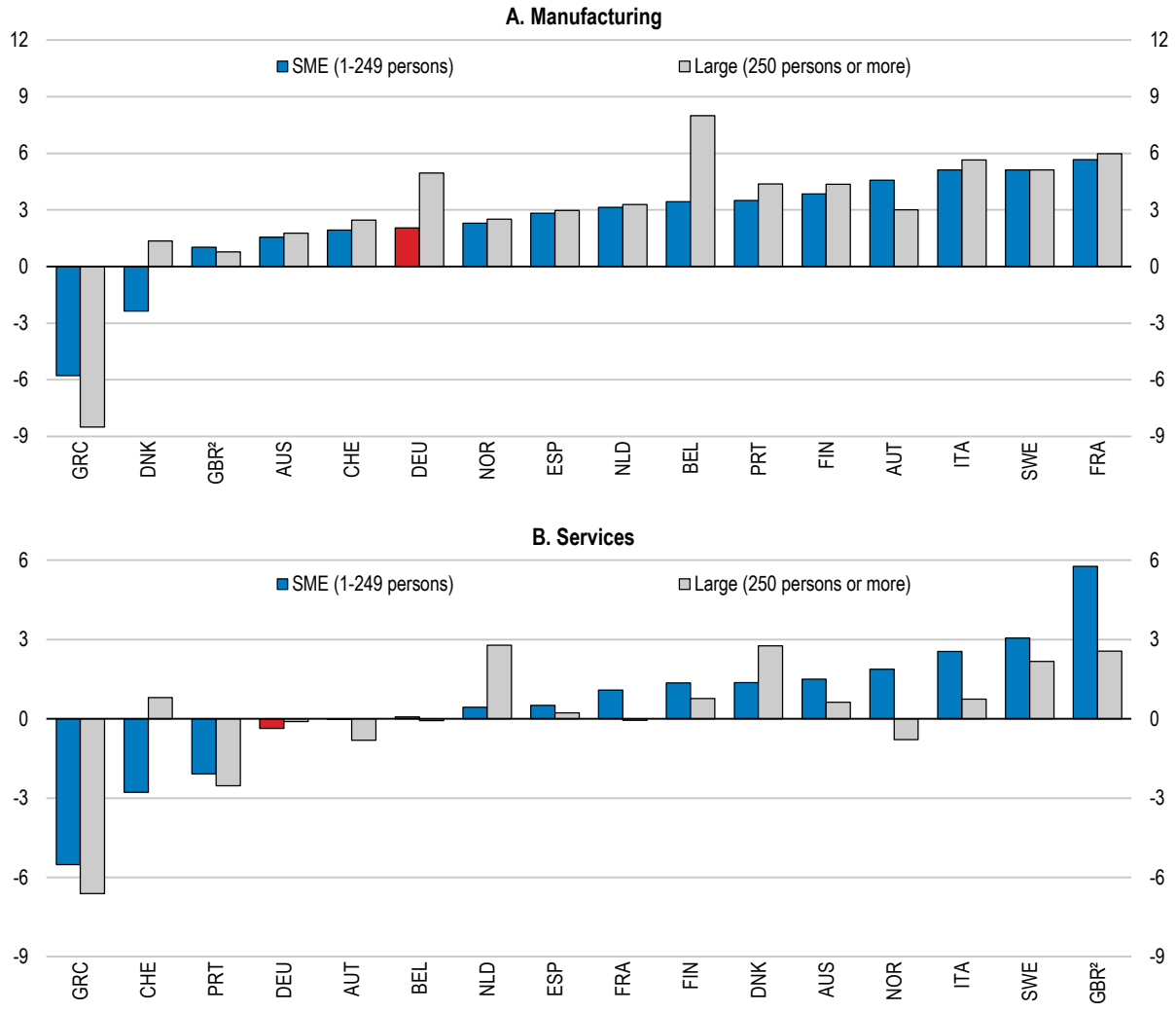
Within the manufacturing sector, labour productivity growth has been significantly slower among small and medium-sized enterprises (SMEs) compared to large enterprises Figure 1.5, Panel A). In contrast, productivity growth has been weak for both SMEs and large enterprises in the service sector (Figure 1.5, Panel B). Furthermore, in both manufacturing and service sectors, German SMEs' productivity growth underperformed SMEs in several other advanced economies markedly. This has contributed to a productivity gap between SMEs and large firms that is larger than many other advanced European economies (Figure 1.6). The gap is particularly pronounced in the manufacturing sector where medium-sized firms are only 65% as productive as larger firms (OECD, 2017[94]). These observations indicate that there are large untapped productivity gains from enhancing diffusion of new technologies among firms in the service sector and among SMEs. Boosting productivity growth of SMEs in the service sector would improve the overall productivity performance of the sector, given that about two-thirds of workers in this sector are employed by SMEs (OECD, 2017[94]).

Figure 1.5. Labour productivity growth of small and medium sized enterprises is low

Real value added per person employed, average annual growth rate, 2009-2014 or latest year[1]



1. Average annual growth rate over 2010-14 for Switzerland, 2009-13 for France and 2009-12 for Finland and Portugal.
2. The charts exclude small unregistered businesses; these are businesses below the thresholds of the value-added tax regime and/or the pay as you earn (PAYE) regime.
Source: OECD (2017), *Entrepreneurship at a Glance 2017*.

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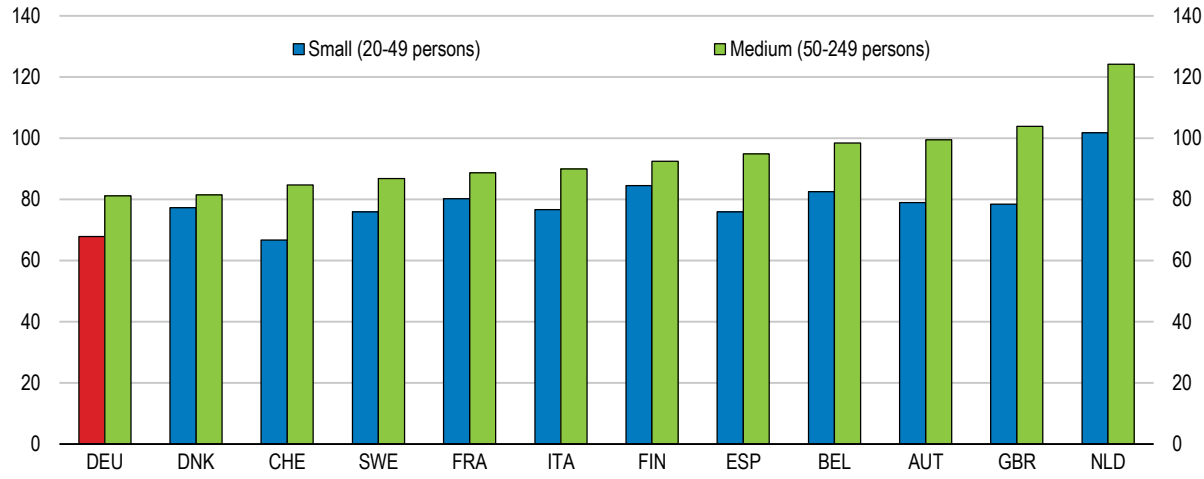
Figure 1.6. The productivity gap between large firms and SMEs is large

Value added per person employed for SMEs, percentage of the level of large firms, 2014, or latest year



Note: Large firms are firms with more than 250 employed persons.
Source: OECD (2017), *Entrepreneurship at a Glance 2017*.

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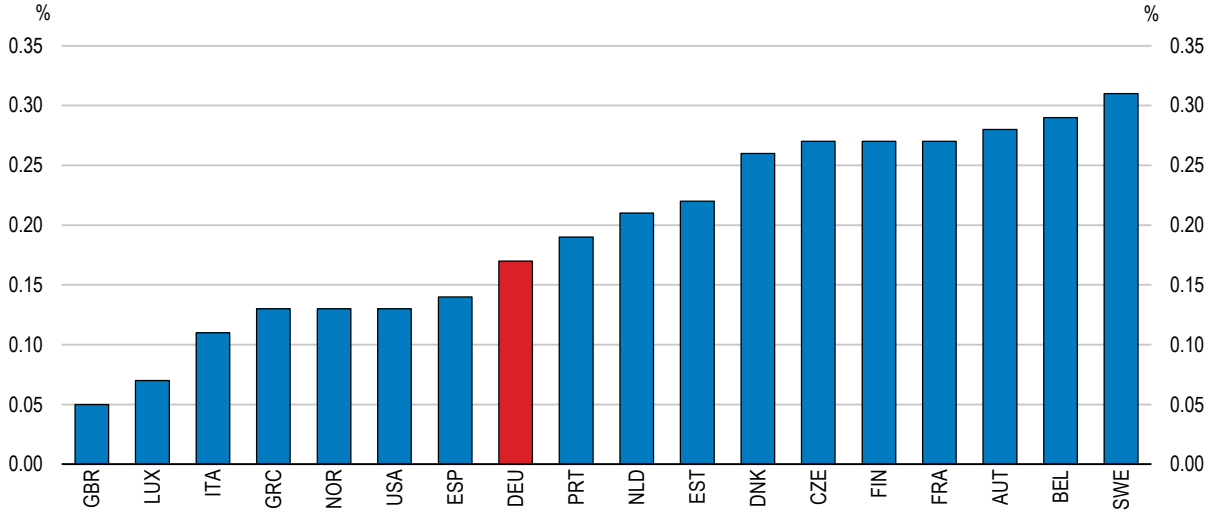
Knowledge-based capital contributes little to productivity growth in Germany

Knowledge-based capital (KBC) increasingly determines productivity growth, because it plays a central role in the diffusion of new technologies through commercialisation, learning and complementary organisational change required for new technologies to yield productivity gains (OECD, 2013[95]). Germany's investment in KBC is concentrated in the manufacturing sector, and is predominantly R&D and organisational capital (Belitz, Le Mouel and Schiersch, 2018[96]). Investment in the service sector is low when compared to the manufacturing sector, or to the service sector of other countries. The low investment intensity in the service sector results in low overall investment in KBC compared to other advanced OECD countries (OECD, 2016[9]), and a smaller contribution of KBC to labour productivity growth (Figure 1.7).

A recent study (Belitz et al., 2017[97]) has shown that investment in KBC contributes to higher productivity of German firms, but that it is concentrated among large firms in the manufacturing sector and in a few service sectors such as ICT services or telecommunication. SMEs invest a significantly lower share of their value added in KBC than large enterprises, although the marginal gains in productivity from a unit of investment in KBC are similar in large firms and SMEs (Belitz et al., 2017[97]). This implies that stronger KBC investment by SMEs can contribute to closing the large productivity gap with large firms. Investment in software and organisational capital, two types of KBC that are often complementary in reaping the benefits of digitalisation (Brynjolfsson, Hitt and Yang, 2002[98]) are particularly associated with large productivity gains (Belitz et al., 2017[97]).

Figure 1.7. The role of knowledge-based capital in productivity growth is small

Contribution of KBC to labour productivity growth, business sector, 2000-14



Note: Contributions are calculated using a standard non-parametric growth accounting method for market sectors (i.e. ISIC Rev.4 Divisions 01 to 82 excluding 68, and 90 to 96) for the overall period, assuming constant returns to scale and full competitive markets, where production technology takes a log linear form and output elasticities are equal to factor shares. KBC capital includes software, R&D and organisational capital.
Source: OECD (2017), OECD Science, Technology and Industry Scoreboard 2017: The digital transformation.
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Investment in some KBC involves large upfront costs and considerable uncertainties on its return. The intangible nature of KBC makes it less suitable as collateral, which limits the possibility of small younger firms debt financing the investment in KBC (OECD, 2013[95]). Also, due to its non-rival nature, KBC is associated with strong economies of scale. The return to KBC investment depends crucially on how fast innovative firms that deploy novel KBC can expand their market shares and grow in size. An efficient resource allocation that allows innovative firms to attract sufficient capital and personnel is thus essential for promoting stronger KBC investment among smaller firms (OECD, 2016[9]).

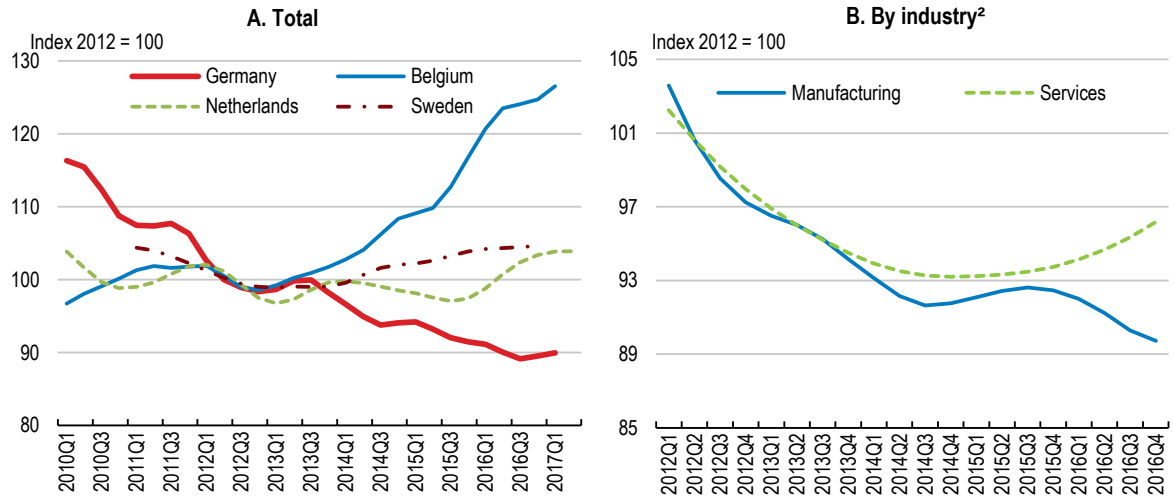
Vigorous entrepreneurship accelerates technology diffusion

Entrepreneurship is an important driver of technology diffusion. Young firms often introduce new technologies into markets (OECD, 2015[99]). They also engage more in high-risk break-through innovation (Färnstrand Damsgaard et al., 2017[100]). ICT start-ups introduce new digital services. In this way they open new pathways for entrepreneurial activities, by increasing availability of affordable digital tools and access to market demand through digital platforms (OECD, 2017[101]). Entrepreneurship that effectively deploys new technologies and business models is particularly important in boosting the productivity in the service sector and among SMEs.

New enterprise creation in Germany has been declining since the financial crisis (Figure 1.8, Panel A), although it has been recovering in the service sector after 2015 (Figure 1.8, Panel B). Firm creation has been declining in all regions except in Berlin.

Figure 1.8. New enterprise creation is weak

Number of new enterprises, by industry, trend-cycle[1]



1. The trend-cycle component is extracted from quarterly data by applying seasonal adjustment to quarterly series. Refer to the source for more details.
2. Manufacturing refers to ISIC Rev.4 Divisions 10 to 33. Services refer to Divisions 45 to 82 excluding 64 to 66.
Source: OECD (2017), *Entrepreneurship at a Glance 2017*.

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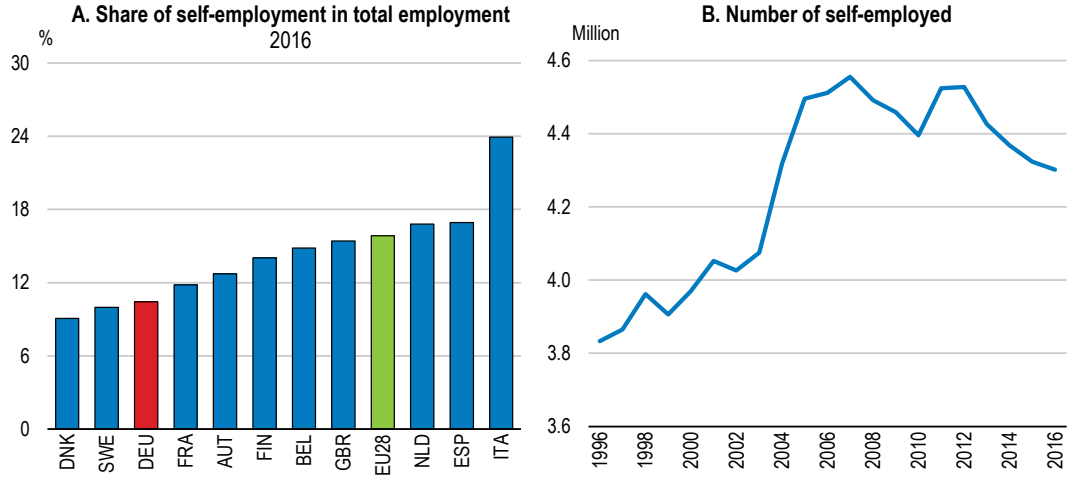
Self-employment in Germany is around 10% of total employment, lower than in many other advanced European countries (Figure 1.9, Panel A). The number of self-employed increased rapidly after 2002 as labour market reforms that tightened access to unemployment benefits and unfavourable labour market conditions encouraged the unemployed to start their own business (Figure 1.9, Panel B). It has been decreasing since 2012, as improved labour market conditions reduced such necessity-driven start-ups (KfW, 2017[102]).

Figure 1.9. The share of self-employment is relatively low



Source: OECD (2018), "Labour Force Statistics: Summary tables", OECD Employment and Labour Market Statistics (database).

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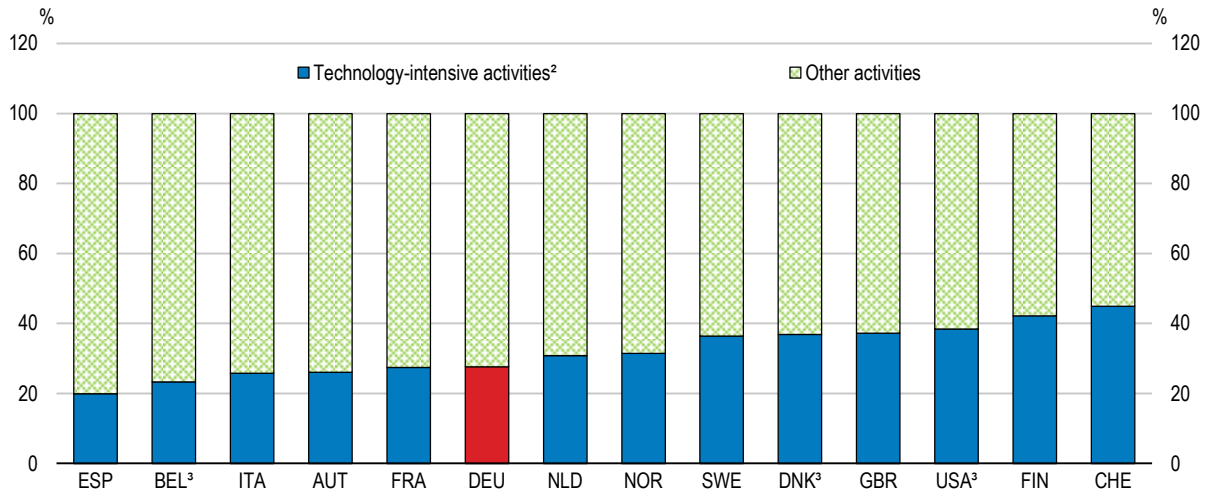
Current entrepreneurship in Germany is primarily driven by start-ups motivated by business opportunities (KfW, 2017[102]), which tend to bring more innovation to the market, employ more staff and survive longer. Yet, the number of such opportunity-based start-ups has been declining as well, as potential entrepreneurs are less willing to choose self-employment that is associated with significantly lower income security than employment (KfW, 2017[102]). Indeed, financial risk is the top reason cited by the individuals that seriously considered starting their own business but abandoned their plan to do so (Metzger, 2015[103]). As discussed below, the relatively high costs of failure and lower coverage of the self-employed with social protection are likely to constitute an effective barrier to entrepreneurship.

Entrepreneurship in Germany is biased towards low-tech sectors. There are few start-ups in knowledge intensive service sectors. The share of jobs created by new firms in technology-intensive sectors is low compared to several other advanced economies Figure 1.10). In 2016, only 9% of entrepreneurs conducted research and development (R&D) in order to turn technological innovations into new products and services (KfW, 2017[102]). Furthermore, businesses operated by the self-employed have a smaller chance to survive in Germany than in several other advanced European economies (Figure 1.11) in spite of favourable economic conditions. This may also be related to the higher chance of finding good employment opportunities in Germany.

Figure 1.10. Entrepreneurship is concentrated in less technology-intensive activities

Share of sectors in total employment created by employer enterprises birth[1], 2014 or latest year



1. An employer enterprise birth refers is the birth of an enterprise with at least one employee.
2. Technology-intensive activities refer to industry, information, communication, financial intermediation, real estate, and professional scientific and technical activities.
3. 2013 for Belgium and Denmark. 2012 for the USA.
Source: OECD (2017), *Entrepreneurship at a Glance 2017*.

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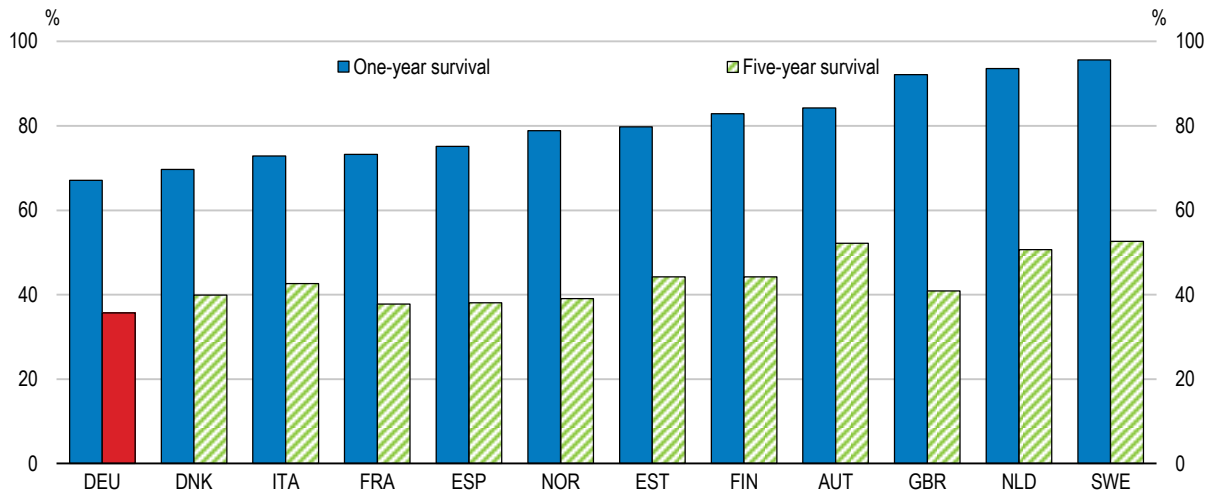
Figure 1.11. The survival rate of the self-employed business is low



Source: OECD/EU (2017), *The Missing Entrepreneurs 2017: Policies for Inclusive Entrepreneurship*.

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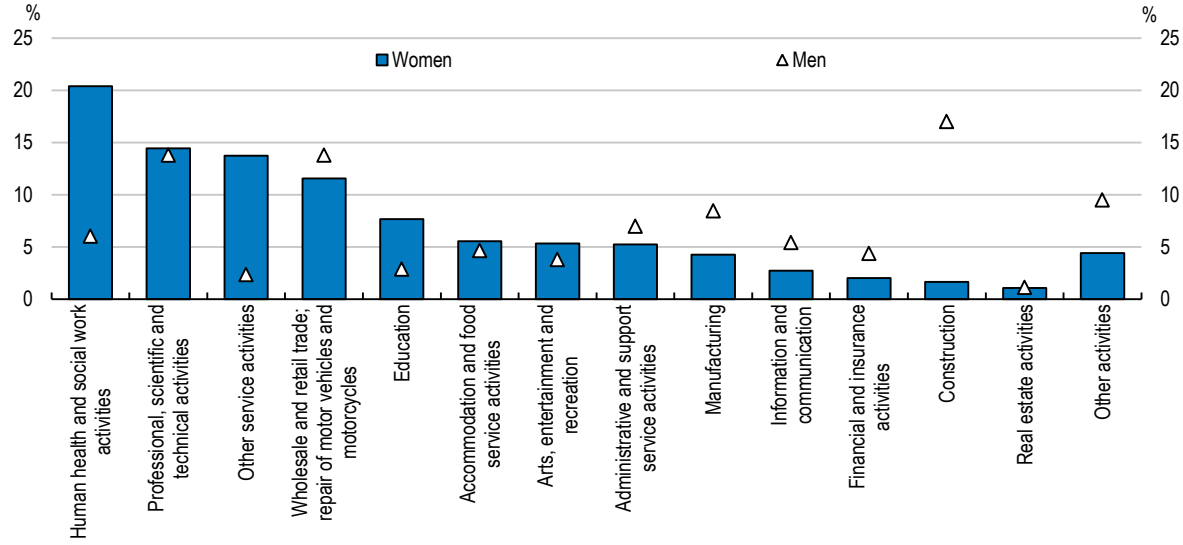
Promoting women's entrepreneurship

The role of women in entrepreneurship in Germany is small, especially in sectors where technology diffusion is strong. Only 8% of all active female workers are self-employed, less than in the average of European Union countries (13%), although this share has been rising (OECD, 2017[104]). About 90% of self-employed women work in the service sector, mostly in personal and business services and rarely in technology intensive services such as information and communication (Figure 1.12). Only 13% of high tech start-ups are led by women (OECD, 2017[104]). Female entrepreneurship is also motivated more by necessity than by business opportunities and about two-thirds of self-employed women are "solo" self-employed (OECD, 2017[104]), who include employee-like workers (see below). Across several OECD countries including Germany, start-ups founded by one or more women are less likely to receive financing from venture capital than other start-ups and a smaller amount of finance if they receive any (Breschi, Lassébie and Menon, 2018[105]). More vigorous entrepreneurship by women, especially in high technology sector, can enhance technology diffusion.

The commercialisation of new technologies and the introduction of new business models applying new technologies require advanced entrepreneurial skills. According to the Global Entrepreneurship Monitor (GEM), one-third of surveyed women in Germany reported that they have knowledge and skills to start up a business (Figure 1.13). However, this share is lower than among men, as in all countries (OECD/EU, 2017[106]). The existing entrepreneurship education in Germany, mostly offered in upper-secondary vocational training and in tertiary education, promotes a classic model of entrepreneurship (i.e. full-time self-employment), that is often not conducive for women (OECD, 2017[104]). For instance, many entrepreneurial women run their start-ups part-time, most likely due to family obligations (KfW, 2017[102]). The entrepreneurial education should advocate diverse forms of entrepreneurship (OECD, 2017[104]). The National Agency for Women Start-up Activities and Services (*Bundesweite Gründerinnenagentur*) provides adult education targeted to encourage female entrepreneurship.

Figure 1.12. Women's self-employment is concentrated in less technology intensive services

The sectoral share of self-employment, 2016



Note: The share of each sector in the self-employment of 16 to 64 years old women and men.
Source: Eurostat (2018), Employment and unemployment (Labour Force Survey) Statistics.

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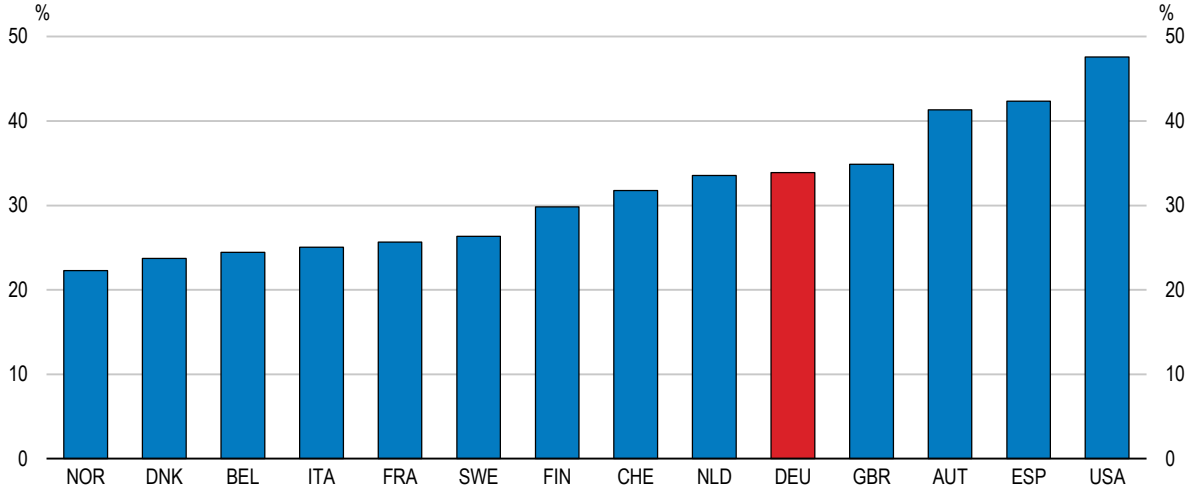
Figure 1.13. About one-third of German women have entrepreneurial skills

The share of surveyed women with knowledge to start up a business[1], 18-64 year-olds, 2012-16



Note: Share of surveyed 18-64 years-old women who responded "yes" to the question "Do you have the knowledge and skills to start a business?" The difference between men is the difference between surveyed men who responded "yes" to the question.
Source: OECD/EU (2017), *The Missing Entrepreneurs 2017: Policies for Inclusive Entrepreneurship*.

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Although self-employment may allow women to choose flexible working hours and thus balance work and family obligations, self-employed women across OECD countries actually work longer hours than women employees (OECD/EU, 2017[106]). In Germany,

they work on average 14% longer hours than women employees. While the longer working hours are motivated by diverse reasons, it is likely to be partly due to the relatively low net income from self-employment compared to employment (OECD/EU, 2017[106]). In Germany, the annual net median income of self-employed women was 10% lower than that of employed women in 2015.

Women's full-time entrepreneurship is likely to be held back by the same factors discouraging women's full-time employment, notably the high tax burden on second earners as well as insufficient supply of full-day childcare and full-day schooling. Women's entrepreneurship could be encouraged by making entrepreneurship more compatible with giving birth. Maternity benefit coverage depends on the women's choice of health insurance package. Self-employed women on maternity leave receive a benefit of about 70% of their previous income if they are covered by statutory insurance and have opted for sickness benefits. Alternatively, if they have purchased private health insurance with an option for a daily sickness allowance, they may receive a sickness allowance during the maternity protection period if they do not work or if they work only a limited time. In both cases, self-employed women with full maternity benefit coverage pay higher insurance contributions than self-employed workers without full coverage. Hence, the economic costs of childbirth are not spread across society, which raises the burden to women who consider going into maternity. By contrast, in the Netherlands, all self-employed women can receive a maximum of 100% of the minimum wages for 16 weeks, paid from general tax revenue (Conen, Schippers and Schulze Buschoff, 2016[107]). Ensuring adequate maternity benefits also for self-employed women would make entrepreneurship more compatible with giving birth.

Promoting role models encourages women's entrepreneurship and breaks gender stereotypes (OECD, 2017[104]). It can also encourage female students to pursue studies in science, technology, engineering and mathematics (STEM) fields, where women are under-represented (Kugler et al., 2017[108]). The Federal Ministry of Economy and Energy (BMWi) has launched an initiative *(FRAUEN unternehmen*) that advocates successful examples of female entrepreneurship. This initiative can be stepped up by advocating examples of successful female entrepreneurs in technology intensive sectors and cases of successful business models that effectively adopted new technologies in personal and professional services.

Increased presence of women in companies' management boards is effective in enlarging the pool of experienced female managers who are role models to potential entrepreneurs (Schmitt, 2015[109]). Following the introduction of legislation requiring publicly traded companies to have at least 30% female board members, the share of women on the supervisory board of those companies rose to 32%. However, the share of women on the boards of the largest listed firms is still lower than in Nordic countries and France (Holst and Wrohlich, 2018[110]). The government should encourage more firms to increase women's presence in the highest decision-making bodies. A higher share of women on boards is associated with better corporate performance in some cases (Post and Byron, 2015[111]) and with stronger corporate social responsibility (Bear, Rahman and Post, 2010[112]).

Reducing further the administrative burdens on entrepreneurship

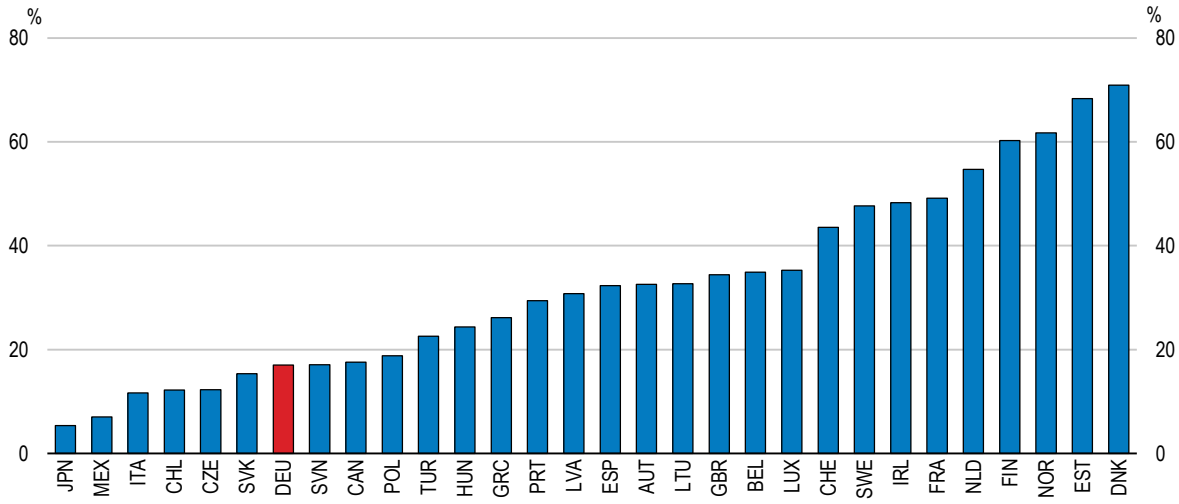
The administrative burdens on entrepreneurship are still considerable. Setting up a company in Germany takes more procedural steps and more time than in other advanced OECD economies (The World Bank, 2018[113]). There is scope to reduce the complexity of

administrative procedures, for instance, by applying more generally the "silence is consent" rule, whereby licences are automatically issued if the competent authority does not act within the statutory period (OECD, 2016[9]).

Administrative burdens can also be reduced by a well-developed e-government service that allows all procedures needed for starting up a company to be processed online. The government currently provides few online application forms and issuance of licences and certificates. Few individuals submit forms online (Figure 1.14). Furthermore, the scope of available services differs across municipalities and information is scarce (Commission of Experts for Research and Innovation, 2017[114]). Data exchange among authorities or between authorities and citizens is low, requiring firms and individuals to submit similar information to several authorities.

Figure 1.14. The use of e-government services is low

The share of individuals submitting forms to authorities online, 2016 or latest year



Note: Data refer to using the Internet for sending filled forms in the last 12 months. For country exceptions, see footnotes for Figure 4.15 in the publication, *OECD Digital Economy Outlook 2017*.
Source: OECD (2017), *OECD Digital Economy Outlook 2017*.

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Steps were taken to establish nationwide uniform online services while expanding the scope of services. Important legislation in late 2016 laid the framework for such upgrading of e-government service. For instance, the Online Access Improvement Act stipulated that the central and local governments must offer their administrative services online within five years and make them accessible via centralised administrative portals at the national or Länder level. Furthermore, the central government was given a mandate to design access to the administrative services of the Federal, *Länder* and municipal authorities. This legislation should be implemented swiftly. Upgraded e-government services should particularly enhance data exchange among authorities or between authorities and citizens.

Nationwide upgrading of e-government will raise demand for ICT solutions. For instance, digitalisation of some of the most essential administrative services would require an investment of around EUR 1.7 billion (Commission of Experts for Research and Innovation, 2016[115]). Public expenditure on e-government can be used to stimulate entrepreneurship, by reserving part of the public tender to ICT start-ups. An extensive use

of e-procurement, which Germany employs little (OECD, 2016[9]), encourages firms to adopt digital technologies and facilitate the participation of ICT start-ups in the public tender process.

Digitalisation of public services generates large administrative data. These data are valuable for researchers and entrepreneurs who can introduce new knowledge and products. However, the central government data portal (GovData) launched in 2015 is incomplete as it was left to each jurisdiction to decide on which administrative data should be made available on the portal. Some *Länder* are not participating. The data portal needs to be upgraded both in quality and scope. A law implementing open data principles in the federal administration entered into force in July 2017. Some *Länder* are also drafting their own laws for open data. In order to ensure uniform access to public data, the government should establish common criteria for administrative data that must be made available. In South Korea, the front runner in online accessibility to government data, the government mandates ministries and municipalities to make all data that match such criteria available in a centralised government portal (OECD, 2017[116]).

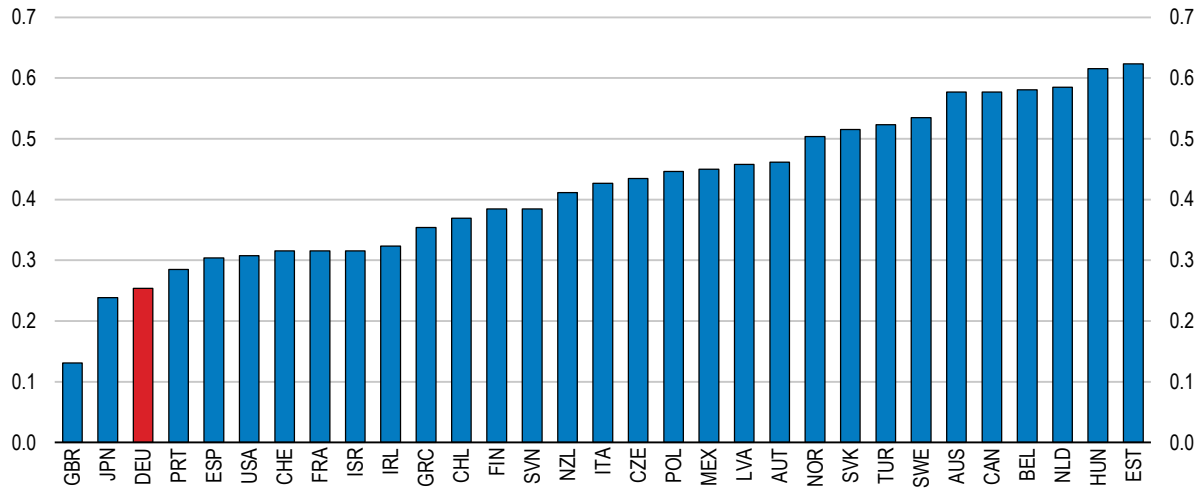
Making the insolvency regime less penalising to failed entrepreneurs

Entrepreneurship that leverages new technologies involves high risk of failure and a trial and error process. An efficient insolvency regime allows entrepreneurs to exit unsuccessful business in a timely fashion and start a new venture (Calvino, Criscuolo and Menon, 2016[117]). In particular, insolvency regimes which avoid harsh penalties for bankrupt entrepreneurs reduce the risk of entrepreneurship and are associated with higher rate of firms creation (Lee et al., 2011[118]). While an insolvency regime that is lenient to debtors may hold back lending, international evidence suggests that entrepreneur-friendly reforms in insolvency regime overall increase entrepreneurship (Fossen and König, 2015[119]). For instance, the reform of German personal bankruptcy law in 1999, which introduced debt relief measures, promoted entrepreneurship (Fossen, 2014[120]).

As a result of substantial reforms to facilitate restructuring, Germany's insolvency regime is among the most efficient in OECD countries (Figure 1.15). However, bankrupt entrepreneurs must wait up to 6 years until they are discharged from pre-bankruptcy indebtedness, resulting in high personal costs for failed entrepreneurs compared to many other OECD countries. The discharge period is on average 2.9 year among OECD countries (Adalet McGowan, Andrews and Millot, 2017[121]). The reform in 2014 allowed the discharge period to be reduced to 3 years, if the bankrupt entrepreneur repays 35% of debt. However, the repayment condition can be too demanding in some cases and could then undermine the purpose of providing a fresh start to failed entrepreneurs (Fossen and König, 2015[119]). The government should consider making the conditions for early discharge more flexible while maintaining adequate safeguards for creditors.

Figure 1.15. The insolvency regime is among the most efficient in OECD countries

OECD indicator of insolvency regime, composite indicator based on 13 components, 2016



Note: The OECD insolvency regime indicator capture (1) personal costs to failed entrepreneurs that include the time to discharge, (2) lack of prevention and streamlining and (3) barriers to restructuring. Higher values of the composite indicator correspond to more inefficiency.
Source: Adalet McGowan, M., D. Andrews and V. Millot (2017), "Insolvency regimes, zombie firms and capital reallocation", *OECD Economics Department Working Papers*, No. 1399.

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Ensuring a competitive business environment

Regulatory barriers to entry in some service sectors prevent new firms from introducing innovative business models that exploit new technologies. Some professional services in Germany remain protected by exclusivity rules and entry regulations. For example, some legal transactions for creating new businesses require notary services at a high regulated price, which also adds to administrative burdens on entrepreneurship.

It is particularly important to ensure that new markets created by digital technologies such as digital platforms remain competitive and open to entry. In highly dynamic digital services, large incumbents often acquire young innovative firms to expand their market dominance. An amendment to the competition law was passed in 2017 empowering the competition authority to investigate mergers and acquisitions (M&A) involving companies with relatively small turnover (less than EUR 5 million) but large transaction value (more than EUR 400 million) (BMWi, 2017[122]). The competition authority can also halt an M&A until the investigation concludes. The contestability of technology-intensive markets can also be preserved by allowing innovative start-ups to grow quickly (see below).

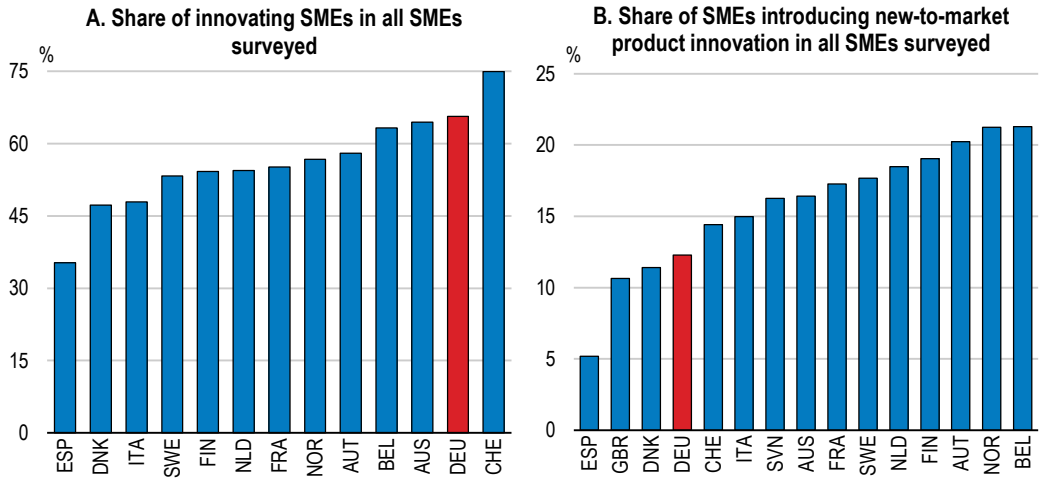
Supporting the innovation and growth by young firms and SMEs

Fast technological diffusion requires smooth resource allocation to innovative firms (Andrews, Criscuolo and Menon, 2014[49]). This is particularly important for start-ups at growth stage and for SMEs which need external funding to carry out drastic innovation. Although SMEs in Germany are on average more innovative than those in other advanced European countries (Figure 1.16, Panel A), they engage in incremental innovation rather than in radical innovation. For instance, fewer SMEs introduce novel products in Germany

than in peer countries (Figure 1.16, Panel B). Furthermore, the number of innovating SMEs in Germany is decreasing (KfW, 2016[123]). Subdued innovation activities such as research and development (R&D) hold back productivity growth and also limit the capacity of SMEs to absorb new technologies. In particular, the low take up of digital technologies by SMEs constrains their innovation capabilities, as ICT investment leads to more innovative activity (Fabritz, 2014[124]).

Figure 1.16. German SMEs engage more in incremental innovation

2012-14



Note: Based on the 2017 OECD survey of national innovation statistics and the Eurostat, Community Innovation Survey. International comparability may be limited due to differences in innovation survey methodologies and country-specific response patterns.
Source: OECD (2017), *OECD Digital Economy Outlook 2017*.

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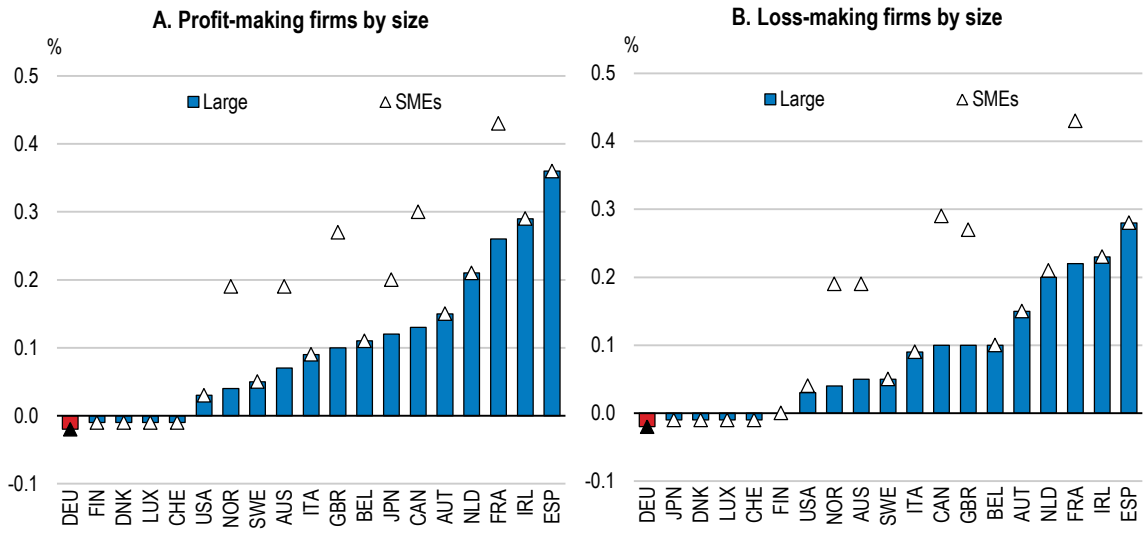
The investment costs for radical innovation may be becoming increasingly penalising for SMEs, as they need to spend more for qualified research and development personnel (Commission of Experts for Research and Innovation, 2016[115]). While Germany offers various types of research grants and technical assistance such as Competence Centres, it does not provide tax relief for business R&D activities (Figure 1.17). Most OECD countries combine direct support and tax incentives to stimulate innovation (Appelt et al., 2016[125]). The coalition agreement envisages the introduction of R&D tax incentives. The effectiveness of such tax incentives depends on their design. Many countries provide more generous tax relief to SMEs than large firms by targeting explicitly young firms or SMEs. (Figure 1.17, Panel A). Young firms or smaller firms indeed tend to react more strongly to R&D tax incentives than large firms (Appelt et al., 2016[125]).

In order to fully benefit young and small firms and projects involving basic research, R&D tax incentives often include cash refunds or reductions in social security and payroll taxes. For instance, France's *Crédit d'Impôt Recherche* provides young firms and SMEs immediate tax reimbursement on 30% of R&D expenses up to EUR 100 million. France also offers abatement of corporate tax and social security contributions for small firms younger than eight years which spend more than 15% of total expenditure on R&D for a limited period (*Jeune Entreprise Innovante* programme). The tax incentives should also be designed to allow young firms that are not yet generating taxable profits to be able to

benefit. Many countries indeed provide R&D tax relief to loss-making firms (Figure 1.17, Panel B), through a carry forward measure. For example, Ireland allows the R&D credit to be carried forward indefinitely or to be refunded gradually over a three year period that follows the R&D investment.

Figure 1.17. Germany does not provide tax relief to R&D expenditure

Tax subsidy rates on R&D expenditures (1-B-Index), by firm size and profit scenario, 2017



Note: 1-B index is an indicator capturing the extent to which the tax subsidy relieves the R&D costs of firms. It is based on quantitative and qualitative information representing a notional level of tax subsidy rate under different scenarios. It requires a number of assumptions and calculations specific to each country.
Source: OECD (2017), *OECD Science, Technology and Industry Scoreboard 2017: The digital transformation*.
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The effectiveness of R&D tax incentives also depends on the broader regulatory environment and how they are combined with direct support to innovation. Rigorous ex-post evaluation is needed to assess whether R&D tax incentives are stimulating innovation by SMEs in a cost-efficient way.

Start-ups at the growth-phase often find it difficult to finance their investment due to their young age, limited collateral and high risk. Young German high-tech start-ups particularly rely on equity financing (Metzger and Bauer, 2015[126]). Yet, the supply of private venture capital and growth financing is limited (OECD, 2017[94]). In 2017, private equity investment in Germany amounted to EUR 11.3 billion, 80% of which was buyouts (BVK, 2018[127]). Growth financing and venture capital comprised only 12% and 8% of total equity investment, respectively. Several measures promote equity financing for start-ups at different stages of development. They provide government-funded venture capital in partnership with private investors. For example, a public fund provides equity to business angels for financing innovative companies in their early phases, while another finances fast-growing underfunded companies. Altogether, these funds amount to approximately USD 4 billion (OECD, 2017[101]). Furthermore, legislation adopted in 2016 expanded the options for carrying forward losses when a business is sold. This tax reform may increase the supply of venture capital.

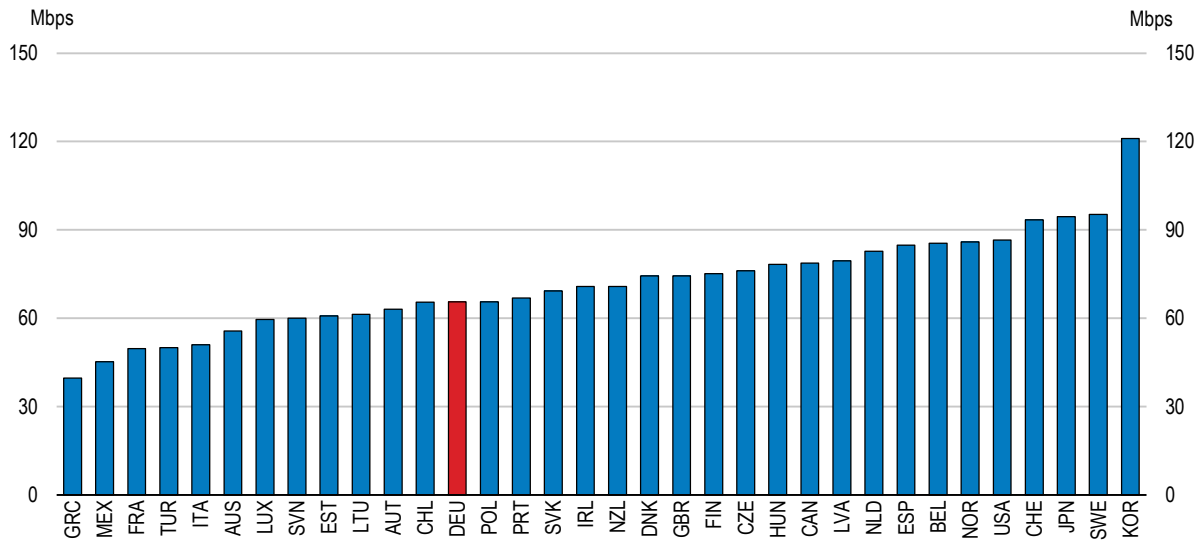
Initial public offering (IPO) is a key avenue for innovative start-ups in growth phase to attract sizable capital. It also provides private venture capital with high-return exit opportunities. However, the number of IPOs in Germany has been subdued after the financial crisis (Metzger and Bauer, 2015[126]). The number of IPOs and their value in Germany (Deutsche Börse) is considerably smaller as compared to the United Kingdom (London Stock Exchange), Switzerland (SIX Swiss Exchange) or Sweden (Nasdaq Stockholm) (Pricewaterhouse Coopers, 2017[128]). A new market segment in Deutsche Börse for young high growth firms ("Scale") was launched in 2017, replacing the previous equivalent segment "Entry Standard," with stricter admission criteria and follow-up obligations. A network was founded by the stock exchange *Deutsche Börse* for firms that have the potential for an IPO (*Deutsche Börse Venture Network*), which can provide technical assistance to help young firms seeking IPOs comply with those procedures.

Strengthening competition in high-speed broadband networks

High-speed Internet is a prerequisite for the adoption of many data-intensive new technologies (OECD, 2017[101]). However, the average Internet connection speed is considerably slower in Germany than in peer countries (Figure 1.18). Furthermore, the connection speed to access the Internet varies greatly across regions within Germany. The government and the business community recognise that lagging average Internet connection speed is an important impediment to more intensive use of digital technologies (BMWi, 2017[129]). Meanwhile, related to lower levels of competition, average mobile data use is low in Germany compared to many OECD countries.

Figure 1.18. The internet connection speed is slow

Akamai's average peak connection speed, Q1 2017



Source: Akamai (2017), "Akamai's state of the Internet report: Q1 2017 report", https://www.akamai.com.

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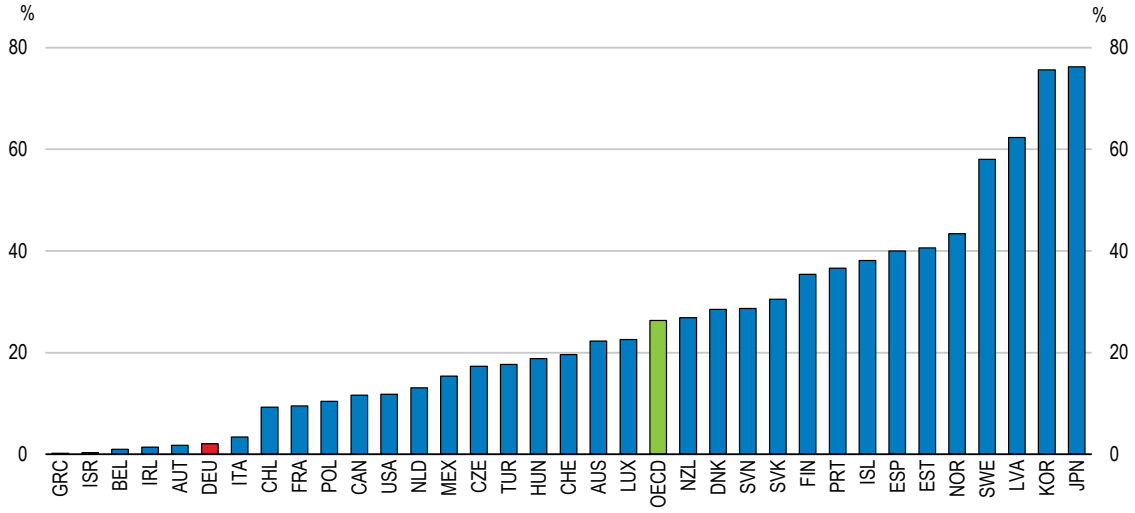
Expanding use of data-intensive new technologies in the near future, such as autonomous vehicles, will require digital infrastructure with significantly higher transmission capacity. Although network operators are deploying more fibre into their network to cope with the growing demand for data transmission, the deployment of fibre in the final connections to

users has been very slow (OECD, 2017[101]). As a result, only 2.1% of broadband subscriptions in Germany are fibre connections, a share that is much smaller than in most other advanced OECD countries (Figure 1.19).

Figure 1.19. Fibre penetration is significantly lower than the OECD average

Percentage of fibre in total broadband subscriptions, June 2017



Note: Fibre subscriptions data includes FTTH, FTTP and FTTB and excludes FTTC.
Source: OECD (2018), Broadband Portal, www.oecd.org/sti/broadband/oecdbroadbandportal.htm.

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The government aims at rolling out a comprehensive gigabits network throughout the country by 2025. A public and private sector consortium (*Netzallianz Digitales*) agreed to invest EUR 100 billion to reach this goal. However, the government acknowledges that a faster pace of investment is needed to reach the goal (BMWi, 2017[122]). It foresees additional public investment especially in rural areas where private, unsubsidised infrastructure provision may not be sufficient (BMWi, 2017[122]). The coalition agreement put forth the Gigabit Fund of EUR 10 to 12 billion using revenues from a forthcoming radio spectrum auction. Public funding for investment projects should be based on cost-benefit analysis.

Private investment in gigabit networks should be accelerated while strengthening competition. The government envisages allowing providers of a fibre access network to charge higher wholesale prices to third parties, in order to make the investment more attractive (BMWi, 2017[122]). However, if this fibre is provided by a new entrant and the access price for the wholesale fibre network is considerably higher than that of a copper network, Internet service providers may prefer to use the existing copper network to provide less expensive services (Briglauer, Cambini and Grajek, 2017[130]), even though the quality of services offered could be substantially higher when using a fibre network. This may reduce the demand for fibre networks and thus the return to such investment. On the other hand, if fibre networks are provided mainly by the incumbent replacing copper networks, the envisaged higher wholesale price would result in higher access prices and a substantial increase of the incumbent's market power. This would limit access by small firms and by consumers to high-speed Internet services. An alternative path would be lighter regulation for wholesale-only providers of fibre networks.

The efficiency of investment in gigabit networks can be improved by adequate regulation. For example, the government recently introduced regulation making it mandatory to lay fibre optic cables in the construction of new roads and residential buildings, a welcome measure that increases supply of fast networks at lower cost. The government can extend this obligation to the renewal and repair of existing roads and buildings.

Regulation can be used to invigorate competition by promoting market entry in mobile networks. Germany has three mobile network operators. Experience across countries has shown that moving from three to four operators (such as in France) makes a substantial difference for service prices and innovation (OECD, 2014[51]). Higher demand for mobile services would also raise the demand for services on the fixed broadband network, facilitating their quicker deployment and reducing access prices, as scale economies could be utilised. The upcoming spectrum auction for mobile communication is an opportunity to boost market entry. For example, the Canadian government has been setting aside a significant share of radio frequency spectrum to new entrants, in order to promote competition (Industry Canada, 2014[131]). The German government could consider a similar approach to foster new entry for the next radio spectrum auction expected to be used for 5G. The potential demand from new entrants can be large. For instance, Australia, Italy and Singapore are moving from three to four mobile operators in 2018.

German workers need to prepare for the future of work

The diffusion of new technologies has often been associated with concerns that it displaces workers whose tasks and skills are rendered obsolete (Autor, 2015[132]). Routine tasks follow well-defined protocols which can be programmed and executed by computer-controlled machines. While many routine manual tasks have already been automated, digital technologies are now automating routine cognitive tasks often performed by middle-skilled workers (Autor, Levy and Murnane, 2003[133]; Goos, Manning and Salomons, 1993[134]).

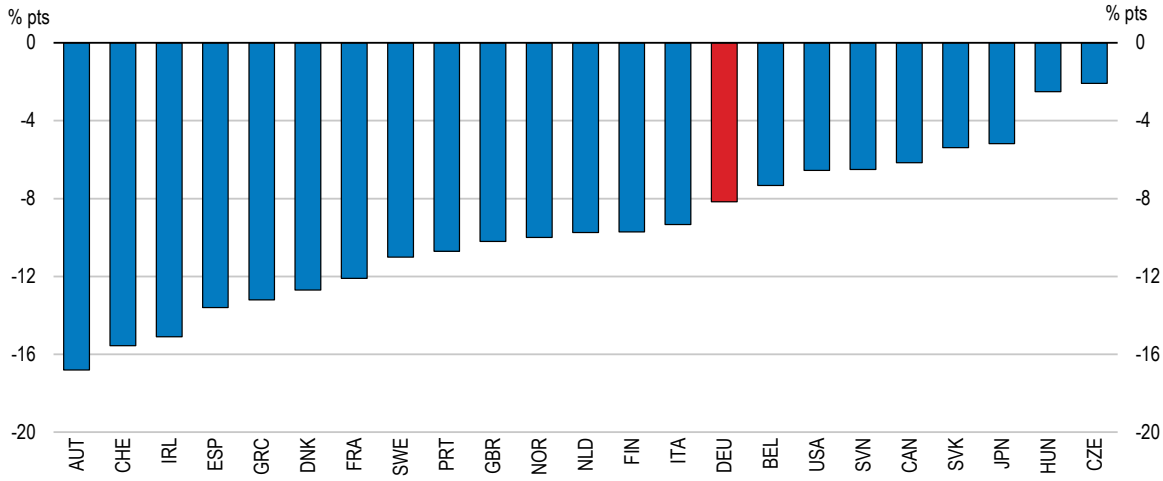
Across OECD countries, the share of jobs requiring mid-level skills has declined (Figure 1.20), while those of high-skilled and low-skilled jobs increased. This phenomenon has also occurred in Germany, although not to the same extent as in Nordic countries and the United Kingdom. While some growing service and sales occupations are classified as low-skilled jobs, they require vocational education and training in Germany and thus may be considered middle-skilled jobs (BDA, 2017[135]). However, such jobs earn only two-thirds of the mean hourly wage in Germany (Eurostat 2014 Structure of Earning Survey). The share of middle-skill jobs in Germany decreased in a wide range of manufacturing industries and important services such as wholesale and retail trade (Figure 1.21). However, it increased in a few sectors such as finance and accommodation. Decreasing middle-skill jobs implies diminished opportunities for low-skilled workers to upskill and move up to jobs that provide decent income and living standards.

Cognitive non-routine tasks typically taken up by high-skilled workers are less likely to be automated (Autor, Levy and Murnane, 2003[133]). In particular, digital technologies increase the demand for workers endowed with skills that are complementary, such as advanced reading, numeracy and problem solving skills (OECD, 2016[136]). Those workers are likely to be well remunerated. On the other hand, it is foreseen that the demand for low-skilled workers will decrease in Germany, although not as much as for middle-skilled workers (Warning and Weber, 2017[54]). Low-skilled workers are also likely to suffer wage losses as they compete with displaced middle-skilled workers for low-skilled jobs. The impacts of new technologies on labour demand and earnings inequality are compounded by the

"winner-takes-all" product market structure brought about by new technologies such as digital platforms. The large rents generated by such a market structure tend to accrue mostly to top managers and investors financing the innovation (Guellec and Paunov, 2017[137]).

Figure 1.20. The share of middle-skilled jobs in employment has declined

Percentage point change in the share in total employment between1995 and 2015



Note: Middle-skilled occupations include jobs classified under the ISCO-88 major groups 4, 7, and 8. These are clerks (group 4), craft and related trades workers (group 7), and plant and machine operators and assemblers (group 8).
Source: OECD (2017), *OECD Employment Outlook 2017*.

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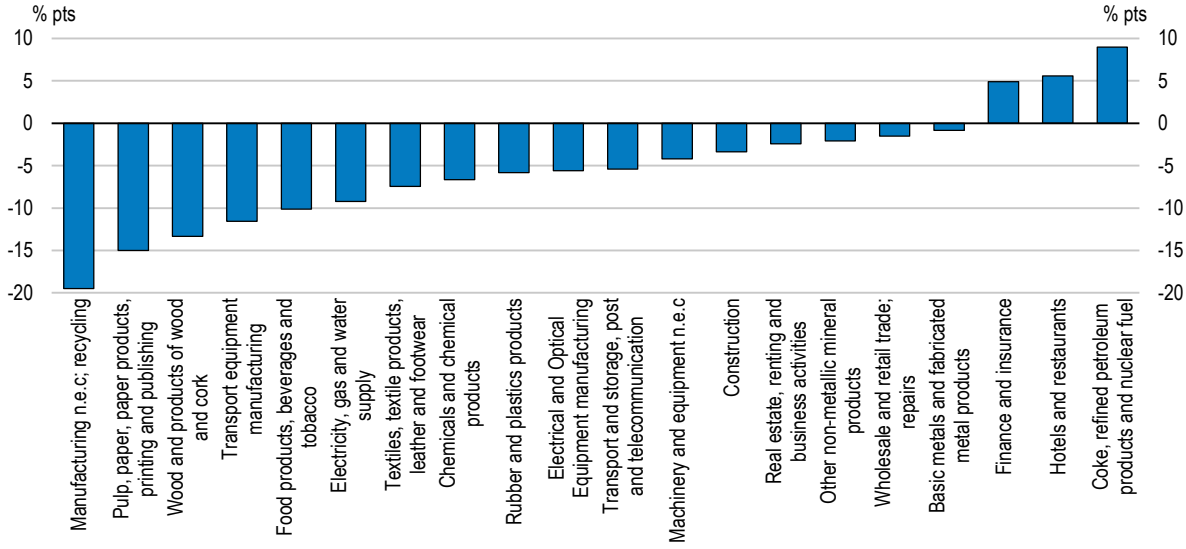
According to estimates using workers' reports of tasks involved in their job from the OECD's Survey of Adult Skills (PIAAC), Germany has a relatively high share of jobs that are at risk of automation (Nedelkoska and Quintini, 2018[138]). In about one-third of jobs, between 50% and 70% of tasks are at risks of automation (Figure 1.22). While these jobs may not be substituted by machines, workers will need to acquire new skills as these jobs likely will undergo radical transformation.

The risk of automation or radical changes in tasks differs substantially across jobs in Germany (Figure 1.23). While low skill routine jobs such as food preparation assistants, cleaners and refuse workers are most prone to such risks, some mid-level skill jobs requiring at least some training such as drivers and machine operators or jobs involving cognitive routine tasks such as clerical support workers are also highly exposed to the risk of automation. On the other hand, managers and professionals with specialised knowledge, who are mostly engaging in non-routine cognitive tasks, are least prone to automation.

The risk of automation or radical changes in tasks also differs substantially across industries (Figure 1.24). Labour intensive services such as transport and storage, accommodation as well as wholesale and retail trade have the highest shares of jobs that are prone to such risks. These services included 23% of employment in Germany in 2016 (European Labour Force Survey). On the other hand, sectors that already underwent significant digitalisation such as ICT services and telecommunication have relatively low shares of jobs prone to automation. Sectors that are characterised by non-routine cognitive tasks such as education and professional services or non-routine manual tasks like care and social work activities are also less exposed to the risk of automation.

Figure 1.21. Middle-skilled jobs in Germany decreased in a wide range of sectors

Percentage point change in the share in total employment between1995 and 2015



Note: Middle-skilled occupations include jobs classified under the ISCO-88 major groups 4, 7, and 8. That is, clerks (group 4), craft and related trades workers (group 7), and plant and machine operators and assemblers (group 8).
Source: OECD calculations based on European Labour Force Survey.

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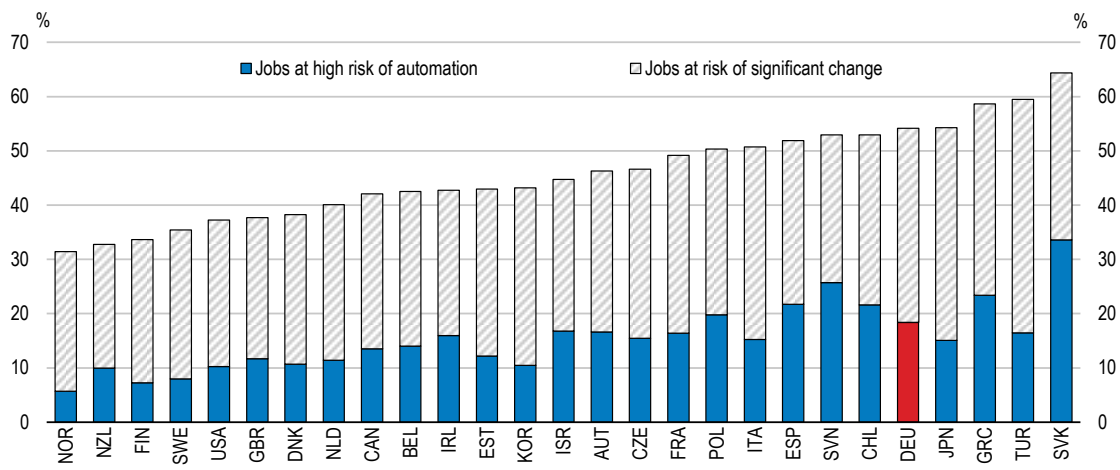
Figure 1.22. Many jobs are at risks of significant change

The share of jobs at high risk of automation and significant change



Note: Jobs are at high risk of automation if the likelihood of their job being automated is at least 70%. Jobs are at risk of significant change if the likelihood is between 50 and 70%.
Source: Nedelkoska, L. and G. Quintini (2018), "Automation, skills use and training", *OECD Social, Employment and Migration Working Papers*, No. 202, OECD Publishing, Paris.

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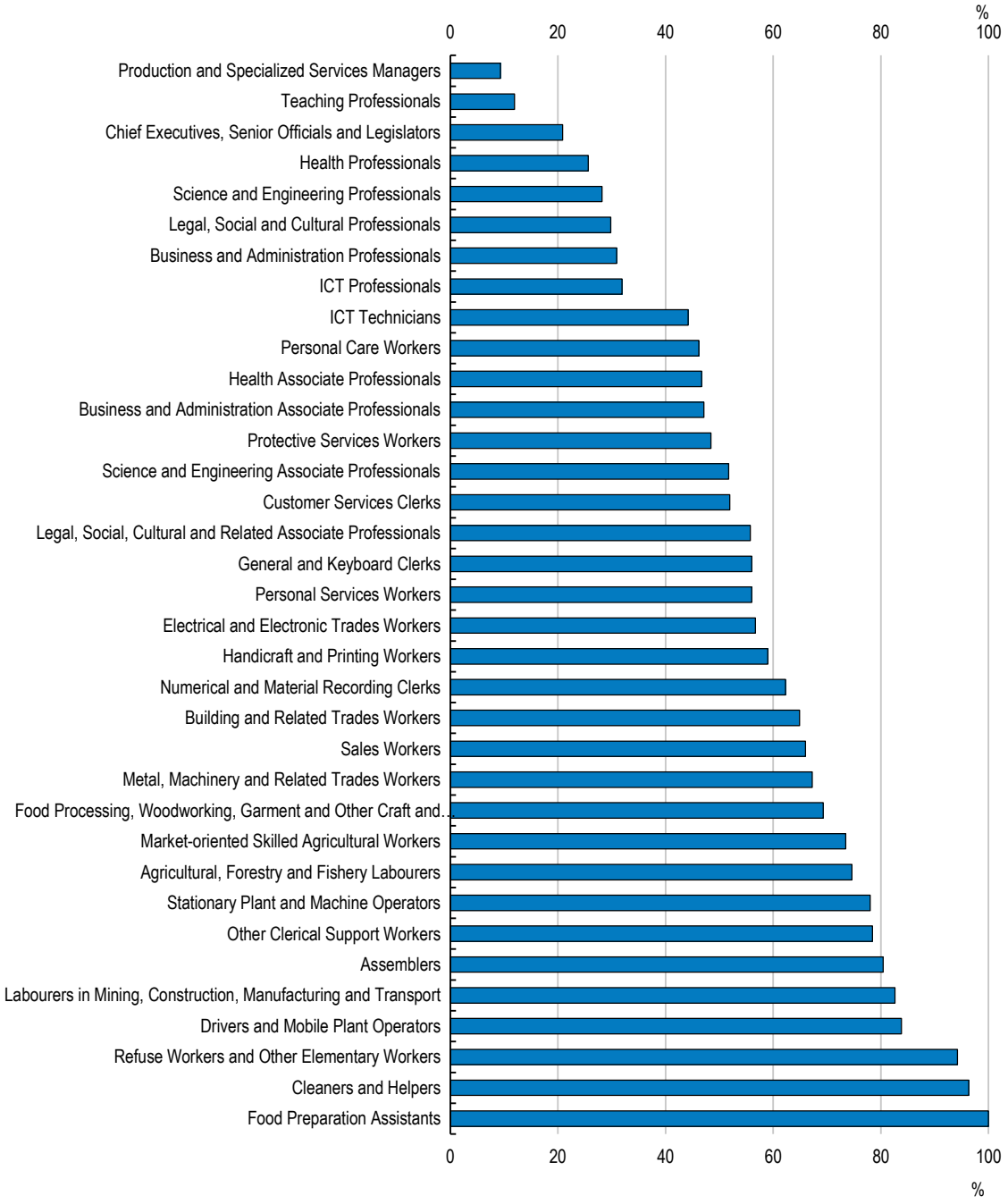
Figure 1.23. Low- to mid-level skill jobs face particularly high risk of automation

The share of jobs at high risk of automation and significant change, by occupation



Note: Jobs are at high risk of automation if the likelihood of their job being automated is at least 70%. Jobs are at risk of significant change if the likelihood is between 50% and 70%.

Source: Nedelkoska, L. and G. Quintini (2018), "Automation, skills use and training", *OECD Social, Employment and Migration Working Papers*, No. 202, OECD Publishing, Paris.

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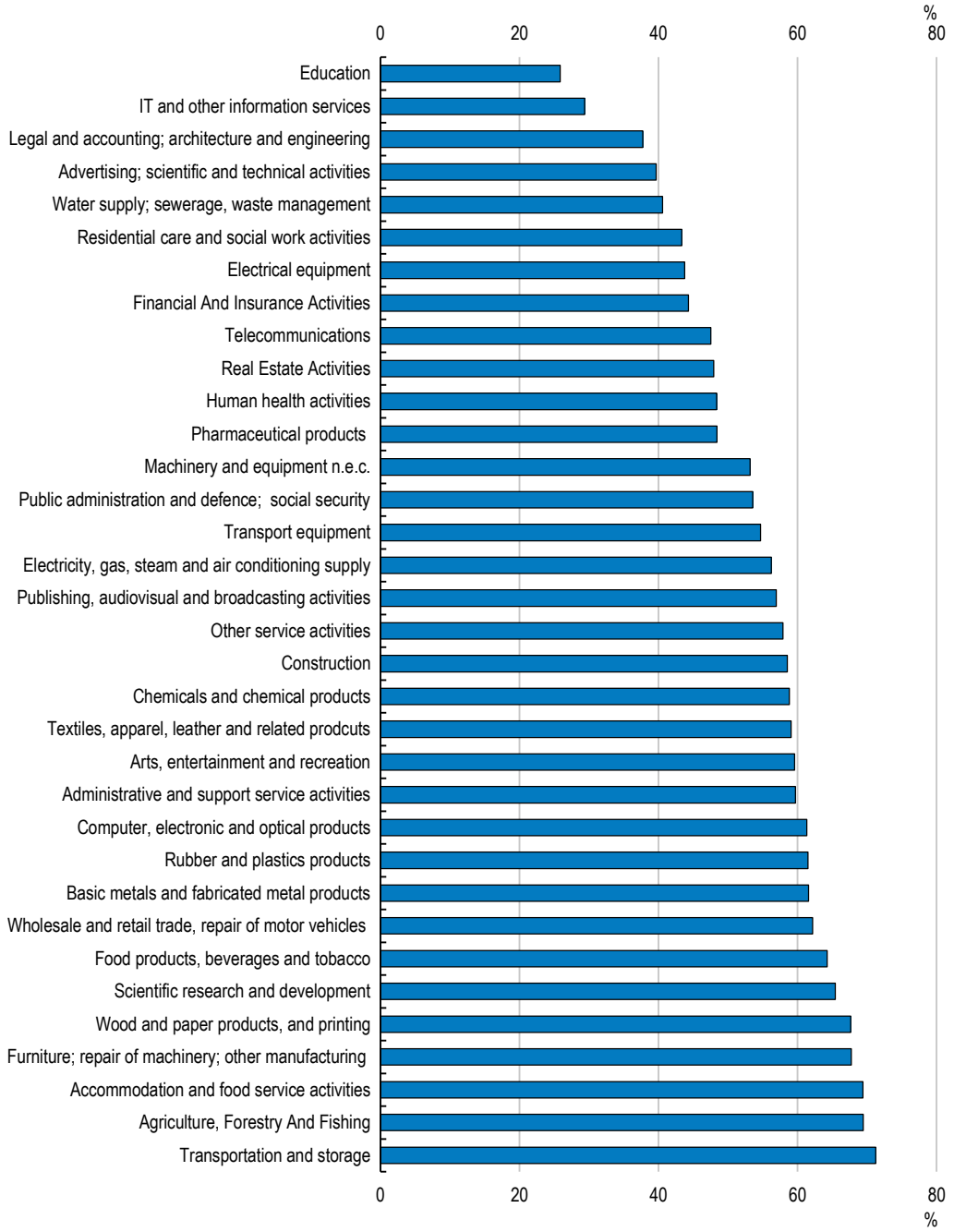
Figure 1.24. Manufacturing and some services face particularly high risk of automation

The share of jobs at high risk of automation and significant change, by industry



Note: Jobs are at high risk of automation if the likelihood of their job being automated is at least 70%. Jobs are at risk of significant change if the likelihood is between 50% and 70%.
Source: Nedelkoska, L. and G. Quintini (2018), "Automation, skills use and training", *OECD Social, Employment and Migration Working Papers*, No. 202, OECD Publishing, Paris.

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The current trends in the labour market driven by digitalisation indicate the need to prepare many workers for new jobs and tasks shaped by digital technologies. To this end, the

coalition agreement foresees strengthening preventative active labour market policies to increase the employability of workers, especially at old age, through continuous skill updating and career counselling. It also envisages increasing participation in lifelong learning. While these initiatives are welcome, low- and middle skilled workers whose jobs are most vulnerable to technological change participate less in lifelong learning than high-skilled workers (OECD, 2016[9]). Efforts to reach out to low- and middle skilled workers and encourage their upskilling are needed to ensure the effectiveness of those measures. Chapter 2 elaborates on skill formation and its effective use.

Higher flexibility in work must be flanked by effective worker protection

Preventing exploitation under flexible work arrangements

Digital technologies offer opportunities for more flexible work arrangements which allow workers to balance work with family obligations and leisure. German workers indeed express strong preference for more autonomy with respect to where and when to work (Federal Ministry of Labour and Social Affairs, 2017[139]). Especially for working parents, being able to work at least partially from home improves work-life balance considerably. Increasingly many German parents express wish for such work arrangement, but often face unavailability due to their employers not offering such an option (Federal Ministry for Family Affairs, Senior Citizens, 2016[140]). At the same time, flexible work arrangements increase risks of overwork and breakdown of boundaries between work and private life that impact worker's health negatively. Also, diffusion of new digital technologies are shaping new norms so that workers are expected to be reachable outside working hours, which can jeopardise work-life balance (Federal Ministry of Labour and Social Affairs, 2017[139]).

Germany's Working Time Act contains regulations that are stricter than the European Working Time Directive. For instance, the working hour limit is on a daily basis (eight hours per day) instead of weekly, and the rest day is designated as Sunday. Those regulations may limit work flexibility in Germany compared to other European countries (The Council of Economic Experts, 2017[141]). Although the Working Time Act already includes provisions to extend the daily working hours upon collective agreement, it is worth assessing if such provisions are sufficient for fully reaping the benefits of flexible work arrangements. In the near term, there may be a case for allowing employers and employees to choose between daily or weekly limits on working hours through collective agreement, while maintaining the general daily limit as default where such agreements do not exist. In the medium term, comprehensive legislation stipulating a worker's right to choose the length of working time or scheduling of their working time should be introduced. This view was also expressed in a white paper by the Federal Ministry of Labour and Social Affairs (Federal Ministry of Labour and Social Affairs, 2017[139]) although it does not represent the official government view.

Extending protection to the self-employed working on digital platforms

Digital platforms facilitate more efficient matching between the demand and supply of labour, products and tasks. This creates greater opportunities for workers to enjoy the flexibility and benefits of freelancing, and to combine several jobs. As more workers take up short-term one-off jobs (gig work) on digital platforms, the number of self-employed workers, especially those without employees (solo self-employed) is likely to rise. Not all platform workers are (solo) self-employed, because there are employees, students or pensioners who also work on digital platforms to earn additional income. On the other hand, some (solo) self-employed working on digital platforms can be regarded as employees, if

they are bound to rules on working hours and places of work or are dependent on equipment and tools provided by the platform or the customer (Waas et al., 2017[142]). They can also be regarded as "employee-like persons" if their primary income depends on the revenue from the work they receive via a specific platform or customer (Waas et al., 2017[142]).

The share of solo self-employed in Germany has been rising since the 1990s but declined somewhat in recent years to 5%. This contrasts with some countries such as the United Kingdom or the Netherlands where the share surged. However, the current strong labour market performance may be masking a structural increase in solo self-employment facilitated by digital platforms, as opportunities to work as an employee are abundant.

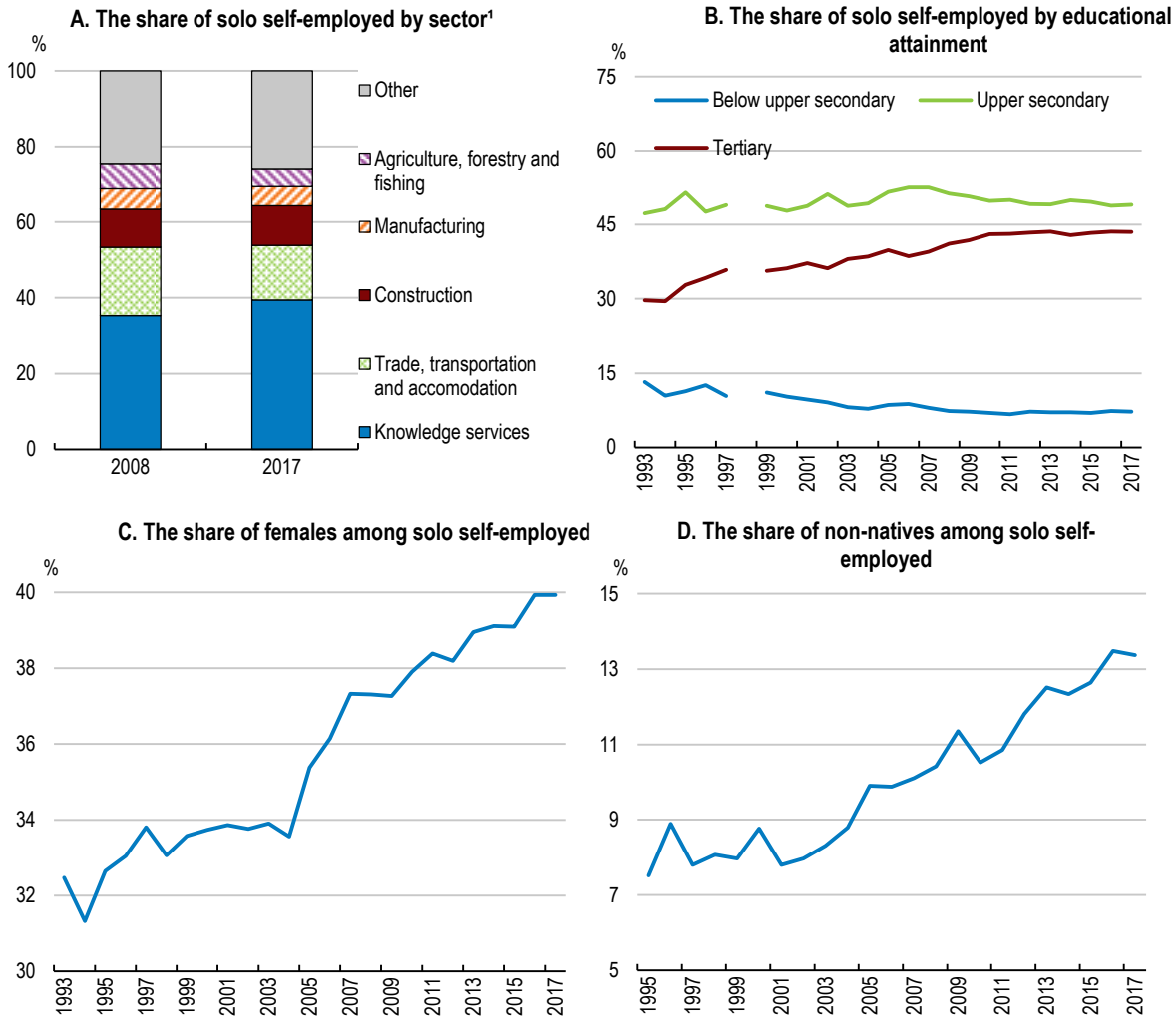
Solo self-employed include diverse types of workers. Some 40% of the solo self-employed engage in knowledge-intensive activities such as professional services, information and communication, art and entertainment, teaching and finance (Figure 1.25, Panel A). Also, they have become more likely to be highly educated (Figure 1.25, Panel B). On the other hand, one-third of solo self-employed engage in less technology intensive activities such as health and social work, wholesale and retail and construction. Some individuals choose solo self-employment out of necessity, for instance because standard employment does not provide sufficient work flexibility or income (Conen, Schippers and Schulze Buschoff, 2016[107]). The share of women and immigrants in solo self-employment have been rising (Figure 1.25, Panel C and D). About 40% of solo self-employed are women. The share of immigrants is likely to rise further as some refugees who are granted asylum may start their own businesses.

As in many countries, measures to protect workers from exploitative work conditions in Germany are intended for employees and do not extend to most of the self-employed. For instance, the statutory minimum wage does not apply to the self-employed. There are also no legal measures to protect the self-employed from excessive working hours or job termination, and this also applies to self-employed workers who rely on digital platforms for employment. The self-employed also do not enjoy paid holidays and paid sick leave, which are guaranteed by law for employees. The self-employed are also not covered by the mandatory accident insurance against workplace injuries, except for few occupations. They enrol on voluntary basis to insurance provided by professional associations (*Berufsgenossenschaft*) and pay the contributions themselves. Such gaps in protection measures between employees and the (solo) self-employed are problematic when the self-employed are employee-like persons.

The self-employed are often not covered by the social protection that workers with standard employment contracts enjoy. In particular, with exception of some professionals, the self-employed in Germany are not covered by the mandatory public pension. This raises the risks of old-age poverty where the self-employed have to rely on social assistance benefits during their retirement (Spasova et al., 2017[143]). Extending the coverage of mandatory public pension to the self-employed allows Germany to prepare for the future of work. The new government indeed plans to introduce compulsory pension insurance for the self-employed, eventually including them in the public pay-as-you-go pension scheme. Inclusion in the public pension system appears to be the most effective, for example to cover disability risks, ensure integration with the means-tested minimum pension and avoid mobility barriers.

Figure 1.25. The solo self-employed in Germany are diverse

15-64 year-olds



Note: Classification of economic activities based on NACE Rev. 2.
Source: Eurostat (2018), Employment and unemployment (Labour Force Survey) Statistics.

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The self-employed in Germany are required to enrol in health insurance but are not covered by the public health insurance unless they were insured by public insurance before becoming self-employed (Spasova et al., 2017[143]). They must instead purchase private insurance with contributions that are not income contingent. The self-employed earning low income often face difficulties in paying such contributions (OECD, 2014[144]). The government should allow all self-employed to enrol in public healthcare insurance.

Establishing bargaining frameworks for platform workers

Some workers providing services on digital platforms can be comparable to employees (see above). Yet, platform workers tend to receive lower compensation compared to dependent employees doing the same job (Katz and Krueger, 2016[145]). Their bargaining power with respect to customers or platform providers can be weakened by the lack of representation

and collective bargaining framework. Increasing the representation of platform workers would allow them to engage in effective bargaining for their remuneration as well as for benefits such as workplace injury insurance.

European competition regulation forbids independent contractors from bargaining collectively (OECD, 2017[146]). However, such regulation does not apply to the self-employed that are deemed as employee or employee-like persons. Also, the Collective Agreement Act allows trade unions and professional associations to engage in bargaining on behalf of the self-employed, if they are deemed employee-like persons (Federal Ministry of Labour and Social Affairs, 2017[139]). The government is providing support for online platform workers to organise. Some social partners have engaged to set up a guideline for the contract relation on digital platforms. Further steps to establish an effective bargaining framework for platform workers that are deemed as employee-like persons are warranted.

Recommendations for boosting productivity and preparing for the future of work

Strengthen entrepreneurship

- **Ease the conditions for bankrupt entrepreneurs to be discharged of debt after three years while maintaining adequate safeguards for creditors.**
- **Create a one stop shop to process all procedures for starting up a company online.**
- Encourage firms to increase women's presence in the highest decision making bodies.

Promote competition in and expand higher speed broadband networks

- **Use the upcoming radio spectrum auction to promote competition in the mobile market.**
- Consider reserving a part of the auction of radio spectrum for new entrants.
- Foster deeper and faster deployment of fibre in fixed networks through competition, such as that generated by municipal networks, particularly in smaller cities and rural areas.
- In the absence of sufficient infrastructure competition, continue to ensure that access seekers have the ability to provide services over fibre networks, particularly those that involve public funding. Also look for opportunities to lighten regulations for wholesale-only networks.

Strengthen the protection of workers with flexible work arrangements

- **Make enrolment in public old-age pension mandatory for the self-employed who are not covered by old-age pension insurance.**
- **Open access to public health insurance to all self-employed.**
- Support platform workers deemed to be employee-like persons to get organised.

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Chapter 2. Improving skills and their use

Cognitive skills, such as reading and numeric skills, are key determinants of wages, employment and long-term economic growth. Good cognitive skills also reduce poverty risk and improve non-material wellbeing, such as health and social cohesion. Non-cognitive skills, such as skills to use information and communication technology as well as managerial skills, also help workers adapt to new technologies and globalisation. In Germany cognitive skills among adults are above OECD average, but weaker than in leading economies, especially among individuals with low and middle qualifications. Much progress has been made to improve learning outcomes of youth with disadvantaged socio-economic background. Nonetheless, high-quality childcare, early childhood and full-day primary education still need to expand. The vocational education system is very successful in integrating young people well in the labour market. Strengthening general education within the successful vocational education and training system could help ensure the capacity of graduates to adapt to technological change at higher age in the future. Participation in life-long learning could be encouraged by better addressing individual training needs. This could improve prospects for adults without professional qualifications. Women's skills are used less well than men's, calling for policies to address gender imbalances in the labour market.

Adult skills are a major determinant of long-term growth and wellbeing

Skills are a strong determinant of economic growth. For example, simulations have suggested that an improvement from a middle to a top-range position across OECD countries in average cognitive skills over a 20-year period would raise GDP by 4% after 35 years and by more than 25% after 75 years (Hanushek and Woessmann, 2008[147]) mostly by boosting productivity. The link between skills measures and growth is particularly strong for Germany (Hanushek et al., 2015[148]). The OECD Programme for the International Assessment of Adult Competencies allows analysing skills in the adult population and their impact across countries (PIAAC; Box 2.1).

Cognitive and non-cognitive skills also raise individual employment and wage prospects substantially. They put individuals in a better position to take advantage from technological change and globalisation. Moreover, skills have substantial impacts on other wellbeing dimensions, such as health. How much workers can use their skills at the workplace also has an impact on their wages, productivity and job satisfaction (Box 2.2). Hence, policies which strengthen workers' skills and their use are key for wellbeing and competitiveness.

Box 2.1. The OECD Programme for the International Assessment of Adult Competencies (PIAAC)

The PIAAC survey is based on a questionnaire administered to individuals in households representing the population aged between 16 and 65. On average, across countries, 77.5% of participants were assessed on a computer, while the rest took the paper-based assessment. It was designed to measure key cognitive and workplace skills and provides indicators on the proficiency of individuals in literacy, numeracy and problem-solving in technology-rich environments, measured on a 500-point scale. PIAAC has extensive information on skill use at work and at home and background variables such as educational attainment, employment status, job, socio-economic background and personal characteristics. Most participating OECD countries, including Germany, conducted the survey in 2011-2012. Further countries conducted the Survey in 2014-15.

Source: Adalet McGowan, M. and D. Andrews (2017), "Skills mismatch, productivity and policies: Evidence from the second wave of PIAAC", *OECD Economics Department Working Papers*, No. 1403.

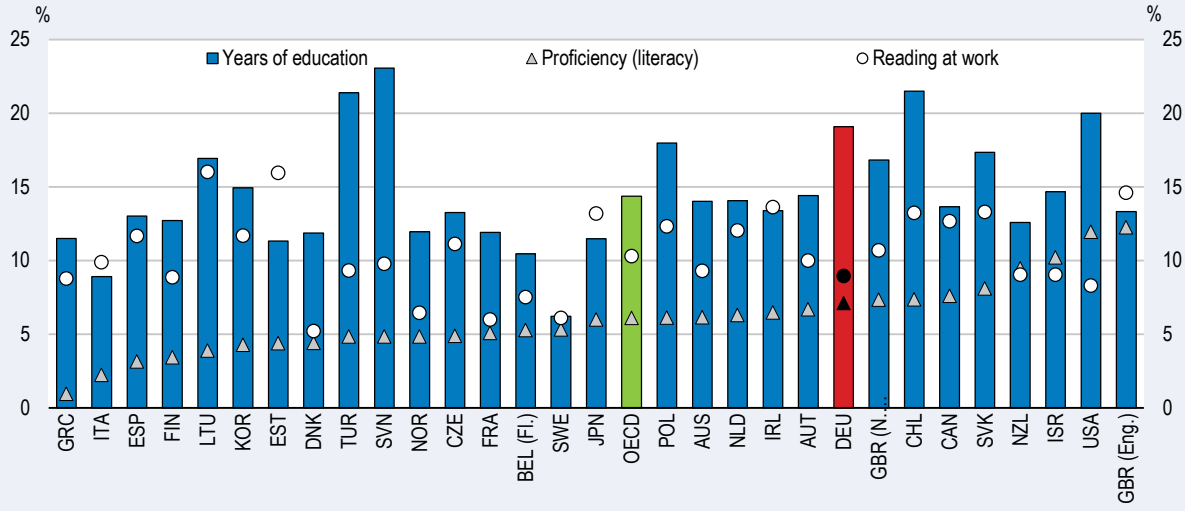
As this chapter will argue, Germany has a strong vocational skills system, supporting an excellent integration of young people in the labour market as well as the country's specialisation in high-productivity technology-intensive manufacturing and sophisticated business services. Germany has also made reforms to improve education outcomes, in particular among pupils with a disadvantaged socio-economic background. Nonetheless, looking into the future, demographic ageing and skill-biased technological change pose additional challenges, to which the skills system needs to adapt to make sure it continues to deliver. Scope also remains to boost skills among individuals with disadvantaged socio-economic background.

Box 2.2. Impact of skills on earnings, productivity and wellbeing

Among the adult population, three years more of full-time education is associated with almost 20% higher wages in Germany, according to the PIAAC study. In addition, adults with the same education level but higher reading proficiency earn substantially higher wages. These impacts are bigger in Germany than in many other OECD countries (Figure 2.1), which may reflect stronger specialisation on skill-intensive activities than in other OECD countries. Cognitive skills also raise employment prospects. This impact rises with age, suggesting that skills are also important to make the most of ageing (Hanushek et al., 2015[149]). Competencies related to information and communication technology are also strongly related to higher wages (Hanushek et al., 2015[149]).

Figure 2.1. Education, literacy proficiency and use of reading at work boost wages

Percentage change in wages associated with a change of one standard deviation in years of education, proficiency in literacy and use of reading at work



Note: Hourly wages, including bonuses, in PPP-adjusted USD (2012). Coefficients from the OLS regression of log hourly wages on years of education, proficiency and use of reading skills at work, directly interpreted as percentage effects on wages. Coefficients adjusted for age, gender, foreign-born status and tenure. The wage distribution was trimmed to eliminate the 1st and 99th percentiles. One standard deviation in proficiency in literacy is 48 points. One standard deviation in years of education is 3.2 years.
Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

StatLink http://dx.doi.org/10.1787/888933738274

Controlling for proficiency, greater use of reading, writing and ICT skills is also correlated with higher hourly labour productivity. This is shown for the use of reading at work in Figure 2.1. How much workers use their skills at the workplace has an even stronger impact on wages than skills themselves (OECD, 2016[150]). These findings suggest that policies need not only support skills but also skills use. Improving skills use also requires making skills more visible e.g. through forms of assessment and recognition of skills (see also below).

Cognitive skills are also an important determinant of participation in global value chains (GVCs) and associated productivity gains. For example they help workers incorporate imported technology-rich goods in domestic production. Countries can also reduce

workers' exposure to the risk of job displacement by investing in skills, as some skills are more difficult to outsource.

Non-cognitive skills are also important so workers can make the most of technological change and globalisation. Jobs that involve face-to-face interactions, the need to be on-site, and decision making are less easy to offshore. ICT skills, management and communication skills, and readiness to learn show a significant positive correlation with productivity and the capacity to supply products to GVCs.

Better education and skills has contributed to lengthening life expectancy. More intensive use of skills is also associated with better job satisfaction (OECD, 2016[150]). More literate adults are more likely to engage in volunteering, trust other humans more and have more confidence in their own capacity to influence collective decision-making. Social skills are strongly related to life satisfaction and, to a lesser extent, self-rated health (Kosse et al., 2016[151]). The important role of education and acquired skills in upward social mobility has also been well documented.

The impact of skills on economic growth, income and wellbeing is reinforced by skill-biased technological change (Chapter 1). Hanushek and co-authors argue that more rapid economic change boosts the returns to cognitive skills, as they put workers in a better position to take advantage of technological change and reduce the risk of being left behind. Indeed, in countries with a strong record of economic growth, individual returns to adult numeracy skills tend to be higher (Hanushek et al., 2017[152]).

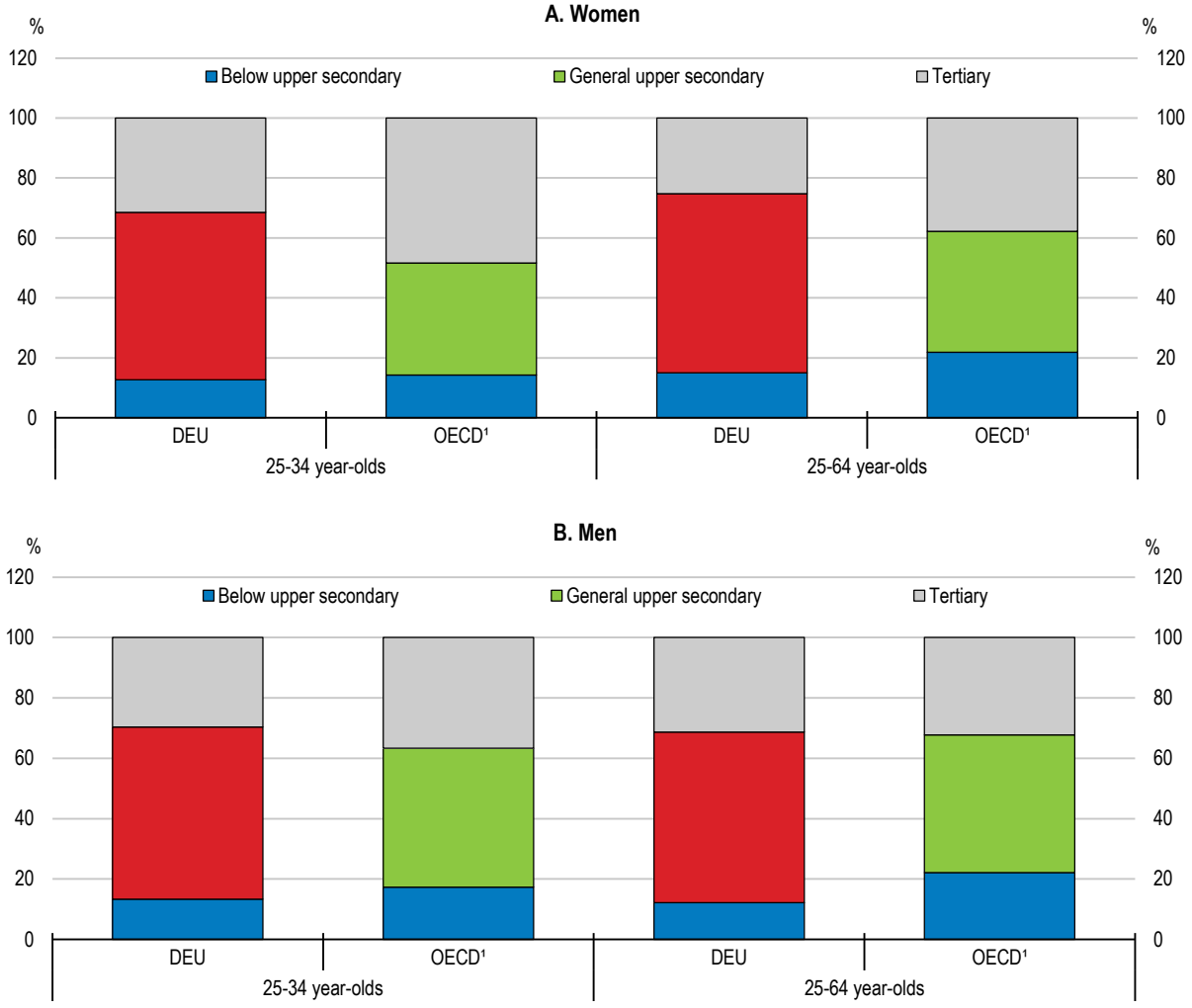
Educational attainment is strong and has improved modestly across generations

Some 86% of adults in Germany have obtained at least an upper secondary qualification (equivalent to an apprenticeship degree or an academic degree qualifying for university entry), more than in most OECD countries (Figure 2.2). The share of the population with at least upper secondary education has been fairly stable over the generations. Some 13% of young people between 20 to 29 years old are without a qualification and this share has fallen little in recent years (Bundesinstitut für Berufsbildung, 2016[153]). Some countries (such as Korea, Poland, Canada or Switzerland) have succeeded in reducing this share more than Germany.

While tertiary attainment has increased, it remains slightly below the OECD average. The share of young adults with a master's or doctoral degree is comparable to OECD averages, but in OECD comparison there are relatively fewer graduates leaving university with a short-cycle qualification such as a bachelor's degree. Unlike elsewhere in the OECD, tertiary attainment across all age groups is slightly lower among women than among men and is broadly balanced among young Germans.

Figure 2.2. Almost all Germans have attained at least upper secondary education

Share of population by educational attainment, by age group and gender, 2016[1]



1. Unweighted average of OECD countries excluding Japan and including data in 2015 for Chile and Ireland.
Source: OECD (2017), "Education at a glance: Educational attainment and labour-force status", *OECD Education Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933738293

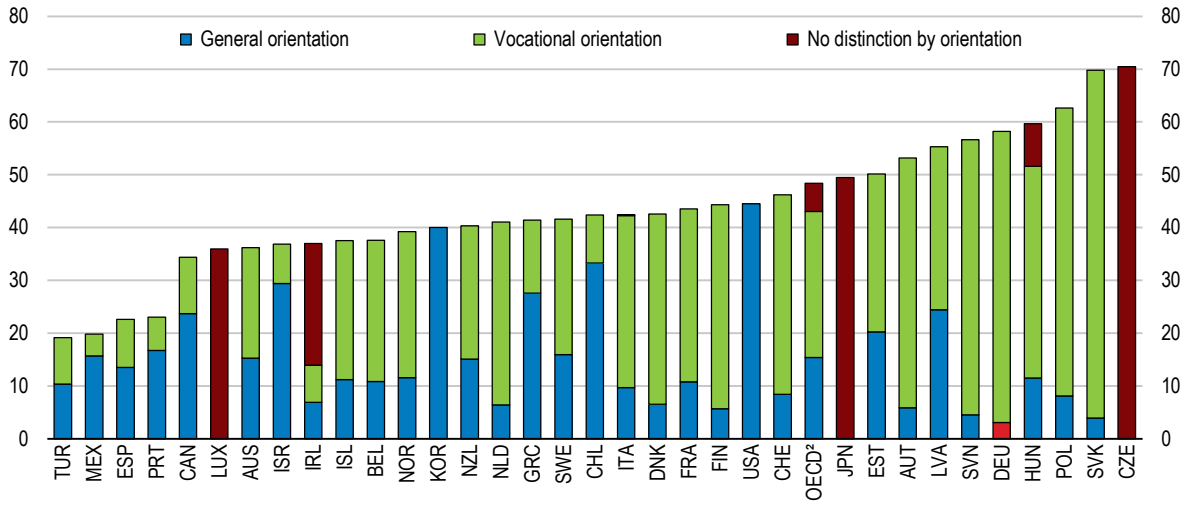
Around half of the adult population in Germany has a vocational upper secondary or post-secondary non-tertiary qualification when they leave full-time education (Figure 2.3). This share is little lower among 25 to 34 year-olds. About 75% of youth in vocational education and training (VET) pursue an apprenticeship within the dual education system. The remaining 25% pursues school-only vocational education, which mostly provides training for health and social service occupations. Dual VET programmes can take between two and three and a half years to complete. However, the number of young people in vocational education diminished between 1991 and 2009 from 1.6 million to 1.3 million (Sachverständigenrat, 2017[154]). This trend mainly reflects diminishing demand for apprenticeships, in part because youth cohorts have shrunk. In addition, the number of children who entered the academic track in lower secondary education has increased. This track provides the main access pathway to university education. The choice of track is

therefore an important determinant of the decision to pursue academic or vocational education. Rising educational attainment in the parent generation has likely contributed to this trend, as the parental social and education background is a key determinant of the choice of lower secondary school track (Sachverständigenrat deutscher Stiftungen für Integration und Migration, 2013[155]). Structural shifts in employment towards the services, where apprenticeships are less widespread, a higher demand for theoretical and general skills in the context of a more knowledge-intensive economy, and a declining willingness of small firms to offer apprenticeships may be further reasons (Mohr, Troltsch and Gerhards, 2015[156]). However, for the first time since 2011, the number of newly enrolled vocational students increased in 2017.

The percentage of young people going to academic upper secondary education, which prepares for university entry, rose from 31% to 52.8% since 1992. Most pupils in academic upper secondary education eventually go to university, although some will first do an apprenticeship. The number of youth studying for a university degree is therefore likely to continue rising while the number of youth entering the labour market after obtaining upper secondary vocational degrees is therefore likely to diminish. On the other hand, many students who do not complete their university studies continue their professional careers by doing an apprenticeship instead (Heublein et al., 2017[157]). Combining an apprenticeship with university studies, following an upper secondary academic degree, is especially widespread in financial services.

Figure 2.3. Most adults possess upper secondary vocational degrees

Percentage of 25-64 year-olds whose highest level of education is upper-secondary or post-secondary non-tertiary, by programme orientation, 2016[1]



1. For Denmark, Finland, Ireland, Latvia, Luxembourg and Slovenia data for the breakdown by programme orientation are available only for 15-34 year-olds. Reference year is 2015 for Chile and Ireland.
2. Unweighted average.
Source: OECD (2017), "Education at a glance: Educational attainment and labour-force status", *OECD Education Statistics* (database).

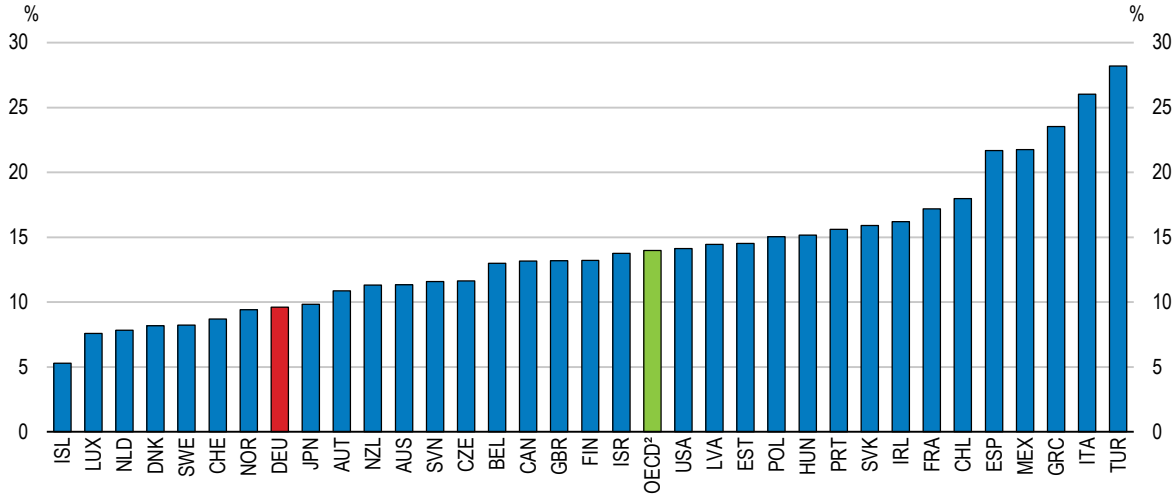
StatLink http://dx.doi.org/10.1787/888933738312

The German vocational education and training system ensures excellent integration of young people in the labour market. Employment rates for individuals with upper secondary or post-secondary non-tertiary vocational qualifications aged 25 to 34 years are as high as for individuals with a tertiary degree (86% and 87% respectively) (OECD, 2017[158]). The

share of young people not in employment, education or training is among the lowest in the OECD (Figure 2.4).

Figure 2.4. Most German youth are either in employment, education or in training

Youth not in employment, education or training (NEET), per cent of 15-29, 2016 or latest year[1]



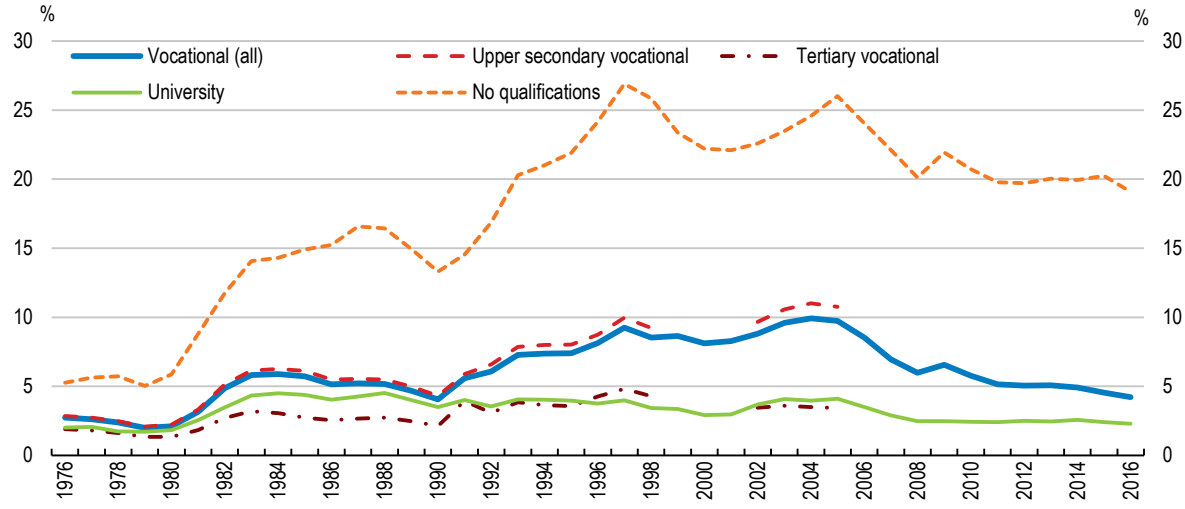
1. 2015 for Ireland and Chile. 2014 for Japan.
2. Unweighted average.
Source: OECD (2017), "Education at a glance: Educational attainment and labour-force status", *OECD Education Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933737172

Over the past 40 years, unemployment rates between the main education levels have drifted apart (Figure 2.5), in particular at times of rising unemployment, showing that skills have become more important to make workers resilient. More recently, over the pasts 20 years, employment in high-skill occupations has increased markedly, whereas the share of employment in middle-skill jobs has fallen, although to a lesser extent in Germany than in some other countries (Chapter 1). At the same time wages paid for high-skill workers have risen, while they have fallen for middle and low skilled workers who are middle-aged (Figure 2.6), suggesting that these trends are driven by labour demand. In part they may be driven by stronger use of digital technology (Dauth et al., 2017[153] and Chapter 1).

Figure 2.5. Unemployment is high among the unskilled

Unemployment rates by qualification



Note: Registered unemployment. Data until 1990 cover West Germany. Data from 1991 cover Germany.
Source: Hausner, Karl Heinz; Söhnlein, Doris; Weber, Brigitte; Weber, Enzo (2015), Qualifikation und Arbeitsmarkt: Bessere Chancen mit mehr Bildung. IAB-Kurzbericht, 11/2015. Röttger, Christof; Weber, Brigitte; Weber, Enzo (2017), Qualifikationsspezifische Arbeitslosenquoten. Aktuelle Daten und Indikatoren, IAB.

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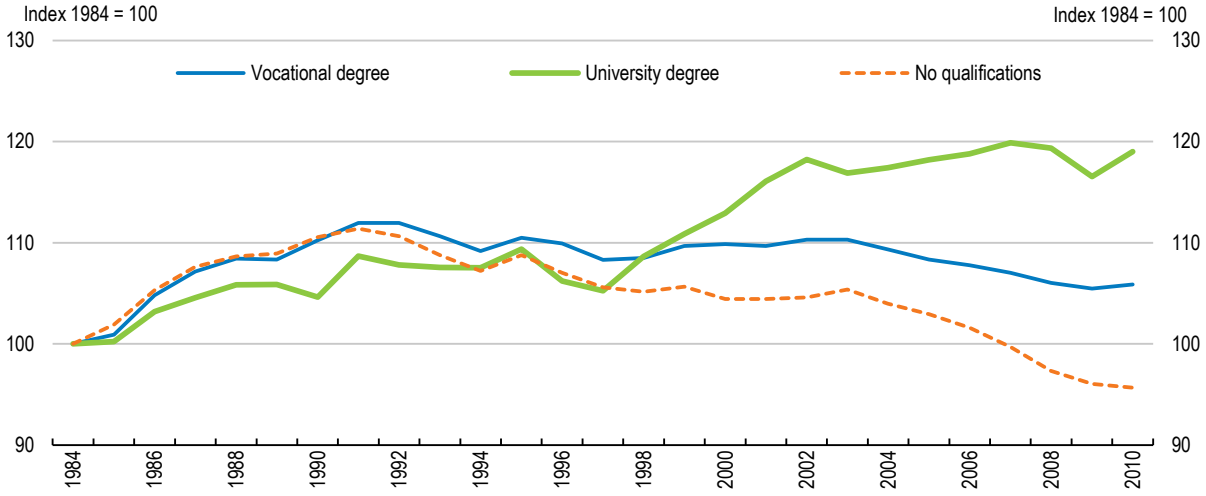
Figure 2.6. Real wages rose only for high-skill workers between 1990 and 2010

Real wages by qualifications, full-time male workers aged 40



Note: Data cover West Germany.
Source: Integrated Employment Biographies (IEB) from the Institute for Employment Research of the Federal Employment Agency (IAB, Institut für Arbeitsmarkt- und Berufsforschung)

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Germany specialises in many technologically advanced industries, including high- and medium/high-tech manufacturing and complex business services, such as research and development or computer and related activities (OECD, 2017[159]). This specialisation

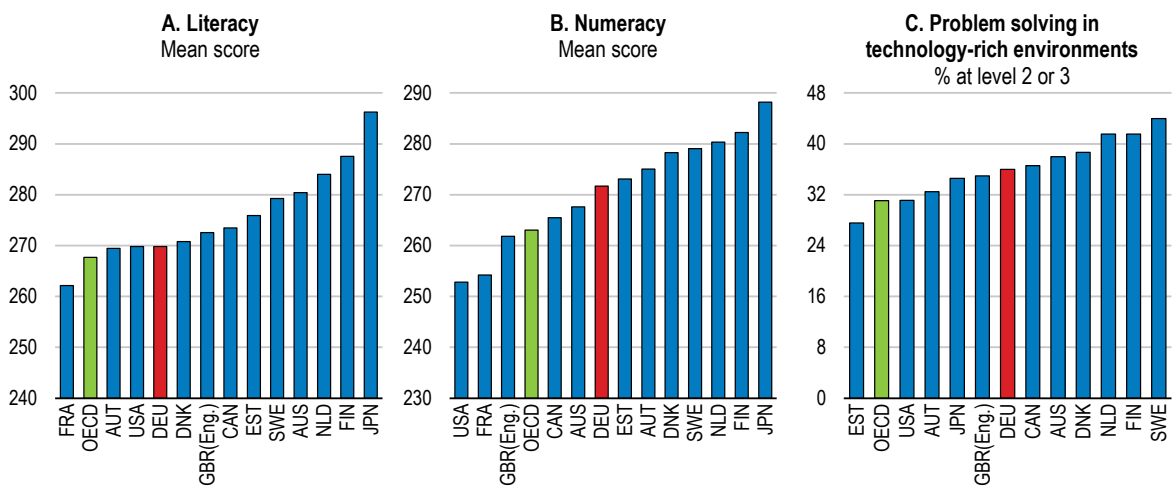
pattern is supported by the country's strong advantage in high-end science, technology, engineering and mathematics (STEM) education. About 35% of all tertiary-educated adults have a degree in a STEM field, the highest in the OECD. The share is even somewhat higher among recent graduates. At vocational upper secondary level, a third of graduates have studied engineering, manufacturing or construction-related professions. However, women are under-represented in most of the STEM fields, both at the upper secondary and at the tertiary level, where they are only 28% of new entrants. PIAAC data also shows that German workers perform STEM tasks more often than in most OECD countries (OECD, 2017[159]). Unlike in many advanced OECD economies, German manufacturing is strongly integrated in global value chains, yet manufacturing employment has increased since 2010 (OECD, 2017[160]).

Adult cognitive skills are somewhat lower than in best-performing countries

The average PIAAC literacy proficiency score is above the OECD average (OECD, 2016[150]) but lower than in the best-performing countries (Figure 2.7). Average scores in numeracy and problem-solving skills in a technology-rich environment compare more favourably. Still, outcomes lag behind Nordic countries or the Netherlands. However, most recent PIAAC results for Germany are from 2012. Adult cognitive skills are likely to be improving, as youth with stronger reading and numeracy skills leave school. PISA scores in Germany have improved over the past 15 years, more so than in many other OECD countries.

Figure 2.7. Adult skills are above OECD average, but lower than in leading OECD countries, especially in literacy

Mean proficiency scores in literacy and numeracy, and the percentage of adults scoring at level 2 or 3 in problem solving in technology-rich environments, 15-65 year-olds, 2012



Note: France did not participate in the problem solving in technology-rich environments assessment.
Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

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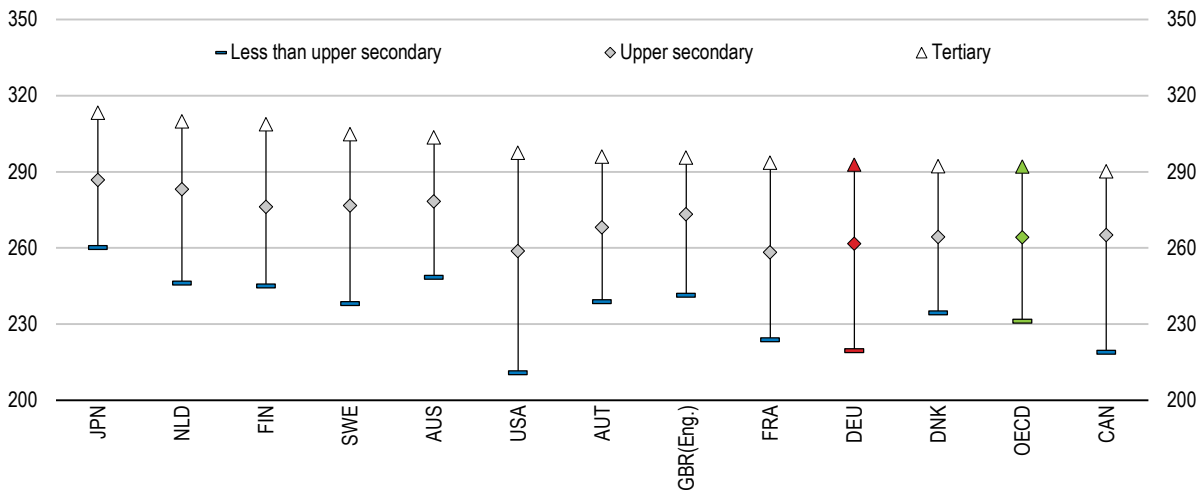
Proficiency is relatively weak among adults with low (below-upper secondary) educational attainment. It is slightly above OECD average for adults with higher education but slightly below OECD average for adults with middle (upper secondary) education (Figure 2.8). In Germany, workers who have been educated to the upper secondary level have mostly gone through the vocational education system.

Figure 2.8. Performance gaps with respect to leading countries are larger for adults with low and intermediate educational attainment

Mean proficiency scores in literacy, by educational attainment, 25-65 year-olds, 2012



Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

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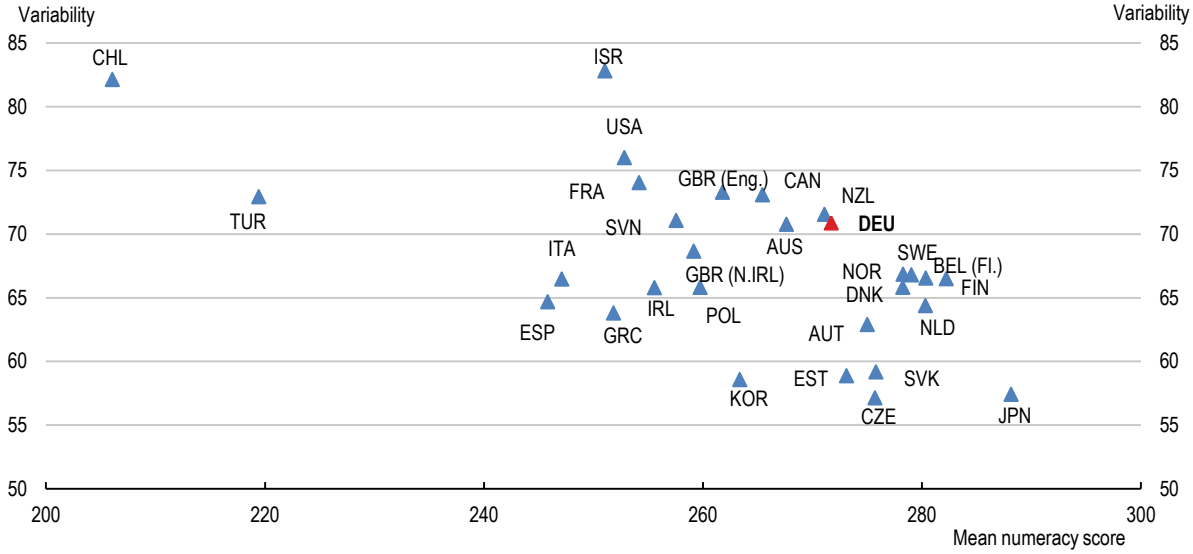
The variably of proficiency of literacy and numeracy scores is wide. Countries with the highest average scores tend to have less variability, as they are more successful in limiting the number of adults with low cognitive skills (Figure 2.9). A German study on functional illiteracy suggests that 15% of the German population have insufficient literacy skills to understand a full text or deal with every-day literacy requirements. Most of them are employed, have intermediate upper secondary vocational qualifications and speak German as mother tongue. They are broadly evenly distributed across age groups (Bundesinstitut für Berusbildung, 2017[161]).

Eurostat's 2017 Digital Skills Survey sheds additional light on adult digital skills. The Survey measures skills based on a self-assessment of selected activities related to internet or software use. Only around 40% of prime-age Germans had above basic skills enabling them to be more active in the use of information and communication technologies (ICT), well below top-performing countries (Figure 2.10).

Workers in Germany carry out tasks independently and plan their own work on the job more frequently than in other OECD countries. However, they are less likely to perform managing, communicating and marketing tasks. They also show a lower readiness to learn than on average in OECD countries (Grundke et al., 2017[162]). Where workers specialise in marketing and accounting or management and communication tasks (and thus require the corresponding skills), they are more closely integrated in GVCs through their production (OECD, 2017[159]). These skills are also in high demand by employers. In view of the increasing complementarity of services and manufacturing these skills may need further development.

Figure 2.9. Dispersion of adult cognitive skills is large

Average and variability of PIAAC numeracy scores, 25-65 year-olds, 2012



Note: The measure of variability used is the interquartile range (difference between the third quartile minus first quartile).
Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

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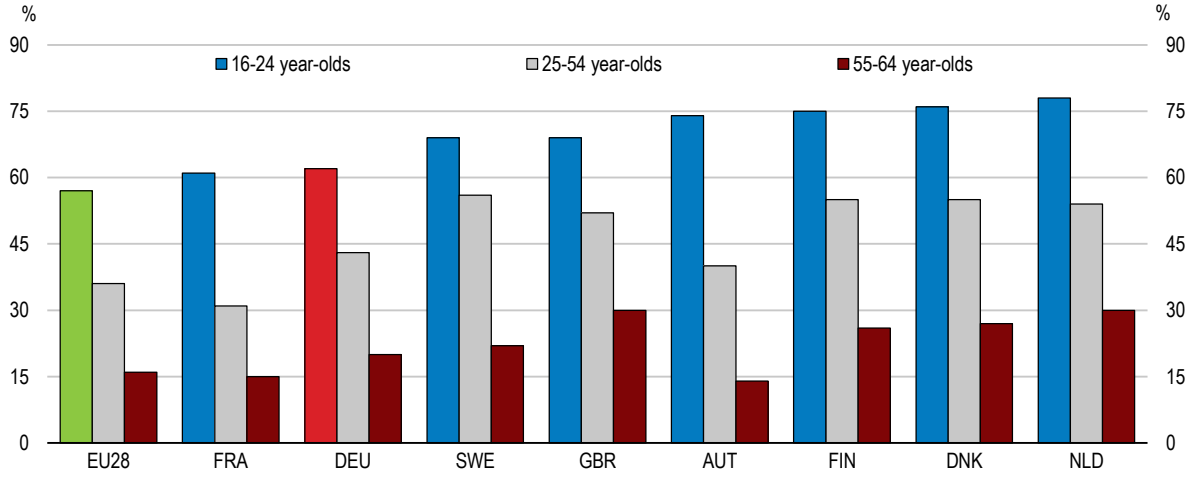
Figure 2.10. ICT skills are lower than in leading countries, especially among the young

The share of population with above basic ICT skills, by age cohort, 2017



Source: Eurostat (2018), *Individuals' level of digital skills* (database).

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Improving the matching of worker skills to jobs could boost productivity

The PIAAC study distinguishes field-of-study mismatch, qualification mismatch and skill mismatch (Box 2.3). Field-of-study mismatch in Germany is among the lowest in the OECD. This is likely to reflect strong work-based training in vocational education, which allows many vocational education graduates to continue working with the same employer

after completing their degree. Strong supply and demand of STEM skills also contributes. A well-developed system of career counselling for young people may also help. Vocational counselling and orientation for young people start about two years before pupils finish upper secondary school. Career and study orientation is part of education in all schools.

Box 2.3. Skill mismatch measures in the OECD PIAAC study

Qualifications mismatch arises when workers have an educational attainment that is higher or lower than that required for their job. This is assessed in relation to workers' answer to the question about the usual qualifications, if any, "that someone would need to get (their) type of job if applying today". The answer to this question is used as each worker's qualifications requirement and compared to their actual qualifications to identify mismatch.

Field-of-study mismatch occurs when workers are employed in a different field from that in which they have specialised. The matching is based on a list of occupations (at the
3-digit ISCO classification) that are considered as an appropriate match for each field of study.

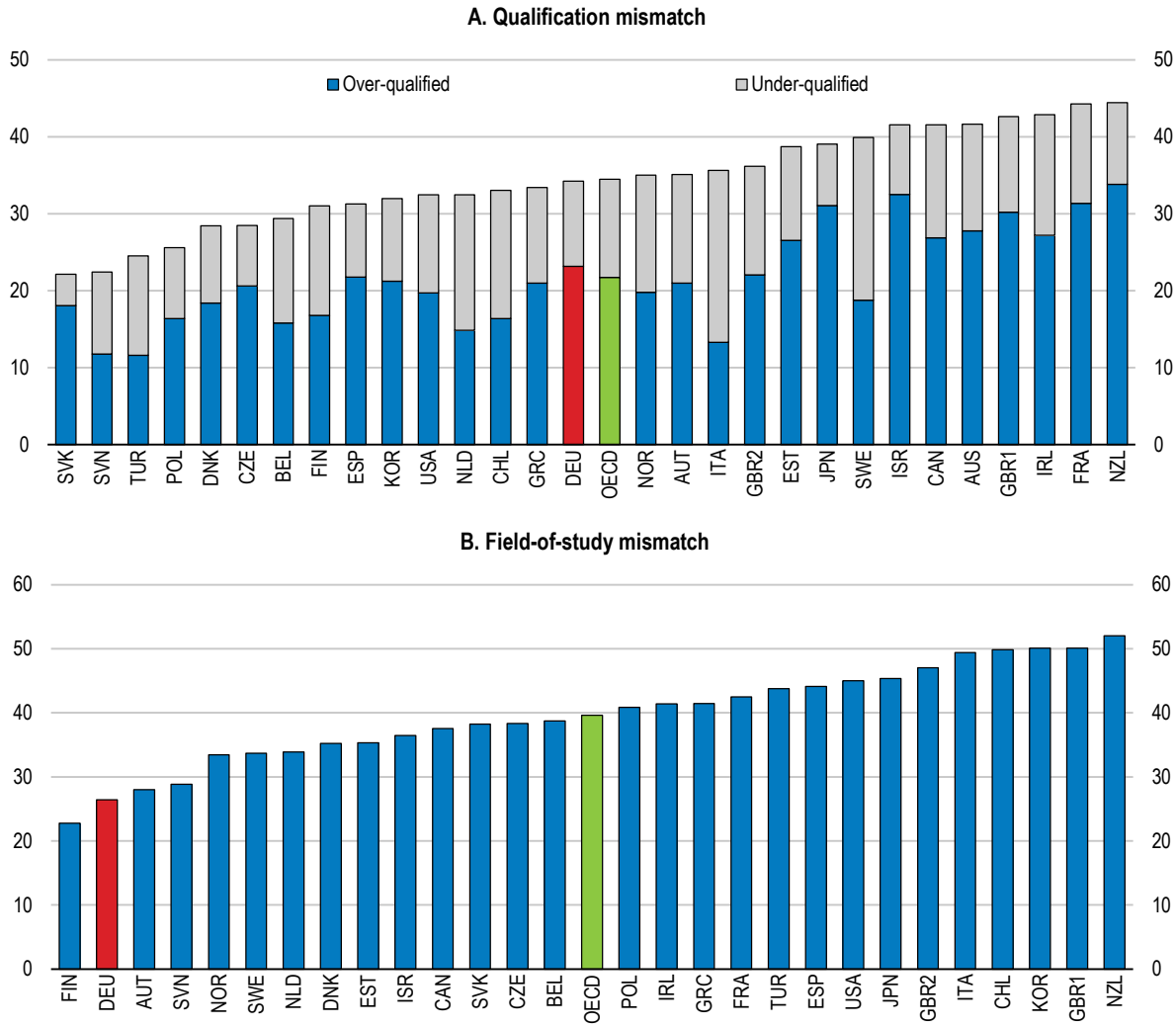
Skills mismatch arises when workers have higher or lower information processing skills proficiency (such as in literacy or numeracy) than required for their job. To assess skill proficiency requirements for a job, workers were asked whether they feel that they "have the skills to cope with more demanding duties than those they are required to perform in their current job" and whether they feel they "need further training to cope well with their present duties". Workers are classified as well matched in a domain if their proficiency score is between some minimum and maximum score observed among workers who answered "no" to both questions in the same occupation and country. In the PIAAC study, workers are overskilled in a domain if their score is higher than the 95th percentile of self-reported wellmatched workers; they are under-skilled in a domain if their score is lower than the 5th percentile of self-reported well-matched workers. It should be noted that the PIAAC study does not measure all forms of skills mismatch – it focuses on information processing skills in the domains assessed but, for example, leaves out mismatch related to job-specific skills or that involve generic skills.

Source: This box was taken from the 2017 OECD Economic Survey of New Zealand

While underqualification is also low in international comparison, overqualification is relatively high (Figure 2.11). These results also emerge on the basis of survey evidence, in which workers themselves assess how well their skills are matched to their jobs. Overqualification is more widespread among workers with middle qualifications (upper secondary education (CEDEFOP, 2017[163]). This could perhaps reflect workers with middle qualifications replacing workers with low qualifications on jobs with low skill demands. Overqualification has a strong negative impact on hourly wages, estimated to be close to 15% in Germany (OECD, 2016[150]). Being foreign-born or on a temporary contract increase the probability of overqualification by 10 percentage points. Improving the match of worker skills with job requirements can boost productivity substantially. Reducing skill mismatch to the lowest levels in each industry across countries which have participated in the PIAAC study would boost the level of productivity by 6% (Figure 2.12).

Figure 2.11. Field-of-study mismatch is low but overqualification is above the OECD average

Percentage of mismatched workers, by type of mismatch, 2012 and 2015[1]



Note: Qualifications mismatch occurs when a worker has a higher or lower level of qualification than is required for his/her job. Field-of-study mismatch occurs when a worker has a qualification in a different field than required for his/her job.

1. Data correspond to 2015 for countries participating in the second round of the Survey of Adult Skills: Chile, Greece, Israel, New Zealand, Slovenia and Turkey. For other countries, data correspond to 2012 based on the first round of the Survey of Adult Skills. Data indicated as Belgium correspond to Flanders; GBR1 = England and GBR2 = Northern Ireland.

Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

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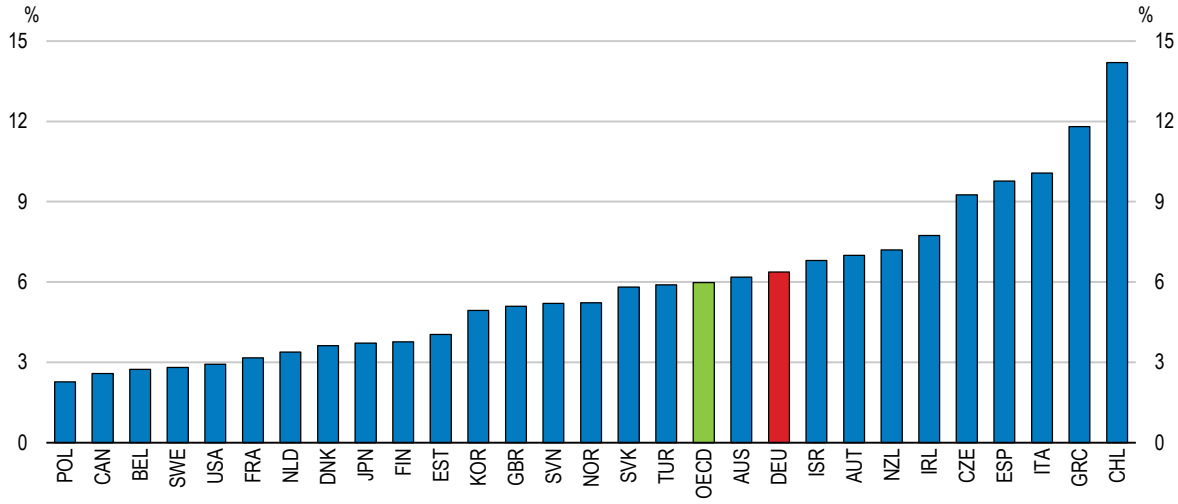
Figure 2.12. Reducing mismatch boosts productivity

Simulated gains to allocative efficiency from lowering skill mismatch to the best practice



Note: The chart shows the difference between the actual allocative efficiency and a counterfactual outcome based on lowering the skills mismatch in each country to the best practice. Mismatch indicators are aggregated for 11 market industries using a common set of weights based on the industry employment shares for the United States. Skills mismatch is captured using the 2012 and 2015 waves of PIAAC data.
Source: Adalet McGowan, M. and D. Andrews (2017), "Skills mismatch, productivity and policies: Evidence from the second wave of PIAAC", *OECD Economics Department Working Papers*, No. 1403.

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Gender inequality contributes to mismatch

Broad gender equity in educational attainment contrasts with the large earnings gap between men and women. This difference is more marked between highly educated men and women. Full-time working women with tertiary education earn about 70% of what men earn (Figure 2.13). The earnings gap is even bigger when hours worked are taken into account. In 2015, 47% of all women in employment were working part-time, while this was the case for only 9% of men. About 72.7%, mothers with children under the age of 18 are especially likely to work part-time. Part-time work reduces earnings not only through the reduced working time itself, but also through less experience.

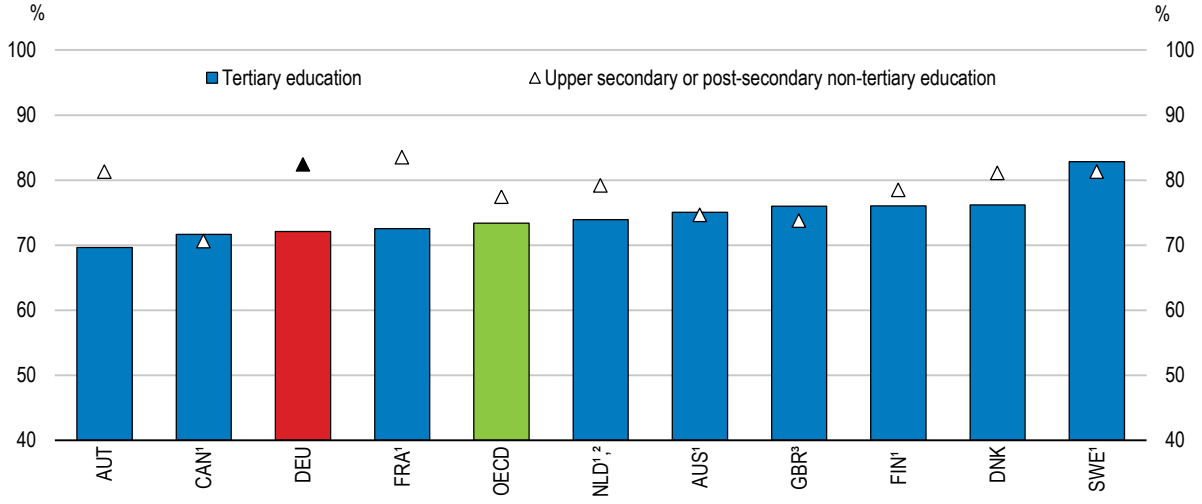
Women's skills are used less then men's, and this difference is more marked than in other high-income countries with strong PIAAC results (Figure 2.14, unadjusted results). A large part of this difference can be attributed to the different incidence of part-time work and occupational choice. Gender differences in skill use are much lower after controlling for these variables (Figure 2.14, adjusted results). Indeed, part-time workers are 25% more likely to be overqualified than full-time workers in Germany (OECD, 2016[150]). This makes part-time employment among women a major cause of overqualification, explaining about a third of the total incidence. Part-time work also raises the probability of overskilling by 10 percentage points. Moreover, part-time employment among women generates poverty risks, especially following separations and in old age as argued in the *2016 Economic Survey* (OECD, 2016[164]) and by research in Germany (Bundesinstitut für Bevölkerungsforschung, 2017[165])).

Most women state that they work part-time voluntarily. However, their decisions are influenced by the incentives in the tax system and the availability of childcare and full-day schooling. Indeed, in a tight labour market, with particularly low unemployment rates for qualified workers, addressing barriers to full-time employment and broadening barriers to occupational choice of women could boost productivity and wages for women. As argued in previous Economic Surveys (OECD, 2016[164]), steps to lower the taxation of second earners, who are often women, would boost their incentives to work longer hours. Expanding the provision of full-day formal childcare and primary education would also help.

There are large differences in the proportion of men and women across professions, as in many other countries. Professions in which women are more strongly represented tend to pay less. One explanation is that jobs which offer better compatibility, in terms of working time, with family life offer lower wages. More working time flexibility is typically associated with higher female participation (Wrohlich and Zucco, 2017[166]). Jobs offering part-time work options and flexibility are in high demand among many women, which lowers the wage (Haan, Hammerschmid and Rowold, 2017[167])).

Figure 2.13. The earnings gap between men and women is particularly large among highly educated workers

Women's earnings as a percentage of men's earnings, by educational attainment, 25-64 year-olds with income from full-time employment, 2014



1. 2010 for the Netherlands. 2012 for Australia, France and Sweden. 2013 for Canada and Finland.
2. Educational attainment levels are based on the ISCED-97 classification.
3. Data for upper secondary attainment include completion of a sufficient volume and standard of programmes that would be classified individually as completion of intermediate upper secondary programmes (18% of the adults are under this group).
Source: OECD (2016), *Education at a Glance 2016: OECD Indicators*.

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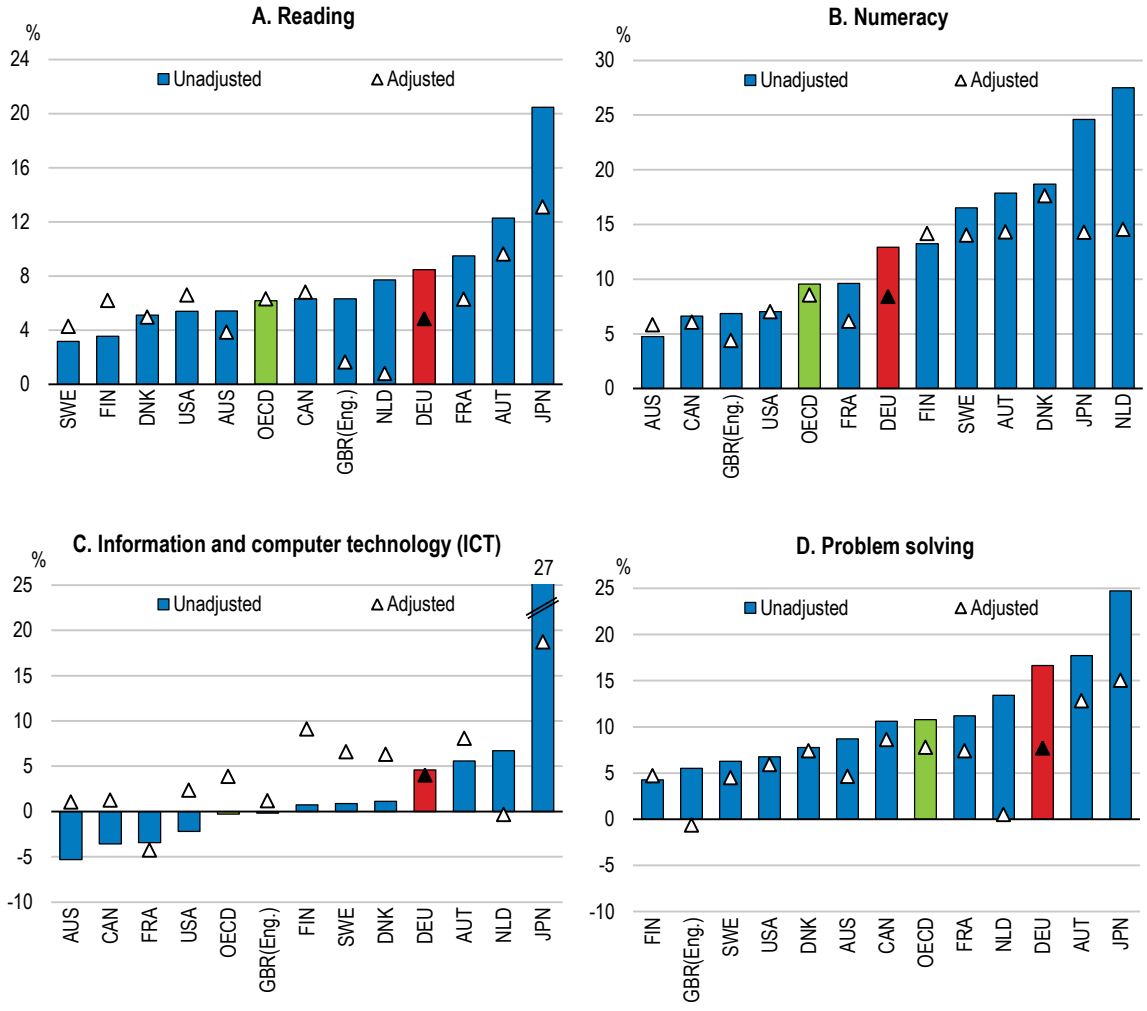
Take-up of parental leave influences the distribution of home and childcare responsibilities between women and men. Since 2007 parents of young children can receive a parental leave cash benefit amounting to 65% of previous net earnings, subject to a ceiling. It can be drawn either by the father or the mother for a maximum of 12 months, if they temporarily stop working to look after their children. If the second parent takes at least 2 further months off work to look after a child, the total duration for the couple is 14 months. Since 2015,

parental leave has become more flexible, allowing parents to combine part-time work with parental leave benefits at reduced rates. Parents may receive an additional four months of parental leave benefits if they choose to simultaneously work between 25 and 30 hours per week during that time.

Figure 2.14. Women's skills are used less than men's

Gender differences in the mean use of information-processing skills at work (men minus women), % of the mean use of skills by women, 2012



Note: Adjusted estimates are based on ordinary least squares (OLS) regressions including controls for literacy and numeracy proficiency scores, hours worked, and occupation dummies based on the International Standard Classification of Occupations (ISCO, 1-digit).
Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

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These entitlement rules have provided incentives for fathers to take some parental leave. Moreover, it has resulted in a substantial reduction in the prevalence of social norms according to which it is the women who are expected to look after children and home rather than their careers. As a result of the introduction of this benefit, the share of fathers who took at least two months of parental leave increased sharply from less than 3% in 2006 to

34% ten years later (Unterhofer and Wrohlich, 2017[168]). Moreover, social norms have changed beyond the parents, resulting in better acceptance of mothers taking up paid full-time employment. These social norms have in turn influenced female labour supply behaviour. However, mothers generally take 12 months of leave whereas fathers often take only 2 months and often at the same time as the mothers (Unterhofer and Wrohlich, 2017[168]). These findings suggest that requiring fathers to take more parental leave for the couple to benefit from the maximum joint allowance would result in further benefits in terms of reducing gender stereotypes, earlier return and stronger labour market participation by women, and better skills use.

Removing geographical barriers to mobility can reduce mismatch

Rental prices have increased strongly in major urban centers over the past decade, whereas low and middle incomes have not. Housing construction in many rural areas, where population in some cases falls, has been stronger than what demographic trends would require, resulting in vacant stocks of older housing. Housing supply does not keep pace with rising population in urban areas (Philipp Deschermeier et al., 2017[169]). High housing costs prevent people from moving into economically successful, highly productive urban areas. Such barriers can reduce national GDP by considerable margins (OECD, 2017[170]). Planning restrictions that prevent densification are particularly costly, as there is a negative relationship between a region's developed area per capita and its economic growth.

Densification of urban and sub-urban residential areas and adapting land use regulation accordingly can improve housing supply (OECD, 2017[170]). Federal planning law does not hinder densification. Soil protection and densification are general planning principles. Federal legislation states that urban development is to primarily take place through measures of inner urban development. However, it is the *Länder* and municipal governments which set specific zoning regulations. The federal government does not monitor municipal zoning regulation as it would be incompatible with the German constitution.

Restrictive zoning regulations and planning decisions can limit the possibilities for densification in many cities. They include explicit density restrictions (for example through floor-to-area ratios) and implicit density restrictions (for example minimum lot-size requirements and restrictions on multi-family homes), although generally these may be exceeded provided the general requirements on healthy conditions are safeguarded. The municipality can also waive restrictions, or change plans. Easing density restrictions is most important in low-density areas close to city centres and along public transport corridors, but gradual densification should be permitted throughout most parts of an urban area. More proactive policies to foster densification can include incentives for compact development on brownfield sites (OECD, 2015[171]).

Higher urban density results in more proximity between businesses and people's homes, which promotes sustainable transport, like walking or cycling. This in turn promotes health and results in lower CO2 emissions. Transport-related urban emissions are much lower in compact cities, such as Shanghai and Barcelona, (OECD, 2015[171]). Higher urban density also limits the loss of natural habitat and biodiversity through urban sprawl, which is one of the major environmental policy challenges in Germany according to the German Federal Environment Agency.

Germany has boosted mobility with a relocation subsidy for unemployed workers who accept a job in a distant location. This scheme has improved the stability of employment and pay in the newly found job among workers who benefited from the subsidy, as a result

of a better match between worker and job (Caliendo, Künn and Mahlstedt, 2017[172]). However, entitlement rules to social assistance transfers prevent young people from moving out of their parents' home, as below 25-year-olds cannot claim such benefits, which may impede mobility. Moreover housing benefits for low-income households prevent relocation, because benefit recipients cannot move to housing that is more expensive. (Sachverständigenrat, 2017[154]). The coalition agreement foresees more funding for social housing, which could make it easier for workers to move to dynamic urban centers.

The new government plans to give financial support to families with children who build or buy their own private homes (up to EUR 1 200 per child for ten years subject to an income ceiling of EUR 75 000, or higher for families with children). However, this measure risks pushing up prices in urban areas. The measure may therefore result in more construction in thinly populated areas, which could be counterproductive with respect to densification (Michelsen, 2018[173]). The subsidy is not targeted at low-income households and has a high budgetary cost (EUR 22 billion over ten years). Moreover OECD research with cross-country data has shown that the impact of subsidies for owner-occupied housing on prices may even reduce access to housing for low income households (Andrews, Caldera Sánchez and Johansson, 2011[174]). Whether prices in urban areas increase depends on the supply of construction sites. The government, plans complementary measures to increase the amount of construction sites especially in urban areas. The coalition agreement also includes a commitment to higher spending for the construction of social housing.

Inclusiveness has improved but more progress would boost skills

Education and socio-economic background is strongly transmitted between generations. Adults with a parent with a higher education background score more than 50 points (equivalent to about 3.5 years of full-time education) higher than adults with unskilled parents (Figure 2.15, unadjusted impact). This difference is even larger among young adults (age 25-34 years; results not shown). In Sweden, for example, this difference amounts to 30 points (equivalent to 2 years of education). In the case of Germany, much of this transmission can be explained by educational attainment, immigrant status, and other socio-economic variables. After removing the impacts of these variables, the impact of parental education background is lower (Figure 2.15, adjusted impact). The impact of parental educational background on adult cognitive skills appears to be transmitted through its influence of parental educational attainment to the educational attainment of their children.

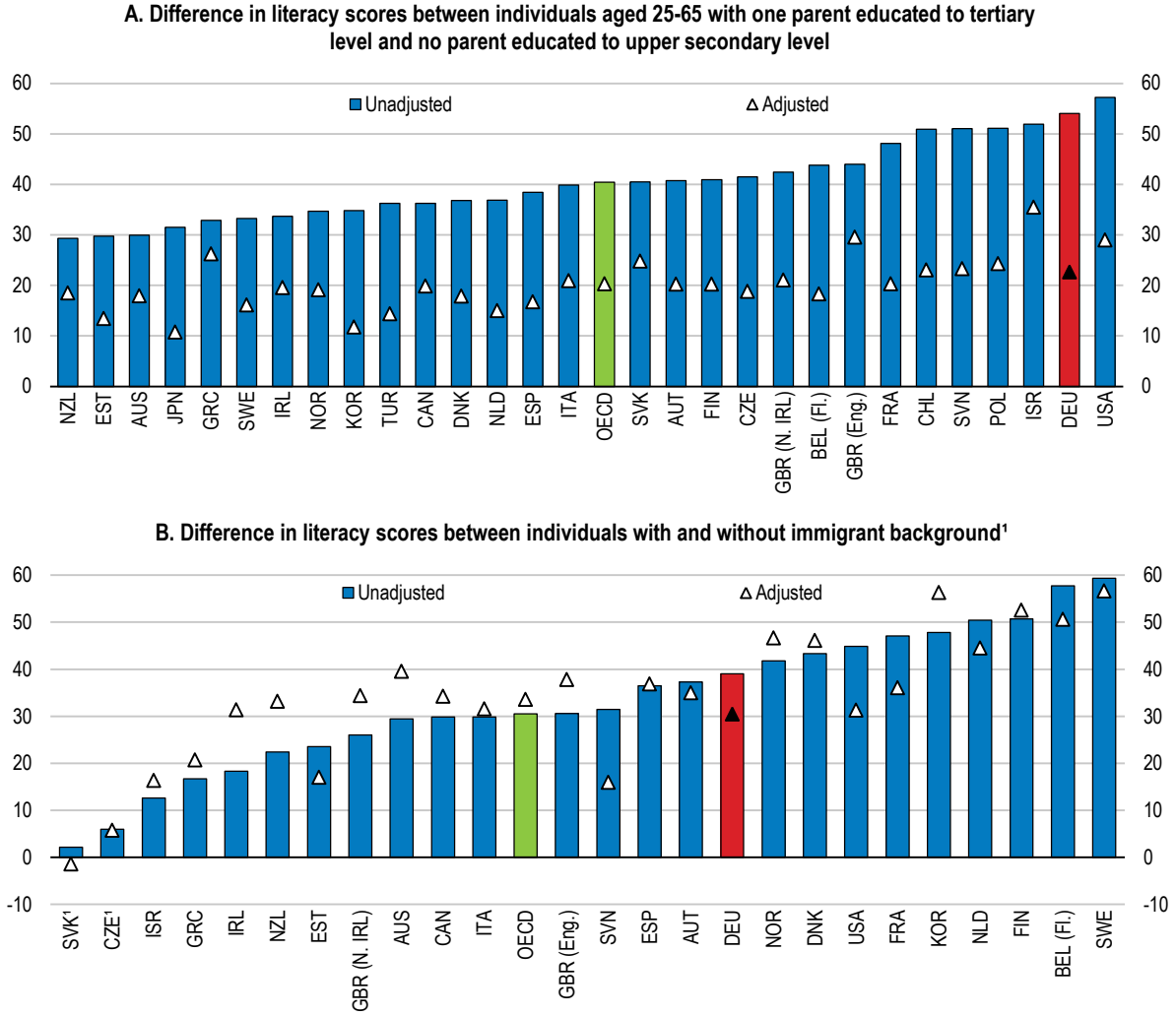
Upward mobility through education pathways has improved only slowly (OECD, 2017[158]). About 13% of 45-59 year-olds whose parents did not attain tertiary education have attained an academic tertiary qualification themselves. Among 30-44 year-olds, the figure is almost the same, at 14%. Another 11% have attained a vocational tertiary qualification. The percentage of migrants attaining a higher education entrance qualification increased substantially among younger age groups. There is nonetheless still a marked gap relative to people without migrant backgrounds.

The risk of failing to get an upper secondary degree is also much higher for individuals whose parents have immigrated and have low education background, and this difference is much bigger than in most countries, notably Canada, Denmark or France. Very few youth with immigration background whose parents have low education make it to tertiary education.

Weaker education outcomes caused by parents' low income or lack of education is a key transmission mechanism through which inequality can have a negative impact on economic growth and thereby reduce living standards (OECD, 2015[62]). For example a large share of workers with weak cognitive skills contributes to the incidence of low-pay work, which is high in Germany, resulting in higher social transfers to prevent poverty.

Figure 2.15. Low parental education is an important predictor of skills

Differences in PIAAC literacy scores between contrast categories within various socio-demographic groups, score-point difference, 2012 and 2015



Note: Unadjusted differences are the differences between the two means for each contrast category. Adjusted differences are based on a regression model and take account of differences associated with the following variables: age, gender, education, immigrant and language background and parents' educational attainment.
1. Individuals that are both native-born and speak a native language is compared to those who are both foreign-born and speak a foreign language as their mother tongue.
Source: OECD (2016), *Skills Matter: Further Results from the Survey of Adult Skills*.

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The intergenerational transmission of low education is reinforced by child poverty. Child poverty is significant, as in other OECD countries. In Germany it is unusually strongly concentrated among parents with low education. Child poverty in families in which the

parents have middle education is also substantial. Poverty is also persistent: For 21% poverty lasts at least five years (Tophoven et al., 2017[175]). Among these children 49% live with a single parent, 46% have immigration background and 37% have at least two siblings.

The economic benefits of achieving more equity in education are large. Completing university has been shown to increase the earnings of men with disadvantaged family backgrounds, including from migrant backgrounds, even more than for those from more favoured backgrounds (Perini, 2014[176]), perhaps because motivation of talented youth from disadvantaged backgrounds is particularly strong.

Means-tested support for youth from low-income families pursuing higher education and upper secondary education from low-income families amounts to up to EUR 735, depending on family income. For students in tertiary education, half of the amount is generally provided as a grant, half as an interest-free loan. Students can earn additional income up to EUR 450 per month without any deductions. Government-sponsored loans are also available, but for most of them students have to pay 3.5% interest ("*KfW Studienkredit*") and repayments are not income-contingent.

One option to reduce the intergenerational transmission of income and improve access to higher education for youth from low-income families with low-education parents is to provide the full amount of means-tested support as a grant for these youth. Indeed, access to grants for students from the most disadvantaged backgrounds is particularly important. Families with low income and low education often underestimate the benefits of higher education, providing a case for subsidising access more strongly for them (OECD, 2008[177]).

Conversely, students from high income families could make a bigger contribution to the cost of higher education through the payment of university fees, which have been abolished in most *Länder* in recent years. Detailed empirical evidence on the impact of raising fees for study at universities, accompanied by the introduction of government-sponsored loan schemes in which repayments are tied to the level of income attained once students have graduated is available for Australia. It shows that this policy has allowed widening access to university education by mobilising private funds, while the higher fees did not alter the composition of the studentship to the disadvantage of students with modest socio-economic background (Chapman, 2006[178]).

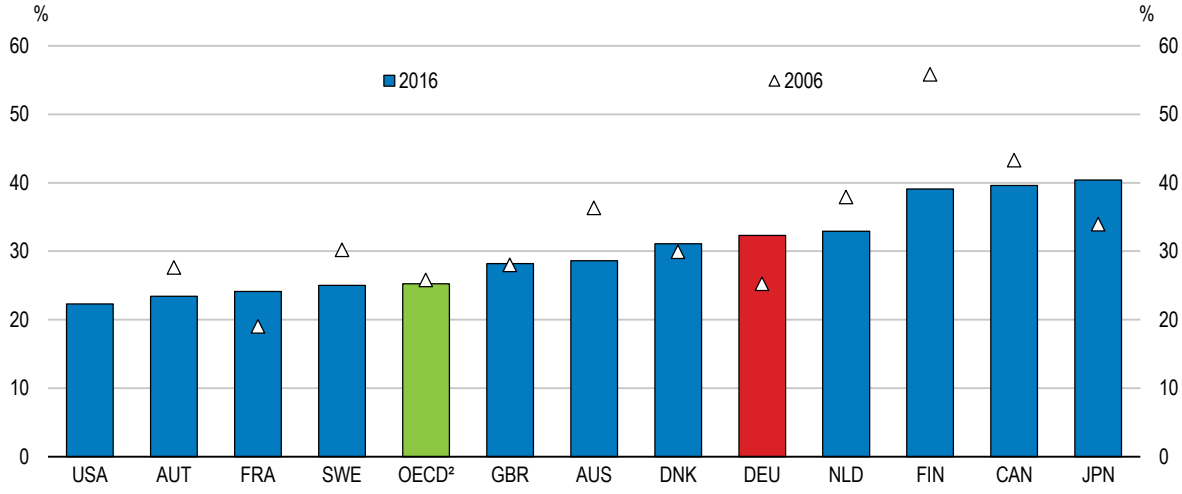
Education outcomes of disadvantaged youth have improved strongly but early tracking may still hinder equity

Progress has been made in improving education outcomes of youth at school, including those with poor socio-economic background, since the PISA study in 2006. For example, the share of 15-year-old pupils with weak socio-economic background who were resilient in their proficiency rose from 25% to 32% between 2006 and 2015 (Figure 2.16), a bigger improvement than in most OECD countries. Pupils' performance is defined as resilient if their performance is equal or higher than the OECD median in all three PISA domains – reading, mathematics and science. Both higher average performance and higher equity raise the number of resilient students (Agasisti et al., 2018[179]). Fostering cultural activities, through extracurricular education is one successful strategy (Borgonovi and Pál, 2016[180]), as in the programme *"Kultur macht stark"* (Prognos AG, 2016[59]), see also Box 2.4. Nonetheless, the strength of the impact of socio-economic background on student performance in science remains above the OECD average (OECD, 2017[181]). The probability of weak performance is still 3 times higher among pupils with disadvantaged socio-economic background, for example in science (Figure 2.17). Performance

differences are particularly strong between schools which differ in the socio-economic background of their pupils.

Figure 2.16. The share of resilient students has increased strongly over the past 9 years

Percentage of resilient students among disadvantaged students[1], PISA 2006 and 2015



1. Resilient students are the 25% most disadvantaged students in their country according to the PISA index of economic, social and cultural status but are able to achieve at or above level 3 in all three PISA domains – reading, mathematics and science. Level 3 corresponds to the median proficiency level across all OECD countries on average.
2. Unweighted average of available countries. PISA 2006 results in reading are not available for the United States.
Source: Agasisti, T., et al. (2018), "Academic resilience: What schools and countries do to help disadvantaged students succeed in PISA", *OECD Education Working Papers*, No. 167.

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High performance and greater fairness in education opportunities and outcomes are not mutually exclusive. Among the most successful countries and economies in mean PISA proficiency, socio-economic disadvantage tends to play a relatively minor role in explaining variation in student performance. One key factor that improves performance of pupils with disadvantaged socio-economic background is the integration of pupils with different socio-economic background in the same school (Agasisti et al., 2018[179]).

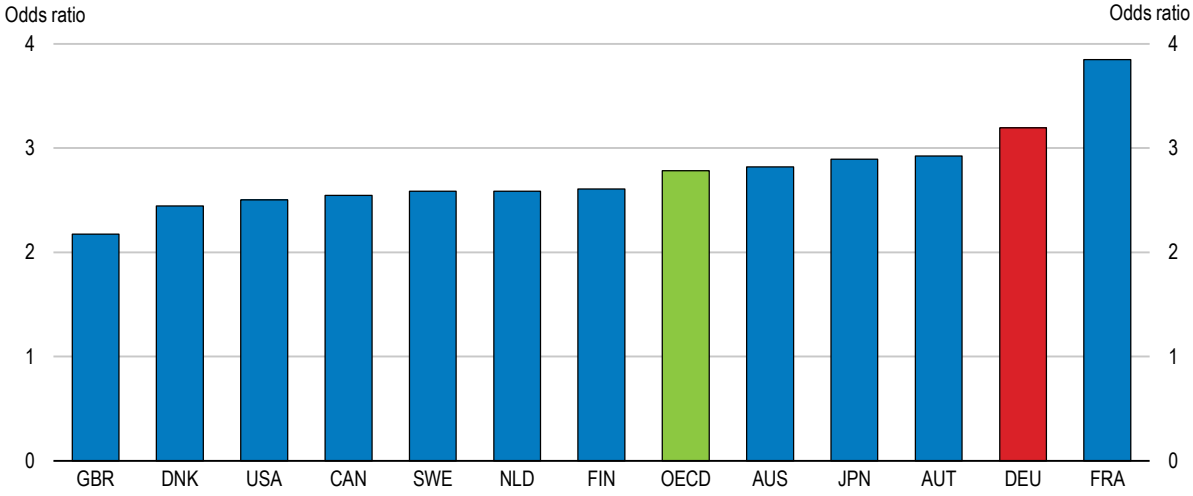
A majority of pupils, typically between 10 and 12 years of age, undergo a selection process into secondary schools where student performance or teacher recommendations from feeder schools are used as criteria. One of the principle objections to early tracking is that it reinforces intergenerational immobility in terms of educational achievement and later economic outcomes, although the impacts of tracking on student performance are controversial. Research shows considerable influence of gender, cultural and family background on the assigned type of track, reducing social integration. A relatively high rate of grade repetition also contributes (OECD, 2014[182]).

The influence of parental background on offspring performance at secondary school tends to be lower in countries where tracking takes place at a later stage or in comprehensive systems with less ability grouping within schools. Early tracking appears to exacerbate achievement differences associated with the school's socio-economic mix without increasing overall performance (Causa and Johansson, 2010[183]). Research by (Pekkarinena, 2009[184]), which exploits the fact that the move from tracking to a

comprehensive system in Finland was implemented gradually across the country's municipalities during a six-year period, indicates that the reform reduced the impact of parental earnings on their childrens' earnings (so called intergenerational income elasticity) substantially, as pointed out in the OECD *Economic Survey of Switzerland* (OECD, 2017[185]).

Figure 2.17. Disadvantaged students are at higher risk of low performance[1]

Likelihood of low performance among disadvantaged students, relative to non-disadvantaged students, 2015



Note: A socio-economically disadvantaged student is a student in the bottom quarter of the distribution of the PISA index of economic, social and cultural status (ESCS) within his or her each country/economy.
1. Score below level 2 (baseline level of proficiency) in science in PISA.
Source: OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*.

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Some *Länder* have taken important measures to avoid potentially negative effects of tracking on equity. The number of school tracks has fallen. In some *Länder*, in addition to the *Gymnasium* which prepares for university entry, there is only one school form, with several levels of courses. In Hessen parents can choose between 4-year and 6-year primary schools, and in Berlin and Brandenburg, all primary schools are comprehensive until grade 6 (age 12).

Tracking is only one of many factors which may contribute to unequal cognitive skill development. The incidence of poor learning outcomes is already substantial among 11-year-old children, who have been subject to tracking for at most a year (Mullis et al., 2017[186]). Among 11-year-olds, almost 20% of pupils reach at most basic reading competencies. The difference in results between pupils of parents that possess many books and those who have few books is marked, equivalent to what pupils in primary education learn in one year.

Further improving early childhood education and care and full-day primary education

Investing at an early stage in children's development and education can produce high returns on investments since this lays down a crucial foundation for future learning, especially for children with weak socio-economic background. A growing body of research

recognises that high-quality early childhood education and care (ECEC) brings a wide range of benefits, for example, better child well-being and learning outcomes as a foundation for lifelong learning; more equitable child outcomes and reduction of poverty; increased intergenerational social mobility; more female labour market participation; increased fertility rates; and better social and economic development for the society at large (OECD, 2012[187]). Analysis of data from the OECD Programme for International Student Assessment (PISA) finds that a student who did not attend early childhood education is about 3.1 times more likely than a student who attended for one year or more to perform below the baseline level of proficiency in science, after accounting for socio-economic status (OECD, 2017[188]).

The number of enrolled children under the age of three has risen from 18% in 2008 to 33% in 2017. Enrolment of above-3-year-olds in early childhood education is near universal. The federal government continues to support the expansion of childcare facilities by means of targeted investment programs. For example, the *"KitaPlus"* programme, launched in 2016, focuses on the provision of a wider range of opening hours. However, demand is still higher than the number of available childcare places (Alt et al., 2017[189]). It is welcome that the coalition agreement foresees providing more funding for early childhood education and care. It foresees reducing fees paid by parents and improving quality. It also foresees introducing a legal entitlement to full-day primary education.

Children with a migration background as well as children of parents with low levels of education attend early childhood education and care (ECEC) less and later, even though ECEC would have the biggest benefits for them (Schober, Spieß and Stahl, 2017[190]). In 2016, 20% of under-3-year olds with a migration background attended an ECEC facility, while the share among under-3-year-olds without a migration background stood at 38%. The participation of under-3-year-olds in childcare who have parents with low levels of education even decreased from 19% in 2012 to 16% in 2015 (Autorengruppe Bildungsberichterstattung, 2016[191]).

Private funding still contributes 22% towards the cost of childcare, more than in most OECD countries (OECD, 2017[192]). In relative terms, the financial burden on low-income households who make use of childcare facilities is still high high (Schmitz, Spieß and Stahl, 2017[193]). Surveys indicate that high-income households would be willing to pay more for childcare services than they do.

The effect of ECEC attendance on subsequent education outcomes depends on the quality of the interactions and learning environment in these institutions (Anders et al., 2011[194]). Higher childcare quality also increases health benefits. Participation in formal childcare can substantially reduce health risks for children at higher age (Peter, 2014[195]). By encouraging more parents to make use of childcare facilities, it also boosts female labour market participation (Schober and Spieß, 2014[196]). The quality of childcare is uneven in Germany (Stahl, Schober and Spiess, 2017[197]). For example, there are differences in the staff-to-children ratio and in qualification levels (Bertelsmann Stiftung, 2017[198]). Many young children from disadvantaged socio-economic backgrounds are enrolled in lower-quality institutions (Schober and Pia, 2017[199]).

The federal and *Länder* governments have taken further initiatives to improve access to and quality of early childhood education and childcare, such as the programme "*Kita-Einstieg – Brücken bauen in Frühe Bildung"* (Entry into ECEC – building bridges to early education), the programme "*KitaPlus"* or "*Sprach-Kitas"* (child care centers with focus on language education and development). In recent years, the German government has also

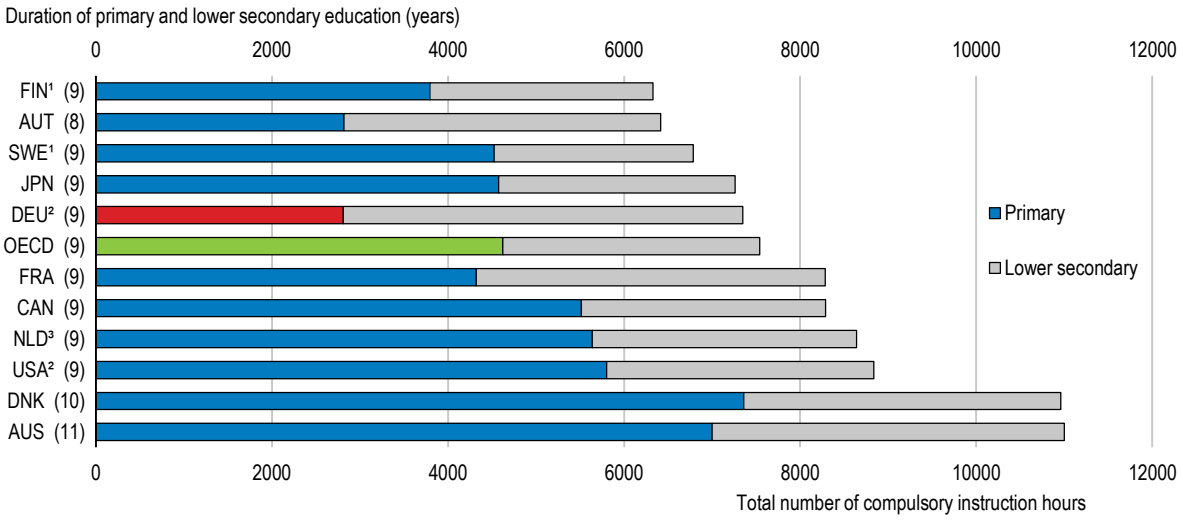
supported improving the qualifications of daycare staff. The federal government and the governments of the *Länder* have also taken stock of progress in improving quality and identified further steps to be taken (Bundesministerium für Familie, Senioren, Frauen und Jugend, 2016[200]).

It is particularly important to improve quality standards across Germany to help avoid quality gaps for young children who need the most support. However, this requires adequate monitoring of quality. The German government has therefore decided to participate in the OECD *Starting Strong Teaching and Learning International Survey*, which collects data on ECEC quality from ECEC staff and centre leaders. However, monitoring of quality may be insufficient in most individual *Länder* (OECD, 2016[201]). In addition, incentives need to be developed to encourage parents with low socio-economic background to enrol their children, for example, with conditional cash benefits, in addition to free enrolment.

In Germany, 66% of primary schools provide full-day schooling and 40% of the pupils attend. Indeed, teaching time is short in international comparison (Figure 2.18). Differences between the *Länder* are marked. The quality of programmes is key for obtaining benefits from full-day schools. Many full-day schools provide mostly childcare in the afternoon, rather than education. Among schools which provide education also in the afternoon, afternoon teaching is often not integrated with the morning curriculum, reducing the benefits of full-day education (StEG, 2016[202]); see also Box 2.4.

Figure 2.18. Instruction time in primary education is low

2016



1. Estimated number of hours by level of education based on the average number of hours per year, as the allocation of instruction time across multiple grades is flexible.
2. 2015 for Germany and 2012 for the United States.
3. The number of grades in lower secondary education is three or four, depending on the track. The fourth year of pre-vocational secondary education (VMBO) was excluded from the calculation.
Source: OECD (2016), *Education at a Glance 2016: OECD Indicators*.

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Box 2.4. Realising the potential of full-day school to boost cognitive and non-cognitive skills: Results of evaluation in Germany

Research commissioned by the federal government shows that all-day schools have the potential to have a positive influence on the individual development of pupils (StEG, 2016[202]). High quality all-day school can strengthen social and emotional skills and thereby contribute to better success at school.

All-day schools foster non-cognitive personal and social skills, in particular motivation to learn and self-confidence. Indeed, these non-cognitive skills are key for success in the adult social and economic life. They also help acquire cognitive skills. Sports and music classes at all-day schools reach target groups of pupils with weak socio-economic background who did not previously make use of such opportunities (sports clubs, music or art schools).

All-day schools also support the reconciliation of work and family life, particularly as far as working mothers are concerned. Working parents and single parents are particularly likely to send their children to all-day schools. Families with fewer resources in particular consider that all-day schools relieve the pressure and have a positive effect on family life.

Full-day schooling aims at enhancing the individual promotion, in particular of pupils/students with migrant backgrounds or from difficult social backgrounds. Head teacher surveys also suggest that full-day schools make it easier to integrate children with special needs.

Enriching the social environment bears the potential to close the observed developmental gap in social skills between children with different socio-economic status. Research suggests that children participation in programmes addressing prosocial behaviour can improve these skills especially among children with low socio-economic status (Kosse et al., 2016[151]).

The biggest and most prominent programme at the federal level to strengthen such skills is *"Kultur macht stark - Bündnisse für Bildung"*. The government spent EUR 50 million annually between 2013 and 2017 and the programme will be extended for additional five years. More than 450 000 children and young people benefited from the programme. The target group of the programme is 3- to 18-years old children and young people from disadvantaged socioeconomic backgrounds. The programme supports local alliances of institutions offering cultural activities, including activities that relate to architecture, literature, music, theatre and circus as well as everyday culture with schools. Targets of the programme include educational equality, social participation and personality development of young people.

Strengthening digital skills at school

According to the International Computer and Information Literacy Study (ICILS) from 2013, 30% of German pupils only had rudimentary computer skills. The use of digital media at school has barely expanded in recent years. According to the study, poor technical equipment contributes to low computer skills. More training of teachers in the teaching of ICT skills and in the use of ICT in general education could help improve student skills

(Sachverständigenrat, 2017[154]; Bos, 2014[203]). Schools do not generally offer optional courses providing digital skills (Sachverständigenrat, 2017[154]). However, new ICT technologies also offer opportunities to improve access to better education outcomes and better access to economic opportunities for pupils with low socio-economic background, for example, because they make it easier to provide tailored, individual support to each pupil (Eickelmann, Bos and Gerick, 2015[204]).

Adapting the successful vocational education system in the light of skill-biased technological change

An important strength of the dual system is cooperation between companies and public vocational schools. On-the-job training is complemented by teaching in part-time VET schools where students usually spend 12 hours per week. At VET school, one third of teaching is in general education and two thirds occupationally-specific education. The system is regulated by the federal government, the *Länder*, the business chambers and the social partners (Box 2.5).

Thanks to the dual system, Germany enjoys excellent integration of young people in the labour market and low field-of study mismatch, as argued above. It has contributed to maintaining manufacturing employment in Germany. This could also help explain why Germany has not experienced an increase in inequality on the same scale as the United States (Aizenman et al., 2017[205]).

Vocational education programmes are adjusted regularly and quickly to adjust to technological change. Since 2000 two thirds of the 327 programmes have been revised at least once and 40 new ones have been created (Sachverständigenrat, 2017[154]). To address the changing skill requirements from digitalisation the Federal Ministry of Education has in introduced the programme *"Berufsbildung 4.0"* (VET 4.0). It includes the creation of inter-company vocational training centres and subsidies for the procurement of digital equipment by schools, to ensure VET graduates are equipped with up-to-date digital skills. The coalition agreement contains various plans to further promote digital skills in vocational education and training, such as comprehensive measures to digitally train teachers in vocational schools and further educating instructors, a digital equipment campaign for vocational schools and vocational training centres, as well as expanding VET 4.0.

Wage and employment prospects of vocational education graduates at higher age may be more exposed to risks as a result of technological change that occurs after they complete their degree. As the theory of endogenous technological change implies, firms become more likely to adopt modern technologies if workers whose skills complement new technologies are available. As a result, the supply of modern-skilled graduates may create its own demand at the expense of the demand for incumbent workers with outdated skills (Janssen et al., 2017[206]). Moreover, as the demand for skills has become increasingly stronger for high and low-skill activities (as argued in Chapter 1), the wage and employment of middle-skill vocational workers may continue to weaken.

Box 2.5. Institutional responsibilities in Germany's vocational education and training system

The Federal Ministry of Education and Research has overall responsibility for VET strategy. The *Länder* have responsibility for the VET schools. They design the school curricula, train and pay the teachers and are responsible for legal supervision of the Chambers of industry and commerce, crafts and trades. Occupation-specific content is set according to a framework curriculum issued for each profession by the Standing Conference of Ministers for Education and Cultural Affairs of the *Länder* jointly for vocational subjects and by the *Länder* individually for general subjects (Hoeckel and Schwartz, 2010[207]).

The social partners are involved in the development and updating of the curricula, issued by the Ministry of Economic Affairs and Energy in most cases, and determine apprenticeship salaries through collective wage negotiations.

The business chambers register apprenticeship contracts, assess the suitability of training firms and monitor their training, assess the aptitude of VET trainers, provide advice to training firms and apprentices, organise and carry out the final exams and issue the degree certificates.

The responsibility for funding vocational schools lies with the *Länder* (mainly teacher salaries) and local authorities (equipment, infrastructure), while companies bear the costs of training in the workplace. In some sectors, companies have created a general fund to which all companies pay contributions and through which the costs for the apprenticing institution are covered, while in other sectors each company bears its own costs. Overall, the biggest share of the costs for dual system VET falls to training firms (Hoeckel and Schwartz, 2010[207]).

While occupation-specific upper secondary vocational education and training helps with school-to-work transitions, especially in countries with strong apprenticeship systems, it appears to be linked with a stronger decline in employment prospects later in life, relative to general education or tertiary education Table 2.1. This is also shown by evidence across high-income countries (Hanushek et al., 2015[149]; Hampf and Woessmann, 2016[208]; Forster et al., 2016[209]). According to the most recent evidence (Hampf and Woessmann, 2016[208]), who refute contrary results by others on this point (Forster et al., 2016[209]), the decline in employment prospects at higher age is strongest in apprenticeship-based training systems.

The risk of long-term unemployment appears to rise relatively strongly for graduates from vocational upper secondary education above the age of 45 years, as research undertaken for the OECD with German Socio-Economic Panel (SOEP) data shows. Among 45-55-year-old graduates, a quarter of unemployment spells observed since 2005 has ended with a new job only after 22 months. The research also shows that longer unemployment spells generally result in a bigger loss of subsequent wage earnings, compared to what they would have been without the unemployment experience. There appears to be a significant depressing impact of unemployment duration on subsequent wages in particular for unqualified workers and workers with intermediate vocational skills, whereas this relationship is not statistically significant for other skill groups. However, differences between skill groups are not statistically significant either. Across all skill groups,

unemployment depresses subsequent wages more strongly at higher age. Unemployment appears to depress wages in subsequent employment somewhat less for workers with a university degree than for vocationally-trained workers (Effenberger et al., 2018[210]). All this evidence points to the importance of preparing workers for the labour market impacts of technological change, especially at higher age.

Table 2.1. Employment rates by educational attainment and age group, 2016

Age group	Below upper secondary education	Upper secondary and post-secondary non-tertiary general education	Upper secondary and post-secondary non-tertiary vocational education	Tertiary education
25-34	55.3	55.0	86.3	87.0
35-44	63.2	71.9	88.0	91.4
45-54	67.1	77.1	87.3	93.5
55-64	51.5	65.5	67.5	80.3

Source: OECD (2018), "Education at a glance: Educational attainment and labour-force status", *OECD Education Statistics* (database).

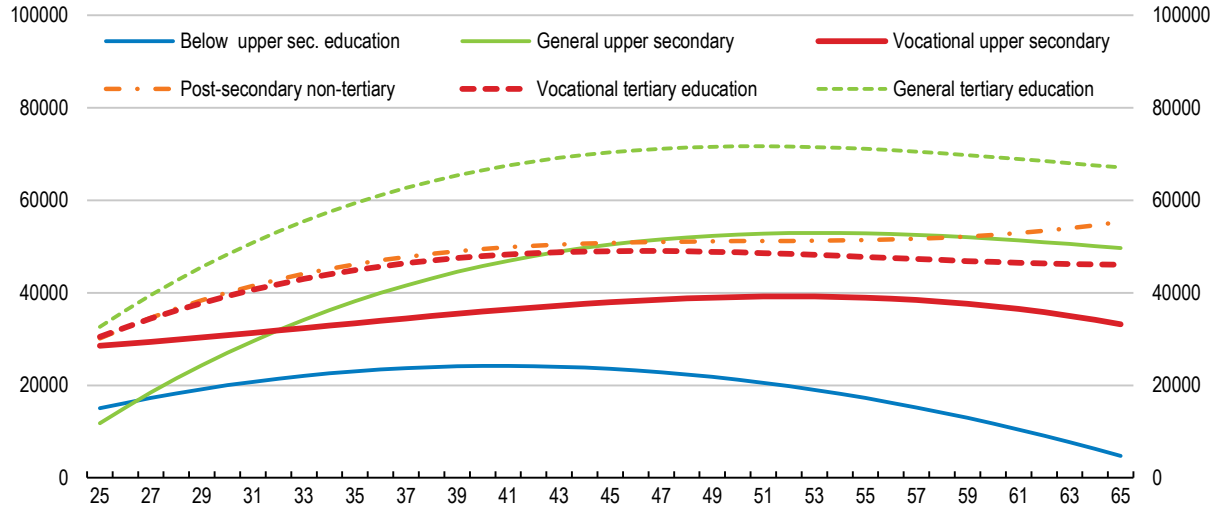
OECD research with data from the SOEP, which collects data on individuals throughout their lifetime, indicates that similar findings apply to earnings. Whereas average earnings of graduates from academic upper secondary and tertiary degrees more than double, average earnings of upper secondary vocational graduates grow by only 30% between the age of around 25 and 50 years. Average earnings of workers with tertiary vocational skills also rise relatively slowly with experience (Figure 2.19). The dispersion of earnings among individuals within the same education group is however large, especially for vocational education graduates. In fact, 28% earn more than the average university graduate.

When vocational training programmes are updated to integrate new technologies, the earnings of incumbent workers, who completed their training before the update, fall. This is shown by evidence on earnings of machinery technicians who had completed their apprenticeship after the training programme was updated to include up-to-date information and communication technology (Janssen et al., 2017[206]). Even young incumbent workers experienced long-lasting earnings losses after the IT-skilled graduates entered the labour market. The estimated loss was only around 5%. However, if several updates occur over a lifetime the losses could be a multiple. New IT-skilled graduates crowded out incumbent workers of their occupation, and incumbent workers forwent promotion, although incumbents experienced only little unemployment (Janssen et al., 2017[206]). Incumbent machining metal operators became significantly less likely to remain in the metal working sector and significantly more likely to enter the service sector, particularly, low-wage service jobs. The risk of adverse consequences of routine-biased technological change appears to be most substantial for medium-educated workers, in particular, for medium-educated production workers (Goos, Salomons and Manning, 2014[211]).

Entry in vocational education has diminished the most in those sectors which have experienced the most rapid renewal of vocational education programmes, namely in industry and the crafts (Sachverständigenrat, 2017[154]), which suggests that uncertainty and expectations about depreciation of technology-specific skills may have made youth more attracted to university study programmes.

Figure 2.19. Earning profiles by education level

Yearly earnings in euros, by educational level, 25-65 year-olds, men



Note: The earning profiles are estimated on the basis of data from the German Socio Economic Panel, which follows individuals living in Germany throughout their lifetime. The sample includes data from 1984 to 2012 for individuals living in Western Germany. Earning profiles were estimated by running a regression of earnings of each economically active individual on time dummies as well as linear and non-linear age variables for each education level. They capture average profiles. There is heterogeneity of earnings around each estimated profile. Individuals with post-secondary non-tertiary attainment typically hold both a general upper secondary and a vocational upper secondary degree.
Source: OECD calculations on the basis of the German Socio Economic Panel (SOEP).

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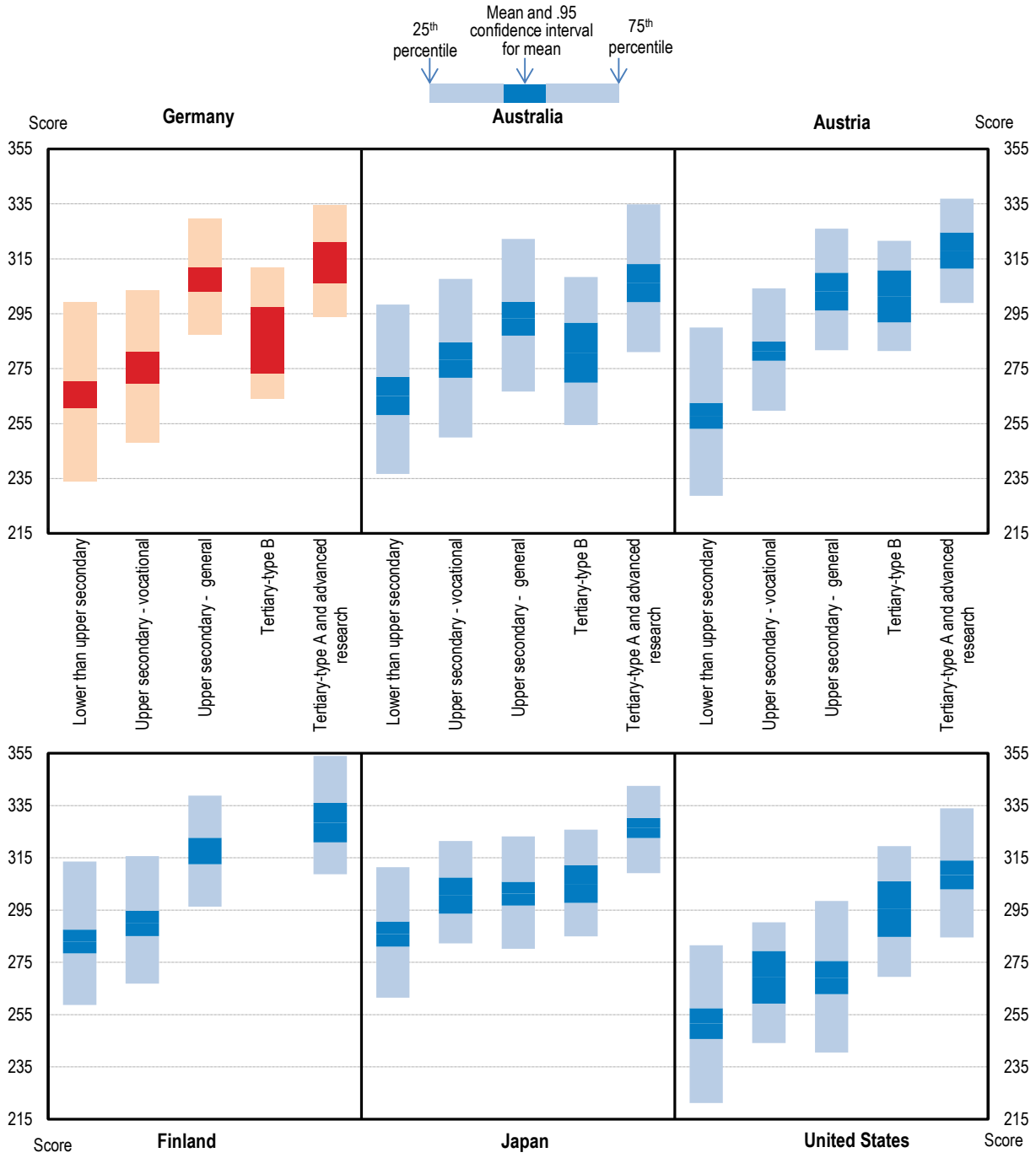
Stronger basic cognitive skills are needed

Literacy skills are relatively low among young people in vocational education coming from lower secondary education compared to countries who are strong PIAAC performers (Japan, Finland, Australia), for example with respect to reading (Figure 2.20). As the PIAAC Survey of adult skills was undertaken in 2012, it is likely that test scores would today be higher, reflecting reforms which have boosted PISA scores for 15 year-olds, especially among those with weak socio-economic background. Many of these youth have entered upper secondary vocational education subsequently. However, PIAAC scores among upper secondary vocational students and graduates also appear little higher than those of young people with no upper secondary degree, suggesting that cognitive skills improve little in vocational education schools. By contrast, academic secondary as well as tertiary university students and graduates have strong cognitive skills. Tertiary vocational graduates do less well.

Also, only a minority of upper secondary vocational education pupils learn English, fewer than in most other vocational education systems across Europe (Figure 2.21). Stronger English language skills are in higher demand in workplaces which are more digitalised and would also prepare graduates better for globalisation (CEDEFOP, 2017[163]). In 2015, the *Länder* adopted a framework agreement to be able to better react to the requirements of a globalised working world in vocational education. The opportunities to spend time abroad during education and training were improved. This includes the extension and deepening of foreign language competence according to its significance in each vocational qualification.

Figure 2.20. Literacy skills improve modestly in upper secondary vocational education

Mean literacy proficiency and distribution of literacy scores, by educational attainment, 16-29 year-olds, 2012



1. The estimate for Tertiary-type B for Finland is based on a sample size very close to 30 and is not shown at the country's request.
2. Only a sample of countries is shown as an example.
Source: OECD (2013), *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills*.

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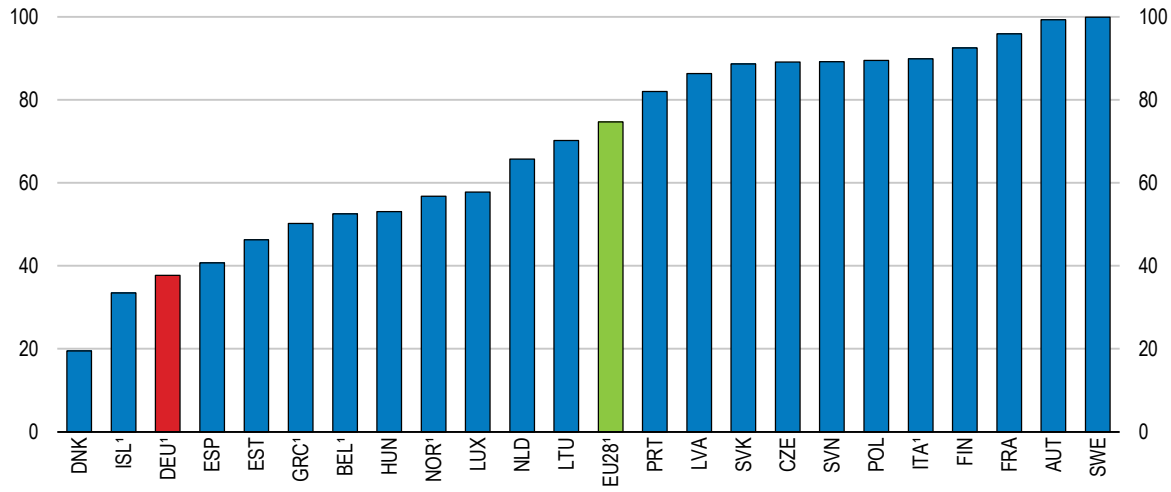
Figure 2.21. Few students in vocational education learn English

Share of students learning English in upper secondary vocational education, 2016 or latest year



1. 2015 for Belgium, Germany, Greece, Iceland, Italy, Norway and the European Union.
Source: Eurostat (2018), *Education and training Statistics* (database).

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Graduates with low cognitive skills levels may be less prepared to acquire new skills and adapt to evolving technologies and skills demand. For example, adults with lower cognitive skills are less likely to engage in job-related adult education and training later on. Modest cognitive skills also weaken access of upper secondary vocational education graduates to higher education, which is low (see below). Cognitive skills, and their impact on the capacity to engage in lifelong learning, may be especially important in view of the evidence of rising demand for high-skill workers in the context of digitalisation. Ensuring that VET graduates have strong literacy and numeracy skills is therefore essential. One policy option may therefore be to strengthen general cognitive skills within the apprenticeship system (Hoeckel and Schwartz, 2010[207]). Strengthening non-cognitive general skills such as to perform managing, communicating and marketing tasks, as well as ICT skills, is also important. A strong ability to perform such non-routine tasks can also protect workers against the job risks of automation.

The evaluation of dual system students at the end of the apprenticeship is dominated by the final chamber exam, which tests occupation-specific skills. It alone determines whether the apprentices receive their formal VET qualification. The training employer also provides a written evaluation and the part-time VET school provides a certificate from the part-time VET school. But general education examination results (maths, German, etc.) are not generally included in the degree diploma. Inclusion of the school mark as a component of the final diploma is voluntary. Because their school performance does not count in the chamber exam, students may not take their schooling seriously (Hoeckel and Schwartz, 2010[207]). While around 75% of trainees themselves report satisfaction with the firm-based training only 55% do so for the schooling part (Institut der deutschen Wirtschaft, 2015[212]).

One way of improving general skills would be to introduce a first year to develop basic skills, as recommended by the OECD (Hoeckel and Schwartz, 2010[207]), offering general education as well education in a broad professional area. This would also postpone occupational choice, helping to reduce traditional gender bias. Some OECD countries, for

example Denmark, already organise their VET system this way and offer a general first year to students where they can try out different elements of a professional cluster before committing themselves to a specific occupation.

Access to higher education has improved, but more could be done

The *Länder* opened formal access to universities for vocational education graduates in 1995. Graduates from apprenticeships can access university with further qualifications, such as vocational education degrees at the tertiary level. In addition, vocational education graduates are also given access to university education in their area of expertise after three years of professional experience and an entrance exam or a trial study period. Recently programmes combining apprenticeships with higher education have been created (*duales Studium* – dual studies), but they aim at youth who have done general upper secondary education and so have access to university anyway. Only 2.4% of young people entering university got there on the basis of a vocational upper secondary degree.

One *Land* decided to go further and to give access to university without the three-year professional experience requirement, while maintaining the entrance exam or trial study requirement. Indeed, evaluation has shown that professional experience did not play an important role for the chances of success at university (Euler and Severing, 2016[213]). Moreover, if students can pursue higher education earlier, they can earn a return on it over a longer period of time, improving incentives to do so.

Graduates from apprenticeship programmes interested in taking study further may need special support in order to start studying. Higher education institutions have adapted the structure and organisation of courses of studies regarding the needs of this target group. In addition, the higher education institutions offer preparatory courses, and distance-learning and part-time programmes, so that a course of study can be completed while working. Nonetheless, this share has barely risen since 2011. Easier access to higher education would also improve social integration among higher education students and foster upward intergenerational social mobility.

There is also scope to develop general guidelines to improve the recognition of skills acquired in vocational education by universities, so vocational education graduates can acquire higher education qualifications more easily. The federal and regional governments could also provide financial incentives to universities to provide study offers that facilitate the transition to vocational education graduates (Wissenschaftsrat, 2014[214]).

Boosting life-long learning would raise well-being and inclusiveness

Life-long learning is becoming more and more important as rapid technological change makes skills obsolete more quickly. At the same time the working lives are likely to lengthen as life expectancy rises, while fewer young workers join the labour market after completing full-time education. Most workers expected to be active in the labour market in 2030 are already working today, yet technologies will have changed skills demand substantially, in part through automation (Chapter 1). Work-related lifelong learning can take many forms, including formal and non-formal education, on-the-job training and informal education (OECD, 2017[158]).

Life-long learning raises earnings and improves employability among participants (European Commission, Directorate General for Employment, Social Affairs and Inclusion, 2015[215]). In Germany subsidised adult vocational training (mostly for unemployed workers) has been shown to increase the probability to be employed by about

10% to 20% (McCall, Smith and Wunsch, 2016[216]). OECD research with data from the German Socioeconomic Panel indicates that participation in employer-sponsored training reduces unemployment among experienced workers.

Life-long learning also helps improve economic opportunities for workers with poor qualifications, boosting inclusiveness. Adult learning opportunities improve labour market integration of the 1.5 million refugees, most without formal certified skills, Germany received for humanitarian reasons in 2015 and 2016 (OECD, 2016[164]). Life-long learning also improves job satisfaction, in part through career advancement (OECD, 2017[217]; Roggenkamp, 2016[218]). It increases self-confidence and overall life satisfaction (European Commission, Directorate General for Employment, Social Affairs and Inclusion, 2015[215]). Life-long learning can also boost civic engagement. It can also improve learning and wellbeing among children, as the impact of adult education on youth education outcomes is marked.

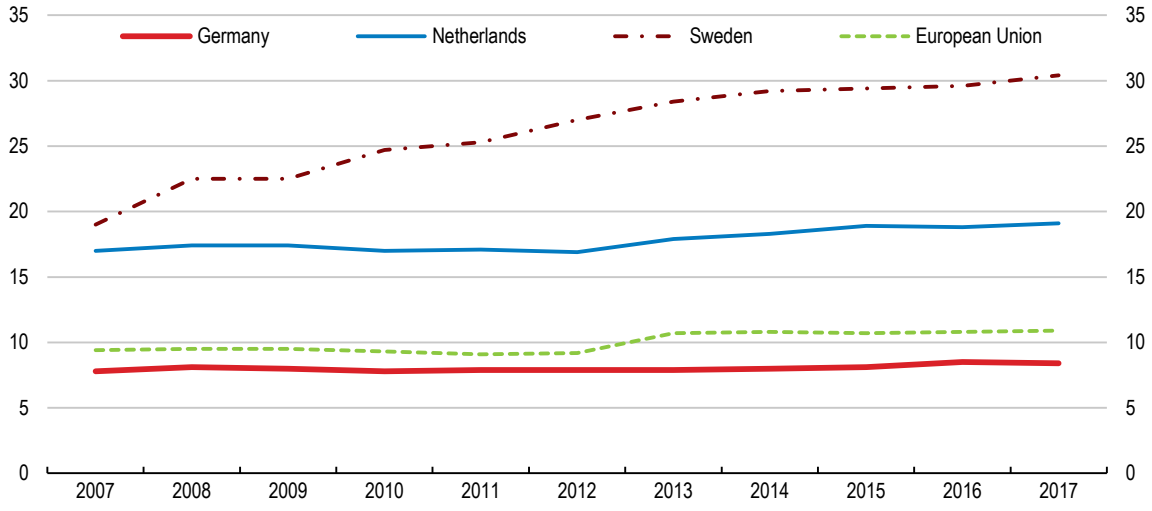
Adult participation in life-long learning has risen little in recent years and is well behind best-performing high income countries, such as Denmark, Finland and Sweden, according to Labour Force Survey data (Figure 2.22) and the Adult Education Survey (AES). The latest results of the Adult Education Survey show that one in two adult Germans participated in at least one adult education measure in 2016 while in the best-performing countries this number rises to nearly three out of four. Participation in formal and non-formal education and training is relatively low also according to the 2012 OECD PIAAC Survey. As in other countries, participation is particularly low among older workers as well as among people with only basic education or low literacy skills, but also among graduates of vocational education. Most non-participants do not want to participate and see no need for education and training, more so than in peer countries. This is consistent with the low readiness to learn according to the PIAAC study and may reflect discouraging experience made in full-time initial education at young age, especially among the unskilled. The new government's coalition agreement proposes to develop a national strategy for continuing education, to be agreed with social partners, with the aim of coordinating existing programs and strengthening life-long learning. This is welcome. However, care must also be taken that the plan takes the interests of unskilled workers into account, who are often weakly attached to the labour market. Their interests may be less well represented by the social partners.

Among German medium-sized enterprises fewer than 50% provide ICT training. In other high-income countries this share can reach 55% to 60%. Training by companies is mostly directed to medium and high-skilled workers, not low skilled workers (OECD, 2017[219]).

Germany is among the few countries with lower female participation compared to men. Women above the age of 35 are particularly unlikely to participate in life-long learning, likely reflecting family responsibilities. Women with young children in the household participate less than women with older children (PIAAC) (OECD, 2017[158]). Far more women than men report that family responsibilities and distant training venues are barriers (EU Adult Education Survey 2016). Men's participation rates are also substantially lower above the age of 35. Conceivably, family duties can lower participation by both parents, especially in the context of couples with one main earner. It may be easier to participate in adult education in couples in which both partners can work if participation results in some loss of wage income. Indeed part-time employment boosts participation by men. The opposite is true for women.

Figure 2.22. Participation in life-long learning can be raised further

Participation in life-long learning[1], % of population aged 26-64, 2017



1. Includes formal as well as non-formal education and training. The reference period for the participation is the four weeks prior to the interview.
Source: Eurostat (2018), *Education and training* (database).

StatLink http://dx.doi.org/10.1787/888933737837

Improved modular training offers could boost life-long learning

Several OECD studies examine policy practices to encourage lifelong learning in order to respond to the changing skill needs (OECD, 2017[220]; [221]; [222]; 2014[223]; 2003[224]). Steps to better validate uncertified skills acquired-on-the job, combined with developing modular learning approaches, can boost incentives to participate in life-long learning. In this way, adults could target formal learning efforts to those skills they still need to obtain a desired qualification. Such an approach, in the context of demographic change, may also allow employing education and training infrastructure better whilst its utilisation by young people in full-time education falls. To this end, Germany is well-placed to build on its excellent vocational education system including the involvement of the social partners and business chambers which already play a role in validating skills (Desjardins, 2017[225]). Since 2005, vocational education qualifications can be pursued part-time, so it could be more easily used in the context of adult learning, although this option is rarely taken up.

By making it easier to have skills certified, effective systems for identifying, recognising and validating skills, including those acquired on-the-job, pay a triple divided: 1) they improve opportunities to use skills more effectively reducing skill mismatch; 2) they boost activation and worker bargaining power, with a positive impact on wages; and 3) they create incentives for adults to engage in continuous skills development (OECD, 2017[221]). When there is no validation of informal competences workers find themselves obliged to follow courses for skills they already possess (OECD, 2016[226]). Skills recognition can hence avoid unnecessary repetition and lower training costs (OECD, 2003[224]). This could boost motivation and the completion of learning programmes. The impact may be substantial as informal learning on-the-job is widespread (De Grip, 2015[227]). Government-funded recognition of skills acquired on-the-job has boosted adult learning in Portugal, especially among the unqualified. The modular training offers for the unemployed reduced the duration of unemployment (Lima, 2012[228]). Also in Denmark a modular approach to

adult learning boosted participation, including among unskilled adults (Desjardins, 2017[225]).

Counselling and assistance can help identify suitable further training to obtain a complete formal qualification. Counselling is offered in OECD countries with well-implemented skills validation and certification systems (Gaylor, Schöpf and Severing, 2015[229]). The Federal Employment Agency already offers independent professional career guidance nationwide. It involves the provision of advice and information concerning career choice, occupations and the respective requirements, funding options for vocational education and training, developments in the working world, the situation and expected trends in the job market, and finding a job. Furthermore the Federal Ministry for Education and Research has created an advisory service which it is extending. The coalition agreement also proposes to improve information and counselling services.

The benefits may be particularly large for adults with no formal qualifications. Achieving a first qualification can open access to higher-level qualifications (Bertelsmann Stiftung, 2018[230]). Skill recognition may hence foster equity in educational outcomes including for older workers, low-skilled employees and migrants (Kis and Windisch, forthcoming[231]). Modular training offers combined with formal skills recognition can also make it easier for workers to keep their skills up to date and adapt to technological change, helping to maintain employability at higher age. Skills recognition will also make it easier for workers to move to emerging occupations in fields related to their initial VET training, improving skills use (Kis and Windisch, forthcoming[231]). Modular life-long learning offers need not imply lowering standards for the qualifications required for specific professions but widens access to such qualifications (Kis and Windisch, forthcoming[231]).

In Germany, training modules have been defined in the vocational education system (e.g. *Kölner Bildungsmodell*, *Perspektive Berufsabschluss*, *TrialNet*), and in advanced further training programs (master degrees in the crafts). However, it is not possible to complete only selected modules and have them certified. Also in taking an examination for the purposes of skills recognition (*Externenprüfung*), missing skills in part of the examined competences leads to failing the whole examination. Skills proven in successful parts of the examination are not recognised (Wittig and Neumann, 2016[232]). In the White Paper "Work 4.0" the government has recognised that modularisation needs to be strengthened to improve qualifications among the adult population. The coalition agreement plans to support further development of attractive, learning opportunities accessible to the low-skilled to allow for more inclusiveness.

Validation and assessment of skills obtained on-the-job have been initiated in Germany to facilitate the integration of immigrants, especially refugees (such as in the programmes include "Recognition Finder"). A pilot project has also been initiated to recognise skills of formally unqualified workers (Integration through Qualification Programme; ValiKom). These should be further developed to a general competence recognition system, recognising both (modular) formal and non-formal qualifications and enabling workers to receive certificates when they complete a full professional qualification, comparable to certificates of formal education (Bertelsmann Stiftung, 2018[233]). Applying a unified competence approach could also allow for more transparency. There are many certified adult training programmes, sometimes certiying similar competencies. This reduces the information value of certificates (Wittig and Neumann, 2016[232]).

Overall, compared to some other European OECD countries skill validation and recognition is weak in Germany (Bertelsmann Stiftung, 2018[233]). In many countries there is a legal entitlement for access to skills validation, backed up with public funding (e.g.

France, Norway, Denmark, Finland, Switzerland) (Gaylor, Schöpf and Severing, 2015[229]). According to a survey by the Federal Institute of Vocational Education and Training (BIBB) these should also be adopted in Germany (Velten and Herdin, 2016[234]). Recognising work-based learning also demands the use of more task-based methods in skill validation processes (e.g. final "external" examination, *Externenprüfung*) rather than just offering formal exams (Gaylor, Schöpf and Severing, 2015[229]).

Strengthening support for life-long learning

OECD work suggests that government financial support for life-long learning should be targeted to adults with the lowest qualification or literacy level (OECD, 2003[224]). While the impact of government funding on participation in adult education is not clear overall, when it comes to the low-skilled public spending can make the largest difference (OECD, 2003[224]). Recent evidence confirms this (European Commission, Directorate General for Employment, Social Affairs and Inclusion, 2015[215]). Indeed, low-income, low-education individuals have the lowest capacity to pay and may also be least aware of the benefits of education.

Firms invest less in low skilled employees because of lower returns (OECD, 2003[224]). However, the social returns of life-long learning for adults with low qualifications are likely to be higher because it may help reduce unemployment benefit claims and other transfer spending for low income households, and boost inclusive growth. While subsidies to businesses also increase participation in life-long learning (European Commission, Directorate General for Employment, Social Affairs and Inclusion, 2015[215]), businesses typically do not address the needs of low skilled employees, such as to boost general skills, including ICT, language or soft skills (OECD, 2017[235]; McCall, Smith and Wunsch, 2016[216]).

Germany offers a multitude of financing schemes aimed at a variety of groups. Recently, government support for adult learning has been strengthened (e.g. with the amended Advancement Promotion Act). However, a review of the programmes show that there is little support for low-skilled adults who are neither unemployed nor at risk of job loss; see (Bundesministerium für Bildung und Forschung,(n.d.)[236]; Deutsches Institut für Internationale Pädagogische Forschung, 2018[237]; Bundesagentur für Arbeit,(n.d.)[238]), for programme overviews). Germany could target funding to low-skilled low-income workers (OECD, 2017[221])

Lost earnings are a key barrier to private investment in adult education and training (OECD, 2017[239]). Paid educational leave is available in most *Länder* but is limited to 10 days only within two years. An expansion of paid educational leave could boost participation. The coalition agreement proposes to expand financial support and to consider the implementation of individual training accounts.

Current financial support and educational leave generally require participants to complete a full programme leading to a new professional qualification. In order to allow for more flexibility, these policies could be adapted to support modular programmes. Modular training and its funding should be accompanied by close professional counselling. Indeed, empirical evidence suggests that guidance and counselling boost training participation, reinforcing the positive impact of financial support (European Commission, Directorate General for Employment, Social Affairs and Inclusion, 2015[215]) .

According to the European Inventory on the validation of non-formal and informal learning (CEDEFOP, 2017[240]) low-skilled individuals, early school leavers, those without jobs and

at risk of unemployed, older workers, immigrants and people with disabilities take up validation opportunities insufficiently. Since benefits are likely highest for these groups, public support should be focussed on them.

Recommendations for improving skills and their use

Reduce skill mismatch

- **Increase the minimum amount of time the second parent has to take parental leave, from the current two months, for the couple to receive the maximum leave entitlement.**
- Improve housing supply in dynamic cities fostering densification in urban areas, for example with incentives for compact development on brownfield sites.

Improve ICT skills

- Expand ICT equipment at schools, improve teachers' digital teaching skills and the offer of digital courses at schools.

Improve equity in education

- **Raise quality standards in childcare and early childhood education.**
- **Expand primary education to high-quality full-day education programmes.**
- Use evaluation to guide full-day primary school programme design.
- Introduce more generous grant-only financial support for university students from low-income households and parents with low-education background.
- Require a regular qualitative evaluation of pedagogical quality in childcare in all *Länder*.
- Delay tracking in compulsory education.

Improve upskilling opportunities in the vocational education system

- **Strengthen general education in vocational schools, and maintain the strong labour market orientation of vocational education and training.**
- Introduce nationwide benchmarking of quality of learning outcomes in part-time dual vocational schools.
- Improve access to university education for upper secondary vocational graduates, for example by doing away with requirements of professional experience, and by strengthening incentives to universities to offer suitable programmes for vocational education graduates.

Boost participation in life-long learning

- **Offer more training programmes for the modular acquisition of qualifications in life-long learning and foster the recognition of skills acquired on-the-job.**
- **Strengthen support for unskilled adults to obtain professional qualifications.**
- Ensure modular training contributes towards full qualifications.
- Provide financial incentives for employers to provide workplace learning for the low-skilled.

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