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The economic situation and policies of Austria were reviewed by the Committee on 19 June 2017. The draft report was then revised in the light of the discussions and given final approval as the agreed report of the whole Committee on 28 June 2017.

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Information about the latest as well as previous Surveys *and more information about how* Surveys *are prepared is available at* www.oecd.org/eco/surveys.

BASIC STATISTICS OF AUSTRIA, 2016

(Numbers in parentheses refer to the OECD average)*

LAND, PEOPLE AND ELECTORAL CYCLE

Population (million)	8.6		Population density per km^2	105.5	(37.2)
Under 15 (%)	14.3	(17.9)	Life expectancy (years, 2014)	81.6	(80.6)
Over 65 (%)	18.9	(16.6)	Men	79.2	(77.9)
Foreign-born (%, 2014)	17.5		Women	84.0	(83.3)
Latest 5-year average growth (%)	0.4	(0.6)	Latest general election (presidential)	December 2016	

ECONOMY

Gross domestic product (GDP)			Value added shares (%)		
In current prices (billion USD)	386.4		Primary sector	1.3	(2.5)
In current prices (billion EUR)	349.4		Industry including construction	28.1	(26.7)
Latest 5-year average real growth (%)	1.1	(1.9)	Services	70.7	(70.8)
Per capita (000 USD PPP)	50.1	(42.1)			

GENERAL GOVERNMENT

Per cent of GDP

Expenditure[a]	51.1	(40.9)	Gross financial debt (2015)	106.2	(109.0)
Revenue	49.5	(38.9)	Net financial debt (2015)	57.1	(70.0)

EXTERNAL ACCOUNTS

Exchange rate (EUR per USD)	0.904		Main exports (% of total merchandise exports, 2015)		
PPP exchange rate (USA = 1)	0.798		Machinery and transport equipment	39.9	
In per cent of GDP			Manufactured goods	32.5	
Exports of goods and services	52.1	(53.9)	Chemicals and related products, n.e.s.	12.4	
Imports of goods and services	48.6	(49.4)	Main imports (% of total merchandise imports, 2015)		
Current account balance	1.7	(0.3)	Machinery and transport equipment	34.2	
Net international investment position	4.9		Manufactured goods	30.7	
			Chemicals and related products, n.e.s.	13.7	

LABOUR MARKET, SKILLS AND INNOVATION

Employment rate for 15-64 year-olds (%)	71.6	(67.0)	Unemployment rate, Labour Force Survey (age 15 and over) (%)	6.0	(6.3)
Men	75.4	(74.7)	Youth (age 15-24, %)	11.2	(13.0)
Women	67.7	(59.3)	Long-term unemployed (1 year and over, %)	1.9	(2.0)
Participation rate for 15-64 year-olds (%)	76.2	(71.7)	Tertiary educational attainment 25-64 year-olds (%, 2015)	30.6	(35.0)
Average hours worked per year (2015)	1 625	(1 766)	Gross domestic expenditure on R&D (% of GDP)[a]	3.1	(2.4)

ENVIRONMENT (2015)

Total primary energy supply per capita (toe)	3.8	(4.1)	CO_2 emissions from fuel combustion per capita (tonnes, 2014)	7.1	(9.4)
Renewables (%)	29.2	(9.6)	Municipal waste per capita (tonnes)	0.6	(0.5)
Exposure to air pollution (more than 10 µg/m^3 of $PM_{2.5}$, % of population)	86.5	(75.2)			

SOCIETY

Income inequality (Gini coefficient, 2013)	0.280	(0.311)	Education outcomes (PISA score, 2015)		
Relative poverty rate (%, 2013)	9.0	(11.1)	Reading	485	(493)
Median disposable household income (000 USD PPP, 2013)	29.3	(22.0)	Mathematics	497	(490)
Public and private spending (% of GDP)			Science	495	(493)
Health care (2015)	10.4	(9.0)	Share of women in parliament (%)	30.6	(28.7)
Pensions (2013)	14.0	(9.1)	Net official development assistance (% of GNI)	0.41	(0.39)
Education (primary, secondary, post sec. non tertiary, 2013)	3.2	(3.7)			

Better life index: *www.oecdbetterlifeindex.org*

** 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.

a) 2015 for the OECD average.

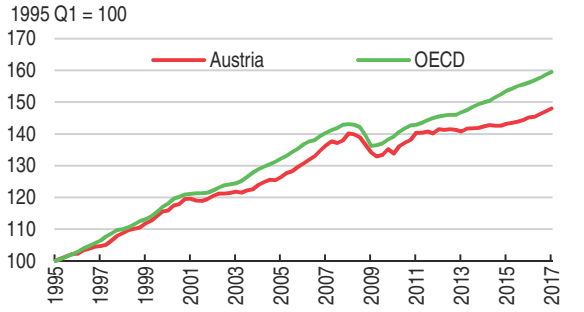
Source: Calculations based on data extracted from the databases of the following organisations: OECD, International Energy Agency, World Bank, International Monetary Fund and Inter-Parliamentary Union.

Executive summary

- *Growth has picked up but fundamentals should be strengthened*
- *Austria's transition towards digitalisation has been lagging*
- *Changing demand for skills affects equality of opportunity*

Growth has picked up but fundamentals should be strengthened

Growth is regaining momentum



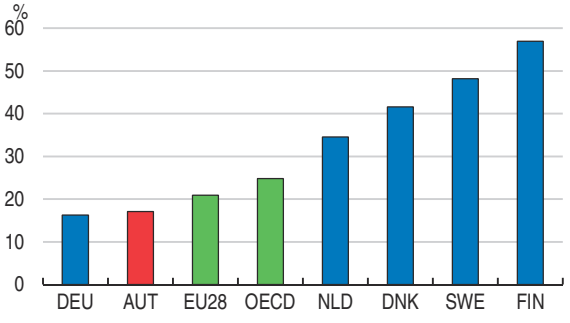
Source: OECD Economic Outlook 101 database.

StatLink http://dx.doi.org/10.1787/888933537102

Austria is a stable and wealthy economy and growth has picked up following the 2016 tax reform and the recovery of export demand. However, like in most OECD countries, trend output growth has declined since the 1990s. Labour supply has expanded, driven by rising participation of women and elderly and an increase in immigration, but hours worked per worker have declined. Productivity has slowed and Austria has lost market shares within regional value chains. Investment has recently accelerated, yet enterprise churn, start-up rates and the renewal of business models are weaker than in comparable countries. Reinvigorating business dynamism would improve competitiveness and labour demand, and spur both growth and social cohesion.

Austria's transition towards digitalisation has been lagging

Share of firms using cloud computing, 2016



Source: Eurostat and *OECD Digital Economy Outlook 2017* (forthcoming).

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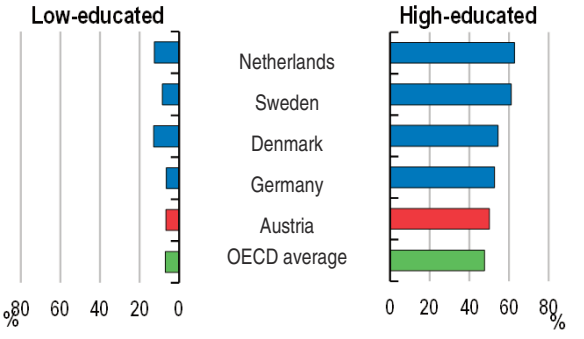
The business sector is adapting to the global digital revolution, albeit at a slower pace than in the most advanced countries, especially among smaller firms. The adoption of information and communication technology (ICT) applications by households is also uneven: while the young and highly educated align swiftly with global trends, older generations and those with lower educational level and immigrants seem to lag behind. Fostering broad-based diffusion of state-of-the-art technologies and digital innovations would help renew business models, work practices and lifestyles throughout Austria, and foster productivity growth, welfare and social cohesion.

Changing demand for skills affects equality of opportunity

Adults with advanced digital proficiency



Source: Survey of Adult Skills (PIAAC) (2012, 2015).

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The digital transformation is redesigning production processes and altering the relationships between work and leisure, capital and labour, skilled and unskilled, wealthy and less-wealthy. To preserve social cohesion, a comprehensive policy approach is needed for ensuring equality of opportunity in the face of technological change and appropriate redistribution of the gains stemming from digitalisation. Schools need to provide digital skills in addition to the traditional ones. Workers having left school will need to catch up via life-long learning solutions. Co-ordination across the many stakeholders of the education system needs to improve so that learning tracks better fit changing labour market requirements.

MAIN FINDINGS	KEY RECOMMENDATIONS
Building on the cyclical upturn	
Fiscal balances and the public debt ratio have improved but the foreseeable costs of ageing remain very high.	Take measures to ensure that the debt ratio declines as targeted. In particular rapidly increase effective retirement ages.
There are inefficiencies in education, health, care and public administration. Funding and management responsibilities are too fragmented across government layers.	Undertake an in-depth spending review in education, health, care and public administration; align taxing and spending responsibilities across government layers.
Bank balance sheet cleaning has made headway but operating costs remain high and bank profitability and capital adequacy weak.	Facilitate digitalisation, restructuring and cost reduction in the banking sector. Rigorously supervise large as well as small banks.
Boosting potential growth	
The external financing of start-ups and small firms is overly reliant on bank credit.	Continue to support venture capital investment and reduce tax and other disincentives for equity investments.
The insolvency framework may discourage risk-taking and firm creation.	Review the insolvency framework benchmarking it against international best practice.
Retail and professional services are over-regulated and entry barriers are high.	Streamline the licence system for retailers and reduce the number of exclusive rights in professional services.
Labour utilisation remains low. The employment rate has improved mainly through increases in part-time work and hours worked per employee declined.	Minimise the tax distortions that penalise transition from part-time to full-time work, subsidise overtime and hold back demand for low-skilled labour.
Work and child-caring remain hard to reconcile.	Introduce legal entitlements for full-day schooling and childcare; further increase capacity for such facilities in the whole country.
Fostering a faster transition to digitalisation	
A 2017 "Digital Roadmap" mainstreams efforts to foster digitalisation and tackle adjustment challenges.	Set up a transparent monitoring system for the implementation of the Digital Roadmap, with timelines and quantitative targets.
Austrian firms, especially SMEs, are relatively slow in adopting ICT innovations. Gaps relative to the global frontier have widened.	Integrate a Digital Skills Plan in the Roadmap, including for small firm owners and managers. Establish targets for ICT-generic, ICT-specialist and ICT-complementary skills.
Enterprises and households use fast broadband less than in comparable countries.	Facilitate new entries and stimulate competition in broadband services in the context of the Broadband Plan 2020.
Digitalisation creates risks of closure, collusion and monopolisation in several market areas.	Ensure that competition policy responds to changing threats to competition in digital markets, including through international co-operation.
Improving trust in digital applications is crucial to reduce transaction costs and facilitate the adoption of digital innovations, requiring addressing key data privacy, consumer protection and security issues.	Promote more effective data protection, cyber security and consumer protection. Improve public awareness that responsibility for risk management remains partly with firms and consumers themselves.
Ensuring inclusive labour markets in the digital era	
New forms of work blur the lines between dependent and independent work. Platform workers often operate outside the scope of standard law and social protection.	Adapt labour law and social institutions to enhance representation and protection of platform workers on the basis of ongoing consultations with social partners. Ensure the portability of ratings for platform workers.
Austrian 15-year-olds lag behind in digital skills, partly owing to outdated teaching practices.	Continue to modernise ICT-related curricula and teaching methods in schools.
Labour market demands related to digital skills change continuously.	Ensure that vocational education and training as well as tertiary education systems adjust to changing needs through both decentralised innovation and professional co-operation.
Available apprenticeships in professions most affected by digitalisation fall short of demand.	Enhance incentives for businesses to offer apprenticeship positions, in particular in professions affected by digitalisation.
Older persons and low-skilled lack basic digital skills.	Further develop special life-long learning schemes focussing on digital skills.

Assessment and recommendations

- *Growth is picking-up and digitalisation brings new challenges and opportunities*
- *Growth is picking up*
- *Macroeconomic policy has been supportive*
- *Raising medium-term growth*
- *Seizing opportunities and addressing the challenges arising from digitalisation*
- *Challenges for green growth*

Growth is picking-up and digitalisation brings new challenges and opportunities

After several years of subdued growth, economic output has accelerated in 2016 supported by a tax reform that entered into force in 2015-16, and more recently a pick-up in international trade. The upturn has improved fiscal balances, and the public debt ratio is on a downward path. The improvement in the macroeconomic situation has strengthened business and household confidence and the short-term outlook is favourable.

Like in most OECD countries, however, potential growth has weakened since the 1990s as capital formation, hours worked per person and total factor productivity have slowed. Austria initially benefitted from the rapid build-up of new regional value chains in Central and Eastern Europe, but has since tended to lose ground in this area. Policymakers currently aim at drawing on the global digital revolution to help renew business models, refuel productivity, accelerate innovation and boost competitiveness.

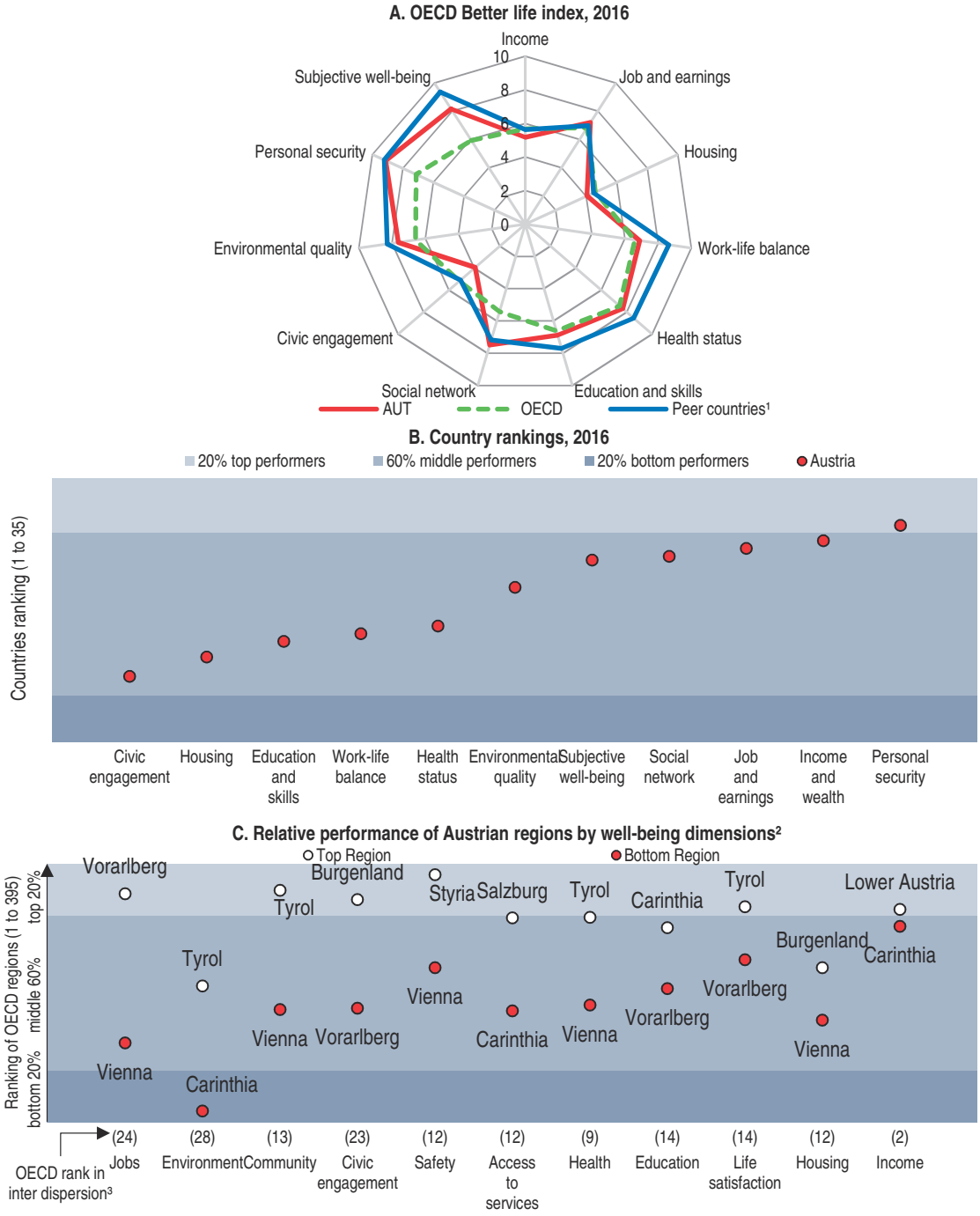
Austria remains a wealthy and stable economy, and its citizens enjoy a high quality of life (Figure 1, Panels A and B). GDP per capita and the employment rate exceed the OECD average. The risk of long term-unemployment is low and so is labour market insecurity. Even if a large share of jobs, particularly for women, is part-time, strong overall labour market performance boosts Austria's favourable international rankings for jobs and earnings, income, and subjective life satisfaction. Nonetheless, the country lags behind other high-income small European economies (henceforth "peer countries") with respect to work/life balance, health and housing, as discussed in recent OECD Economic Surveys, which focused on health in 2011, well-being more broadly in 2013 and gender inequality in 2015.

At the subnational level, Austria is also in the upper half of OECD countries in most well-being dimensions. Inequalities in regional GDP per capita declined since the early 2000s and are currently the second lowest in OECD (Figure 1, Panel C). However, disparities have increased in recent years for other regional indicators, notably with respect to R&D expenditures, unemployment rates and gender gaps in labour force participation.

The redistribution and social protection systems, backed by long-standing social partnership institutions, play an important role. Wage inequalities and poverty compare favourably to other countries, thanks to a tax and transfer system that curbs market income inequality by nearly half (Figure 2). In 2016, social expenditures accounted for nearly 28% of GDP in Austria against an OECD average of 21% (OECD Social Expenditure Database). Austrians finding themselves out of work can expect a lower average income loss than in most other OECD and peer countries (OECD, 2017a). The pension system offers relatively high replacement rates across all earning levels, and old-age poverty is lower than the OECD average, although many leave the labour market before the statutory retirement age, which reduces their pension entitlements.

Financing redistribution, however, is becoming more difficult. The population is ageing and slower growth in total hours worked implies a deceleration of the growth in social contributions. Benefit adjustments have been made over the past decade, and

Figure 1. **Well-being is high**



Note: Well-being dimensions are based on different indicators in panels A and B (where they are based on the OECD Better Life Index database definitions: *www.oecdbetterlifeindex.org*) and in panel C (where they are based on OECD Regional Well-being database definitions: *www.oecdregionalwellbeing.org*).

1. Denmark, Netherlands, Sweden and Switzerland.
2. Relative ranking of the regions with the best and worst outcomes in the 11 well-being dimensions, with respect to all 395 OECD regions. The 11 dimensions are ranked according to the size of regional disparities in the country. In order to increase the sample size, all the annual waves of the Gallup survey between 2006 and 2014 have been pooled together.
3. Gap between top and bottom regions. Austria's rank between 34 OECD countries is shown, 34 (highest dispersion), 1 (lowest dispersion).

Source: OECD (2016), Better Life Index database, *www.oecdbetterlifeindex.org* and OECD (2016) Regional Well-being database, *www.oecdregionalwellbeing.org*.

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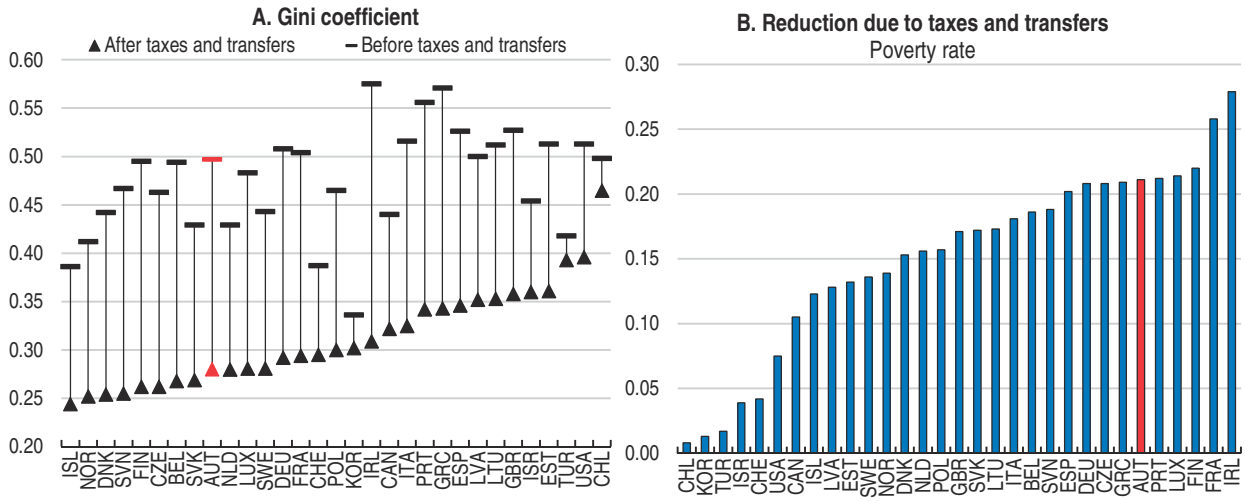
Figure 2. **Redistribution plays an important role**

2013



Note: The Gini coefficient has a range from zero (when everybody has identical incomes) to 1 (when all income goes to only one person). The poverty line is defined as 60% of median income.
Source: OECD database on income distribution and poverty.

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further changes will be necessary in the future to shift the composition of funding away from labour taxes and social contributions towards wealth, consumption and other taxes, which are less distorting (Box 1).

Box 1. **Considering the tax-and-benefit system as a whole**

Successive studies in OECD considered the impact of different types of taxes on economic growth (Arnold et al. 2011) and, more recently, extended the analysis to inclusiveness. This stream of work suggests that when growth and inclusiveness objectives are considered together, the tax-and-benefit system in each country should be examined as a whole (Brys et al., 2016).

Across OECD countries, "recurrent taxes on immovable property" are found to be the least harmful for growth, followed by consumption taxes (including environmental taxes), "other property taxes", personal income taxes and corporate income taxes. The other property taxes encompass "property transaction taxes", "recurrent taxes on net wealth" and "inheritance taxes", the individual impacts of which have not been investigated separately so far.

In the new extended approach, tax design for inclusive growth is defined as "tax policy which reconciles efficiency and equity considerations. This can be achieved either by minimising the trade-offs between efficiency and equity –meaning by reducing the equity costs of efficient tax reforms, or by lowering the efficiency costs of equitable tax reforms- or by implementing tax reforms that enhance efficiency and equity simultaneously".

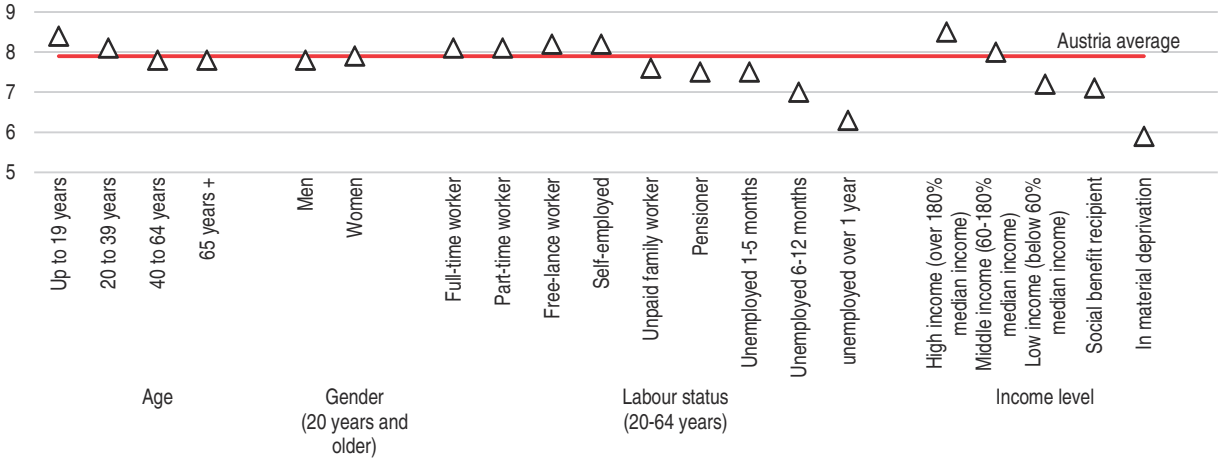
Given the special scope of the tax-and-transfer system in Austria and the need to generate alternative revenue sources to employment-unfriendly labour taxation, a comprehensive reconsideration of the tax-and-benefit system as a whole may help identify various reform options.

In contrast to income, wealth remains very concentrated in Austria. According to the OECD Wealth Distribution Database, as of 2010, the wealthiest 10% Austrian households held 62% of the country's wealth, the second-highest share among 13 OECD countries after the United States (76%). Although in all OECD economies wealth inequality is significantly higher than income inequality (the top 10% of the wealth distribution hold on average half of total household wealth) the stark contrast between Austria's income equality and wealth equality invites further scrutiny. The sources of this contrast are not well understood and need a thorough study of its own. Some very general insights can be offered when looking at OECD work on tax systems analysed for its growth friendliness on the one hand and for its contribution to inclusiveness on the other (Box 1). Another weakness in social cohesion pertains to gender inequalities, which run deeper than in comparable countries. Childbearing tends to worsen gender gaps with respect to the distribution of paid and unpaid work, earnings, career prospects and entrepreneurship opportunities (OECD, 2015a).

Life satisfaction is high for most social groups (Figure 3) but distinctly lower for the long-term unemployed, who account for 2.5% of the adult population, and other social benefit recipients, including pensioners who retired with short contribution histories. Moreover, 3% of the population report experiencing "severe material deprivation" (Eurostat, 2017c) and a larger group of Austrians appear less confident than in the past about their capacity to maintain their well-being and living standards. A 2016 survey had more than half of them expressing dissatisfaction with recent economic and social trends, while going forward 21% expected an improvement in their quality of life and 27% a deterioration, albeit from a relatively high level in international comparison (SORA, 2016a and 2016b).

Figure 3. **Divergences in life satisfaction**

Life satisfaction across social groups, 2015 or latest available



Source: Statistics Austria; EU SILC 2015.

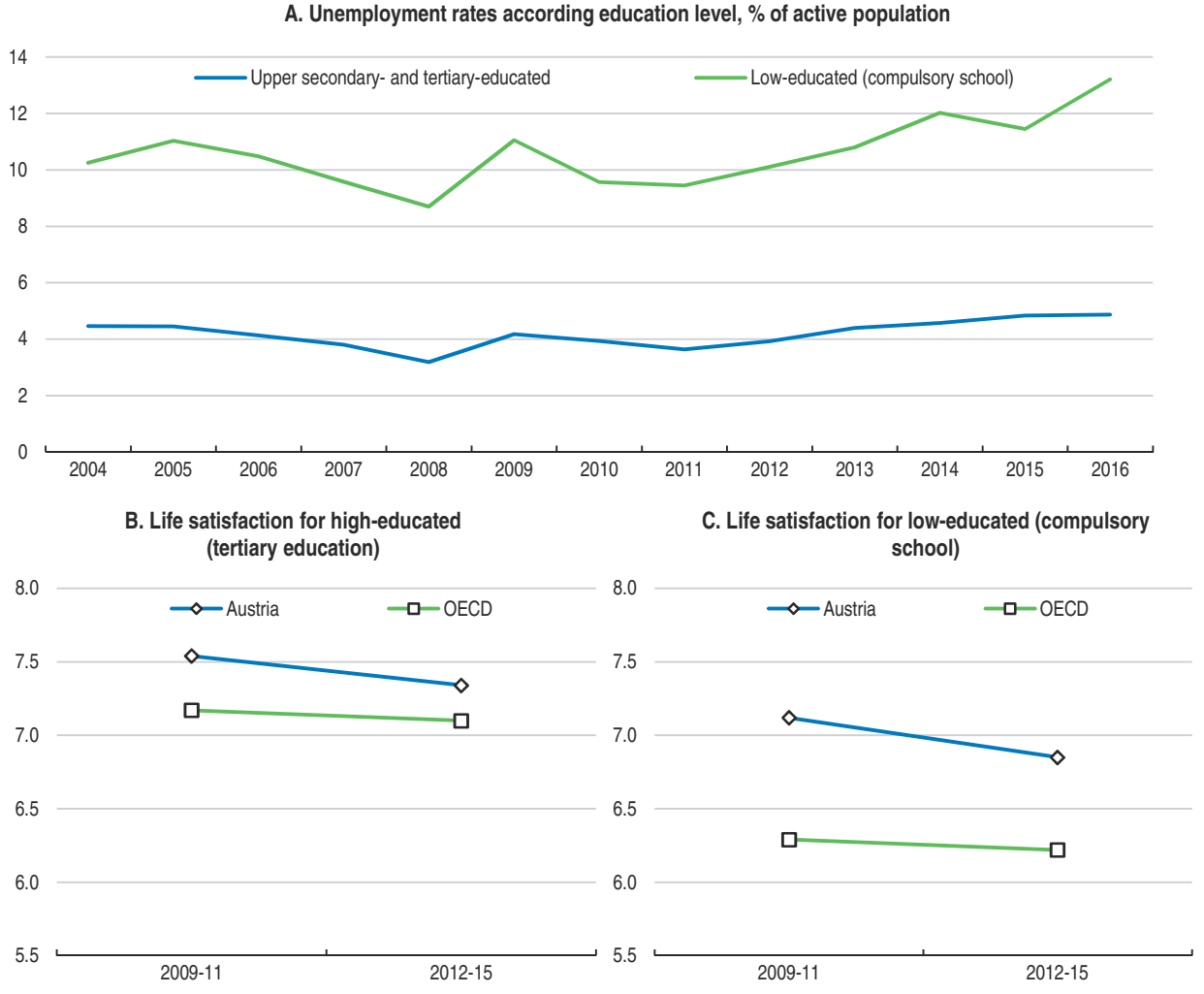
StatLink http://dx.doi.org/10.1787/888933535810

Well-established economic competencies of a majority of Austrian firms and workers have long made for high living standards. However, both firms and workers are challenged by the speed of change induced by global megatrends such as the geographical fragmentation of production and the digital transformation of work processes. Societal and economic structures may be less well suited to embrace these changes. Recent empirical research suggests that plant closures in Austria generate particularly large employment and wage

costs, possibly reflecting the important role but limited portability of enterprise-specific human capital (Winter-Ebner, 2016). Transition probabilities from joblessness to employment have been lower in Austria during 2005-12 than in most peer countries (Cournède et al., 2016). Concerning technological transformations there are many indications that the speed of change is slower in Austrian firms and households than in comparable countries.

All population groups are affected by change, but the low-educated seem to face particular challenges in Austria. Not only their current skills, but also their capacity to upgrade abilities, occupations and jobs appear relatively low. Those with only compulsory education, one fifth of the population, are particularly affected. Their unemployment rate is three to five times higher than the one of other education groups (Figure 4, Panel A). Their subjective well-being, which used to be relatively close to that of higher-educated fellow citizens, remains well-above that of the low-educated in an average OECD country, but has deteriorated in recent years (Panels B and C).

Figure 4. **The low-educated face special pressures**



Source: Statistics Austria; Gallup World Poll.

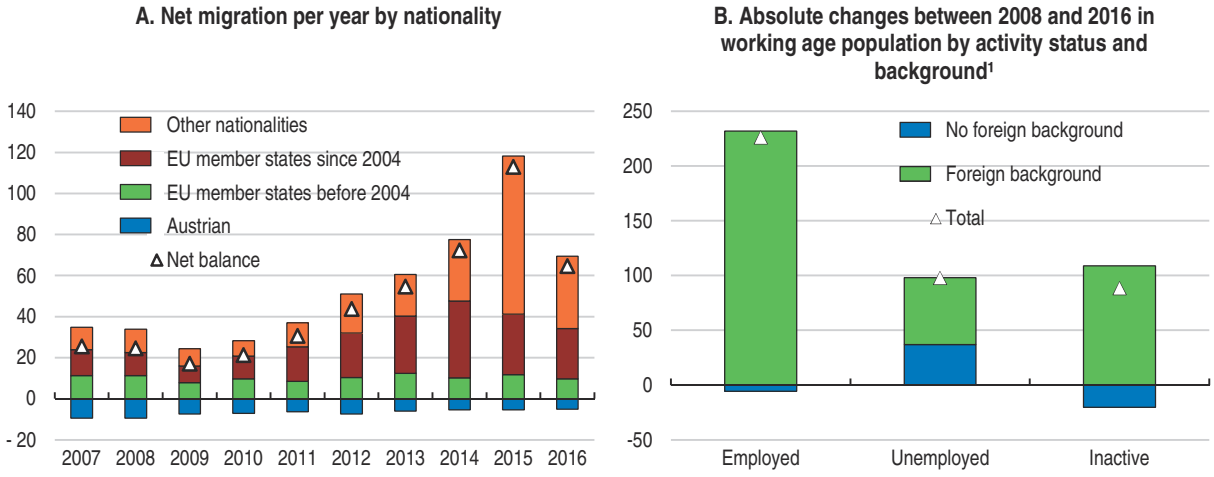
StatLink http://dx.doi.org/10.1787/888933535829

These adjustment challenges tend to be starker for the less well-educated segments of the large immigrant population (OECD, 2014), which justifies the recently increased government efforts to improve their language skills and adaptation to changing labour market demands. Efforts to significantly improve the language capacities of immigrant children with a newly introduced two-year programme in kindergarten are also very welcome. These initiatives entail substantial costs but are crucial investments for future growth and social cohesion.

Austria has experienced increasing inflows of migrants over the past decade, in particular from new EU member states (mainly Romania, Hungary and, to a lesser extent, Poland, the Slovak Republic, Bulgaria and Croatia) and, more recently, from Afghanistan, Iraq and Syria amid the international refugee crisis (Figure 5, Panel A). More than half of the immigrants have been successfully integrated in the labour market, becoming the major driver of total employment growth in Austria (Panel B). At the same time, roughly 15% of the newly arrived are unemployed and another 27% inactive.

Figure 5. **Migration inflows have fostered labour supply**

Thousand persons



1. Foreign background means that both parents are born abroad.

Source: Statistics Austria.

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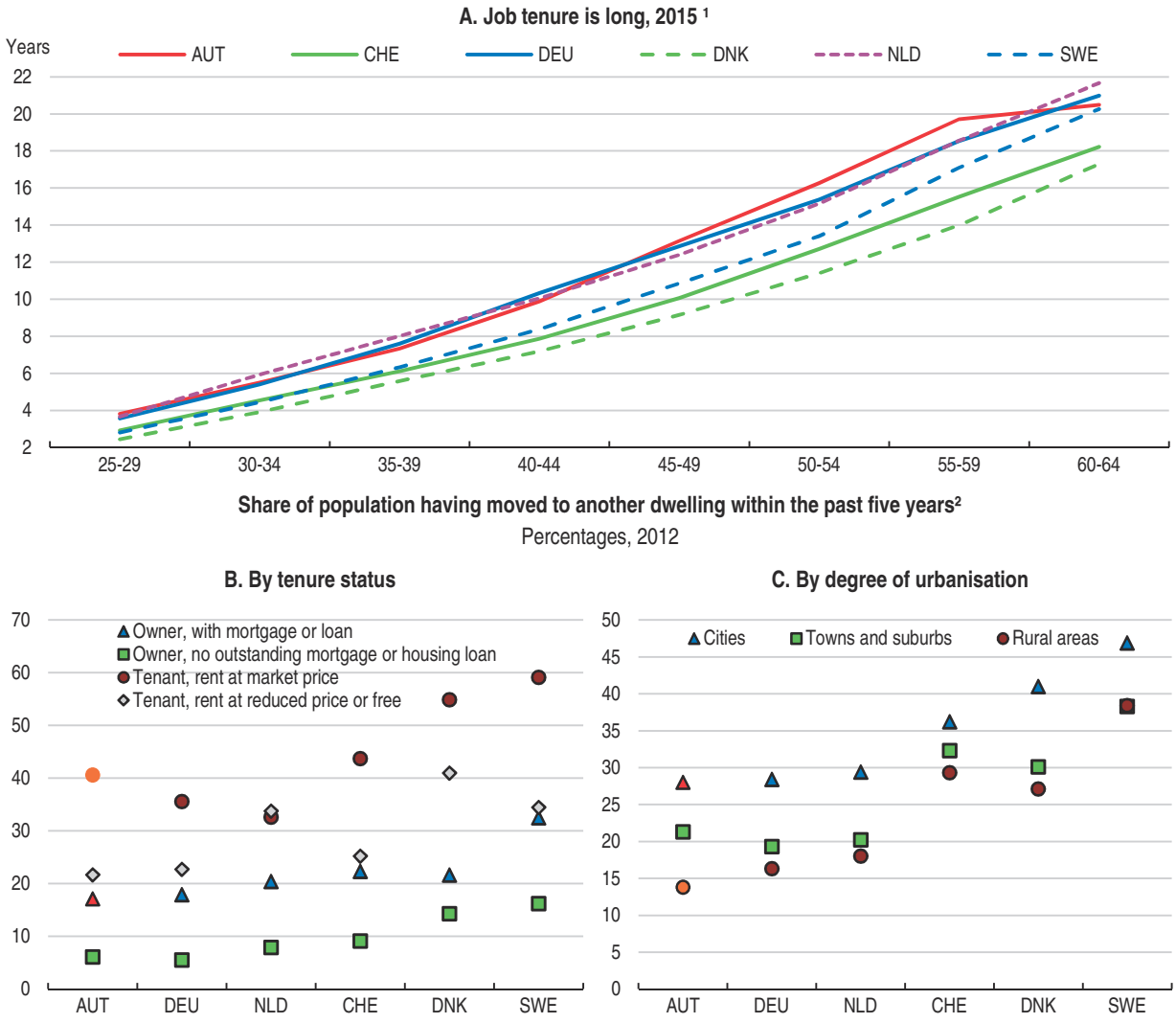
Even if business performance and job creation improve more broadly across the country, a higher degree of geographical mobility may be required in the future to accommodate disruptions arising from reallocations within global value chains and skill-biased technological changes in enterprises. However, many Austrians are very attached to their living place (Figure 6). Average job tenures are long, social networks are locally rooted, and housing arrangements are stable (OECD, 2013a). Many Austrians prefer long commuting times and even weekly long-distance commuting to moving. Government policies such as the commuting subsidy have also supported these patterns so far. Such life choices and policies helped sustain local communities, but pressures for greater mobility may intensify in the future.

Youth employment has traditionally been high. The youth employment rate held up well during and after the global financial crisis, but some groups are now falling behind – possibly revealing emerging tensions in the education and training system as labour market

Figure 6. **Job tenure is long and geographic mobility low**



1. Job tenure is measured by the length of time workers have been working with their current employers.
2. Countries are ranked by total share of population having moved to another dwelling within the past five years.

Source: OECD Labour Force Statistics database; Eurostat.

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needs change rapidly. Some 62% of youth aged 15-29 were in employment in 2015, far above the 51% OECD and 48% EU average. However, 162 000 youth (more than 10% of the 15-29 cohort) were not in employment, education or training (NEET), some 20 000 more than in 2012. In response, public authorities recently introduced new "training guarantees" for those leaving the education system with insufficient skills. Rapid changes in skill demand (Schitter et al., 2012; Benkovskis and Wörz, 2014) may be creating additional challenges for those entering the labour market with weak social and educational capital. The relatively narrow and too occupation-specific scope and low versatility of skills gained in some areas of the vocational education system may be compounding this challenge. Youth whose parents do not have upper secondary education are now over three times as likely to become NEETs as other youth, compared to an OECD average of 1.8 times. Youth born abroad are 2.4 times as likely to be NEET, compared to an OECD average of 1.5. Equality of opportunity and labour market prospects need to be improved across social groups (OECD, 2016f).

Sizeable refugee inflows from war-torn countries compound these social cohesion challenges. Austria has had the third-highest inflow of refugees per capita among OECD countries, and a relatively high share of asylum seekers have been allowed to stay. Immigration is not a new phenomenon in Austria, where more than a quarter of the population has a migrant background, but the composition of new arrivals creates special challenges. Most of the refugees originate from Syria (nearly 30%), Afghanistan (another 30%) and Iraq (around 15%), with employment histories and qualifications rooted in different market conditions. This makes their integration in Austria more demanding than for most earlier immigrant cohorts and calls for effective integration policies. Concerning young cohorts, around 18 000 children with a refugee status currently attend Austrian schools. Experience in comparable countries suggests that effective integration policies include more direct recognition of foreign qualifications, language courses, adult education, mentorship programmes and early labour market entry for immigrants (OECD, 2016g).

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

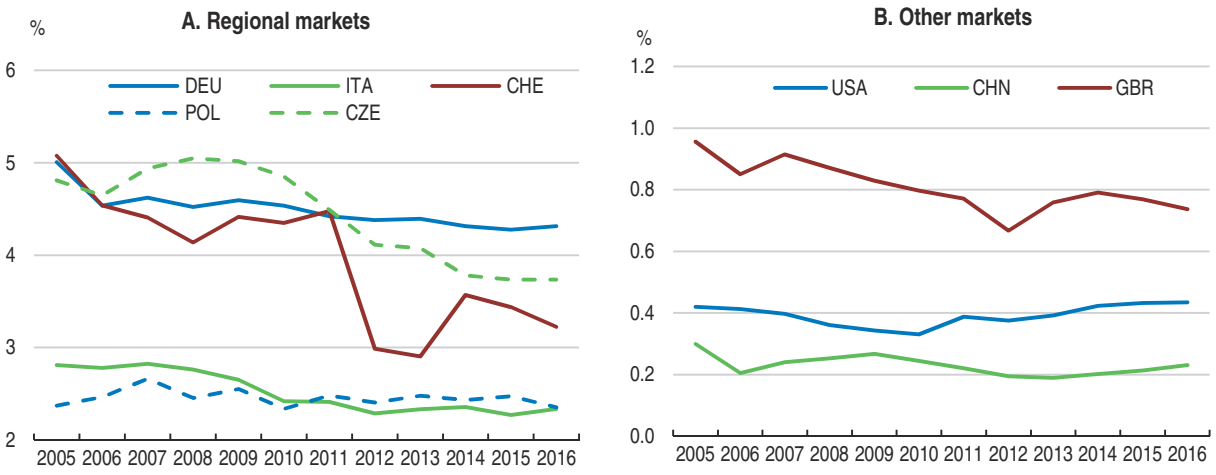
- Potential employment and output growth need to be boosted to improve both fiscal sustainability and social cohesion. This requires deeper structural reforms than currently envisaged.
- Austria's transition to a digital economy and society seems to be slower than in other high-income small European economies. Fostering business dynamism is crucial for the diffusion of new business models and ICT innovations.
- The technology-induced transformation of labour markets calls for a comprehensive approach to ensure equality of opportunity in the face of technological change.

Growth is picking up

Following the initial rebound from the financial crisis, growth languished in Austria (Figure 8, Panel A). Private consumption received a boost in 2015-16 from the tax reform that increased household disposable income by roughly 3% from 2016 onward (Panel C). Compared to its peers, investment has grown less in Austria since 2012 (Panel D), but the investment ratio remains relatively high at around 23% of GDP. Austria's export performance, measured by the cumulated growth of exports over the cumulated growth in export markets, deteriorated by more than 7 percentage points between early 2012 and late 2016 as supply parts of Germany-based regional value chains were lost to emerging Eastern European countries (OECD, 2016e). Similar to other high-income small European economies, Austria's market shares in regional goods markets have weakened (Figure 7, Panel A). At the same time, Austria has gained market shares in the United States (Panel B), which has become the second biggest goods export market for Austria, and other distant markets such as China, India and Japan. On aggregate, Austria's global market share in goods and services has stabilised since 2012 following strong declines in the aftermath of the financial crisis (Figure 8, Panel F) and the current account balance remains in surplus mainly thanks to tourism.

Economic activity picked up in 2016, with growth exceeding 1% for the first time since 2011, reflecting stronger private consumption and investment. Going forward, private consumption will be propelled by gains in disposable income fuelled by the tax reform and favourable labour market developments (Table 1). Income gains had initially gone partly into saving, but the saving ratio has started to edge down as consumer confidence has improved. Investment is projected to gather pace. Accelerating international trade will boost export growth.

Figure 7. **Austria's market share in main export destinations**



Note: Exports of goods only.
Source: IMF (2017), Direction of Trade Statistics (DOTS).

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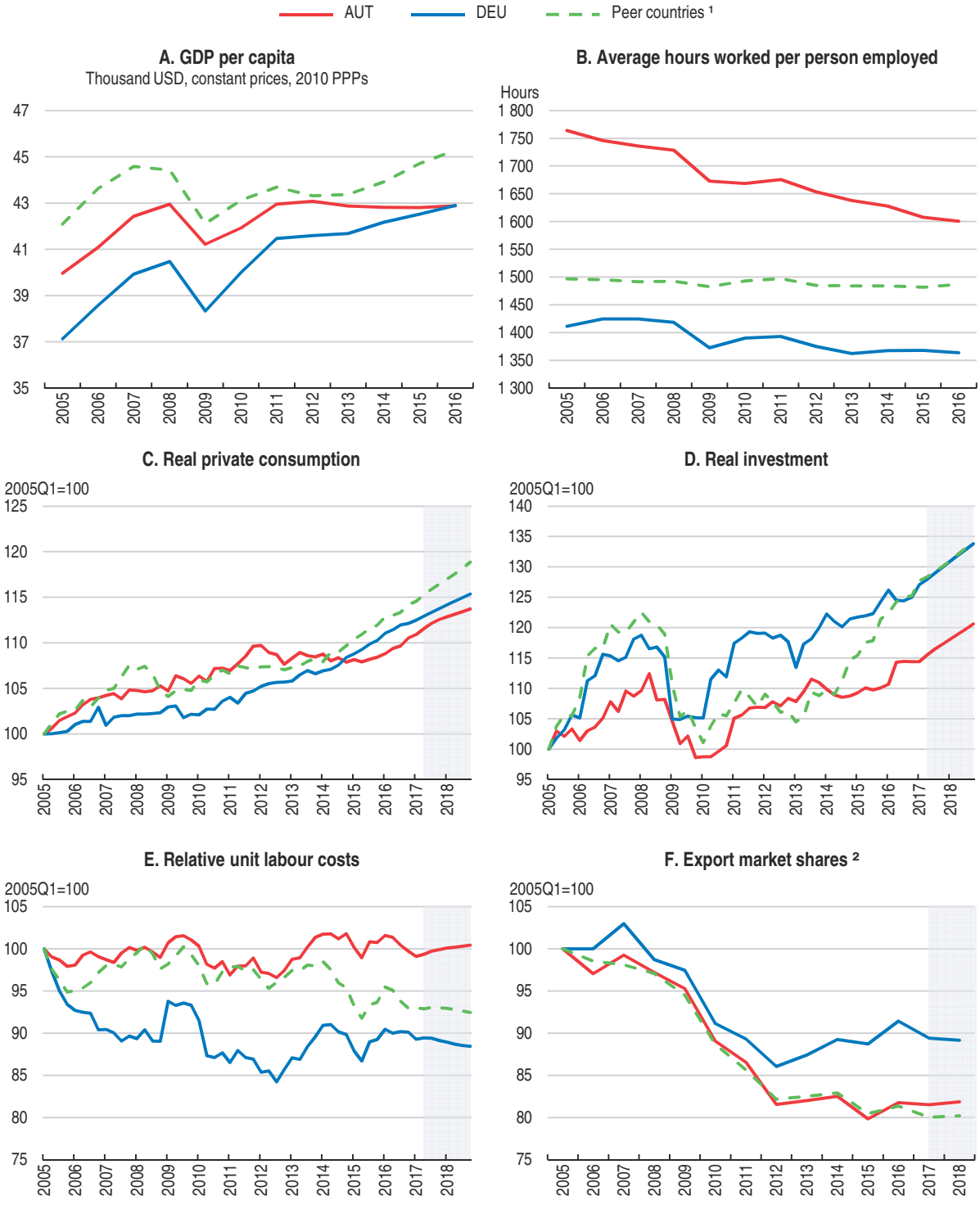
Core inflation remains higher in Austria than in the euro area at large. Most of the wedge is explained by higher price inflation in activities related to the vibrant tourism sector. For instance, the average annual inflation gap *vis-à-vis* Germany since 2012 is roughly 50 basis points, despite more sluggish growth, 30 basis points of which are explained by catering and accommodation services. House prices and rents have also been on the rise in recent years, notably in Vienna. Nonetheless, housing remains affordable in international comparison amid relatively low rent-to-income and debt-service-to-income ratios (OECD Affordable Housing Database).

Austria's labour force has expanded faster than in most peer countries, due to stronger immigration and a larger increase in labour force participation by women and older workers, and unemployment increased from 4.9% in 2011 to 6.0% in 2016. In line with the pick-up in economic activity, unemployment is expected to have peaked in 2016 and is projected to decrease gradually going forward.

The risks to this projection are broadly balanced. The saving ratio could decline less than projected, which would hold back the increase in private consumption and reduce growth. Uncertainty in the run-up to the announced snap elections in October 2017 may affect consumer and business confidence and weigh on domestic demand. Export performance would deteriorate if Austria's market share losses were to continue. Conversely, if international trade picks up more than expected, export growth could be more buoyant and support investment and growth more than projected. A stronger decline in saving would result in stronger consumption growth. Any additional electoral commitments could spur growth in 2018 at the cost of a higher public deficit.

In addition, Austria could be adversely affected by a number of exogenous shocks (Table 2). A rise in geo-political tensions may trigger a new wave of refugees. A resurgence of internal tensions in Europe may negatively affect confidence. Stress in parts of the European banking sector may exert contagion effects. Finally, if the results of snap elections in October were to make the establishment of a stable government more difficult, reform efforts may lose momentum and hold back growth.

Figure 8. **Recent developments**



1. Denmark, Netherlands and Sweden.
2. Share of value exports of goods and services in world exports, USD.

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

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Table 1. **Macroeconomic indicators and projections**

Annual percentage change; volume (2010 prices) unless specified

	2013 Current prices (Billion EUR)	2014	2015	2016	2017 (projected)	2018 (projected)
GDP	**322**	**0.8**	**0.8**	**1.6**	**2.2**	**1.7**
Private consumption	**174**	-0.3	-0.1	1.3	2.0	1.3
Government consumption	**64**	0.8	2.2	1.8	1.5	1.6
Gross fixed capital formation	**75**	-0.8	0.7	3.3	2.2	3.0
Housing	**14**	-0.6	0.9	0.3	2.3	2.3
Final domestic demand	**312**	-0.2	0.6	1.9	1.9	1.8
Stockbuilding[1]	**2**	0.3	-0.1	0.5	0.5	0.0
Total domestic demand	**314**	0.2	0.5	2.4	2.5	1.8
Exports of goods and services	**172**	2.4	3.6	1.4	5.6	4.6
Imports of goods and services	**163**	1.3	3.4	3.1	6.2	5.0
Net exports[1]	**8**	0.6	0.2	-0.8	-0.1	0.0
Other indicators						
Potential GDP	..	1.2	1.1	1.1	1.1	1.1
Output gap[2]	..	-2.7	-3.0	-2.6	-1.5	-1.0
Employment	..	0.2	0.9	1.7	1.7	1.5
Unemployment rate	..	5.7	5.8	6.1	5.7	5.5
GDP deflator	..	1.8	1.9	1.3	2.0	2.0
Consumer price index	..	1.5	0.8	1.0	2.1	1.8
Core consumer prices	..	1.7	1.7	1.6	1.8	1.8
Household saving ratio, net[3]	..	7.0	7.3	8.2	7.1	7.1
Current account balance[4]	..	2.4	1.9	1.7	1.9	1.9
General government financial balance[4]	..	-2.7	-1.1	-1.6	-1.0	-0.7
Underlying government financial balance[2]	..	0.2	1.3	0.2	0.1	0.1
Underlying government primary balance[2]	..	2.2	3.1	1.8	1.5	1.4
Gross government debt (SNA definition)[4]	..	106.8	106.2	106.1	102.7	100.9
Gross government debt (Maastrichtn definition)[4]	..	84.4	85.5	84.6	81.1	79.3
General government net debt[4]	..	59.1	57.1	57.0	53.5	51.8
Three-month money market rate, average	..	0.2	0.0	-0.3	-0.3	-0.3
Ten-year government bond yield, average	..	1.5	0.7	0.4	0.7	1.1

1. Contributions to changes in real GDP, actual amount in the first column.
2. As a percentage of potential GDP.
3. As a percentage of household disposable income.
4. As a percentage of GDP.

Source: OECD (2017), *OECD Economic Outlook: Statistics and Projections 101* (database).

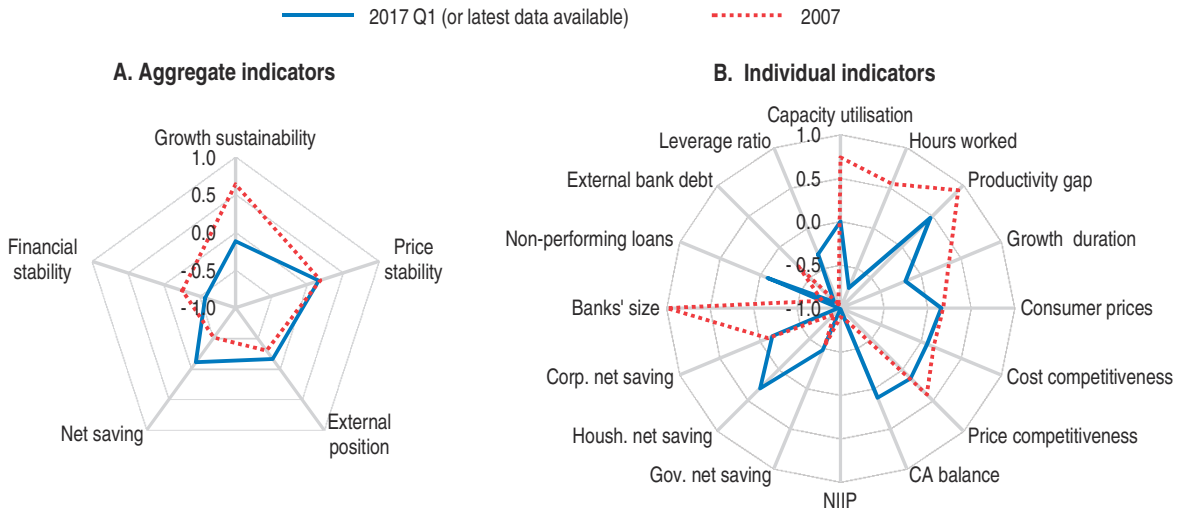
Table 2. **Possible shocks and their economic impact**

Possible shocks	*Likely outcome*
A rise in geo-political tensions triggering a new wave of refugees.	Expenses for integration as well as internal and external security would limit fiscal space and undermine the implementation of planned reforms with adverse consequences for growth.
Resurgence of internal tensions in Europe.	Risk premia could increase and consumer and business confidence could suffer.
Tensions in parts of the European banking sector may increase.	Austrian banks' funding costs could increase and squeeze their margins and capital adequacy.

On the whole, macro-financial vulnerabilities are lower than in 2007 (Figure 9). Leveraging is not excessive and the recent prolonged spell of low growth implies that overheating is unlikely. Price inflation is above trend but not by much and this mostly reflects dynamic service prices (see above). External and saving positions remain favourable, despite a slight deterioration with respect to 2007.

Figure 9. **Evolution of macro-financial vulnerabilities since 2007**

Deviations of indicators from their real time long-term averages (0), with the highest deviations representing the greatest potential vulnerability (+1), and the lowest deviations representing the smallest potential vulnerability (-1)[1]



1. Each aggregate macro-financial vulnerability indicator is calculated by aggregating (simple average) normalised individual indicators. Growth sustainability includes: capacity utilisation of the manufacturing sector, total hours worked as a proportion of the working-age population (hours worked), difference between GDP growth and productivity growth (productivity gap), and an indicator combining the length and strength of the expansion (growth duration). Price stability refers to consumer prices and is calculated as the absolute value of (core inflation minus inflation target) + (headline inflation minus core inflation). External position includes: the average of unit labour cost based real effective exchange rate (REER), and consumer price based REER (cost competitiveness), relative prices of exported goods and services (price competitiveness), current account (CA) balance as a percentage of GDP and net international investment position (NIIP) as a percentage of GDP. Net saving includes: government, household and corporate net saving, all expressed as a percentage of GDP. Financial stability includes: banks' size as a percentage of GDP, the share of non-performing loans in total loans, external bank debt as percentage of total banks' liabilities, and capital and reserves as a proportion of total liabilities (leverage ratio).

Source: OECD calculations based on OECD (2017), *OECD Economic Outlook: Statistics and Projections* (database); OECD (2017), *Main Economic Indicators* (database); OECD (2017), *OECD National Accounts Statistics* (database); and Thomson Reuters Datastream.

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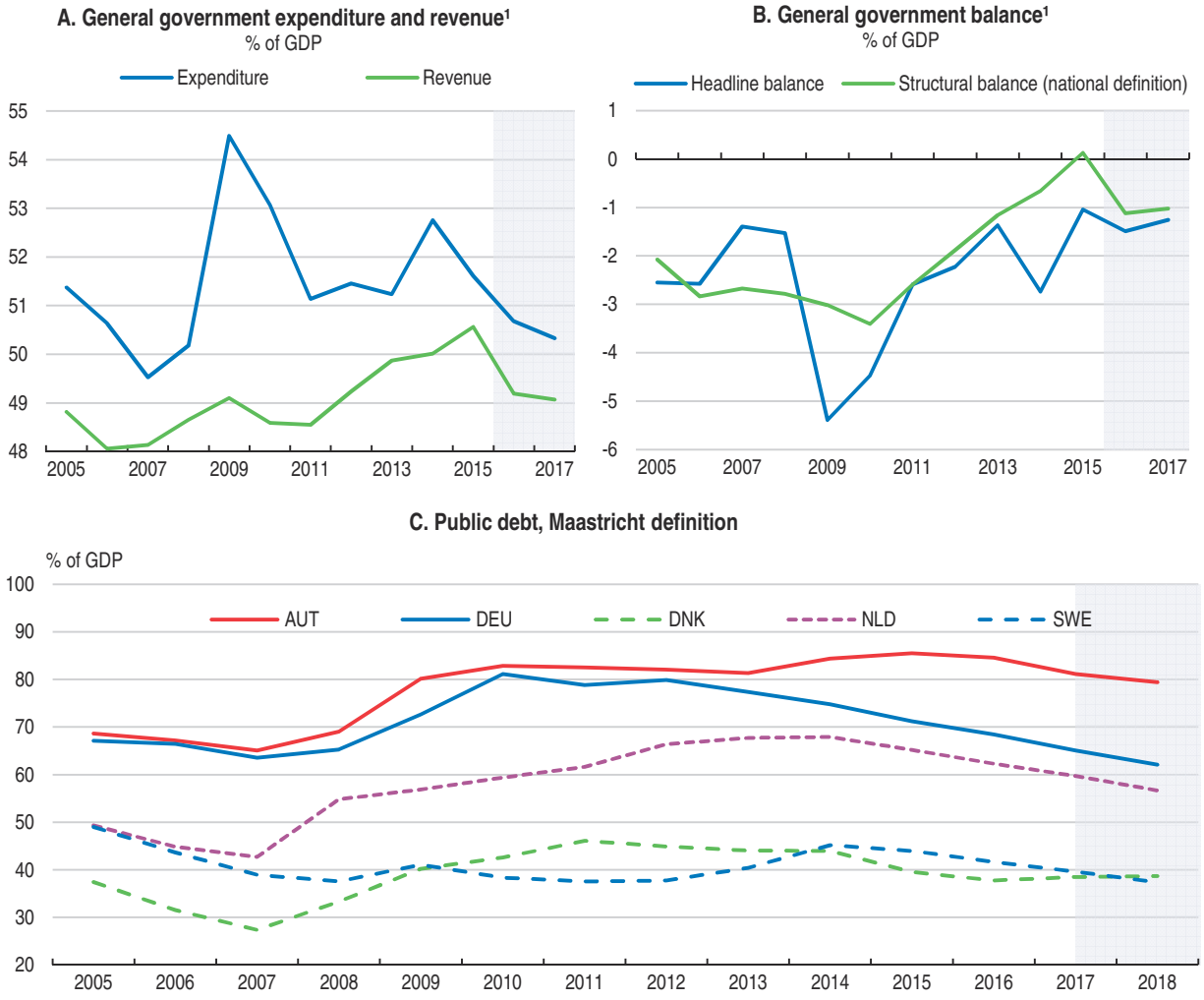
Macroeconomic policy has been supportive

Fiscal policy is being used more actively

Fiscal policy contributed to the cyclical upturn in 2016 (Figure 10). The personal income tax rate for the lowest taxable bracket was cut from 36.5% to 25%, at a tax revenue loss of around 1.4% of GDP. On the spending side, despite pressures from unplanned refugee and security-related costs, targets were met, both at federal and sub-central levels. The public deficit rose to 1.6% of GDP in 2016 from 1.1% in 2015, and the structural deficit (according to the national methodology) rose to 1.1%, against a balanced position in 2015. Nevertheless, public debt, as a share of GDP, is declining, partly thanks to the liquidation of assets of nationalised banks and associated defeasance vehicles.

The 2017 Austrian Stability Programme envisages a broadly neutral fiscal stance. The public deficit is projected to inch down to 1.0% in 2017 and 0.8% in 2018. Excluding the costs related to the refugee crisis and the fight against terrorism, the "adjusted" structural deficit is projected to settle below 0.5% of GDP in 2017 and 2018, consistent with Austria's EU commitments. Against this background, the two coalition parties agreed on a new package of economic measures to make Austria more attractive for business investment (Box 2), but the snap elections might put the implementation of the programme at risk. The budgetary cost of

Figure 10. **Fiscal balances have improved but debt remains high**



1. 2004 revenues include remission of Austrian Federal Railways' (ÖBB's) debt to the federal government. Interest payments exclude swap transactions.

Source: Statistics Austria, Austrian Ministry of Finance, Austrian Institute of Economic Research (GDP), European Commission and Fiscal Advisory Council's fall forecast (2016 and 2017); OECD Economic Outlook database.

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Box 2. **The January 2017 policy package**

In January 2017, the government coalition parties agreed on a new policy package aiming at "strengthening growth and employment, supporting businesses and ensuring sustainability by allowing firms and citizens to seize the opportunities arising from digitalisation and the ecological transition". Some of the measures have already been legislated, whereas others are still subject to political discussion. The most salient components were:

Labour cost reductions

- Halving non-wage costs for each newly created job from Autumn 2017, limited to the recruitment of registered unemployed, holders of a red-white-red immigration card, graduates from Austrian education institutions, and persons having already worked in Austria (estimated costs of EUR 2 billion until 2021 subject to an evaluation in 2019).

Box 2. **The January 2017 policy package** *(cont.)*

- Cutting the employer contribution to the Family Burden Equalisation Fund by 0.6 percentage points in 2017-18, with an expected fiscal cost of around EUR 1 billion per year (0.3% of yearly GDP).

Other labour market measures

- Encouraging geographical mobility of workers through tax incentives and wage subsidies.
- Creation of 20 000 new workplaces for senior workers above 50, if necessary in the public sector.
- Introduction of a minimum wage of EUR 1 500 per month (for full time work), to be discussed between social partners through 2017. As of April 2017, the first agreements had been reached in the textile and hairdressing sectors for gradual catching-up with the targeted minimum. Economy-wide, a total of 300 000 full-time workers currently earning less than EUR 1 500 per month will benefit.
- Indexation of the first two income tax bracket thresholds to inflation from 2019 onwards.

Support to firms

- Frontloading the tax deduction for investment expenditures for firms with over 250 employees.
- Subsidy of 10% in 2017 and 2018 for SME investment expenditures.
- Subsidy of 75% for costs entailed by sickness absences in companies with less than 10 workers.
- New guarantees for the financing of start-ups.
- Streamlining the personal bankruptcy system.
- Expanding public support to business angels, allocating further resources to seed financing and university spin-offs.
- Increasing the research premium from 12% to 14% of all R&D-related expenditures from 2018 onwards.

Education

- 5 000 additional student places in universities of applied sciences (*Fachhochschulen*), which offer excellent job prospects to their students.
- New model of financing for public universities on the basis of study places and student/teacher ratios.
- New measures to improve the social mix in universities fostering, for instance, access to apprentices and more student grants.
- Implementation of the "School 4.0" programme (which is also part of Austria's "Digital Roadmap", see below).
- Introduction of a new apprenticeship package.

Digitalisation

- Reduction of the tax levy on digital infrastructure.
- Doubling of funds by private telecom operators earmarked for the so-called "broadband offensive" (EUR 1 billion to generalise high-speed internet by 2020, including in all SMEs and schools).
- Equipping all schools with broadband and Wi-Fi by 2020.

Refugee integration

- Obligatory integration (education) year for persons granted asylum and for asylum seekers with a high probability to be granted asylum.

the measures was estimated at roughly 0.5% of GDP per year over 2017-18, to be financed through expenditure cuts yet to be specified and additional revenues due to stronger growth.

Additional investments are desirable in high-priority areas, such as child and elderly care, kindergartens, integration programmes for immigrants and asylum seekers, and fast broadband infrastructure. They would help lift potential growth and strengthen social cohesion. However, even if under the fiscal consolidation objectives agreed with the EU such investments are partly exempt from the agreed spending and deficit caps (Box 3), and even if the still very low interest rates create some room for extra spending in the short term without altering the long-term debt dynamics, the best way to durably raise investment in these areas is through savings in spending areas where there is room for rationalisation.

Box 3. **Implementation of a fiscal initiative in the European context**

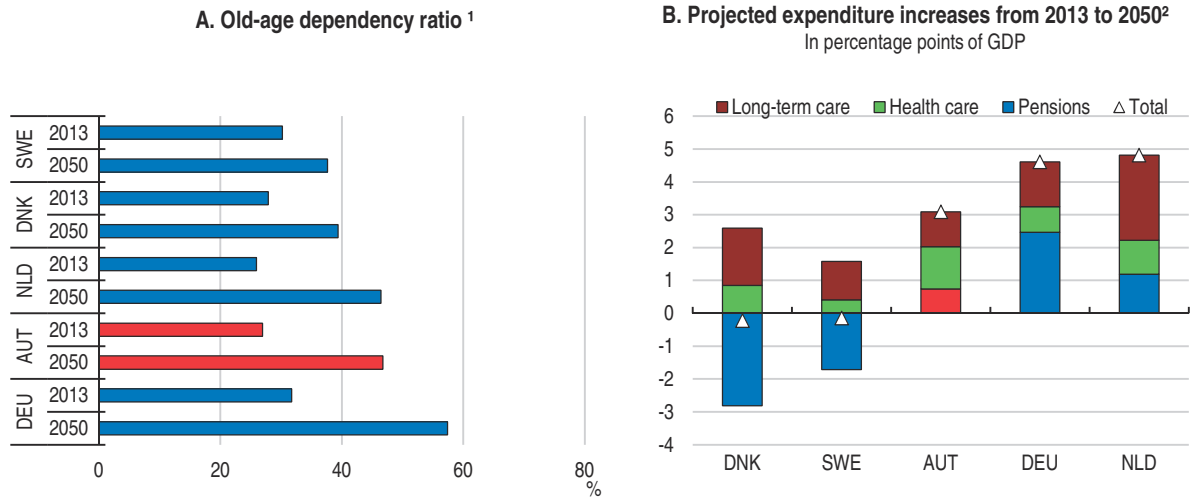
Austria's fiscal policy is subject to the preventive arm of the Stability and Growth Pact and the government has committed to respect the medium-term budgetary objectives agreed with the European Union. Under this agreement, the public debt-to-GDP ratio needs to be reduced below 60% of GDP in the medium-term and the general government headline deficit is capped at 0.5% of GDP in the short term (from 2017). This ceiling can be loosened for cyclical reasons (by 0.25% of GDP when the output gap is wider than -1.5% of GDP and the economy grows below potential), and must be tightened (by 0.25-0.50%) when the output gap is above +1.5% and the economy grows above potential.

This agreement provides room for desirable spending for "investment" and "structural reform" purposes. Spending increases and/or tax cuts for infrastructure projects under EU co-ordination (such as Trans-European transportation and communication projects), as well as for structural reforms with verifiable long-term benefits for potential growth (such as investments in childcare facilities) are eligible. So are refugee costs if they are ratified by the Commission and if the aggregate general government deficit stays below 3% of GDP.

Over the longer term, population ageing will put considerable pressure on Austria's public finances. Old-age dependency ratios are projected to increase by roughly 20 percentage points until 2050 (Figure 11, Panel A). The number of pensioners is set to increase by 40 percentage points over the same period bringing down the ratio of contributors to pensioners from 1.7 in 2013 to 1.3 in 2050. Assuming no policy change, the European Commission (EC, 2015) has projected in its baseline scenario that ageing-related spending (pensions +0.7 percentage point, health +1.3 percentage point and long-term care +1.1 percentage point) will rise by 3 percentage points of GDP until 2050 (Figure 11, Panel B).

In the baseline scenario (Figure 12), where this spending is assumed to be fully debt-financed, the public debt ratio would turn up from 2030 and reach levels higher than seen in the aftermath of the global financial crisis, putting debt on an unsustainable trajectory. In a higher-interest rate scenario, which assumes a 5 basis point increase in the interest rate per year with respect to the baseline scenario, the public debt ratio would exceed 100% of GDP by 2045 and continue to rise further. In contrast, structural reforms such as linking retirement ages to increases in life expectancy or improving the efficiency of health and long-term care spending would not only reduce costs but also spur potential growth. In such a structural reform scenario, the public debt ratio would converge towards 60% by 2035 without the need to increase tax pressure.

Figure 11. **Long-term fiscal pressures arising from ageing are high**



1. The old-age dependency ratio is the population aged 65 and over as a percentage of the population aged 15-64.
2. Baseline scenario for pensions and the European Commission's Ageing working group scenarios for health and long-term care.

Source: European Commission (2015), *The 2015 Ageing Report*, European Economies Series, No. 3/201

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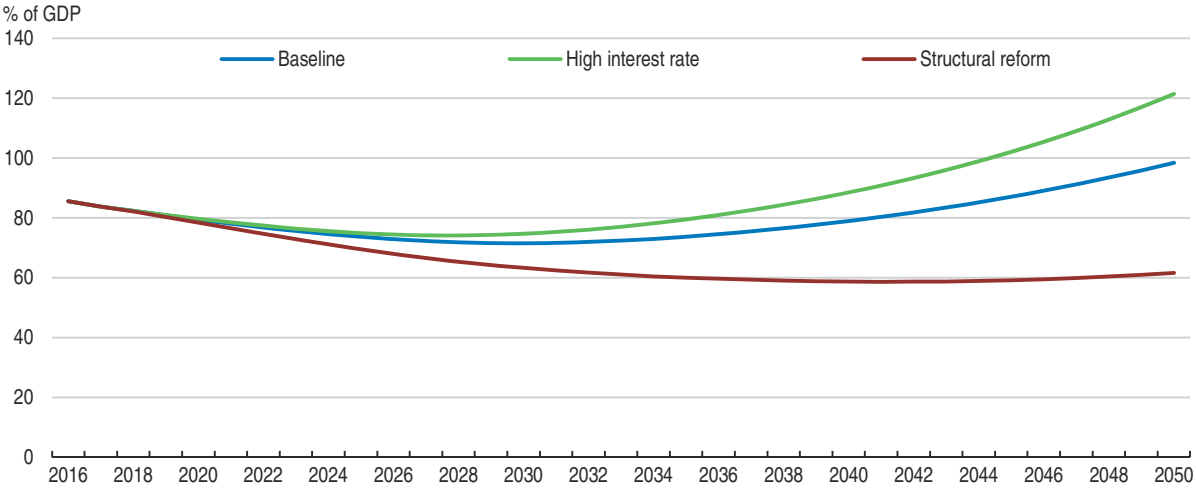
Figure 12. **The public debt path is highly uncertain**



Note: The baseline scenario assumes that ageing costs as projected by the Ageing Working Group (AWG) of the European Commission are reflected one for one in the primary balance. Real GDP growth is as in the Economic Outlook 101 until 2018 and 1.2% per year thereafter. The effective interest rate is assumed to decline to 1.3% by 2022 before rising linearly to 3% until 2050. The "high interest rate" scenario assumes an additional 5 basis points increase of the effective interest rate per year with respect to the baseline scenario (a total of 165 basis points by 2050). The structural reform scenario is based on the AWG policy scenario that links retirement ages to increases in life expectancy combined with the cost-control ("indexed") health care spending scenario, and assumes that annual potential growth is 0.3 percentage points higher.

Source: Calculations based on OECD Economic Outlook 101 database.

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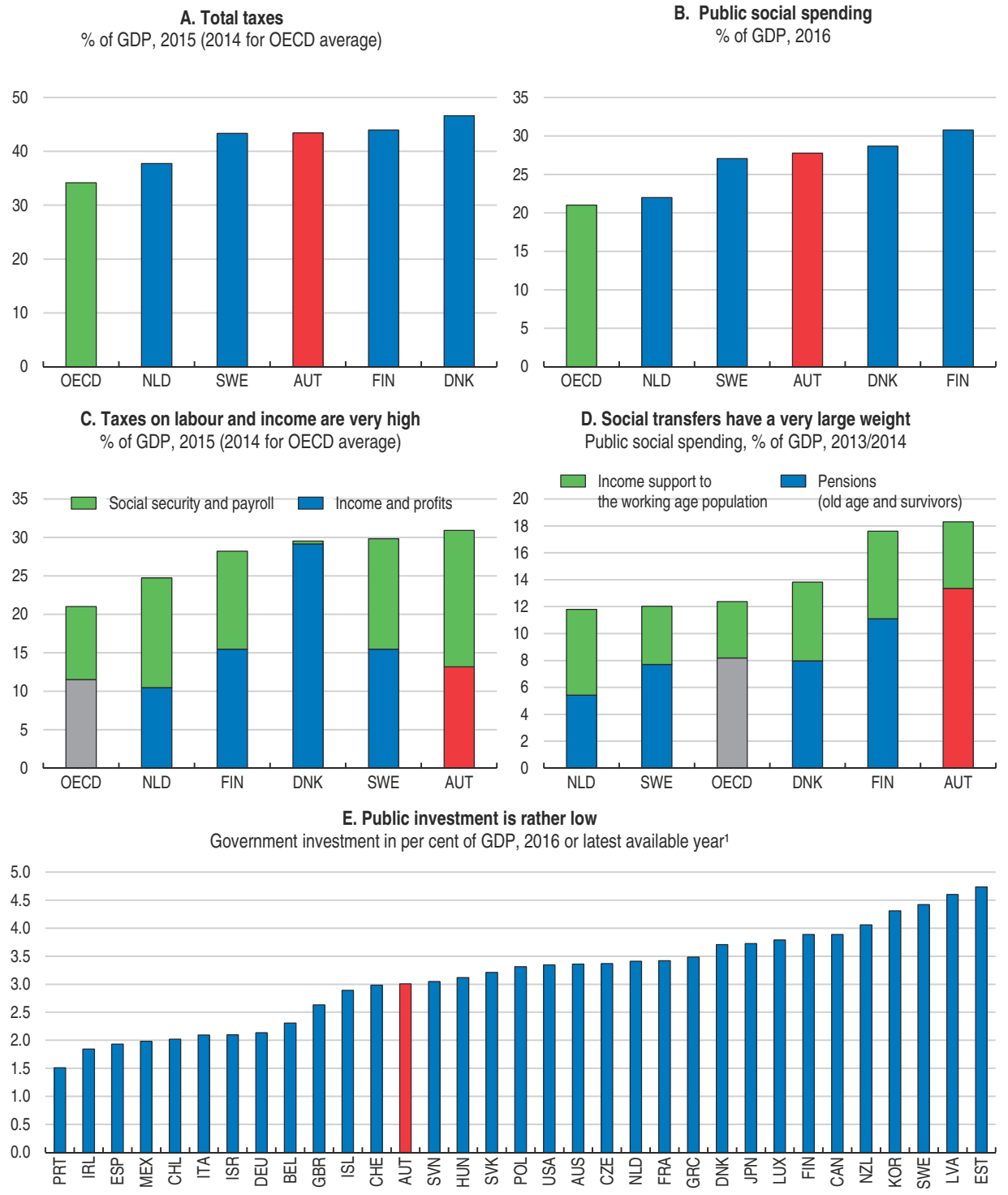
Deeper fiscal reforms should be a policy priority

Despite recent reforms, Austria still faces other longstanding fiscal challenges. High spending on current transfers limits room for savings and reallocations (OECD, 2011; Fischer et al., 2011) towards programmes that would contribute to a more gender-balanced society, with a healthier work-life balance. Additional investment in fast broadband would accelerate

Figure 13. **Revenue and spending structures offer room for reform**



1. Data are not perfectly comparable across countries. If road infrastructure investment is included, Austria's share is 1 percentage point higher.

Source: OECD, Revenue Statistics database; OECD, *Society at a Glance 2016*; and OECD Economic Outlook database.

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the transition towards the digital economy. A thorough public expenditure review would bring useful information on public-sector efficiency, in particular in public administration and healthcare (Dutu and Sicari, 2017), where costs could be reduced and responsiveness to user needs could be improved. The binding constraint in these areas is the fragmentation of funding and spending responsibilities across government layers. Responsibilities are blurred in too many areas, including in core education, health and social services. The 2017 Financial Equalisation Law did little to address this issue.

Austria's tax system could be made more conducive to growth, employment and social cohesion (Köppl and Schratzenstaller, 2015a and 2015b). The 2016 tax reform was a useful step, but revenues remain overly reliant on labour and income taxes (Figure 13). The revenue structure should be shifted towards consumption, environmental, wealth and inheritance taxes, which would also help reduce wealth inequalities (Brys et al., 2016). Any adverse impacts of consumption tax increases on the purchasing power of low-income households could be addressed by targeted transfers. A comprehensive tax reform could have high economic and social returns.

The desirable degree of fiscal transparency has not yet been achieved. In a number of areas, fiscal costs, contingent liabilities and spending outcomes are not fully documented (Fiskalrat, 2016). Transparency is crucial for the development of evidence-based fiscal policies. Austria should emulate international best practice and seize the opportunities offered by "individual level" data to improve the transparency of the take-up rates and outcomes of various public services and transfers, and to strengthen the tax administration. A prime objective is good monitoring of off-budget and quasi-fiscal liabilities, in particular those arising in the financial sector (Schich and Kim, 2012). Past large fiscal liabilities arising from implicit federal government guarantees to Länder-controlled financial institutions have been addressed by reforms (Schich et al., 2014). Government guarantees to both the financial and non-financial sector remain high in international comparison, despite an aggregate decline from 38% of GDP in 2012 to 23% of GDP in 2015 (Eurostat, 2017a).

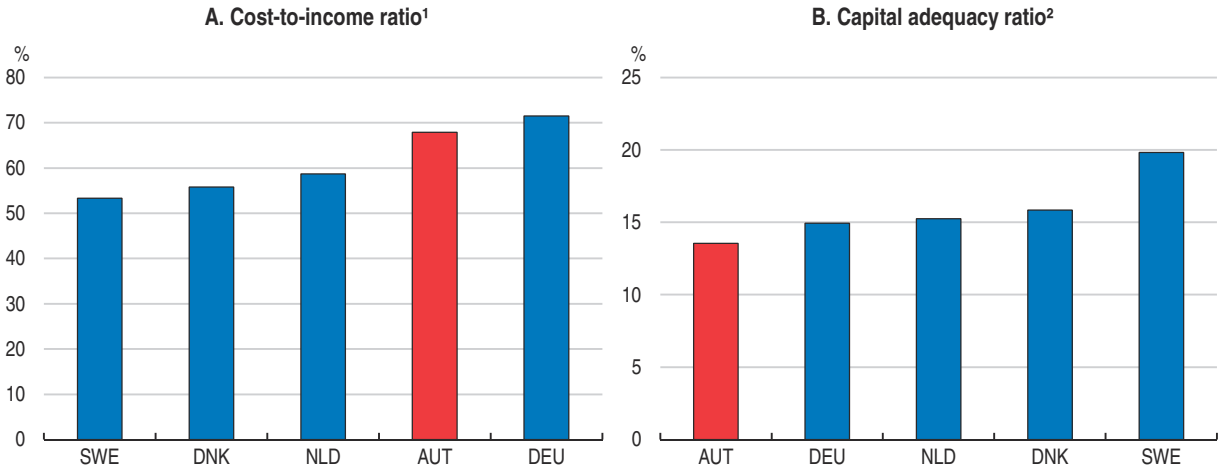
Further rationalisation is desirable in the financial sector

Austria's banking system has largely recovered from the financial crisis. Banks' profits increased in recent years, despite the challenges of the low-interest rate environment. The profitability and funding structure of Austrian banks' large subsidiaries in Central and Eastern Europe (CESEE) have improved. Non-performing loans have declined. Foreign-currency loans to households, while remaining a source of risk, have also been cut significantly since their peak in 2008. The Financial Market Stability Board (FMSB) has advised the Ministry of Finance to expand its macroprudential toolkit and noted that sustainable lending standards in real estate are crucial for maintaining stability and growth (FMSB, 2016). The European Banking Authority's EU-wide stress tests in July 2016 suggested that two large Austrian banks (Erste and Raiffeisen) have adequate capital positions. On aggregate, banks' capital adequacy and profitability ratio remain below comparable European banks (Figure 14). Against this backdrop, rigorous supervision of large as well as small banks is particularly important. Banks concur with the recommendation of national regulators to improve their risk-bearing capacity by increasing their risk buffers by 2% of risk-weighted assets until 2019. To this effect, enhancing profit margins by increasing operational efficiency appears necessary (OeNB, 2017).

Structural change in banking is less advanced than in peer countries (Box 4). Organisational and technological convergence towards international best practices has been

Figure 14. **Bank profitability and capital adequacy are relatively low**

Q3 2016



1. Ratio of total operating expenditures over total operating income of domestic banking groups and stand-alone banks including foreign (EU and non-EU) controlled subsidiaries and foreign (EU and non-EU) controlled branches.
2. Ratio of common tier 1 capital over risk-weighted assets of domestic banking groups and stand-alone banks including foreign (EU and non-EU) controlled subsidiaries and foreign (EU and non-EU) controlled branches.

Source: European Central Bank.

StatLink http://dx.doi.org/10.1787/888933536019

Box 4. **Capacity adjustments in the banking sector**

Austrian banking is characterised by a dense branch network and is more labour-intensive than in peer countries (OeNB, 2016). The number of employees has remained close to its historical peak, though bank employment has declined noticeably in other countries. Moreover, compensation per employee grew more than productivity since the global crisis, and unit labour costs increased, putting additional pressure on bank costs.

To date, pressure to dismiss large numbers of workers has not been strong. Even restructuring banks have refrained from layoffs, rather resorting to attrition and early retirement. When activity is weak, banks traditionally encourage workers to work part-time. Employment protection is strong: many employees have high tenure and would be entitled to receive large severance payments if they were laid off.

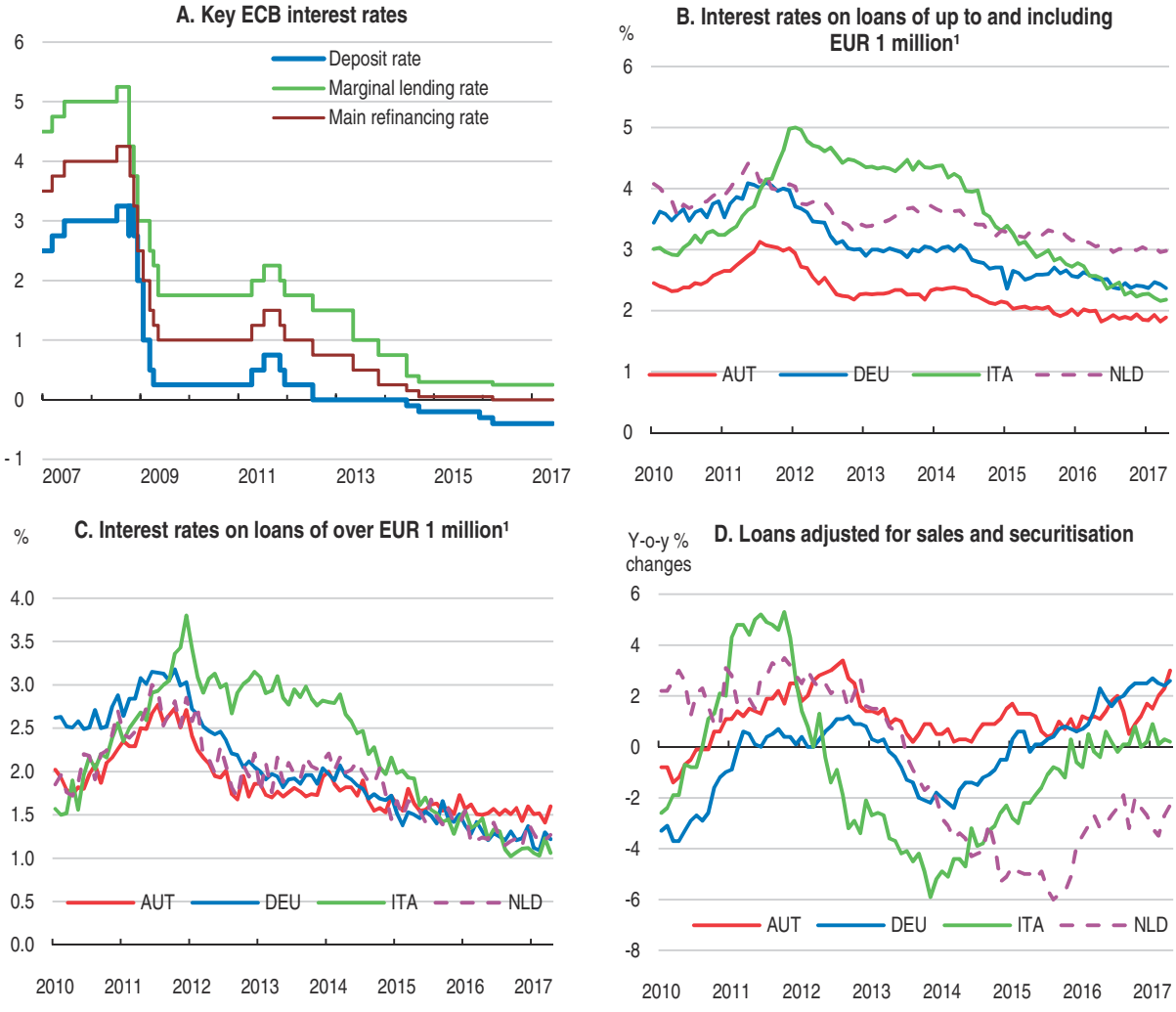
Traditional banking is further challenged by emerging innovations in financial technology, or FinTech. Digital consumer and small business banking, and on-line investment management provide a wider range of products to consumers at lower cost, and reduce demand for bank employees. A related challenge is the advent of less labour-intensive internet competitors to traditional banks.

A number of Austrian banks have recently started to announce restructuring programmes. Österreichische Volksbanken, a co-operative banking group, is expected to merge its formerly 60 individual banks into eight regional banks. Around 2 800 employees of UniCredit Austria have expressed their readiness to leave the bank with extra severance payments. Both OeNB and the public employment service AMS anticipate further employment reductions in banking. A collective agreement in March 2016 included a resolution to create a "labour foundation" for bank employees. Such foundations retrain redundant workers for employment in other sectors, and have been widely used in the steel industry in the past.

Source: Ritzberger-Grünwald, D., A. Stiglbauer and W. Waschiczek (2016), "Banking employment in Austria", in *Financial Stability Report* No. 32, Österreichische Nationalbank, Vienna.

slow. Expansionary euro area monetary policy has been effectively transmitted by banks and has benefited the Austrian economy, but signs of friction point to excess costs and efficiency lags (Figure 15). There is no evidence of credit rationing (IMF, 2017) but a degree of stickiness in the costs (interest rates) of certain types of loans (Panel C) suggests that when loan demand picks up, efficiency bottlenecks may become more taxing. Faster modernisation of the financial sector at large, with a fuller development of securitised sources of funding, would support broader-based investments by large, small and start-up firms alike across the entire territory (Aiyar et al., 2015).

Figure 15. **Monetary policy transmission operates well but there are signs of friction**



1. New business loans with an initial rate fixation period of less than one year. Loans other than revolving loans and overdrafts, convenience and extended credit card debt.

Source: ECB (2017), "MFI interest rate statistics", Statistical Data Warehouse, European Central Bank.

StatLink http://dx.doi.org/10.1787/888933536038

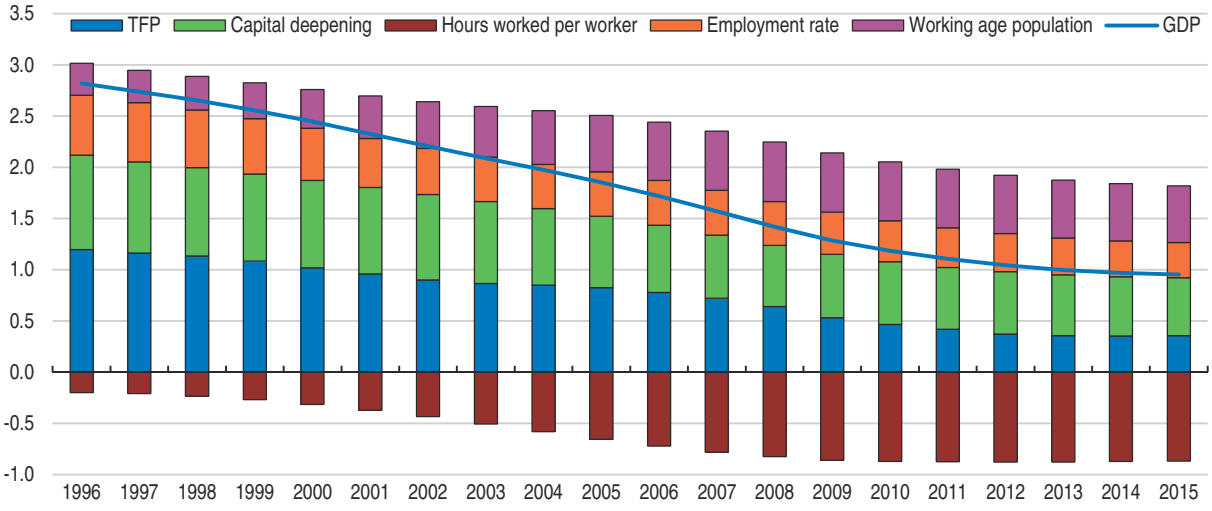
Embracing new financial technologies (FinTech) is one way to promote modernisation, further cost-cutting and rationalisation. So far, Austria has been adopting such technologies rather slowly. With about EUR 1.4 in online alternative financial transactions (crowdfunding, peer-to-peer lending) per capita in 2015, Austria is below the median of European countries, which are led by the United Kingdom (EUR 65.9), Estonia (EUR 24.0) and Finland (EUR 11.65)

(OECD calculations based on Cambridge Centre for Alternative Finance, 2016). A more supportive regulatory environment for FinTech innovation, for example by introducing some proportionality in regulatory obligations to facilitate the entry of smaller service firms, could help foster this development and boost competition and innovation in the banking sector. Switzerland, for example, has proposed amendments to its banking laws to ease the regulatory framework and reduce entry barriers for innovative financial technology companies (crowdfunding platforms and other FinTech firms that do not intend to provide the full spectrum of banking services and do not engage in maturity transformation). Latvia has been drafting alternative financing industry regulation that is expected to be one of the most detailed in Europe. Other countries have established "regulatory sandboxes" that allow regulators to better understand the benefits and risks of new services before they assess their deployment and regulatory requirements. Austria could follow suit in this area.

Raising medium-term growth

Like in most other advanced OECD countries, trend growth has declined considerably in Austria since the beginning of the century, from 2.5% in 2000 to around 1% in 2015 (Figure 16). An important contributing factor to this decline has been lower work intensity – a decline in hours worked per employed, which explains about 40% of the total decline in trend output growth.

Figure 16. **Potential growth has weakened**



Note: Time series for real GDP, capital stock, hours worked, employment and working age population have been smoothed using an HP-filter. Growth rates of trend components are shown.
Source: Calculations based on OECD National Accounts database data.

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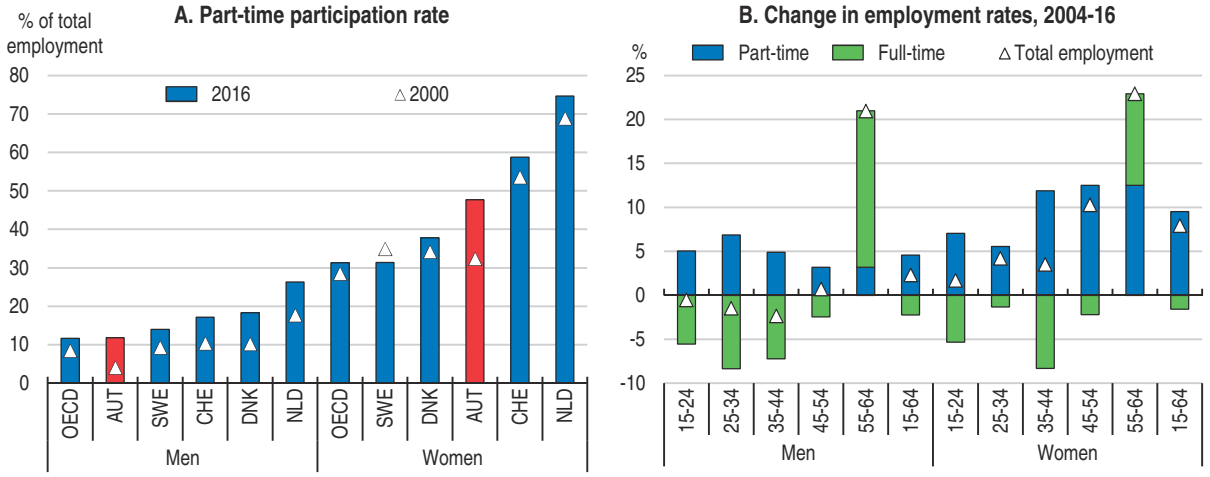
The decline in average hours worked is largely explained by the greater prevalence of part-time employment (Figure 17, Panel A), in particular among women. Austria has the highest share of women in part-time jobs (79%) in the OECD, after Luxembourg. Favourable tax treatment of overtime work (mostly provided in practice by men) contributes to this gender imbalance in work hours. The biggest shift towards part-time occurred for prime-age women with child-caring responsibilities. Greater investments in full-time full-day childcare and school facilities would help parents, especially women, to shift from part-time to full-time jobs, thus contributing to more equality of opportunity across genders and spurring

Figure 17. **Participation increased but mainly in part-time jobs**



Source: OECD National Accounts database; and Statistics Austria, Micro-census.

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medium-term growth. Progress with such reforms that promote gender equality has been limited since 2015 (Table 3). As recommended in the 2015 Economic Survey of Austria (OECD, 2015c), introducing a legal entitlement for a place in childcare centres and full-day schools, and stepping up investment in these facilities, would help reconcile full-time employment and family responsibilities. At present, the decision to transform a standard half-day school

Table 3. **Past recommendations to promote gender equality and actions taken**

2015 Economic Survey recommendation	*Actions taken*
Spur investment in high quality childcare facilities. Enhance the availability of full-day schools and care centres. Consider introducing legal entitlements for these services.	The "Education Investment Law", adopted in 2017, will provide another EUR 750 million for the expansion of full-day schooling until 2025. For the period 2014-17, the federal government has considerably increased earmarked subsidies to *Länder* for financing child day-care.
Reduce the implicit taxation of transition from marginal and part-time to full-time employment and replace the sole-earner tax deduction by targeted transfers to families in need.	No action taken since the 2015/16 tax reform.
Transform childcare allowance and parental leave schemes into a unique childcare account that allows parents to allocate subsidised absence from work flexibly over time. Reserve a sizeable part of this account, at least 33%, for the exclusive use of fathers.	Since March 2017 the new system of flat rate childcare allowance can be taken flexibly within the duration of 456 and 1063 days. 20% is reserved exclusively for fathers (before: 16.5%). The Partner Bonus entitles parents who claim child care allowance almost equally (i.e. the period during which child allowance is received must be distributed either 50:50 or up to 60:40) to a one-time payment of EUR 500 each. Working fathers who take care of their families directly after the birth of a child, are entitled to the "family time bonus" (about EUR 700).
Raise awareness by publicising more information on innovations in study area choices of schoolgirls and schoolboys, earlier return to full-time work of mothers, and fathers' participation in care and household duties.	Several initiatives to mitigate gender stereotypes in educational choices have been undertaken. For example, the possibility to choose between different types of handicraft courses has been abolished in order to avoid reproduction of stereotypes. The new paternity leave entitlement (see above) has the potential to change mind-sets towards more equal sharing of care responsibilities. The campaign "Time for your child" and so-called freecards were designed to raise awareness for fathers in parental leave and draw fathers' attention to this topic.
Develop a comprehensive database on social transfers or a comprehensive panel survey to assess the impact of alternative family policy schemes on labour supply, child care use and net budget costs, and adjust policy packages in the light of this information.	No action taken.

into a full-day school is made by the regional government after consultation of the respective school board. Besides a minimum size of pupils, infrastructure and available alternative care support are taken into consideration. In January 2017, the Education Investment Law (*Bundesgesetz über den weiteren Ausbau ganztägiger Schulformen – Bildungsinvestitionsgesetz*) was adopted to invest another EUR 750 million for the expansion of full-day schools to offer an additional 270 000 places by 2025. Further, raising awareness for the need for convergence in paid and unpaid work across genders, notably through the adjustment of tax incentives and the promotion of flexible work arrangements, would also help to reduce the gender pay gap. Benefits for work-life balance and economic growth can be sizeable, as shown in the 2015 Economic Survey (OECD, 2015a).

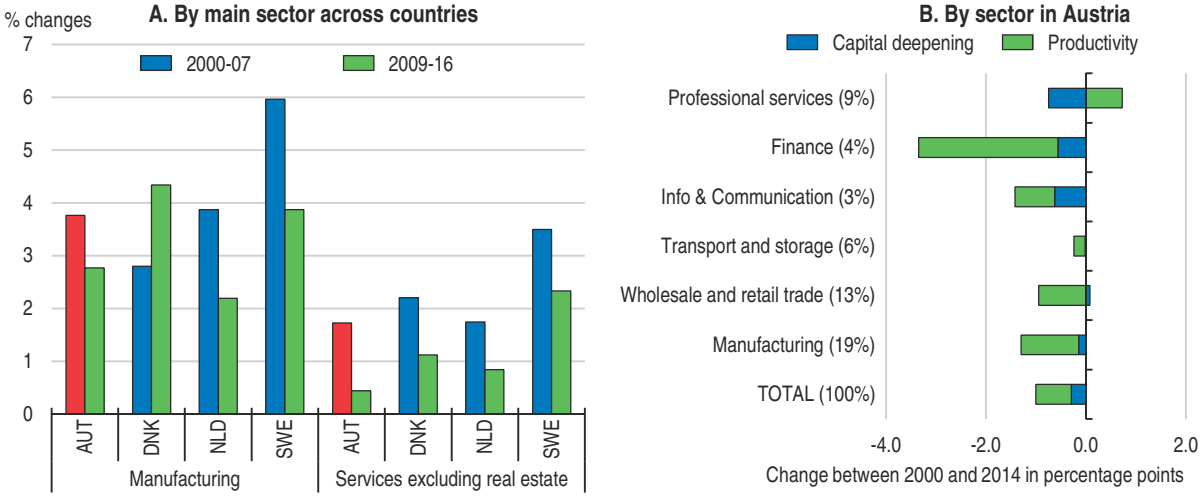
Austria's effective retirement age increased by more than two years between 2010 and 2016 thanks to reforms limiting pathways to early retirement and improving labour market prospects of older workers. Nonetheless, the gender gap remains one of the largest in the OECD mainly reflecting a large gap in the statutory retirement age (women: 60 years; men: 65 years). Labour-market participation of older workers (55-64 year-olds) remains well below comparable countries (46% against 75% in Sweden, 73% in Switzerland, 65% in Denmark or 62% in the Netherlands). Fostering employability of older workers requires skills upgrading, a challenge heightened by the disruptive nature of the digitalisation and off-shoring possibilities provided by globalisation. Raising awareness for the benefits of increased participation of the elderly is necessary to change mind-sets, adapt work environments and reconcile work with life-long learning requirements. Targeted vouchers, for instance for basic digital training, could be useful to support this process.

Fostering innovation and productivity

The slowdown of labour productivity has been uneven across sectors, and more pronounced in services than in manufacturing (Figure 18). While the productivity slowdown is not well understood, a contributing factor seems to have been the weaker growth of the capital stock relative to output (so-called capital deepening). Various explanations have been put forward such as the slowdown of investment in information and communication technology (ICT) following the peak around 2000; population ageing reducing aggregate saving and domestic investment opportunities; weak aggregate demand and balance sheet vulnerabilities in the wake of the global financial crisis further reducing appetite for investment. Another possible explanation is that the need for investment induced by digitalisation may have been lower than in former waves of innovations because new business models related to big data or e-commerce relies less on investment than on network economies of scale and access to supportive services. Platform markets also enable more efficient use of existing capital, for instance, by renting out or selling under-used assets (e.g. AirBnB, e-bay). This is perhaps offset by higher depreciation rates of new types of investments, such as software and databases, and measurement of knowledge-based capital within national accounts may understate investment in intangibles, thereby reducing measured capital deepening (OECD, 2016a).

The churn rate of enterprises (entry and exit of firms) appears lower in Austria than in comparable countries according to the partial information available, and this may slow down the "creative destruction" process and the replacement of less productive firms by more productive ones (OECD, 2016b, Calvino et al., 2015). According to the same set of data, the share of net job creation by new entrants in total employment was among the lowest across OECD countries although their average size was higher than in comparable countries. They

Figure 18. **Labour productivity growth by sector**



Note: Panel A: Annual growth rates of gross value added per hour worked in constant prices are displayed. Panel B: Contributions to change in growth rates of trend labour productivity between 2000 and 2014 is shown for main industries in Austria.
Source: OECD Productivity database; EU KLEMS Growth and Productivity Accounts.

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grow at a slower rate than in comparable countries and, according to the same data, their rate of survival is on the lower side. According to more recent but not fully comparable information, survival rates may have improved in the most recent period (Eurostat, 2017b). On the other hand, Austria also exhibits the lowest share of women inventors across the OECD, hinting yet again at suboptimal use of human capital and unequal opportunities (OECD, 2016b). Further, the OECD's Science, Technology and Industry Scoreboard suggests that SMEs are considerably less innovative than large firms in Austria, in particular in terms of marketing and organisational innovations, and that Austrian firms are less specialised in technological-intensive sectors such as nanotechnology, biotechnology and ICT (OECD, 2015c). Against this background the policymakers have initiated several recent initiatives to stimulate start-up activities in Austria (ABA, 2017).

To this effect they have to address a number of challenges. First, financing of investment activities rely still excessively on internal sources in small firms and the bulk of external financing stems from bank loans, while venture capital and other forms of equity financing are scarce (European Investment Bank, 2017). Second, notwithstanding some recent improvement (Table 4), professional services remain strictly regulated in Austria (Figure 19), in particular via the number of exclusive or shared exclusive rights, compulsory chamber membership and strict education requirements. The update of OECD product market regulation indicators in 2018 will help re-assess the exposure of Austrian firms to new entries and competition, in international comparison. Recent reforms with regard to the recognition of professions and professional qualifications from other EU Member States are expected to help ease the regulatory burden. Third, the retail trade is similarly burdened by the high number of licences and permits needed to engage in commercial activity and inflexible regulation of shop opening hours. Regulation hindering competition in the services sector spills over to the manufacturing sector (Égert and Wanner, 2016), which may have contributed to the recent sluggishness in export performance. Since April 2015, a new regulation exempts non-hazardous small facilities (i.e. retail enterprises with surface areas below 200 m^2) from authorisation procedures thus lowering administrative burdens in the

Table 4. **Past recommendations to promote growth**

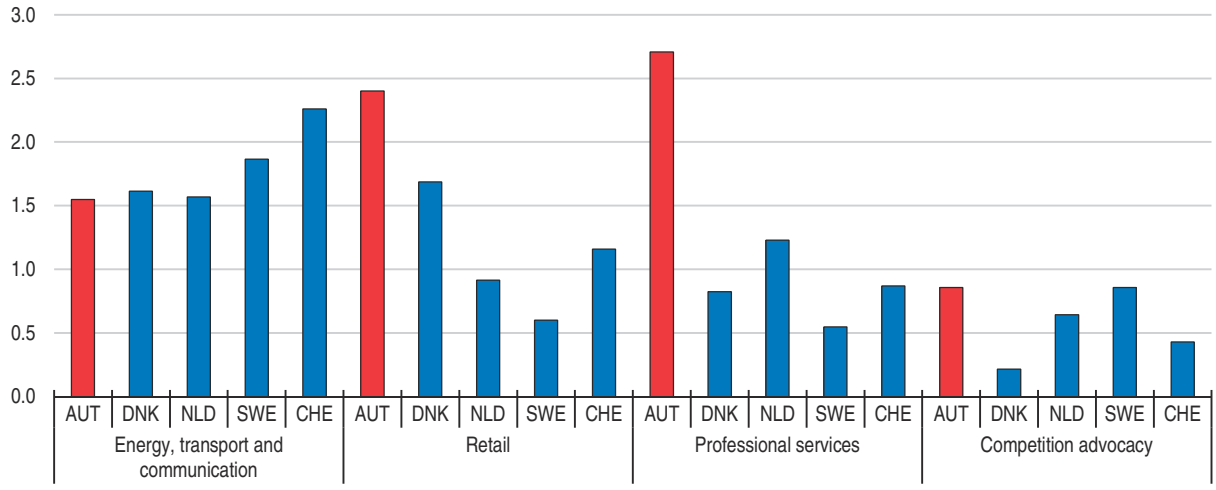
2015 Economic Survey (ES) and Going for Growth (GFG) recommendations	*Actions taken*
Further reduce the labour tax wedge for low-income earners by partly or fully waiving social security contributions, financed by a broadening of the tax base and increases in consumption, environmental and recurrent property taxes (ES, GfG).	Besides the measures taken as part of the tax reform entering into force in 2016 that reduced the tax rate of the lowest tax bracket, payroll taxes will be cut progressively in 2016-2018: the employer contribution to the Family Burdens Equalisation Fund is reduced by 0.4 percentage point in 2017 and by another 0.2 percentage point in 2018. Companies that employ more elderly than on average in their sector are eligible for an additional 0.1 percentage point cut in 2018.
Align the official retirement age for women with that for men. Eliminate all remaining subsidised avenues to early retirement. Tighten eligibility to disability pensions also for those above 50 and help partially-disabled workers to better use their remaining work capacity. Reflect changes in life expectancy more directly in the parameters of the pension system (GfG).	No action taken (In line with 1992 legislation, the statutory retirement age for women will be raised by six months each year starting in 2024; accordingly this process will be completed by 2033).
Reduce barriers to competition in services by easing entry regulations, removing restrictions on capital shares and voting rights of foreign investors and strengthening the investigation power of competition authorities (ES, GfG).	In July 2016 the Recognition and Evaluation Act (AuBG) entered into force. It facilitates and harmonises procedures for the recognition and evaluation of professional qualifications obtained abroad. A recent amendment to the competition law improved the National Competition Authority's powers of inspection (concerning electronic data, saved e.g. on external servers or in a cloud). The Competition Authority's budget will increase by EUR 2 million in 2017.
Make schools and educational tracks more inclusive. Strengthen the early socialisation as well as language and cognitive development of children from disadvantaged backgrounds to improve their intergenerational education mobility (ES).	To ease the transition from kindergarten to school, an exchange of data on learning needs between the relevant institutions has been legislated in 2016 ("Bildungskompass"). Since 2016 a child day care counselling is compulsory for parents and their children, who do not attend kindergarten. Between 2016 and 2018 significant extra funding is being provided for additional teachers, social workers and school psychologists to support language learning and integration of refugees in school and to offer specific courses in adult education. "Inclusive Model Regions" have been introduced in three provinces (Styria, Carinthia, Tyrol), particularly focussing on the inclusion of children with special needs. In 2017, a national strategy for improving the social dimension and inclusion in Higher Education has been launched.
Encourage municipal mergers to exploit economies of scale. Align spending and financing responsibilities at different administrative levels by increasing the tax autonomy of sub-central governments (ES).	The 2017 fiscal equalisation act stipulates inter-municipality co-operation. The tax autonomy to raise the housing subsidy contribution (*Wohnbauförderungs-beitrag*, currently 1% of payroll) is transferred from the central government to the *Länder* with effect in 2018.

retail sector. The 2017 Deregulation Act and the Deregulation Principles Act aim at reducing bureaucratic burdens including through the provision of eGovernment solutions (electronic communication, delivery and tendering). Deregulation in network sectors has also made good progress.

The secular decline in total factor productivity growth, like in most advanced countries, has increasingly been linked to a widening dispersion of productivity across firms due to slower diffusion of innovation and winner-takes-all dynamics (Andrews et al., 2016). Frontier firms have reaped the benefits of digitalisation and participation in global value chains while laggards increasingly struggle to keep pace. Low enterprise churning rates increase economic costs, in particular if non-viable firms survive artificially or inefficient insolvency regimes make firm exit too costly and undermine the culture of risk-taking (Adalet McGowan et al., 2017). The authorities consider that as a whole Austria's insolvency framework is working efficiently, with a recovery rate of assets of over 33% in insolvent companies and relatively short bankruptcy proceedings of 1 to 1½ years, despite relatively high administrative costs of resolving insolvencies, at 10% of the estate against an average of 5% for peer countries according to the

Figure 19. **Retail and professional services remain over-regulated**

Index scale of 0-6 from least to most restrictive, 2013



Source: OECD (2013), Product Market Regulation database, *www.oecd.org/economy/pmr*.

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World Bank's Doing Business indicators. The bankruptcy law for private persons was recently amended and made less penalising for failed entrepreneurs and there is ongoing work to improve the solvency regime. The stock of government guarantees to businesses is also higher than in peer countries, requiring close scrutiny of their impact on credit market discipline and the quality capital allocation. A high share of these guarantees concern export credits and a recent law which lowered their upper limit from EUR 50 billion to EUR 45 billion is welcome.

Seizing opportunities and addressing the challenges arising from digitalisation

The aforementioned measures to increase potential growth and social cohesion by fostering innovation and productivity on the one hand, and promote equality of opportunity in the labour market on the other, will need to be implemented in the context of the digital revolution. The scale and scope of digitalisation call for an integrated policy agenda to seize the opportunities and address the challenges that it raises. Overall, Austria is not among the most advanced OECD countries in this process, but it is stepping up its efforts in this area – to wit, the comprehensive Digital Roadmap announced in January 2017 (Box 5). OECD experience suggests that this Roadmap can be further strengthened by specific targets and deadlines for implementation, as well as by product (competition), labour market and more fundamental tax reforms (OECD, 2017b).

Box 5. **Austria's "Digital Roadmap"**

The Austrian government presented a Digital Roadmap in January 2017, "to shape the path towards a digital future and position Austria amongst the innovation leaders in digitalisation". The strategy aims at integrating different sectoral policies and co-ordinating across stakeholders (government, social partners, business sector, universities and civil society). It emphasises that i) everyone in Austria should be able to participate in digitalisation and the digital gap should be closed; ii) digital education should start as early as possible, and no child should leave school without digital competencies; and iii) as digitalisation creates new business and working models, it requires the adaptation of the

Box 5. **Austria's "Digital Roadmap"** *(cont.)*

legal and regulatory framework. The strategy aims at making Austria a leading digital business location. The Roadmap spells out 12 core objectives:

- Education: encouraging women to specialise in science and engineering (STEM); strengthening digital competencies of teachers; using innovative tools in education and open source software in schools, universities and lifelong learning institutions. A digital strategy for education and training (School 4.0) will be implemented from school year 2017/18.
- Infrastructure: establishing a cutting-edge broadband and mobile digital infrastructure (5G); closing the infrastructure gaps between urban and rural areas.
- Research and innovation: becoming an innovation leader in digital technologies; further supporting R&D in the private sector with a stronger focus on digital technologies.
- Business sector: improving framework conditions for start-ups; providing digital one-stop-shops to entrepreneurs; helping SMEs 'go digital' including by adapting apprenticeship curricula.
- Employment and work: up-skilling employees in new occupations; providing a social security net and co-determination channels for those engaged in new forms of work; adapting the legal framework and the financing sources of the welfare system.
- Health, care and social issues: drawing on digital technologies for assistance and care in living places.
- Environment, energy, agriculture and climate protection: improving energy efficiency with digital applications; promoting smart metering in agriculture; enhancing broadband access in rural areas.
- Mobility and transport: developing a supportive legal and safety framework for driverless transport; promoting smart traffic systems.
- Media and culture: countering the malicious use of new media; fighting the digital diffusion of hate speech.
- Integration and inclusion: generalising education and training in ICT; implementing multilingual service platforms.
- Security, safety and trust: enhancing cybersecurity, including via stronger international co-operation; enforcing high privacy and consumer protection standards.
- Politics and public administration: expanding e-government services and digital one-stop-shops; promoting open data, open government and open source.

A yearly digital summit will ensure constant monitoring and adaptation of the strategy. The responsibility for implementation of the various measures will remain with different line ministries.

The strategy has been designed in line with the EU's Digital Agenda for Europe (EC, 2011), which highlights key policy pillars such as i) promoting digital literacy and inclusion; ii) promoting fast and ultra-fast internet for all; iii) diffusing open standards and interoperability; and iv) developing on-line trust and security. It puts a special emphasis on achieving a single digital European market.

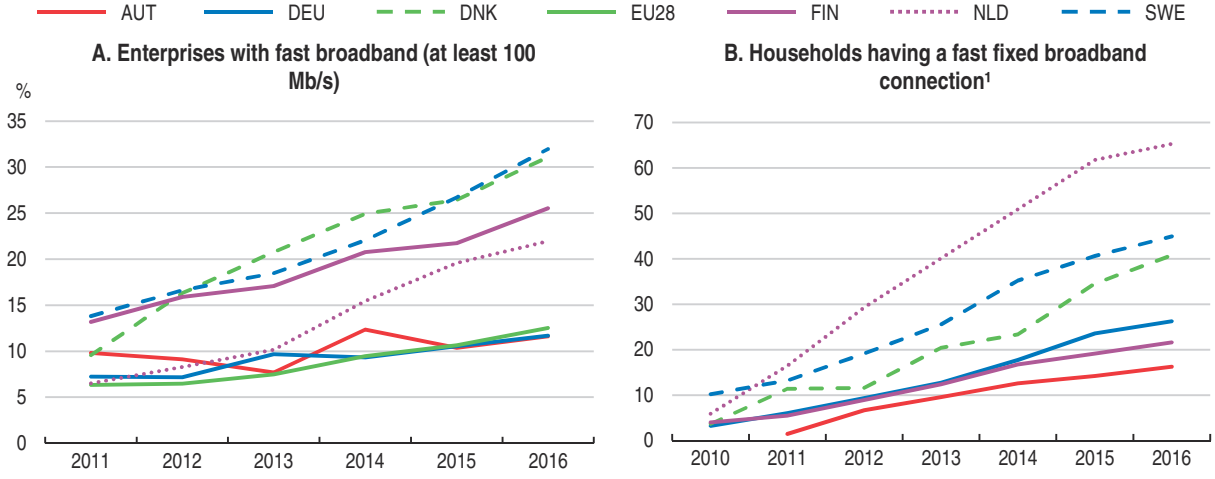
Digitalisation as a new frontier

Digitalisation has revolutionised information processing, data transmission and communication. Economic activities incorporating a significant share of digital techniques in their products, services or work processes are experiencing major changes in their cost

structures and competition conditions. Notably, compared to traditional manufacturing and services, the lower marginal costs of digitalised products and services enable firms and platforms to scale up very rapidly. First movers can gain a dominant position in national and then international markets. On the demand side, the rapid spread of information on social networks hastens the emergence of "superstars", with faster reputation build-up and prompt access to financial markets – which further accelerates the growth of leaders. However, these developments also entail challenges, in particular sharper fluctuations in firm-level employment and skill demand than in the past.

The digital revolution requires adequate physical infrastructure, notably broadband internet, which is well-developed in Austria. However, compared to other countries, the most advanced variants of the infrastructure, necessary for the new generations of high-volume data services, are less utilised by firms and households. Despite attractive service prices, only slightly more than 10% of Austrian firms subscribed to fast broadband (at least 100 Mb/s) in 2016 and 15% of households to "household broadband" (at least 30 Mb/s), against up to three and four-fold higher rates of use in other high-income small European economies (Figure 20). This seems to reflect relatively weaker demand for sophisticated digital services by Austrian enterprises and households, rather than bottlenecks in the supply of infrastructure. Nonetheless, the physical shortcomings of the network (a low share of fibre on long and short-distance connections, and a high share of copper in the "last mile") have created a less dynamic environment for infrastructure innovation. More public investment in the fibre network (as intended in a new Broadband Plan) and more active competition policy to foster competition between service providers would take Austria's digital infrastructure closer to peer country standards.

Figure 20. **Advanced digital infrastructures are less used in Austria**



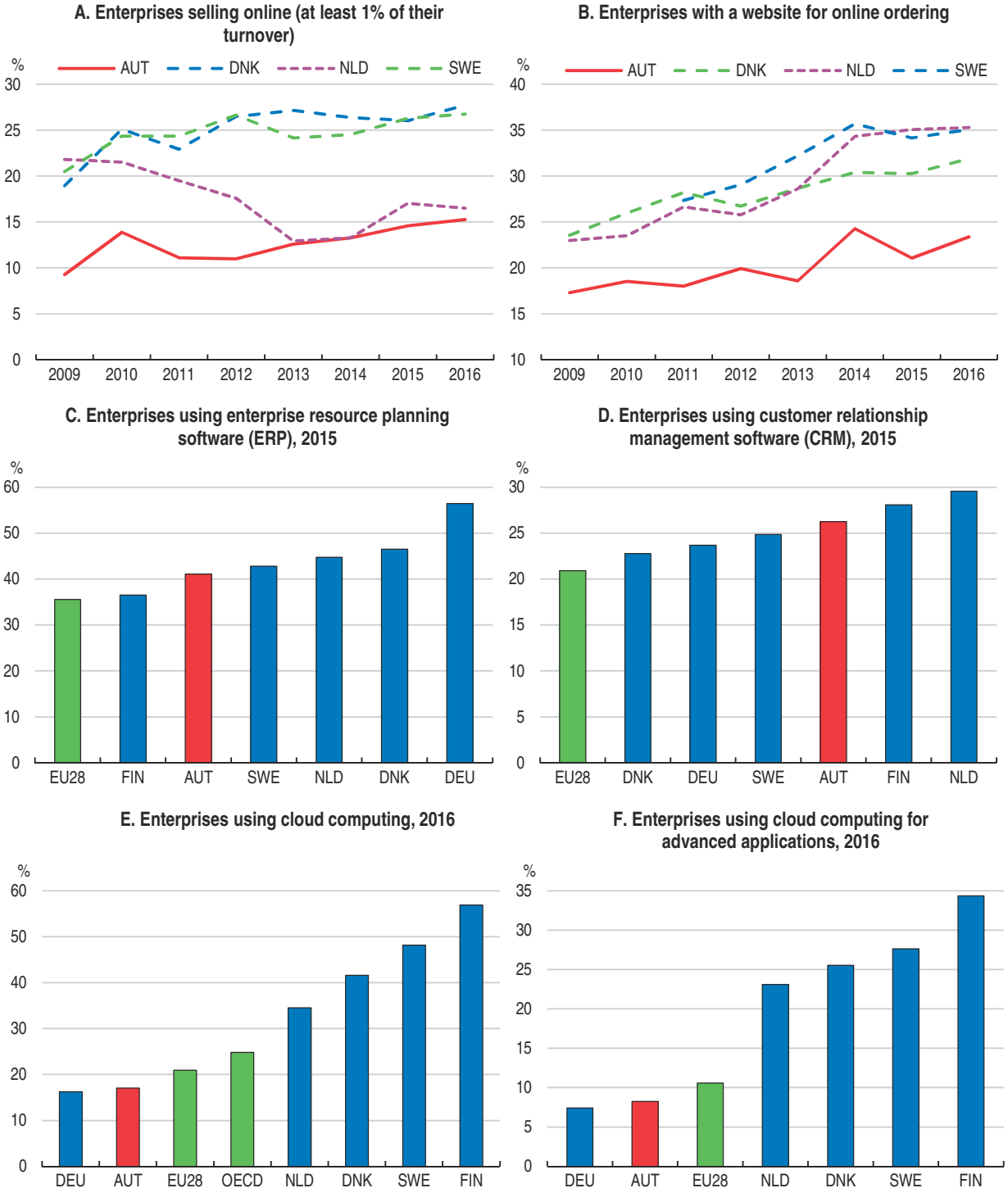
1. Fixed broadband connection with an advertised download speed above 30 Mbps.
Source: Eurostat.

StatLink http://dx.doi.org/10.1787/888933536133

The utilisation of information and communication technology (ICT) applications in the business sector is around OECD averages, but, apart from certain specific areas, behind the most advanced countries (Figure 21). The business sector appears somewhat less digitalised than what could be expected based on aggregate productivity and R&D intensity (Figure 22). This appears in line with Austria's former "technological follower" model (OECD, 2007) but falls short of policymakers' efforts to join the group of OECD innovation leaders (Austrian

Figure 21. **Enterprises lag behind peers in most ICT applications**

Non-financial firms, %

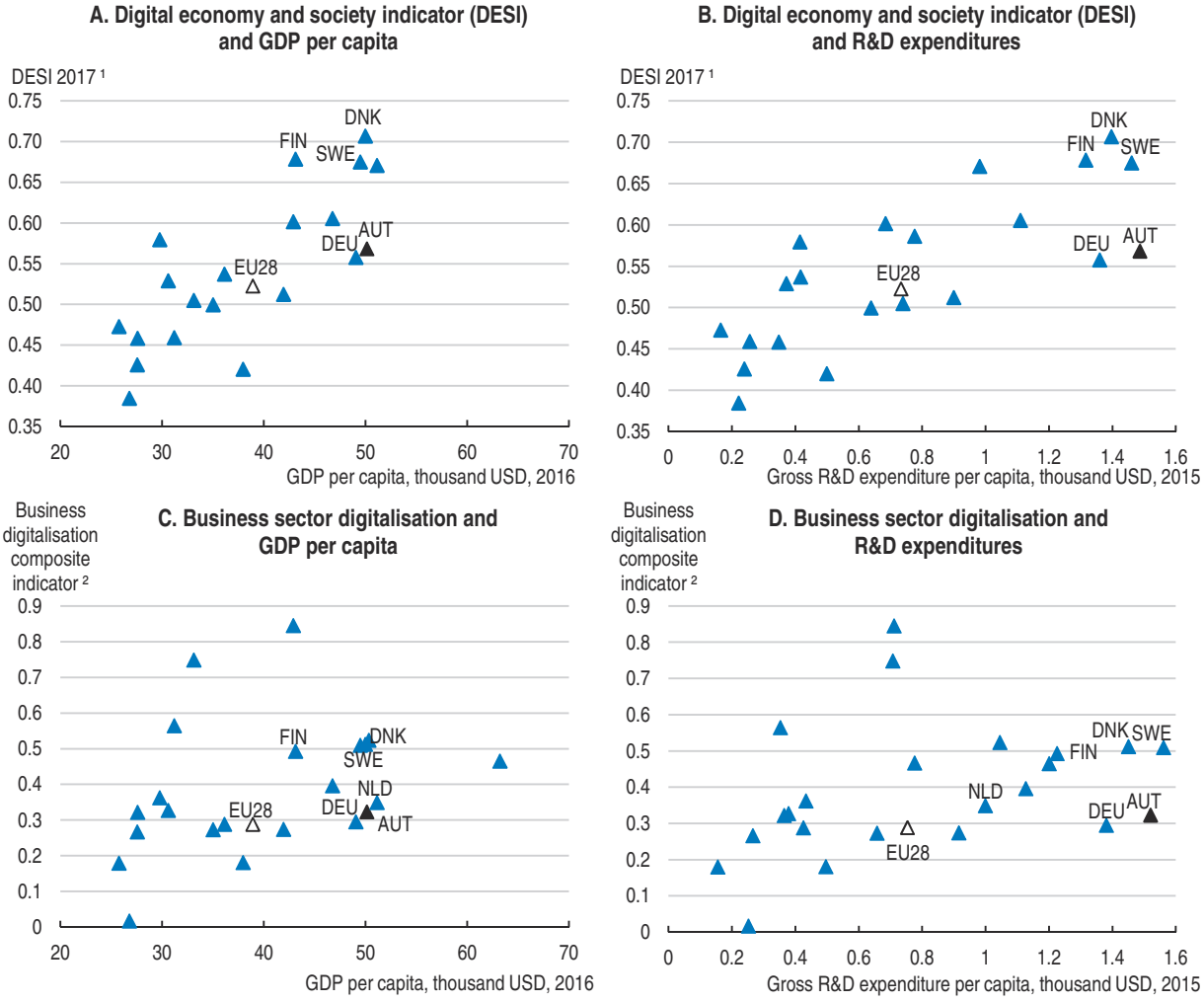


Source: Eurostat and *OECD Digital Economy Outlook 2017* (forthcoming).

StatLink http://dx.doi.org/10.1787/888933536152

Research and Technology Report, 2016). In contrast to other technologies, a systemic lag in digitalisation may create cumulative productivity and competitiveness bottlenecks for Austrian firms in markets where early-mover advantages and winner-take-all dynamics are

Figure 22. **The overall degree of digitalisation is behind its expected level**



1. The Digital Economy and Society Index (DESI) is a composite index by the European Commission based on i) the deployment of broadband infrastructure and its quality; ii) endowment with ICT skills; iii) the variety of activities performed by citizens online; iv) the digitalisation of businesses and in particular SMEs; and v) the digitalisation of public services.
2. The business sector digitalisation indicator is computed as the average percentage share of enterprises i) selling on-line at least 1% of their turnover; ii) connecting to the internet via a mobile broadband; iii) buying cloud computing services over the internet; and iv) exchanging electronic messages with public authorities. It is normalised between 0 (less) to 1 (more digitalisation).

Source: European Commission, Digital Economy and Society Index (DESI) 2017; OECD National Accounts database; OECD Main Science and Technology database; and OECD calculations based on European Commission data.

StatLink http://dx.doi.org/10.1787/888933536171

at play (OECD, 2016a). The Digital Roadmap recognises this challenge and seeks to address it (Box 5).

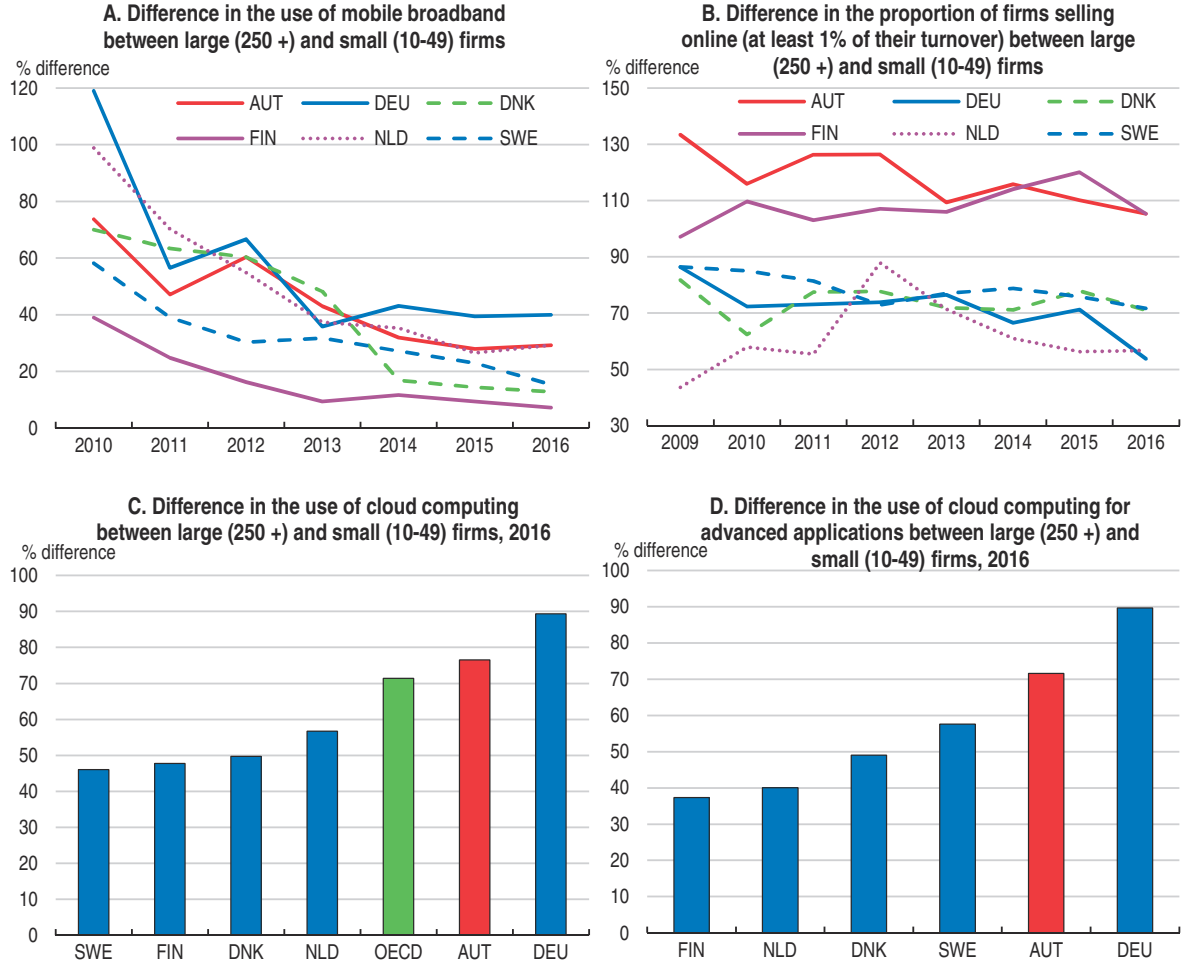
Further progress by Austria is needed in particular in two areas. First, the potential for technological and organisational modernisation in existing firms should be freed up (the so-called "within channel" in technology diffusion). Secondly, business dynamics, i.e. the rate of entry of new firms, the rate of growth of the successful ones, and the rate of contraction and exit of lower-productivity firms should be boosted (the "between" channel). There is considerable room for progress in Austria on both fronts.

Enterprises with certain characteristics are more prone to adopt ICT than others (DeStefano et al., 2017). Large firms (with higher investment capacity) and those producing

digital products and services (with more know-how and human capital in this area) tend to move faster. OECD work also concludes that the effective use of digital technologies relies on the scope of organisational change within firms, led by sound management and leadership, and this capacity may be ampler in large firms (OECD, 2017b). The lag of larger Austrian firms in the absorption of ICT applications against the international frontier is indeed limited. The average gap of the business sector derives principally from the lag of smaller firms (Figure 23). Shortcomings in ICT skills and reluctance to shift to new business models may explain the overall digital gaps in the business sector with respect to peer country counterparts. Limited availability of equity finance (external funding being provided quasi-exclusively through bank loans) appears to further hinder investment in knowledge-based assets, especially by smaller firms (Andrews and Criscuolo, 2013).

Figure 23. **Small firms display distinct weaknesses in ICTs**

ICT utilisation gaps between large and small firms in Austria and peers, 2009-16



Note: For each indicator, differences in the utilisation ratios by large (250 +) and small (10-49) firms are expressed as a percentage of the average utilisation ratio of large and small firms in each country.
Source: Eurostat and *OECD Digital Economy Outlook 2017* (forthcoming).

StatLink http://dx.doi.org/10.1787/888933536190

Changes in banking regulations following the global financial crisis have put constraints on bank lending to SMEs in all OECD countries and in Austria as well. Between 2007 and 2015, the average weight of bank loans in the balance sheet of Austrian SMEs declined from 32% to

28% (OECD, 2016j). According to a 2015 survey by the Austrian Federal Economic Chamber and the austria wirtschaftsservice (aws), nearly 9% of SMEs were already using alternative forms of financing (venture capital, mezzanine capital, silent partnerships, business angels or crowdfunding) and 24% of them were planning to do so (OECD, 2016j).

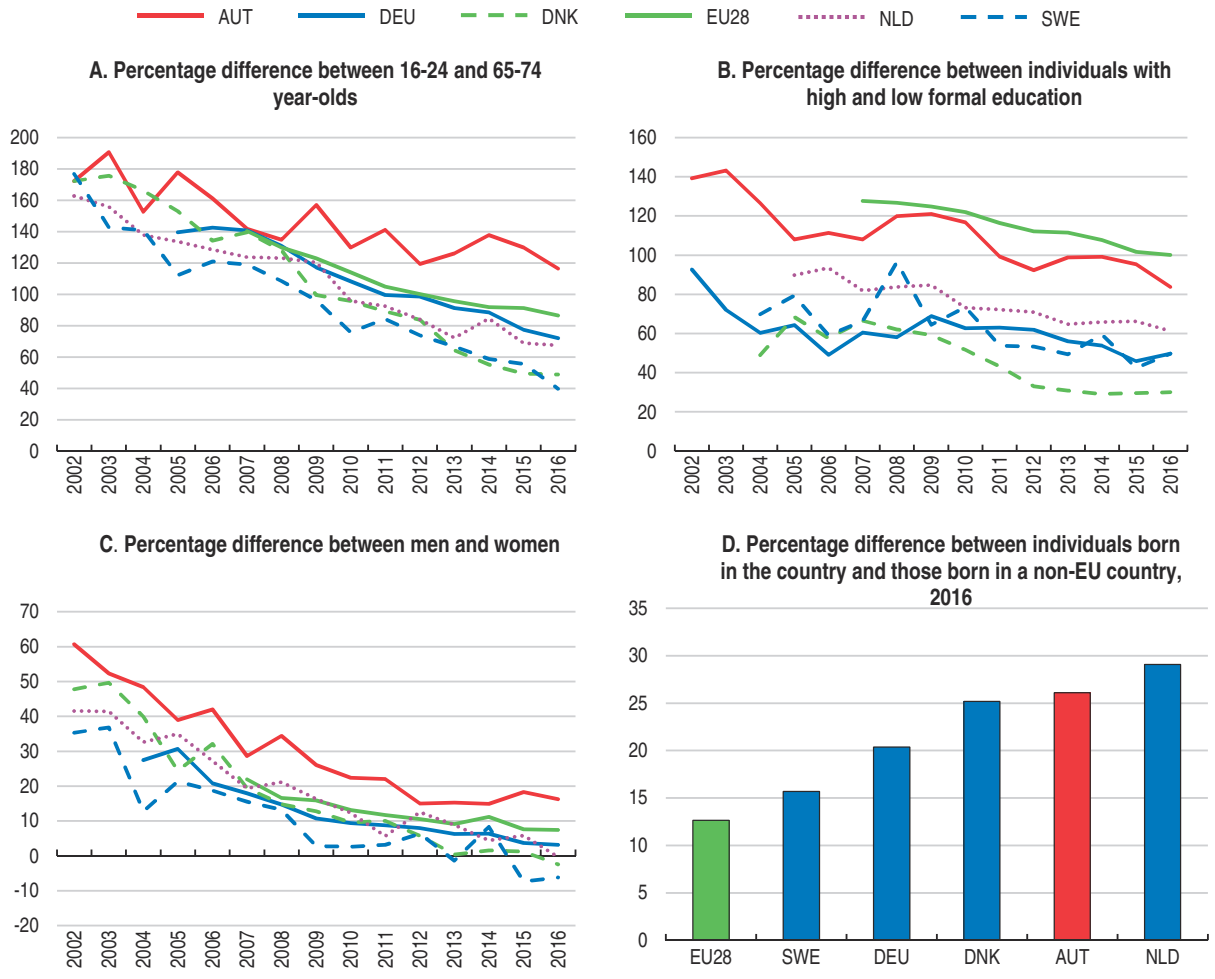
As noted earlier, firm entry and exit are relatively low in Austria and so is the number of start-ups. A recent study which surveyed the business practices of old and new firms in a large number of countries found that young firms make more active use of ICT applications, shift to more innovative business models, and reap additional performance benefits. Enterprises created and run by women are smaller in average, but are more effective users of digital tools, suggesting that traditional size shortcomings could be overcome by younger and better equipped firms (Future of Business Survey, 2017). Freeing-up a new wave of start-ups in Austria is crucial for reactivating the modernisation of the business sector, and the authorities have confirmed their commitment to this goal ("Austria as a Number One Start-Up Country" objective).

Austria's regulatory framework could be improved in several dimensions. The financing infrastructure for start-ups will notably need to be further developed. Fostering a level-playing market, including through active competition policies and competition advocacy would allow new firms to grow and challenge incumbents. This is becoming more important as digitalisation creates risks of closure, collusion and even monopolisation in several market areas. On the other hand, digital innovations also open new avenues for entrepreneurs in all sectors, giving them access to wider markets, facilitating the reaching out to far-off business partners, reducing investment needs through the use of cloud services, and bringing in new funding mechanisms such as crowdfunding. Further progress in these areas would help Austria revive business dynamics (OECD, 2017b).

Like in other countries, not all households adopt digital technologies at the same pace. Young and highly educated Austrians are eager and fast to adopt digital innovations and gender differences are small. In contrast, for older individuals, such gaps are wider, and depend on characteristics such as education and immigration origin (Figure 24). Even if the limited use of digital technologies by private persons may be seen as a matter of free choice or cultural preference, the observed determinants of divergence hint at educational and socio-economic backlogs. This calls for educational campaigns targeting lagging groups. The "Digital Roadmap" includes some initiatives in this direction.

To reduce transaction costs in the digital economy and facilitate the adoption of innovations, trust is crucial. Three key dimensions pertain to cybersecurity, privacy and consumer protection (OECD, 2016h). Like in other OECD countries, digital security is a strategic issue, to be addressed in line with the *Recommendation of the OECD Council on Digital Security Risk Management for Economic and Social Prosperity* (OECD, 2015d). This approach requires a culture of dialogue and co-operation among key stakeholders, which is well-developed in Austria. Privacy issues should continue to be handled along the principles-based privacy framework of the *OECD Privacy Guidelines* (OECD, 2013b). Furthermore, new consumer protection issues are faced in specific activities such as e-commerce, online banking and online user tracking, and legal safeguards beyond general consumer protection rules are needed. Austria's consumer protection agency participates in the International Consumer Protection and Enforcement Network (ICPEN). Guidelines in this area have recently been revised in the *OECD Recommendation on Consumer Protection in E-commerce* (OECD, 2016i).

Figure 24. **ICT adoption gaps between population groups: the case of e-commerce**



Source: Calculations based on Eurostat data.

StatLink http://dx.doi.org/10.1787/888933536209

Managing the labour market and social consequences of digitalisation

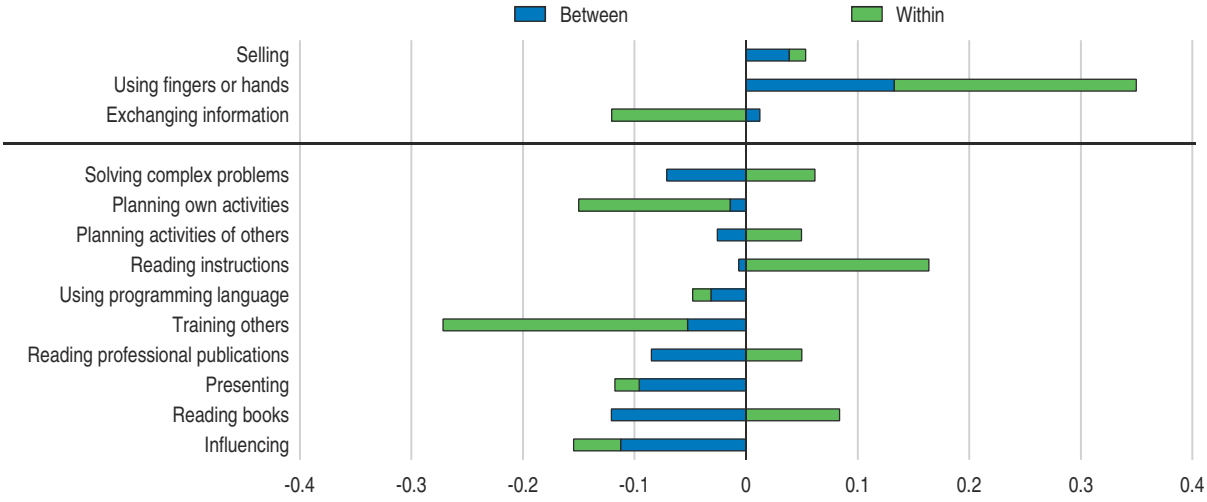
The pace of technological progress has spurred fears of a future with fewer work opportunities, as robots and software replace human workers. The authorities acknowledge the importance of the transformations ahead and have initiated several policy initiatives in this regard (see the Digital Roadmap, Box 5). While the potentially disruptive nature of these technologies for labour markets is undeniable, the net effect of digitalisation on total employment will depend on i) firms' and workers' capacity to identify and nurture complementarities between machines and human beings and ii) the extent to which the absorption of new technologies raises productivity and reduces prices, thereby adding new demand for goods and services. Specifically, labour market disruptions are more likely to lead to changes in the task structure of occupations than the disappearance of entire occupations (Autor, 2015).

Against this background, tasks associated with social and creative intelligence are complementary to digital technologies and less likely to be replaced in the near future (Frey and Osborne, 2017). PIAAC results suggest that Austria's occupational structure is tilted towards occupations that make less use of skills such as "influencing", "reading books and

professional publications", "presenting" or "solving complex problems" (Figure 25), which explains why the country exhibits a relatively high share of jobs at risk of automation (Arntz et al., 2016). This finding echoes the identified backlogs in the transition towards digitalisation and suggests that some adjustments that have already occurred in other countries may still lie ahead in Austria. To preserve social cohesion, policies that foster business dynamics (see above) should be flanked with adequate safety nets and an enabling system of active job search and retraining activities. A more fundamental tax reform to shift taxation away from labour to property, environmental bads and consumption while preserving the purchasing power of the low income groups would support employment and social cohesion and strengthen the sustainability of social institutions and the environment.

Figure 25. **Differences in skills use at work between Austria and peer countries**

Intensity index as defined in PIAAC (0-5)



Note: Differences in the task intensity between Austria and peer countries are shown. "Between" refer to the contributions of the occupational structure to the overall difference (obtained by resampling Austria's occupations with average sampling weights of peer countries and computing the difference between the non-resampled and the resampled weighted average of intensities across occupations). "Within" differences refer to the contribution of differences in the intensity occupation by occupation between Austria and its peers (obtained as the sum of differences in task intensities for each occupation weighted by peer countries' average employment shares). Austria's peer countries are Denmark, the Netherlands and Sweden. The first three tasks significantly increase automation risks, the other tasks are significant bottlenecks to automation (see Arntz et al., 2016).

Source: Calculations based on Survey of Adult Skills – PIAAC (2012, 2015).

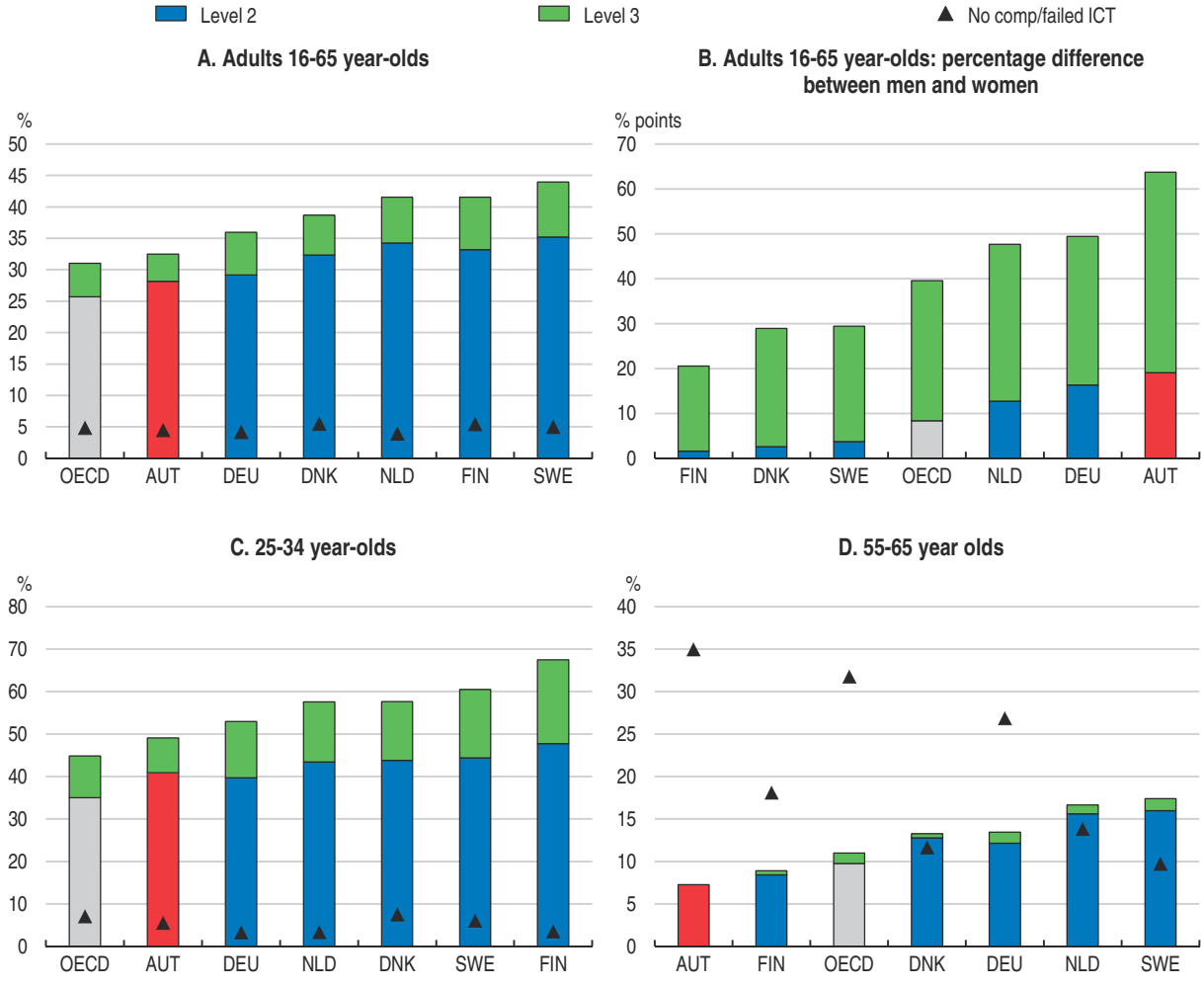
StatLink http://dx.doi.org/10.1787/888933536228

Digitalisation also modifies labour relations as new forms of work have emerged blurring the traditional lines between employers and employees. The "on-demand economy" links crowd-workers via platforms to their customers (consumers and firms). This provides market participants with benefits such as increased flexibility, access to larger markets and superior supply-demand matches. On the other hand, existing labour law and social institutions need to be adapted to avoid benefits accruing disproportionally to firms and platforms due to asymmetric bargaining power, a lack of social protection and precarious working conditions. Authorities should engage a social dialogue with platforms to ensure minimum standards, such as portability of crowd-worker ratings and safeguards against discrimination. Finally, well-designed policies are needed to mitigate the risk of underinvestment in skills as new forms of work often shift the burden of up- and reskilling away from firms to individuals and the public sector.

The penetration of digital tools at work fundamentally changes the set of required skills for a wide range of occupations. To this end, PIAAC added the item "problem-solving in a technology rich environment" to the list of basic skills to be assessed. Results suggest that only 32% of Austrians are able to solve problems that require the use of both generic and more specific technology applications, against 40% in peer countries (Figure 26). Further OECD evidence suggests that digital literacy backlogs may be partly rooted in Austria's school system. Digital reading scores and task-oriented navigation skills fall far behind peer countries and are among the lowest in the OECD (PISA, 2012). The pedagogical approach should be revised in line with international best practices, with a greater focus on collaboration and peer reviewing to upgrade and professionalise teaching practices and benefit from external feedback (Nusche et al., 2016). The planned greater school autonomy, if combined with effective accountability, can play an important role. More elaborated needs-based funding formulas could help to reduce inequalities between schools. Finally, digital education should start with early childhood education for instance by the use of playful approaches to coding and by instructing the prudent usage of digital devices.

Figure 26. **The adult population's digital proficiency is lower than in peer countries**

Percentage of adults scoring at level 2 or 3 in digital problem solving or having no computer experience, 2015



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

StatLink http://dx.doi.org/10.1787/888933536247

With rapidly changing labour market needs, a key priority is to ensure the responsiveness of the education system and to promote work environments that are geared towards reconciling work with the need for life-long learning. In this regard, Austria should build on the high prominence of vocational education and training (VET) and modernise dual apprenticeship systems to preserve their attractiveness to both employers and apprentices. Government measures announced in spring 2017 go in this direction, including subsidies for language training abroad. Cost-benefit analyses suggest that financial incentives for firms vary considerably across training professions. Subsidy schemes and training durations should respond flexibly to supply and demand discrepancies to avoid windfall gains and encourage firm participation in fields where the productivity of apprentices rises only slowly with apprenticeship duration (Mühlemann, 2016; Kis, 2016; Kuczera, 2017).

In order to remain attractive to students, and to respond to increasing demand for flexibility and adaptation, VET programmes should seek to provide skills that go beyond those required for a specific occupation, and also ensure better transitions to higher education. In this regard, the system of modular apprenticeships and VET colleges should be developed further. The projected modification in task and occupational structures strengthens the need for well-designed skill assessment and anticipation exercises as well as for constant up-grading. Building on Austria's strong social partnership foundations, the authorities could consider introducing a generalised subsidy-based lifelong learning incentive scheme akin to Singapore's SkillsFuture Programme.

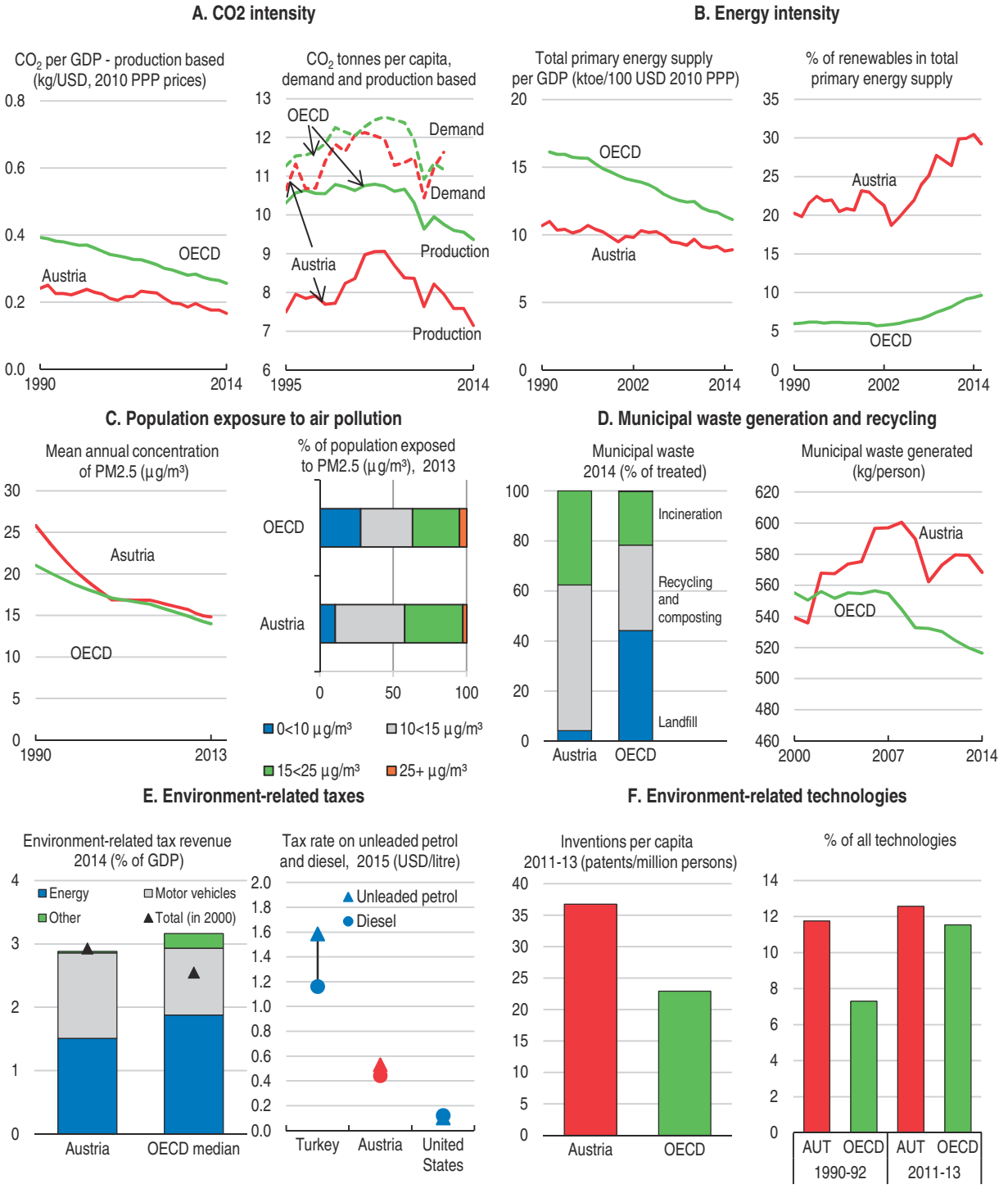
Challenges for green growth

Austria's economy is less energy-intensive than the OECD average and its energy mix features a much higher share of renewables (Figure 27). This share has soared over the past decade to 29% of total primary energy supply (TPES) in 2015. The increase mainly reflects growth in the use of biofuels and waste for heat or power, which now account for 19% of TPES, almost double the 2000 share. Most of the rest is hydropower. The contribution of wind and solar has risen ten-fold since 2000 but still supplies only 2% of TPES. However, when account is taken of estimated CO_2 emissions embodied in exports and imports, per capita CO_2 emissions implied in Austria's final demand structure are close to the OECD average.

Austria does not have an explicit carbon tax, but carbon prices for energy users reflect specific taxes on energy use and the EU Emissions Trading System. Only 57% of Austria's non-road energy related CO_2 emissions were priced in 2012, and only 26% were priced above EUR 30 per tonne of CO_2, that is, above a conservative estimate of their climate cost (OECD, 2016c). Variations across sectors are large and result in mixed price signals. The authorities should extend the use of environmentally-related taxes beyond transport and energy-producing sectors with a view to providing consistent carbon price signals across the economy.

There is also scope to increase tax rates on fossil fuels. Tax rates on petrol and diesel are lower than in many neighbouring countries, which encourages motorists from neighbouring countries and freight haulers (as many international roads cross Austria) to fill their tanks in Austria. This "fuel tourism" contributes to around one third of Austrian transport-related GHG emissions, and, by increasing traffic, to higher levels of air pollution. Although air quality has generally improved, nitrogen oxide emissions remain above the national limit. Road transport is the major source of NO_X emissions, largely due to a high share of diesel in the overall vehicle fleet.

Figure 27. **Green growth indicators: Austria**



Source: OECD (2017), *Green Growth Indicators* (database).

StatLink http://dx.doi.org/10.1787/888933536266

Austria has made some progress in reforming support measures for fossil fuels. For example, the country phased out an excise-tax reduction on diesel fuel for farmers in 2013 (OECD, 2015b). But a number of poor incentives remain, including a tax reimbursement

scheme for industrial energy consumers, which can reduce incentives for energy efficiency (OECD, 2016b). Tax incentives for company cars and commuting costs are also in place, which can encourage private car use, long-distance commuting by car and urban sprawl, increasing emissions of GHG and local air pollutants, noise, congestion and accident risks. The 2016 tax reform has marginally reduced the implicit tax subsidy for highly polluting company cars albeit from one of the highest levels in Europe (EC, 2010).

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ANNEX

Progress in structural reform

Promoting growth

Past recommendations	Actions taken
Further reduce the labour tax wedge for low-income earners by partly or fully waiving social security contributions, financed by a broadening of the tax base and increases in consumption, environmental and recurrent property taxes (ES, GfG).	Besides the measures taken as part of the tax reform entering into force in 2016 that reduced the tax rate of the lowest tax bracket, payroll taxes will be cut progressively in 2016-2018: the employer contribution to the Family Burdens Equalisation Fund is reduced by 0.4 percentage point in 2017 and by another 0.2 percentage point in 2018. Companies that employ more elderly than on average in their sector are eligible for an additional 0.1 percentage point cut in 2018.
Align the official retirement age for women with that for men. Eliminate all remaining subsidised avenues to early retirement. Tighten eligibility to disability pensions also for those above 50 and help partially-disabled workers to better use their remaining work capacity. Reflect changes in life expectancy more directly in the parameters of the pension system (GfG).	No action taken (In line with 1992 legislation, the statutory retirement age for women will be raised by six months each year starting in 2024; accordingly this process will be completed by 2033).
Reduce barriers to competition in services by easing entry regulations, removing restrictions on capital shares and voting rights of foreign investors and strengthening the investigation power of competition authorities (ES, GfG).	In July 2016 the Recognition and Evaluation Act (AuBG) entered into force. It facilitates and harmonises procedures for the recognition and evaluation of professional qualifications obtained abroad. A recent amendment to the competition law improved the National Competition Authority's powers of inspection (concerning electronic data, saved e.g. on external servers or in a cloud). The Competition Authority's budget will increase by EUR 2 million in 2017.
Make schools and educational tracks more inclusive. Strengthen the early socialisation as well as language and cognitive development of children from disadvantaged backgrounds to improve their intergenerational education mobility (ES).	To ease the transition from kindergarten to school, an exchange of data on learning needs between the relevant institutions has been legislated in 2016 ("Bildungskompass"). Since 2016 a child day care counselling is compulsory for parents and their children, who do not attend kindergarten. Between 2016 and 2018 significant extra funding is being provided for additional teachers, social workers and school psychologists to support language learning and integration of refugees in school and to offer specific courses in adult education. "Inclusive Model Regions" have been introduced in three provinces (Styria, Carinthia, Tyrol), particularly focussing on the inclusion of children with special needs. In 2017, a national strategy for improving the social dimension and inclusion in Higher Education has been launched.
Encourage municipal mergers to exploit economies of scale. Align spending and financing responsibilities at different administrative levels by increasing the tax autonomy of sub-central governments (ES).	The 2017 fiscal equalisation act stipulates inter-municipality co-operation. The tax autonomy to raise the housing subsidy contribution (*Wohnbauförderungs-beitrag*, currently 1% of payroll) is transferred from the central government to the *Länder* with effect in 2018.
Allow universities to re-introduce general tuition fees in order to finance quality improvements in the provision of tertiary education. Accompany such fees by a comprehensive grant and income-contingent student loan system to avoid socioeconomic segregation (GfG).	No action taken.

Note: ES = *2015 OECD Economic Survey of Austria*; GfG = *2017 Going for Growth*.

Promoting gender equality

Past recommendations	Actions taken
Spur investment in high quality childcare facilities. Enhance the availability of full-day schools and care centres. Consider introducing legal entitlements for these services (ES, GfG).	The "Education Investment Law", adopted in 2017, will provide another EUR 750 million for the expansion of full-day schooling until 2025. For the period 2014-17, the federal government has considerably increased earmarked subsidies to *Länder* for financing child day-care.
Reduce the implicit taxation of transition from marginal and part-time to full-time employment and replace the sole-earner tax deduction by targeted transfers to families in need (ES, GfG).	No action taken since the 2015/16 tax reform.
Transform childcare allowance and parental leave schemes into a unique childcare account that allows parents to allocate subsidised absence from work flexibly over time. Reserve a sizeable part of this account, at least 33%, for the exclusive use of fathers (ES).	Since March 2017 the new system of flat rate childcare allowance can be taken flexibly within the duration of 456 and 1063 days. 20% is reserved exclusively for fathers (before: 16.5%). The Partner Bonus entitles parents who claim child care allowance almost equally (i.e. the period during which child allowance is received must be distributed either 50:50 or up to 60:40) to a one-time payment of EUR 500 each. Working fathers who take care of their families directly after the birth of a child, are entitled to the "family time bonus" (about EUR 700).
Raise awareness by publicising more information on innovations in study area choices of schoolgirls and schoolboys, earlier return to full-time work of mothers, and fathers' participation in care and household duties (ES).	Several initiatives to mitigate gender stereotypes in educational choices have been undertaken. For example, the possibility to choose between different types of handicraft courses has been abolished in order to avoid reproduction of stereotypes. The new paternity leave entitlement (see above) has the potential to change mind-sets towards more equal sharing of care responsibilities. The campaign "Time for your child" and so-called freecards were designed to raise awareness for fathers in parental leave and draw fathers' attention to this topic.
Develop a comprehensive database on social transfers or a comprehensive panel survey to assess the impact of alternative family policy schemes on labour supply, child care use and net budget costs, and adjust policy packages in the light of this information (ES).	No action taken.

Note: ES = *2015 OECD Economic Survey of Austria*; GfG = *2017 Going for Growth*.

Thematic chapters

Chapter 1

Austria's digital transition: The diffusion challenge

Austria's transition to a digital economy and society is slower than in other high-income small open European economies. The rate and pace of utilisation of eight main ICT applications shows that Austrian firms follow peer country counterparts with a gap, which has widened in most areas in recent years. Two dynamics drive digital transitions and Austria has room for progress in both of them. First, the potential for digitalisation in all firms, and especially in the smaller ones (where gaps are largest) should be freed-up by upgrading the full range of ICT-generic, ICT-specific and ICT-complementary skills. Second, Austria needs to make its business environment more conducive to firm entry and exit. The rate of entry of new firms and their growth are crucial for the diffusion of new business models and ICT innovations but fall behind peer countries. The adoption of ICT innovations by households also follows a staggered path: young and highly educated Austrians adopt ICT applications in similar ways to their counterparts in peer countries, while middle and older age cohorts display noticeable gaps. This calls for policies to help lagging groups become more acquainted with innovations. A whole-of-government approach, including large-scale utilisation of e-government applications in enterprises and households, should help to embrace change and facilitate the flourishing of innovative businesses, work practices and lifestyles throughout Austria.

Austria is in an intermediary position in the digital transition

Austria has set out ambitious objectives for the transition to a digital economy and society, but so far it has been lagging behind comparable economies (OECD, 2015a; Peneder et al., 2016). The composite Digital Economy and Society Index, plotted against broad measures of economic and technological development, illustrates this (Figure 1.1 Panels A and B). A composite indicator of digitalisation in the business sector alone gives a similar picture (Panels C and D). Overall, Austria appears somewhat behind its expected degree of transition to a digital economy and society. The gap was reduced in the early 2010s (OECD, 2015a), but frontier countries seem to have accelerated their deployment of information and communication technology (ICT) innovations since, and wedges for Austria may have widened again. Throughout this chapter digitalisation outcomes in Austria are highlighted in comparison to other OECD countries, but some detailed comparisons refer only to selected digitally-advanced European small economies such as Sweden, Denmark and The Netherlands for which detailed indicators are available (henceforth "peer countries").

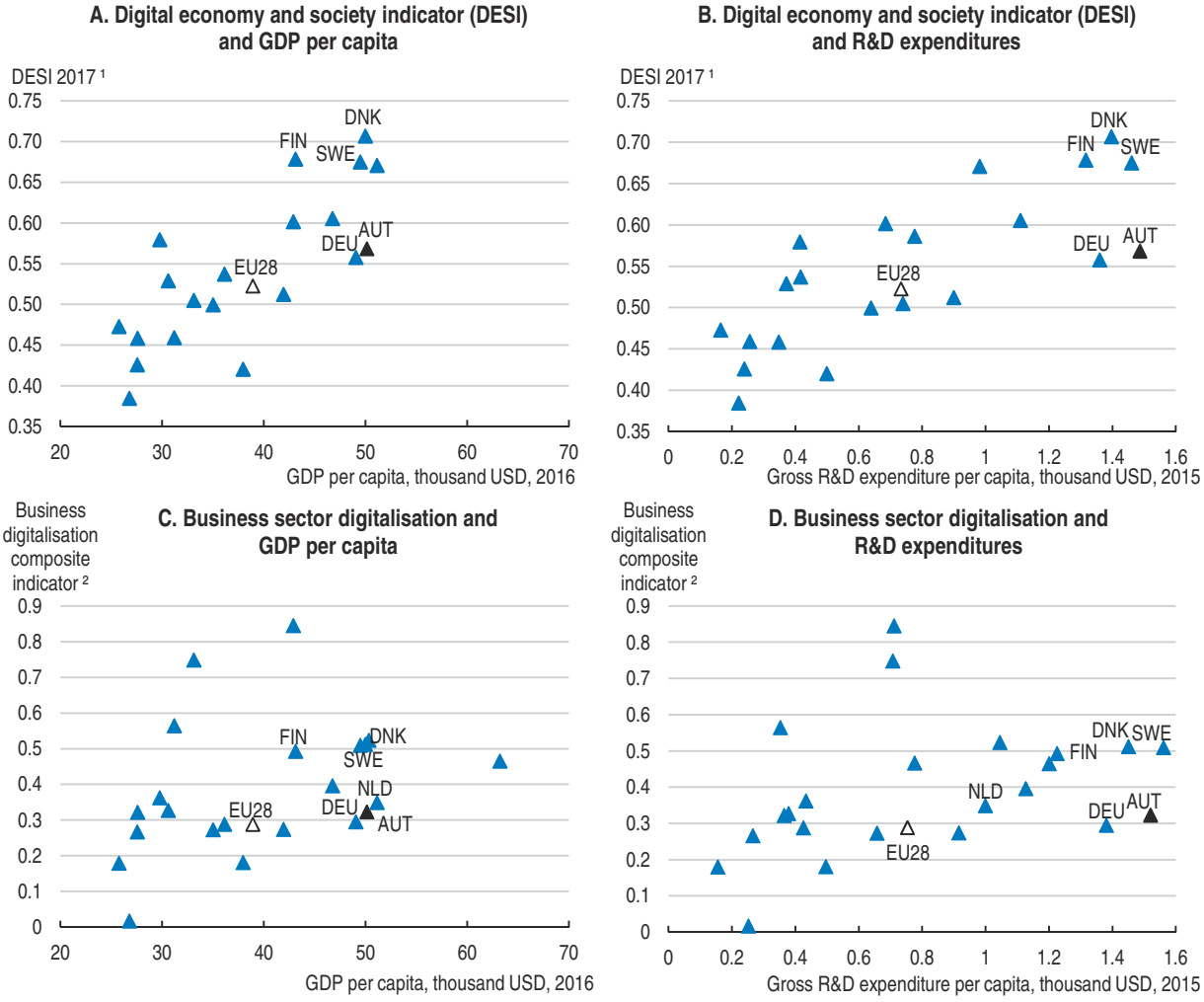
Austria's position is not uniform across dimensions and areas of digitalisation. For example, the tourism sector is close to the international frontier in certain digital applications and remains a laggard in others. Austrian enterprises producing digital goods and services are well advanced in the implementation of their own technologies and have more of an edge over other sectors than in peer countries. E-government is another case in point. Austria is a world leader in several e-government innovations such as electronic signatures and online service completion (Figure 1.2, Panel A), but their diffusion in society is, compared to other countries, relatively faster for firms than for households (Panels B and C). These variations suggest that, as in other OECD countries, there are uneven paths in the diffusion of digital innovations in Austria and room is available for fostering more dynamic diffusion in the lagging areas.

Austria's current position in digitalisation is in line with its secular "technological follower" model (OECD, 2007). The distance of the business sector to the frontier typically widens when the frontier moves rapidly. Even so, gaps tend to be gradually resorbed and global good practices end up being widely shared in the economy and society. Various mechanisms of knowledge diffusion backed by social partnership, including the market-responsive vocational education and training system, help secure this broad-based propagation (Musset et al., 2013). Lags do happen in the diffusion of international innovations (Tellis et al., 2003), but so far they have been considered as temporary and relatively benign. Nonetheless, the present gap in digital innovation may turn out to be more disturbing:

i) Digitalisation entails increasing returns for successful innovators (Box 1.1). Changing competition conditions in "winner-takes-all" markets risk relegating lagging firms far from the global frontier, with durable productivity, competitiveness and well-being losses (OECD, 2016c);

ii) Too small a group of "enabling customers" (households and firms purchasing innovative goods and services) may deprive local producers from a dynamic local market, with

Figure 1.1. **Austria in the international digital transition**



1. The Digital Economy and Society Index (DESI) is a composite index by the European Commission based on i) the deployment of broadband infrastructure and its quality; ii) endowment with ICT skills; iii) the variety of activities performed by citizens online; iv) the digitalisation of businesses and in particular SMEs; and v) the digitalisation of public services.
2. The business sector digitalisation indicator is computed as the average percentage share of enterprises i) selling online at least 1% of their turnover; ii) connecting to the internet via mobile broadband; iii) buying cloud computing services over the internet; and iv) exchanging electronic messages with public authorities. It is normalised between 0 (less) to 1 (more digitalisation).

Source: European Commission, Digital Economy and Society Index (DESI) 2017; OECD National Accounts database; OECD Main Science and Technology database; and OECD calculations based on European Commission data.

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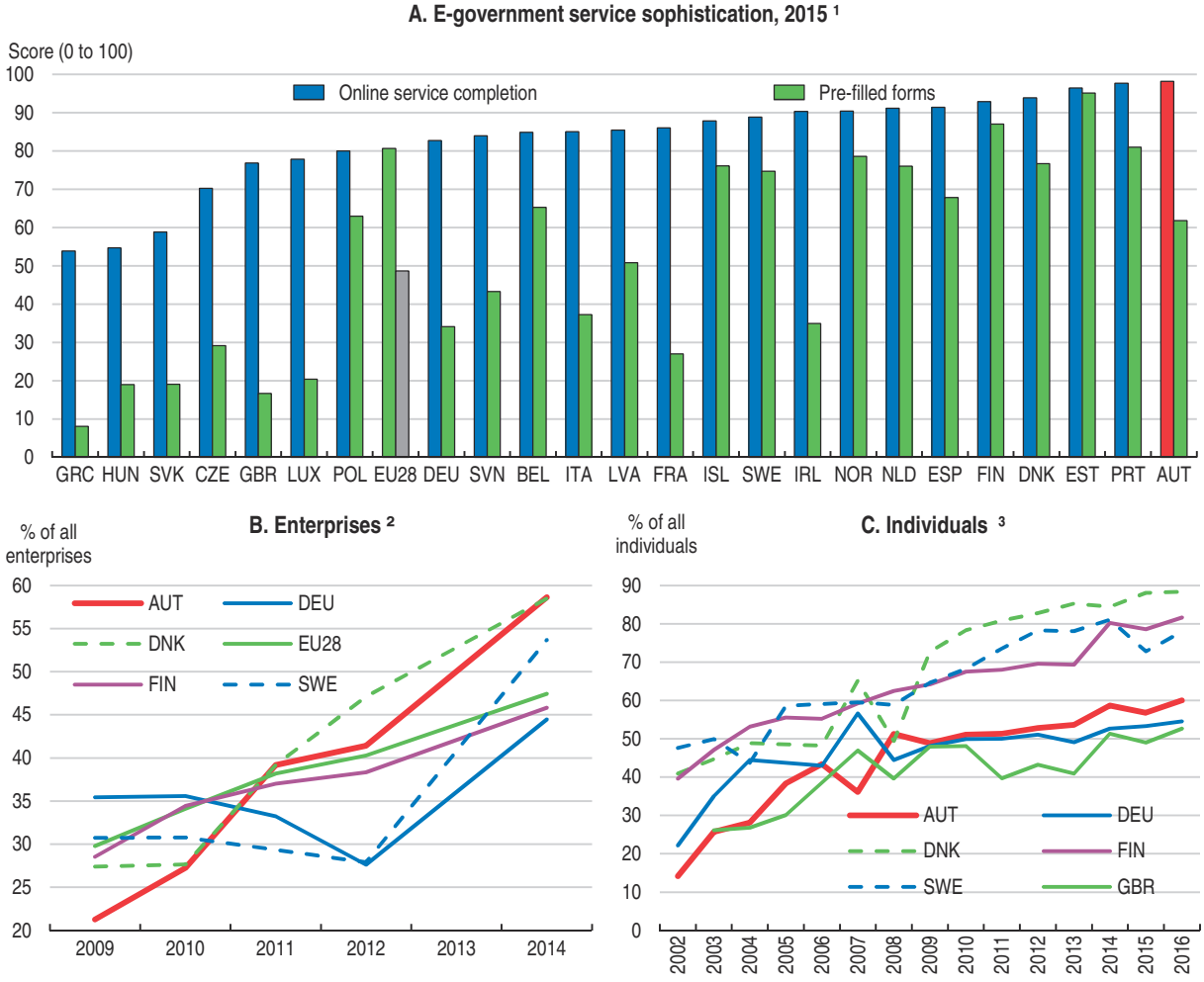
negative feed-back effects if full access to the broader international market is not secured (Atluri et al., 2016);

iii) Active engagement of the society as a whole in support of digitalisation would facilitate the adjustment of the broad set of legal, regulatory and labour contractual frameworks. Successful adjustments may generate a virtuous cycle accelerating digital transitions. Otherwise, a vicious cycle may slow them down (Blix, 2015).

There is shared awareness in Austria of the benefits of broad-based digitalisation, and of the factors which may stagger and therefore slow down its diffusion in the business, government and household sectors. There is also awareness that the acceleration of digitalisation might disrupt the labour market and social cohesion, eroding social support

Figure 1.2. **Austria is an innovation leader in e-government but diffusion is slow among households**



1. Pre-filled forms measures to which extent data known to the public administration is pre-filled in forms presented to the user. Online service completion measures to which extent the steps in an interaction with the public administration can be performed completely online.
2. Enterprises using automated data exchange for sending or receiving data to/from public authorities.
3. Individuals using internet to interact with public authorities.

Source: OECD ICT database and Eurostat.

StatLink http://dx.doi.org/10.1787/888933536285

Box 1.1. **Special economic impacts of digitalisation**

The codification of analogue signals to binary bits and the emergence of internet have revolutionised information processing, data transmission and communication on a global scale. This takes many forms such as exchanging e-mails as a substitute to letters, encoding business and industrial processes, translating analogue measures into a form enabling computer calculations and control, and using social networks as alternatives to face-to-face interaction (OECD, 2017b).

Economic activities subject to digitalisation, i.e. incorporating a significant share of digital techniques in their products, services or work processes, undergo major changes in their cost structures and competition conditions (OECD, 2017a). Notably, contrary to traditional

Box 1.1. **Special economic impacts of digitalisation** *(cont.)*

manufacturing and services with high fixed costs and substantial marginal costs, the lower marginal costs of digitalised products and services enable firms and platforms to scale up very rapidly. In such activities, successful early movers rapidly build up a dominant position in national and international markets, especially in those with network externalities. On the demand side, the rapid spread of information on social networks hastens the emergence of such "superstars", with fast reputation build-up and prompt access to financial markets – which further accelerate the growth of winners. In turn, these developments can suddenly go in reverse. Resulting variations generate sharper fluctuations than in the past in firm-level employment and skill demand, which may conflict with expectations of stability – of employment tenure by workers, of profits by investors and of predictability of aggregate activity in local communities.

for digitalisation. A "Digital Roadmap" introduced in 2017 at the federal government level, and similar initiatives at *Länder* level, reflect this awareness and the shared policy objective of accelerating the digital transitions and anticipating their disruptive impacts (see Box 5, on "Austria's Digital Roadmap", in the Assessment and Recommendations).

Convergence with the global technological frontier is uneven across sectors and firms

Recent OECD research has shed new light on the diffusion of frontier technologies and on productivity convergence in OECD economies, with implications for Austria. Between 2001 and 2013, frontier firms across OECD countries achieved steady productivity increases, while laggard firms did not, contributing to increased productivity and income divergence between the top and the bottom (Andrews et al., 2016). The specific influence of digitalisation in this regard has only just started to be investigated. Early evidence suggests that the discontinuities associated with digitalisation may be further altering the path of diffusion of new technologies, making them even less uniform.

Productivity gaps result less from higher capital investment by successful firms than from their higher multi-factor productivity (MFP) gains, i.e. more efficient combination of capital and labour, partly aided by technological and non-technological innovations. These firms may be more advanced in digital transitions (Hall et al., 2012). They appear to possess superior capabilities to make good use of digital technologies and a more supportive intra-firm environment, such as well-informed management, more information-intensive business models and more innovative and flexible work practices (OECD, 2016c; OECD, 2013b).

The gaps between frontier firms and laggards are the largest in areas where regulation restricts competition. Available estimates suggest that up to half of MFP divergence may have been avoided and the diffusion of the best technologies and organisational models would be accelerated if countries engaged in more extensive market liberalisation, in particular in services (Andrews et al., 2016). As services in Austria are relatively less exposed to competition (OECD, 2017f, EC, 2016), digitalisation in these sectors may be negatively affected.

Specifically, four policy areas are important for the diffusion of best practices: i) reducing barriers to entrepreneurship; ii) reducing the rigidity of employment rules; iii) reducing the

cost of bankruptcies; and iv) improving access to venture capital (Andrews et al., 2015). Austria stands out as one of the OECD countries which can accelerate technological catching-up and productivity convergence through policy reforms in these areas.

Furthermore, trade with frontier countries, participation in global value chains (GVCs), quality of skill match in labour markets and e-government readiness are found to be positively correlated with the diffusion of frontier technologies. Early exit avenues for failing firms also exert an impact. Austria appears to have room for further convergence with OECD policy innovations in these areas as well (Saia et al., 2016).

Start-up dynamics play a special role in technology diffusion and productivity convergence through vintage (firm cohort) effects. Calvino et al. (2016) examine the role of new firm creation and expansion across OECD countries and find that Austria has room for progress. The vigour of the process is measured by the rate of job creation by new firms, and ten policy areas (including tax incentives for start-ups, tax schemes affecting the supply of entrepreneurial funds, independence of bank supervision, etc.) are found to have a relationship with the dynamism of start-ups.

OECD research also suggests that digitalisation makes the diffusion of productivity-enhancing practices more staggered and less linear (OECD, 2016d). In the ICT-intensive sectors, frontier firms increase their market share more rapidly and productivity divergences are deeper. In addition, the productivity of "elite" firms (defined as the 2% most productive enterprises in each sector) diverges further from the already strong productivity of other frontier firms. Declining marginal costs due to digitalisation further nurture such "winner-takes-most" competition (Moazed and Johnson, 2016). Other factors are also found to prevent the broad-based diffusion of new technologies, including their increased complexity, the higher role of tacit knowledge, the monopolistic pricing of some of the goods and services embodying them, and the necessity of complementary investments to transform firms' business models (OECD, 2016d).

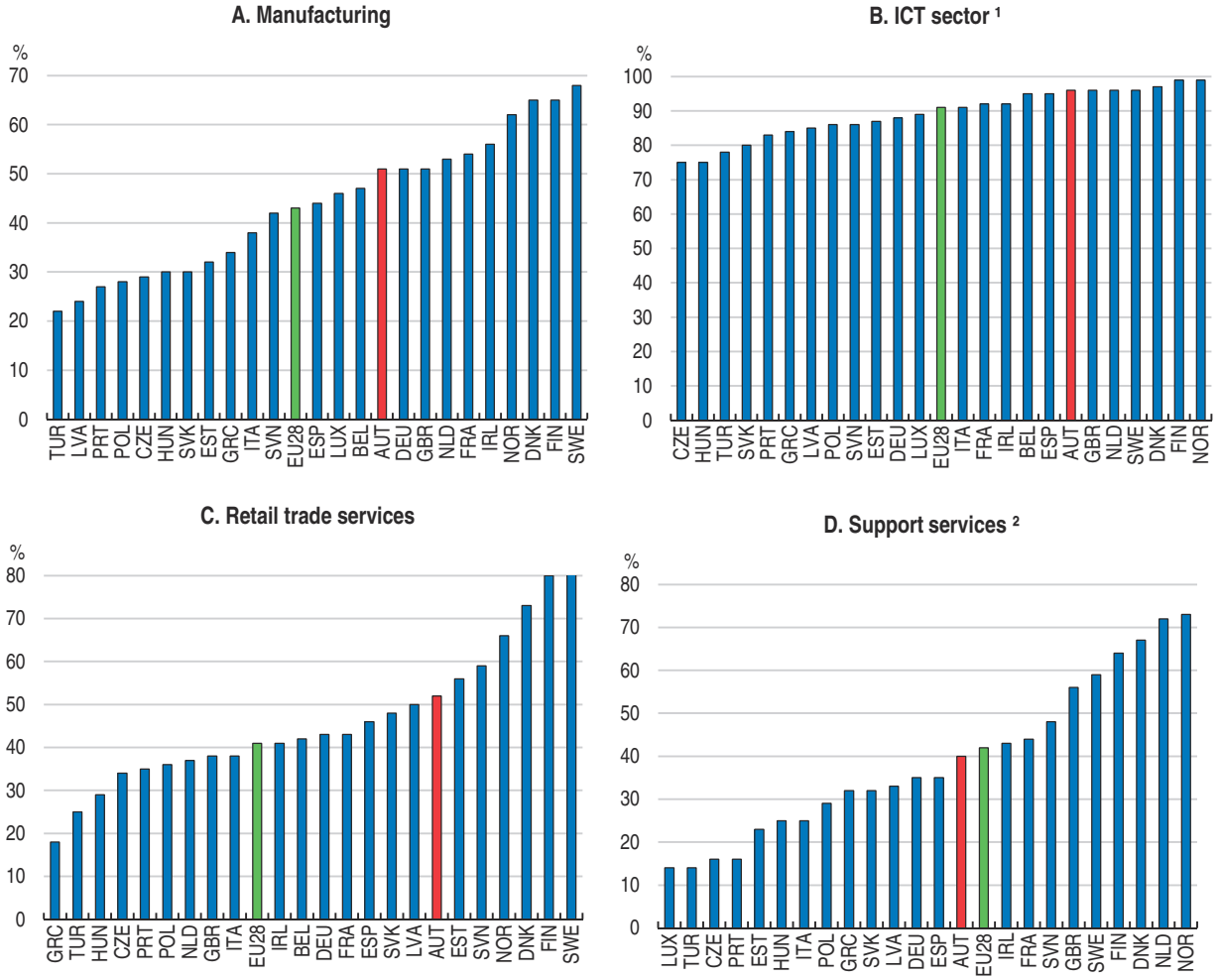
Microeconomic analyses of front-runner and laggard firms highlight some further developments. Tentative metrics on the distance between front-runners and laggards across different dimensions of digitalisation (such as spending in ICT hardware, software, telecommunications; share of digital payments; share of digital tasks and jobs) confirm that gaps between firms are large and are correlated with firms' financial strength and investment and skill acquisition capacity (McKinsey, 2016a). Divergences thus risk becoming self-perpetuating. In addition, three factors influence firms' capacity to converge with the frontier: i) their "operational context" (their market's technical proneness to digitalisation); ii) the degree of competition they are exposed to; and iii) their size. Different sectors populated by different types of firms therefore follow uneven digitalisation paths. "Knowledge-intensive" sectors are already highly digitalised (they encompass ICT producing sectors themselves, media and finance). "Capital intensive" sectors have further potential to digitalise their physical assets, including in oil and gas, chemicals and basic manufacturing. Services have a long tail of small firms with large additional room for digitalisation. These observations imply that Austria's leading manufacturing firms are likely to be close to the global digital frontier, while smaller size manufacturing businesses on the one hand, and service firms less fully exposed to global market conditions on the other, may face handicaps.

As Austria has a strong presence in medium-to-high technology sectors and is an innovative and competitive provider of intermediary inputs in global value chains (Stehrer

and Stöllinger, 2013), the capacity of manufacturing firms to fully draw on the digital revolution is of special interest to policymakers. An aggregate measurement of the propagation of digital technologies across sectors, approximated by the share of workers using a computer with internet access, suggests that Austrian manufacturing is in an intermediary position among OECD countries, but still behind peer countries. This gap is nonetheless smaller in manufacturing than in services (Figure 1.3).

Figure 1.3. **ICT usage across industries**

Share of persons employed using a computer with internet access, 2016 or latest available



1. Production of ICT goods and services.
2. Administrative and support services to businesses and households.

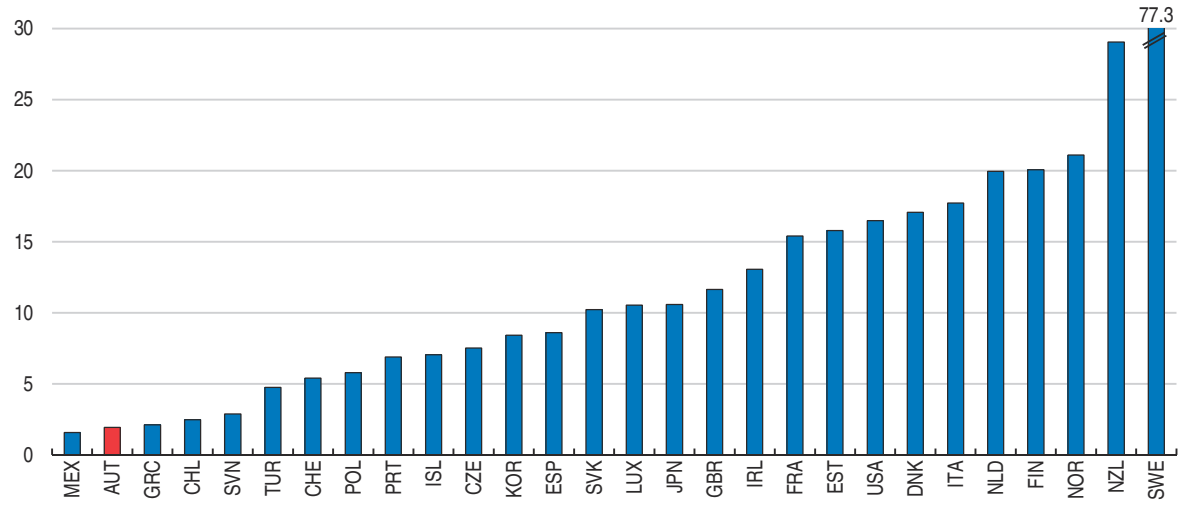
Source: Eurostat.

StatLink http://dx.doi.org/10.1787/888933536304

Digitalisation is more advanced in sectors that themselves produce digital goods and services, and Austria's gap vis-à-vis the OECD frontier is smaller in these activities. However, the diffusion of machine-to-machine communications which can be seen as a measure of progress toward Industry 4.0 points to a large gap for Austrian firms (Figure 1.4).

Figure 1.4. **Machine-to-machine mobile cellular subscriptions**

Subscriptions per 100 inhabitants, June 2016



Note: Machine-to-machine (M2M) connections link remotely located devices over a mobile network. A segment of M2M communication relies on mobile wireless networks and, as with mobile telephony, is based on the use of SIM cards for authentication and telephone numbers for connectivity. They are used in the management of production processes within factories, logistic applications such as the tracking of ships and trucks and the cargo containers that they carry, alarm installations etc. They provide the basic infrastructure of Industry 4.0. Switzerland: data for June 2016 are estimates.

Source: OECD, Broadband Portal, *www.oecd.org/sti/broadband/oecdbroadbandportal.htm*.

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Digitalisation trends in the business sector

While a number of Austrian firms are advanced users and producers of digital technologies (Federal Economic Chamber, 2016), the Austrian business sector as a whole exhibits gaps in the diffusion of standard ICT applications in four key areas: i) broadband connections, ii) digital marketing, iii) digital management, and iv) cloud computing.

The generalisation of ICT applications in the business sector is slower than in peer countries

Broadband access

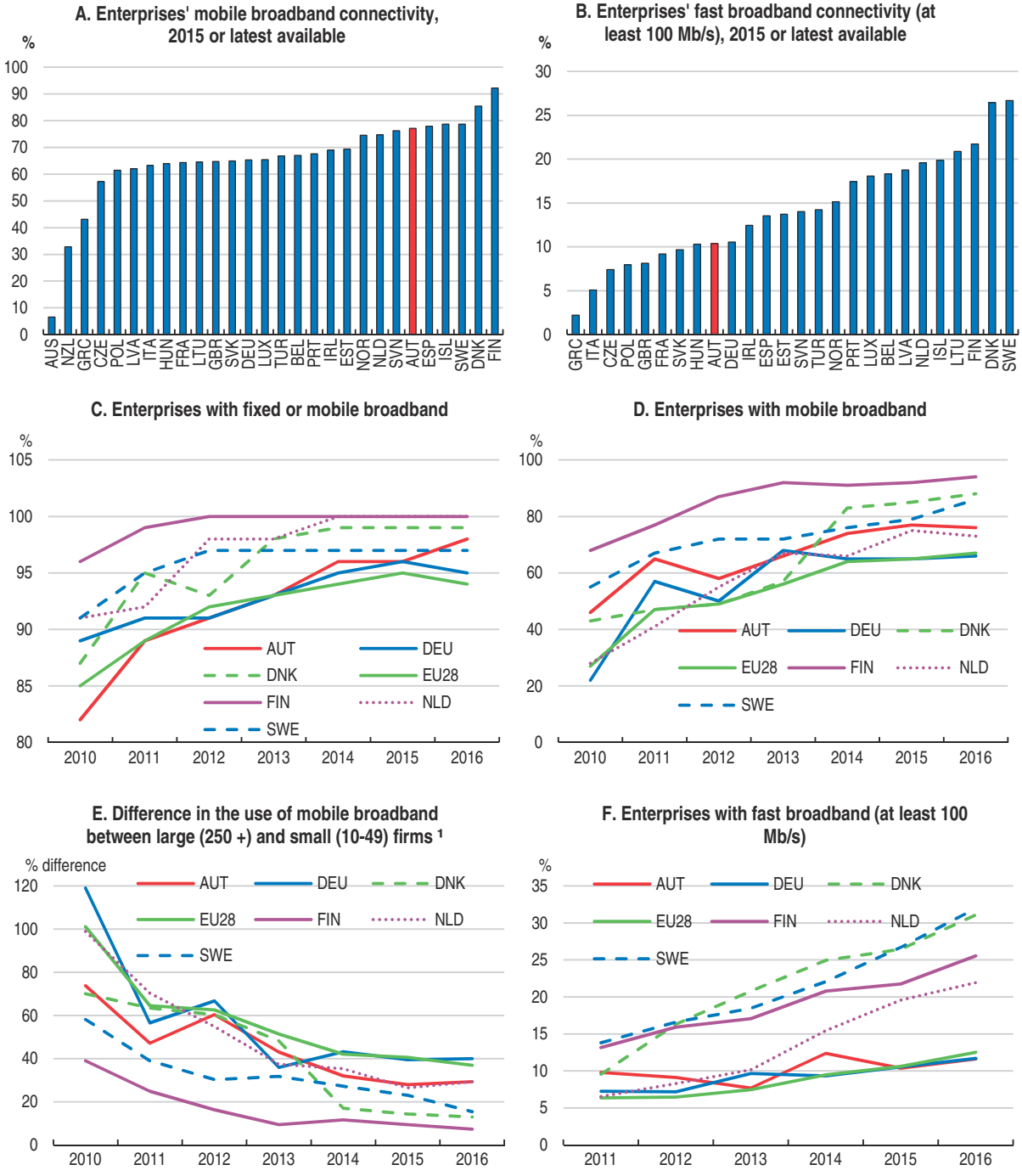
Broadband internet is the infrastructure of the digital society and economy (OECD, 2017a). Demand for faster broadband is increasing due to expanding volumes of Internet traffic, connection of large numbers of smart objects, and access to remotely stored data and software. Given the growing importance of connections on-the-go, mobile broadband has become a natural extension of this infrastructure.

The share of Austrian firms with broadband connections expanded from 82% of all firms with 10 employed persons and more in 2010 to 98% in 2016. Information on micro firms employing less than 10 workers (which represent a quarter of total business sector employment) is incomplete. However, overall, small, medium and large firms have practically caught up with the global frontier of full connectivity (Figure 1.5, Panel A).

However, connectivity to mobile broadband clearly lags behind peer countries. While more than 90% of firms in the most advanced peer countries are presently connected, only 75% are in Austria. Austria is nonetheless doing better than Germany and The Netherlands (Figure 1.5, Panel B). Large and medium-sized firms are well equipped, and firms producing digital goods and services are even better connected than in other countries. However,

Figure 1.5. **Broadband connectivity**

Non-financial firms, %



1. Differences in the utilisation ratios by large (250 +) and small (10-49) firms are expressed as a percentage of the average utilisation ratio of large and small firms in each country.

Source: OECD ICT database and Eurostat.

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barely half of manufacturing firms are connected, against 90% in the most advanced peers. The gap between large and small enterprises is larger than in peer countries, hinting at the possibility of even larger gaps in micro firms (Figure 1.5, Panel E).

Austria lags in the area of fast broadband, which is the infrastructure of the latest generation of ICT applications. Only 10% of Austrian firms subscribed to fast broadband in 2016, against 30% in frontier countries. In addition, while the rate of access to this type of network increased steeply in peer countries in the past five years, it stalled in Austria (Figure 1.5, Panel F). This is occurring despite internationally low service prices in Austria, and seems to reflect a gap in the intensity of external digital communications in businesses of all sizes. Austria displays a particularly large gap vis-à-vis the OECD frontier in the adoption of fibre technologies in its telecommunications network. This may be a handicap in the implementation of the latest vintages of "data hungry" applications (see Figure 1.23 below).

Digital marketing and selling

OECD firms are massively using the web to engage in e-commerce (OECD, 2017a). The majority of enterprises now possess a website or a homepage, and more and more of them support it via social media. Many firms start to take orders online and these represent a growing share of their total sales. The transition proceeds at an uneven pace, however, in different countries. Even in the most digitalised ones, only 20-25% of firms currently realise more than 1% of their sales via internet. In certain areas such as tourism and retail trade e-commerce has taken root more rapidly. Enterprise size also matters: half of large OECD firms achieve more than 1% of their sales via internet, as against some 20% of small firms (OECD, 2017a).

Austrian enterprises have developed e-trade more slowly than in peer countries (Figure 1.6). In 2016, only 15% of Austrian firms realised more than 1% of their turnover online, against 25% in Denmark and Sweden. The lag is larger in smaller size firms (Panel C) and affects all sectors (Panel D). For example, in tourism and accommodation, where Austrian firms are internationally present and competitive, only 30% make more than 1% of their sales on line, against 70% of their counterparts in peer countries.

A large gap is also apparent in retail trade. Only 15% of Austrian retail firms attained the threshold of 1% of e-sales, compared to 30% in peer countries. Austrian retailers' well-established brick-and-mortar networks and the high degree of loyalty that they have built with their local customers (see below) may partly explain this difference.

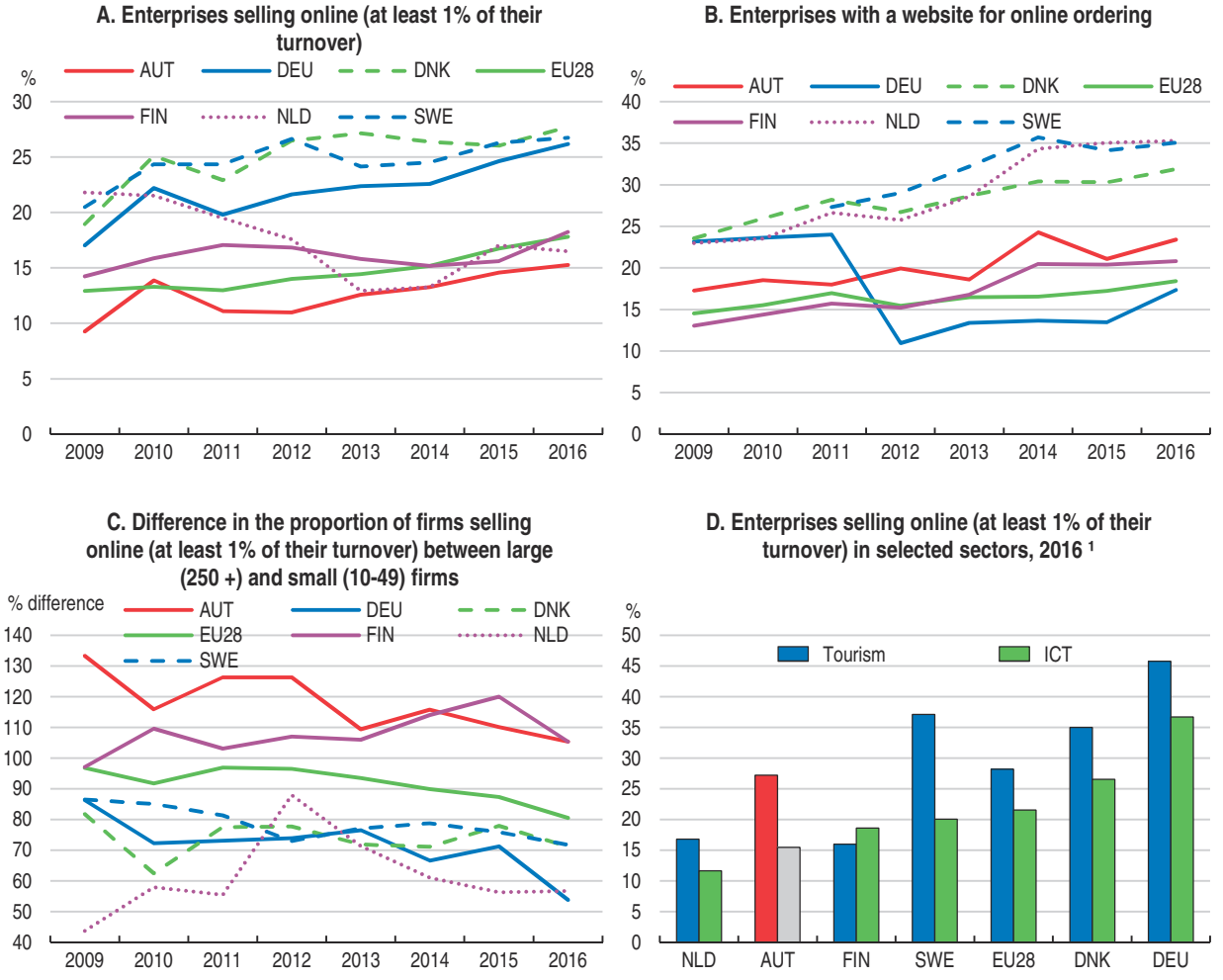
Digital management

OECD firms are integrating ICT tools into an ever-widening set of business functions. These help modernise enterprise management in all dimensions. Innovations are not easy to capture in simple metrics, but the pace of diffusion of new management tools provides proxies. The adoption of two key techniques, enterprise resource planning (ERP), and customer relations management (CRM), provides relevant indicators.

ERP applications encompass product planning, purchasing, manufacturing, marketing, shipping and finance, with a unified software collecting, storing, managing and interpreting data from these different business activities. In the most advanced economies practically all large firms, nearly 80% of medium-size firms and almost 50% of small firms operate ERP systems. The Austrian business sector appears behind (Figure 1.7, Panel A). While large firms are almost as fully equipped as international counterparts, and firms producing digital goods and services are even better equipped than in frontier countries, only around 30% of small firms implement ERP, against 50% in peer countries. There is also

Figure 1.6. **Digital marketing**

Non-financial firms, %



1. 2015 for Austria ICT sector and 2014 Finland tourism sector.

Source: Eurostat.

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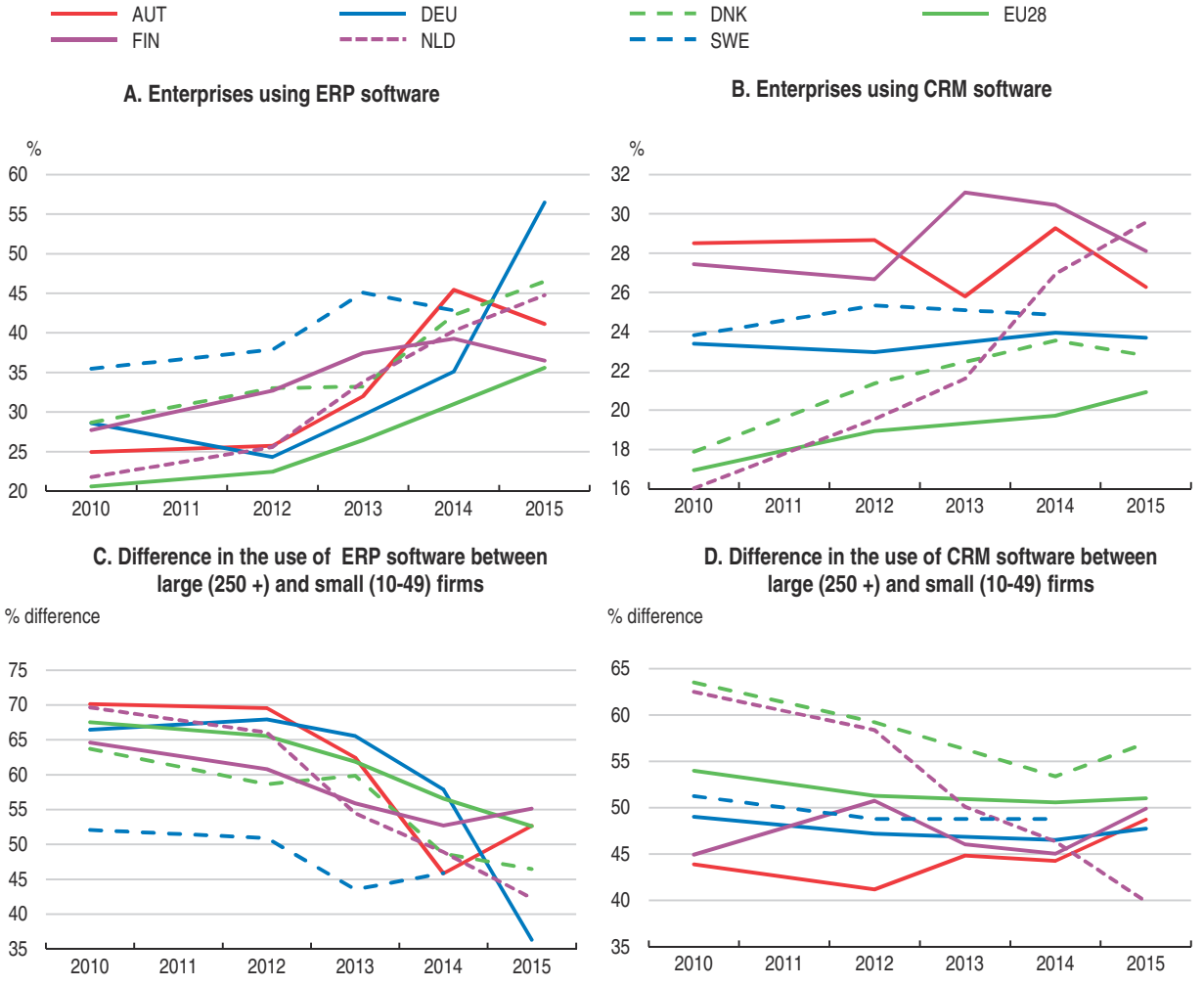
a special gap in manufacturing: 40% of all Austrian manufacturing firms are equipped, compared to 50-60% in peer countries. Less than 25% of Austrian tourism firms have ERP systems, against 50% in peer countries. The low rate of equipment with ERP applications could reflect their outsourcing to external providers, but the low rate of recourse to cloud computing reduces this likelihood.

CRM applications support firms' interactions with current and future customers. They draw on online data from various sources (sales, website visits, social media etc.) and process this information to generate targeted marketing plans. They also help automate interactions with customers, typically via e-mail. Certain CRM systems can trigger geographic marketing initiatives based on customers' physical localisation via GPS applications. Austria is among the international leaders in this area. Nearly 45% of Austrian firms use CRM software, at par with frontier countries, compared to a European average of 33%. The adoption rate ranges from 70% in large firms to 40% in small businesses. The gap between large and small firms is one of the smallest in international comparison. In two areas where Austria is behind in

Figure 1.7. **Digital management**

Non-financial firms, %



Source: Eurostat.

StatLink http://dx.doi.org/10.1787/888933536380

other digital innovations, i.e. retail trade and tourism, it emerges as an international leader in CRM. This superior performance might stem at least in part from the active role of some successful Austrian service firms in this sector (Specific-Group Austria, 2017; Maihiro Group Austria, 2015; Torggler, 2008).

Cloud computing

Cloud computing deserves special attention (OECD, 2015a). It transforms computing into a service model that offers access in a flexible, scalable and on-demand way. Firms may turn the corresponding capital expenditures into operating expenses and can therefore more rapidly shift to advanced applications. Cloud computing represents a new plateau in digital transformations (OECD, 2011; EC, 2014).

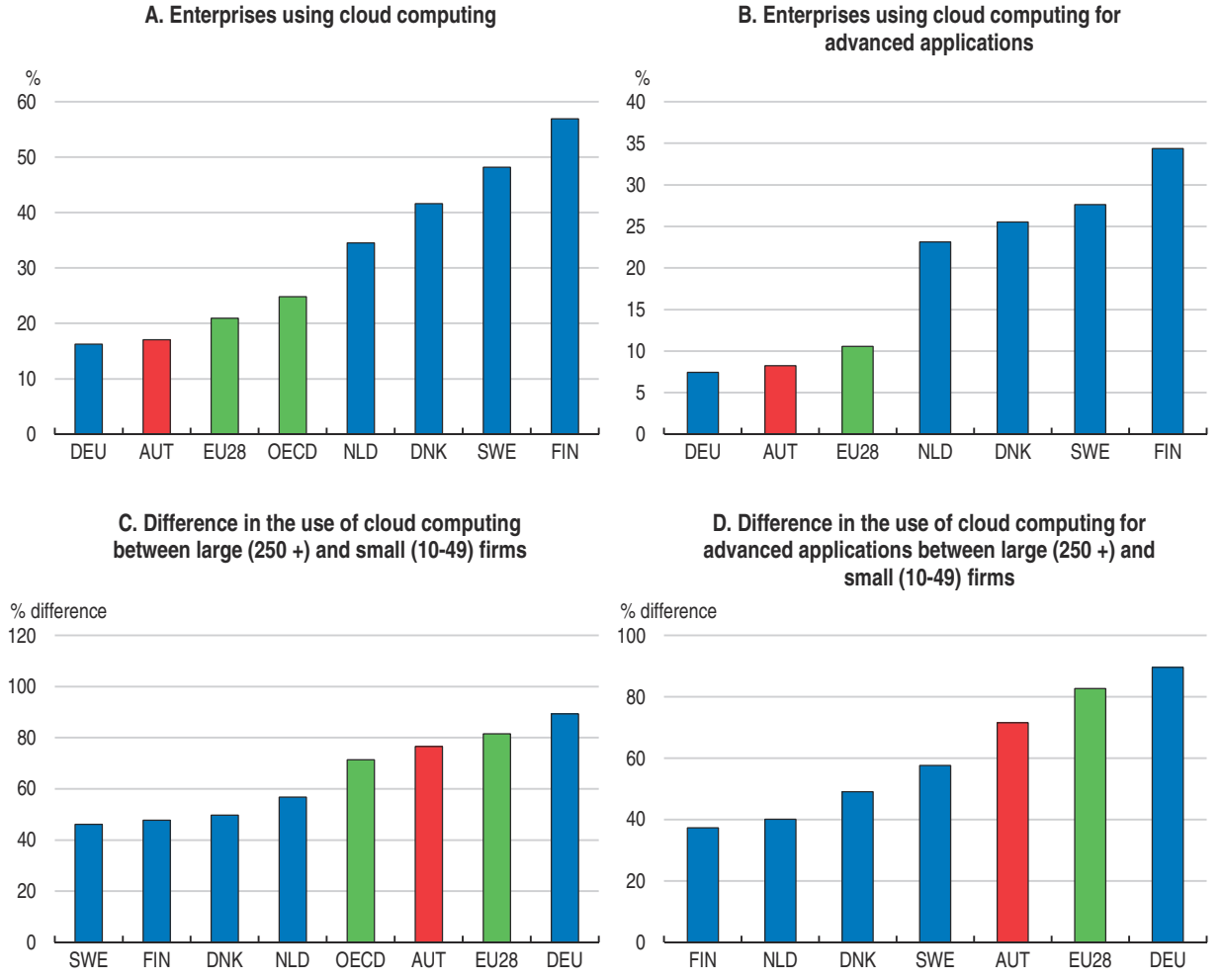
The diffusion of cloud computing has accelerated in all OECD countries in recent years (OECD, 2017a). About 25% of all OECD firms currently use cloud computing, with large differences between countries. Utilisation rates range from above 50% in the most advanced

countries to below 10% in others. Around 40% of all large OECD firms and 20% of all small firms are users.

In Austria, cloud computing is clearly less advanced than in peer countries (Figure 1.8). Only 35% of large firms resorted to cloud computing in 2016 and only around 15% of small firms (Figure 1.8, Panel C). Certain sectors are more engaged than others: firms producing digital goods and services have adoption rates of about 30%. Still, even in these sectors, there are large gaps vis-à-vis international frontrunners.

Figure 1.8. **Cloud computing**

Non-financial firms, %, 2016



Source: Eurostat.

StatLink http://dx.doi.org/10.1787/888933536399

Gaps are also large in more sophisticated cloud applications (Panels B and D). These encompass distant operation of large accounting, management and marketing software packages. Only 5% of Austrian firms use such applications, much less than in peer countries (25%). Gaps are visible in all sectors. In the production of digital products and services, 15% of Austrian firms resort to such applications, against 50% of their counterparts in peer countries. Adoption rates are lower in other activities, gravitating around 5% in other manufacturing and service businesses. Concerns about commercial and personal privacy and related data

breaches are high in Austria, as in Germany, and this may contribute to the low utilisation of cloud services. Policymakers should aim at enhancing trust in online applications.

Three factors foster diffusion in the business sector

The staggered path of digitalisation in Austrian businesses appears to reflect three factors: i) Austrian firms may face shortages in the necessary skills; ii) some of their owners and managers may not be convinced by the benefits of digitalisation and may be less keen to renew their business models; and iii) the channels of know-how dissemination are not uniformly strong.

Access to digital skills

There are apparent gaps in Austria's digital skill base, which may slow down the diffusion of digital innovations. Given the cross-functional character of digital applications, a large spectrum of qualifications and occupations are involved. The OECD has identified two main families of technical skills which are not evenly available across countries: ICT-generic and ICT-specialist skills. The so-called "ICT-complementary" skills play a major role too and will be discussed in a subsequent section.

ICT-generic skills. The OECD Survey of Adult Skills (PIAAC) defines digital problem-solving skills as the capacity to solve problems in a digital environment, i.e. using a computer (OECD, 2016h). These skills include writing an e-mail and browsing the web (level 1), implementing more advanced tasks involving multiple steps (level 2), and the capacity to use both generic and specific software applications with inferential reasoning (level 3). Digital problem solving tests help grade each country's working age population capacities in this area.

In Austria, 33% of the population aged 16-65 have digital problem solving capacities corresponding to levels 2 and 3 (Figure 1.9). This is slightly above the OECD average (31%), but below peer countries (40%). About 37% of Austrian men and 28% of Austrian women possess it, as against up to 46% and 42% respectively in peer countries. This may hamper the diffusion of ICT innovations in the business sector.

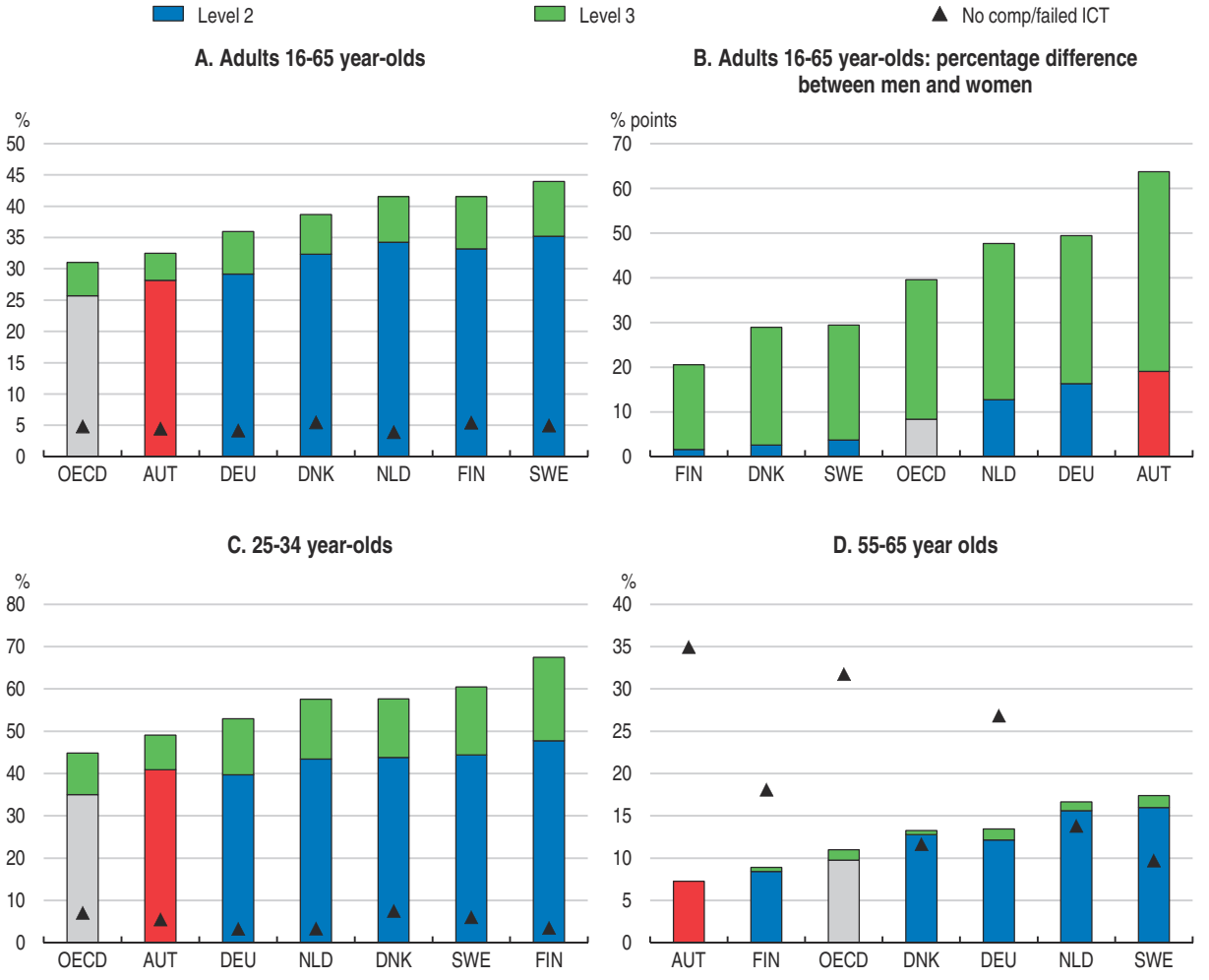
Younger Austrians are more familiar with new technologies. About 50% of those aged 25-34 acquired basic levels 2 and 3 familiarity. This is above the OECD average (45%), but still below peers (60%). For these cohorts gaps are more severe at the higher proficiency level 3: only about 8% of Austrians aged 25-34 have attained this higher degree of acquaintance, against 15-20% of their cohort in peer countries.

Older age cohorts also feature skill gaps but with a different profile. Only 8% of Austrians aged 55-64 have the generic skills of levels 2 and 3, below the 15-20% attained in peer countries. Another gap appears more substantial: those without any computer experience and who failed to take the computer-based test represent as much as 35% of this age cohort, much above the 10% in peer countries. The age-based divide in basic digital skills is clearly deeper in Austria.

Eurostat's 2015 Digital Skills Survey shed additional light on Austria's human capital in this area. The survey was based on self-assessment, with each person identified as having "no", "low", "basic" or "above-basic" skills. Only around 40% of working age Austrians had "above-basic" skills enabling them to be more active in ICT environments, well below peer countries (Figure 1.10). About 40% of prime-age Austrian men and 30% of prime-age Austrian women had this level of proficiency, versus around 60% and 50% in peer countries.

Figure 1.9. **The adult population's digital problem solving proficiency is lower than in peer countries**

Percentage of adults scoring at level 2 or 3 in digital problem solving or having no computer experience, 2015



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

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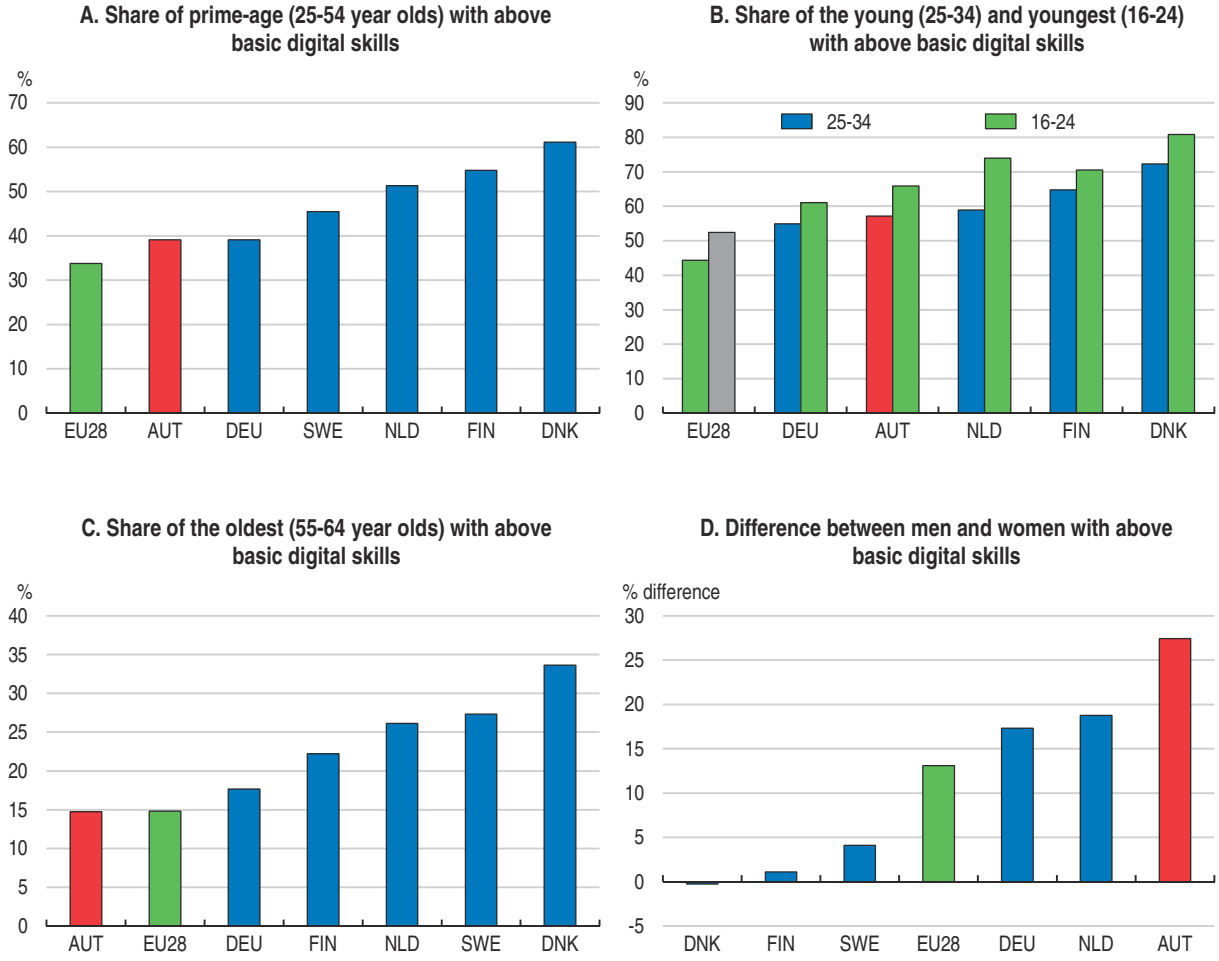
A higher proportion of youth have such above-basic skills. Nearly 60% of young Austrians attained this level, slightly less than their counterparts in the most advanced peer countries (Panel B). The gap for Austrians aged 16-24 is also small. But older cohort gaps continue to weigh down Austria's average. Only about 25% of senior Austrian workers aged 45-54 have above-basic operational skills, against nearly 50% in the most advanced peer countries.

The survey also provides information on the socio-economic determinants of digital skills. The educational background of individuals appears as the driving factor in Austria, more than in peer countries. Austrians with less than upper secondary education display exceptionally low levels of acquaintance with digital technologies. Gender gaps in low-educated groups are also much larger than in peer countries. In contrast, rural versus urban location and income level make a smaller difference in the acquisition of these skills. This observation may be reflecting the fact that societal divides along these lines are less pronounced in Austria (OECD, 2013a).

Figure 1.10. **Too few Austrians have advanced digital skills**

Individuals, in 2016, %



Note: Advanced digital skills are the skills identified as "above basic" in the Methodological Manual for Statistics of the Information Society (Eurostat, 2016). They comprise the ability to create documents which integrate text, pictures, tables and charts; to use advanced spreadsheet functions to organise and analyse data; to write code in a programming language; to transfer files between computers or other devices; to change the settings of operational systems and security programmes; and to upload self-created content to websites.
Source: Eurostat.

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ICT-specialist skills. Austria may also be facing a shortfall in ICT-specialist skills. These encompass the engineering qualifications required for the design and operation of digital systems. Specialists design applications, manage networks and analyse big data (OECD, 2015c). Their training goes beyond programming and must include advanced engineering and domain-specific knowledge.

Labour market indicators for ICT specialists should be interpreted carefully. A country or region may experience a shortfall in these skills not because its supply of specialists is limited, but because its industrial structure or its pace of digitalisation is more dynamic than elsewhere. The reverse may occur in less dynamic countries and regions. Three sources of information are available to document the availability of these skills in Austria: i) the share of ICT specialists in the labour force; ii) the recruitment difficulties faced by enterprises trying to hire specialists; and iii) wage developments for ICT professionals.

Specialists trained in ICTs represented 4% of all employed individuals in Austria in 2015, against an EU average of 3.6% and over 6% in certain peer countries (Figure 1.11). Even if definitional differences may affect international comparisons, this hints at a risk of shortage for such specialists in Austria.

This is confirmed by data on recruitment difficulties (Panel B). According to a Eurostat survey in 2016, 60% of the Austrian firms which tried to recruit ICT specialists met difficulties, against 40% in the European Union and nearly 50% in peer countries. Only a minority of firms try to hire ICT specialists however, and the most dynamic Austrian firms and sectors face the highest tensions (Panels C and D). Hiring bottlenecks rose above 70% in firms producing digital goods and services, against 60% in manufacturing and 40% in retail trade.

The link between productivity and wage growth in ICT sectors also points to tensions (Panel E). Wage growth in Austria's ICT sectors well exceeded productivity growth over the past decade, while it was in line with or even stayed below productivity gains in peer countries. Wage developments have different drivers across countries but the scarcity of specialists probably plays a role in Austria.

Meanwhile, the frontier between ICT-generic and ICT-specialist skills is getting blurred. A recent cross-country review of about 1000 occupations and 20 job families concluded that skill profiles are changing in 40% of existing occupations as a result of digitalisation (WEF, 2016). According to this study, part of the needed adaptations may be achieved by re-training existing employees, but the remainder requires in-depth changes in basic cognitive and professional capabilities. The evidence in this chapter suggests that firms in Austria may be facing this challenge more than in peer countries.

Modernisation of business models and complementary skills

The supply of digital skills does not guarantee their effective use. A vast research literature documents the complementarity between the effective use of ICT innovations and the re-design of firms' business models (Brynjolfsson and McAffee, 2014). ICT applications often involve much larger flows of information, which require firms to re-organise their management and work processes. This calls for "ICT-complementary" skills at all levels in firm hierarchies. A recent OECD review confirmed that effective ICT use depends directly on complementary investments in knowledge-based capital (KBC), and that failing to invest in such complementary skills limits the productivity impact of ICTs (OECD, 2016c). Firms at the global productivity frontier demonstrate a high capacity to combine technological, organisational, and human capital throughout global value chains (GVCs), harnessing the power of digitalisation at a high scale.

New business models come into being gradually: a 2015 survey has over 40% of global business executives reporting that digital technologies are helping them enhance their existing goods and services, and less than 30% that they were instrumental in launching new goods and services (OECD, 2016c). Work organisations become more decentralised, and teamwork more pervasive (Biagi, 2013). Labour relations at shop-floor level evolve accordingly. Field research suggests that workers' commitment also plays an important role in the absorption of ICT innovations (Schröder, 2016; Ortman and Guhlke, 2014). Organisational changes are more effective when the qualifications and interests of those involved at all levels are integrated in decision making.

Figure 1.11. **Austria's position in ICT-specialist skills**

1. In percentage of firms which recruited or tried to recruit ICT specialists.

Source: Eurostat and OECD STAN database.

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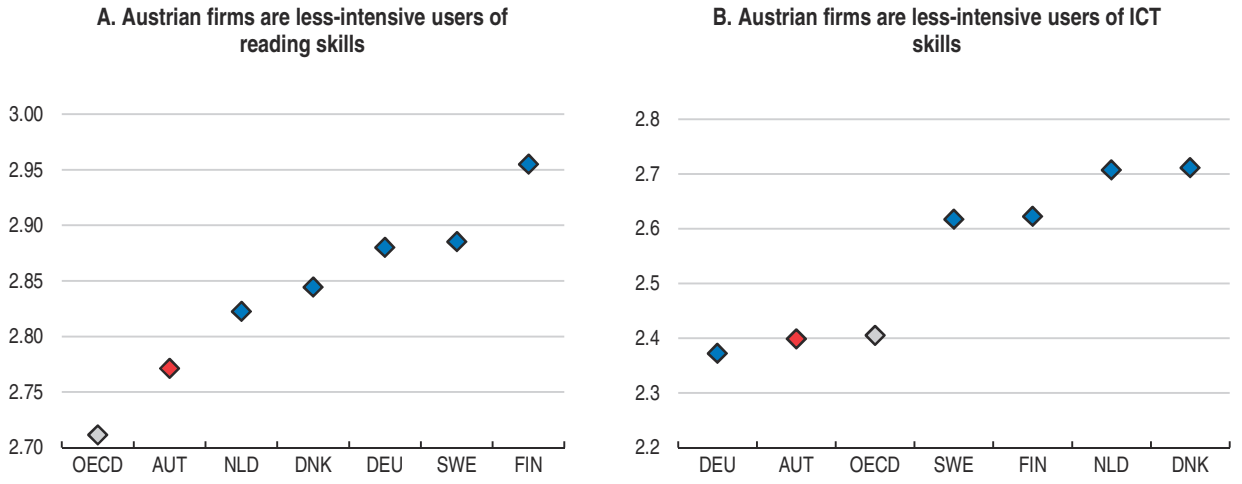
A leading edge of firms notwithstanding, Austria's business sector as a whole appears slower to undertake this organisational renewal:

- In the 2013 OECD PIAAC Survey Austrian firms reported using their workers' information-processing skills less than in peer countries (Figure 1.12, Panels A and B);
- A lower share of small firms than in peer countries have put in place internal teams developing ICT applications (Figure 1.13, Panels A and B).
- A lower share of large firms rely on specialised external services for core ICT functions (Panels C and D).
- General tasks such as holding discussions in real time, executing online transactions and e-mailing are less intensely practiced in Austria than in peer countries. This reflects an occupational structure which is tilted towards sectors that rely less on these tasks, but also the fact that, for the same jobs, these tasks and therefore ICT is less solicited in Austria (see Chapter 2).

Figure 1.12. **Austrian firms' work processes are less information-intensive**

Average skills use from 1 (never) to 5 (every day), working population aged 16 to 65



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

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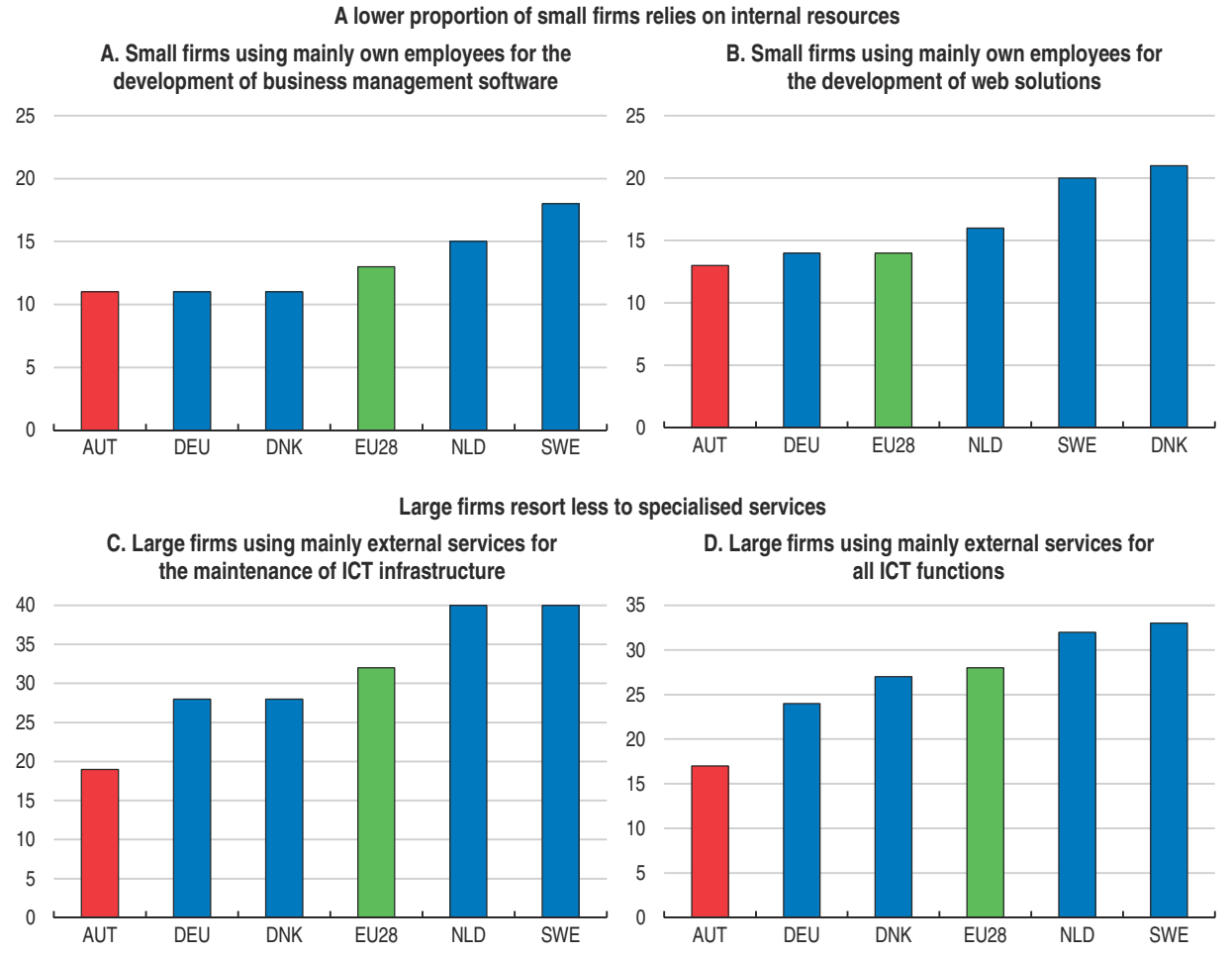
The overhaul of business organisations around ICTs is at an early stage in all OECD countries. Most firms lack a clear view of available options and a strategy in this area (Bughin, 2016). Only a minority of them have successful new business models in place and data is scarce about these (OECD, 2016c). A recent review across OECD countries (Van Ark, 2016) detected several technical and organisational barriers to the overhaul of organisational models. As new business models are moving targets, Austria's position in this area is difficult to evaluate. It nevertheless calls for the attention of policymakers.

A relevant factor is the size-distribution of firms. All studies find that firm size influences the effective use of digital innovations (OECD, 2016b). The latest OECD PIAAC survey confirmed that the intensity of skills use is positively correlated with firm size in all OECD countries, and this is also the case in Austria (Figure 1.14). This prevails even when ICTs help micro and small firms to outsource their internal services, to specialise in activities where they have a genuine competitive advantage, and to reach to broader markets (Bhatt, 2016). The rise of such a "granular" economy permitting small entities to compete more

Figure 1.13. **The organisation of ICT functions in firms differs from peer countries**

Non-financial firms, %, 2016



Source: Eurostat.

StatLink http://dx.doi.org/10.1787/888933536475

effectively will apparently be gradual, and small size remains a handicap. A 2014 survey of 1 000 SMEs in Germany found for example that 70% felt that digitalisation was irrelevant for them. Availability of relevant know-how and supportive finance are reported as obstacles. Another study by the German Ministry of Economy concluded that ongoing research projects on "Industrie 4.0" are not presenting their results in a format and language appropriate for SMEs, calling for additional efforts for adaptation.

The share of SMEs (defined as firms employing to up to 250 workers) is slightly above peer countries in Austria (OECD, 2016j). They represent nearly 70% of total business sector employment, against around 60-65% in comparable countries. Respective weights of size sub-groups are also comparable, including the weight of micro firms (those employing less than 10 workers, which represent around a quarter of total employment in both Austria and peers). More than the specific size composition of the business sector, other factors appear to slow down the modernisation of business models in Austria. Private and public sector initiatives are called for to facilitate knowledge and resource sharing between smaller size firms.

Some 95% of OECD countries have put in place special programmes to support the adoption of ICTs by SMEs (OECD, 2017c). These offer either financial support to ICT investments, via tax incentives, cash subsidies or loans; or non-financial services, e.g. training, consulting and mentoring. In France the programme "Investissements d'Avenir" offers loans to SMEs for the acquisition of robots. In Japan, the Ministry of Economy, Trade and Industry gives tax incentives to promote the productivity-enhancing investments in SMEs, including special incentives for ICT investments. Austria also introduced several programmes to support SMEs in their digital transitions (Box 1.2).

Other countries rely chiefly on non-financial support, notably in the form of business information, trade shows and feasibility studies. In Germany, the public programme "Trusted Cloud" eases the application of cloud technologies by SMEs by offering them a basic introduction to cloud computing. Denmark encourages partnership among SMEs in specific sectors, e.g. retail and wholesale trade and transportation, to promote the use of digital technologies, e.g. ERP, e-sales and marketing.

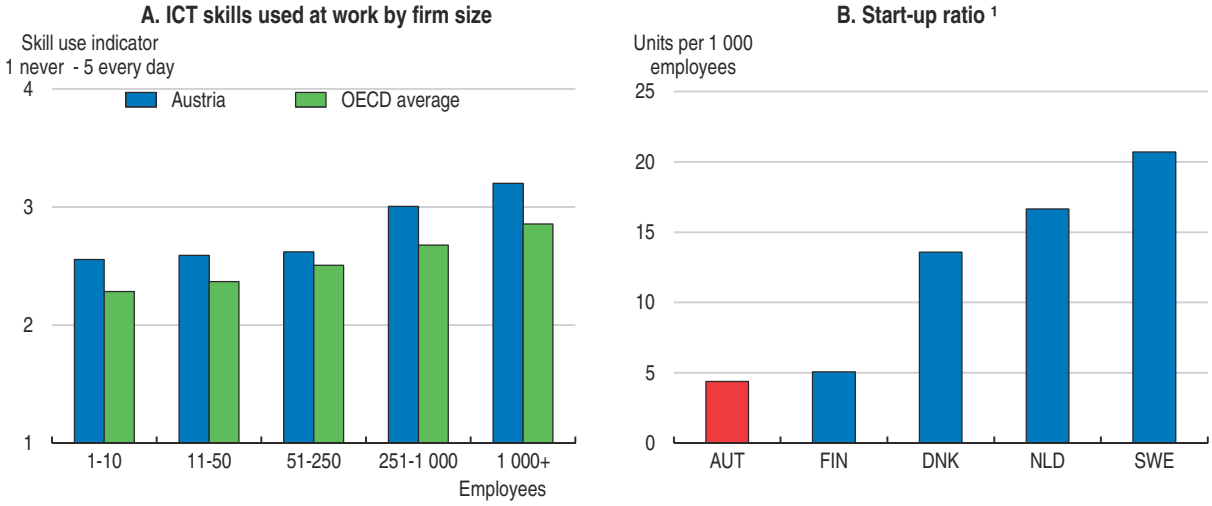
The entry of new firms is also a crucial driver of the renewal of business models and digital transitions in all countries, but Austria has a relatively low level of start-up activity (Calvino et al., 2016; Figure 1.14, Panel B). Exit policies are also likely to play a role, as high exit costs may influence the decision to enter and experiment with radical innovations (Adalet and Andrews, 2016). The special role of new entrants was confirmed by a recent large review of business practices in 33 countries (Future of Business Survey, 2016). It suggests that start-ups make more active use of ICT applications than incumbent firms, and reap additional performance benefits. Interestingly, enterprises created by women are younger and smaller on average, but are also more effective users of digital tools. These findings confirm the relevance of Austria's strategic target of becoming a "Number One Start-Up Country". The regulatory framework will need to be adjusted in several dimensions, and financial markets will need to be diversified further to move in this direction.

Access to financing is a particularly important issue for start-ups. Debt finance dominates external financing for firms, and especially small and medium-sized enterprises in Austria, but is ill-suited for new, small and innovative companies which have a higher risk-return profile and often rely on firm-specific intangibles that are not suitable as collateral. Equity sources and hybrid instruments which combine debt and equity features are relevant in these cases. They have grown in several OECD countries and help young firms reduce their borrowing needs and costs (OECD, 2010). R&D grants, subsidies and tax incentives also mitigate the financing constraints of start-ups. In addition to rather generous R&D and innovation support, Austrian policymakers try to diversify the sources of finance for small young firms beyond traditional bank loans with a "Start-Up Package" topping up (doubling) the investments of eligible business angels in technology start-ups (Invest in Austria, 2017).

Know-how dissemination channels

The propagation of new technologies is supported in all countries by a network of know-how dissemination channels. These are more or less resourced, and active, in diffusing ICT knowledge across sectors, regions and types of ICT applications (OECD, 2017e). The two most common dissemination instruments are technology transfer platforms and local technological clusters.

Figure 1.14. **Firm demographics may be affecting the modernisation of business models**



1. Start-up ratio is the number of entering units (entrants) over total employment (in thousands).

Source: OECD (2016), Skills Matter: Further Results from the Survey of Adult Skills, Table A4.11; Calvino, and al. (2015), "Cross-country evidence on start-up dynamics", *OECD Science, Technology and Industry Working Papers*, 2015/06, *http://dx.doi.org/10.1787/5jrxtkb9mxtb-en*.

StatLink http://dx.doi.org/10.1787/888933536494

Technology transfer platforms. Austria has a time-tested network of technology transfer platforms (Austrian Research and Technology Report, 2016). At the end of 2014, a national "Platform Industry 4.0" was also launched at the suggestion of the business sector, and on initiative of the Austrian Ministry for Transport, Innovation and Technology (BMVIT). The objective is to develop and diffuse good ICT practices, and strengthen Austria's position as a global Industry 4.0 site. BMVIT invested EUR 1 billion in new projects on "production of the future" and "ICT of the future". It funds the development of four 4.0 pilot factories in different regions. The first of these factories opened at the Vienna University of Technology to help companies observe various Industry 4.0 techniques (Aichholzer et al., 2015). Box 1.2 provides more details on the broad strategy and some specific programmes supporting the diffusion of digitalisation knowledge.

Box 1.2. **The Open Innovation Strategy and digitalisation-oriented programmes**

An "Open Innovation Strategy for Austria" was launched in 2016 by the Ministry of Transport, Innovation and Technology and the Ministry of Science, Research and Economy "to expand and develop the innovation system and to improve the digital literacy of innovation actors through new forms of co-operation". Austria is one of the first countries in the world to have introduced this type of strategy (EC, 2017b). Several schemes are being introduced, to involve other ministries in their respective areas as well as provincial and municipal actors.

In the area of Industry 4.0, a "Pilot Fabrics" project supports the experimentation of new techniques and production processes in a realistic environment. It helps SMEs to test new technologies without interrupting current production activities. Partners from larger firms and research laboratories participate in these pilot fabrics.

Box 1.2. **The Open Innovation Strategy and digitalisation-oriented programmes** *(cont.)*

A "Silicon Austria" programme with an annual budget of EUR 110 million supports research and innovation in the fields of electronics, microelectronics and nanoelectronics "as these form the technological basis of megatrends such as autonomous driving, intelligent infrastructures and Industry 4.0". Half of its resources will be used for the creation of a new research centre.

A "Talents Programme" offers traineeships for pupils and provides financial support for regional education projects in schools in the fields of mathematics and informatics. The objective is to engage children and adolescents in science and technology. It has a special "Internships for Female Students" component to help female students discover scientific and engineering positions in industry.

A special programme will co-fund development projects for products operable and usable by older generations with limited ICT-skills. In the spirit of the Open Innovation Strategy, senior citizens will be involved in the research phase of the projects. The programme has an initial annual budget of EUR 2.5 million.

*

The Ministry of Science, Research and Economy introduced a "SME.digital" programme to enhance awareness on digitalisation opportunities. It is publicising information about digital innovations relevant for SMEs, including best practices from other countries (Part I of the programme). It will equally support directly skill acquisitions in SMEs (Part II) and will put in place a network of competence centers ("digital innovation hubs", Part III). The programme will be implemented through 2017 and 2018 and its efficiency and impact will be evaluated at the end of the first year. The initial budget for 2017-18 is EUR 10 million.

The Ministry of Science, Research and Economy has also introduced a "Smart and Digital Services (SDS)" programme to co-fund digitalisation projects with a potential to increase value added and exports in services. It notably aims at raising service companies' awareness about the large potential benefits of R&D investments and aims at involving "non-technological" researchers in these projects. It has a budget of EUR 8.0 million for 2017-18.

Länder governments are also taking initiatives. Upper Austria and Styria are pioneers in Industry 4.0 projects. Upper Austria aims at becoming a model region for Smart Production and launched its own "Platform Industry 4.0" initiative. The region offers favourable conditions due to the legacy of engineering disciplines and plans to co-operate with Styria to pool ICT competences in leading companies and research institutions.

However, most of these dissemination efforts concern manufacturing in Austria. This is a historical legacy, stemming from the traditional focus on the productivity and competitiveness of tradable manufacturing. Today, both the large scope of ICTs in services, and the role of services in overall economic performance justify the extension of such efforts to service sectors. There is awareness of this need, to wit Styria's recent goal to support "Smart Production in Services" (Austrian Research and Technology Report, 2016).

Technological clusters. Several OECD countries are encouraging the development of local ICT clusters (OECD, 2016c and Chapter 2). These operate as networking platforms cultivating science-to-science links (between public and private research centres and universities), science-to-industry interactions (with business firms), and industry-industry partnerships

(between business firms). They also engage in cluster-to-cluster co-operation at interregional and international levels.

Austria has several dynamic ICT clusters. Certain initiatives launched in Upper Austria have been particularly effective and accelerated the diffusion of ICT technologies in several user sectors (European Service Innovation Centre, 2014). Among these initiatives, the Hagenberg Software Park illustrates the potential of the approach (Box 1.3). Similar initiatives should be encouraged in all regions.

Box 1.3. **Hagenberg Software Park**

Softwarepark Hagenberg is a network of companies and educational and research institutions in the area of software development. Founded in 1989 as a spin-off of Johannes Kepler University Linz under the name RISC (Research Institute for Symbolic Computation), in the historical village of Hagenberg im Mühlkreis and in an old industrial region, it was buttressed by the establishment of a University of Applied Sciences in 1993. Back then, the first course in software engineering started with 30 post-secondary students.

Subsequently, an IT cluster was created as an initiative of Business Upper Austria, the business agency of the province of Upper Austria, and the Hagenberg Software Park became part of it. The cluster comprises 160 members, including academic and research institutions (University of Linz and the University of Applied Sciences) and some 140 IT enterprises. It includes a network of seven regional industry clusters, which aim to bring businesses and research institutions together on specific topics (mechatronics, automotive applications, medical technologies, etc.). It supports new start-ups from the concept development to the marketing stage. It also reaches out to 1 900 other companies involved and is Austria's largest IT co-operation network. In 2016, the *Länder* government presented its *20-Point-Plan for the Digital Future of Upper Austria,* which foresees additional investments in the cluster.

Software Park Hagenberg provides a common physical space for ICT innovators, principally in software applications. It includes some 75 enterprises, 11 research institutions and 23 education programmes. With state-of-the-art infrastructure and a diversified network of experienced industry experts, it supports young engineers and students to put their ideas into practice. It is a place of communication and meeting, where around 2 800 people work, research, teach, learn and live. Many successful start-ups were born and grew on its premises. There are plans to expand networking with international technology centres, and developing international student courses and programmes.

Digitalisation trends in households

ICT applications in households offer access to broader and better supplies of goods and services, wider sources of information, and time savings in several household tasks (shopping, banking, paying bills, etc.). The greater the number of households adopting ICT applications, the greater the network economies in the production and utilisation of ICT goods and services.

The generalisation of digital innovations in households is slower than in peer countries

The diffusion of ICT innovations in Austrian households follows a pattern similar to that in the business sector. Young and highly educated Austrians tend to adopt digital innovations in similar ways and proportions to their peer country counterparts. Gender differences are also small in these young groups. In contrast, gaps vis-à-vis peer countries,

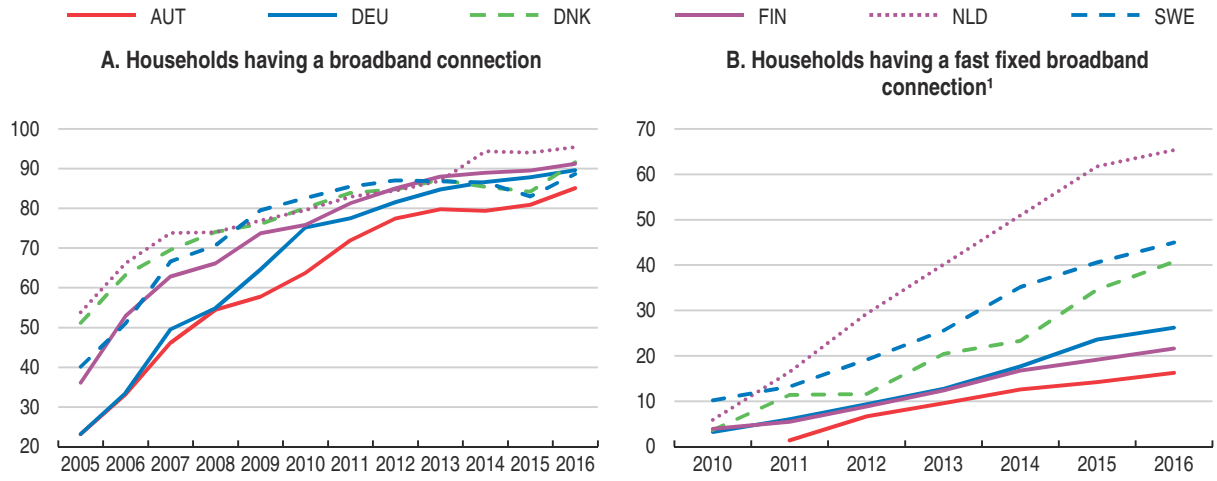
as well as domestic divergences are larger for middle and older age cohorts, according to their education, income level, immigration origin, etc. These divergences are recurrent across ICT applications.

Broadband connectivity

Like in the business sector, broadband connections provide the basic infrastructure of digitalisation in the household sector. Only 25% of Austrian households had broadband in 2005 against 50% in peer countries. By 2016, however, this share had reached 85% in Austria, approaching that in peer countries (Figure 1.15).

Figure 1.15. **Broadband connectivity of households**

Households, %



1. Fixed broadband connection with an advertised download speed above 30 Mbps.

Source: OECD ICT database and Eurostat.

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In the area of fast broadband, however, and like in the business sector, large gaps persist. A negligible proportion of Austrian private persons had access to fast broadband in 2010, against 5 to 10% in peer countries. There has been progress in the 2010s, with the share reaching 15% in 2016. However, in the meantime, connections expanded more rapidly in peer countries and their edge over Austria increased (Figure 1.15, Panel B). This divergence occurred despite very low broadband service prices in Austria. The average download speed (65 Mbps) remains below the OECD average (77 Mbps) and lags well behind the average speed in leading countries such as Sweden (240 Mbps) and Japan (166 Mbps) (Figure 1.16).The low penetration of fibre, especially in rural areas, may be slowing down the introduction of more attractive services (see Figure 1.23 below).

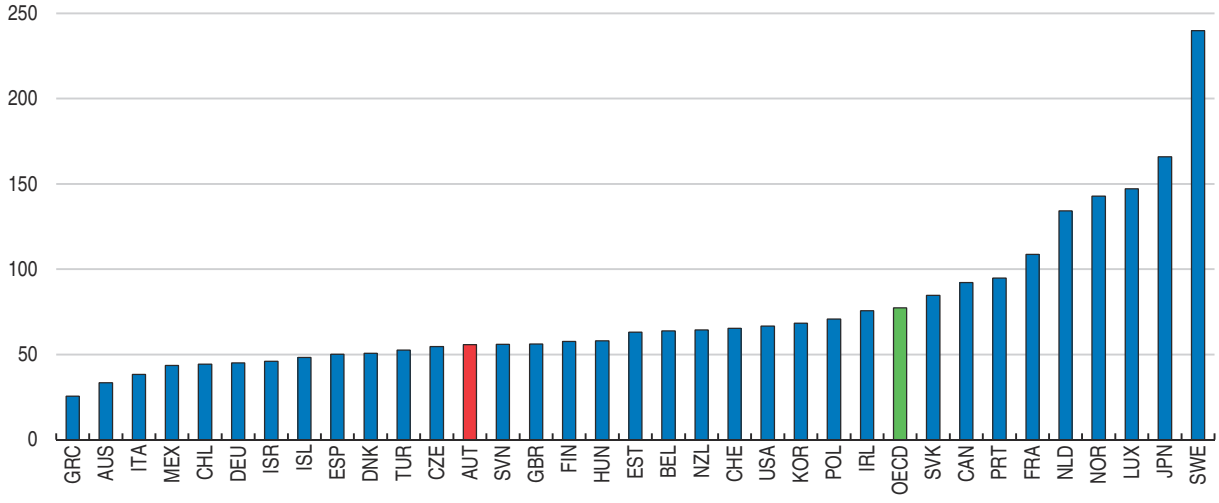
Computer and internet use

The proportion of persons who never use a computer is a standard indicator of ICT diffusion. One third of Austrians had no contact whatsoever with a computer in 2005 against 10-15% in peer countries. Their share declined to below 20% by 2010 and to below 15% by 2016. It remains three times bigger than in peer countries (Figure 1.17, Panel A).

The share of individuals never using the Internet shows a similar picture. About 15% of Austrians had no contact with internet in 2016, slightly below the EU average but well

Figure 1.16. **Average advertised download speeds**

Mbps, fixed broadband, September 2014



Source: OECD, Broadband Portal, *www.oecd.org/sti/broadband/oecdbroadbandportal.htm.*

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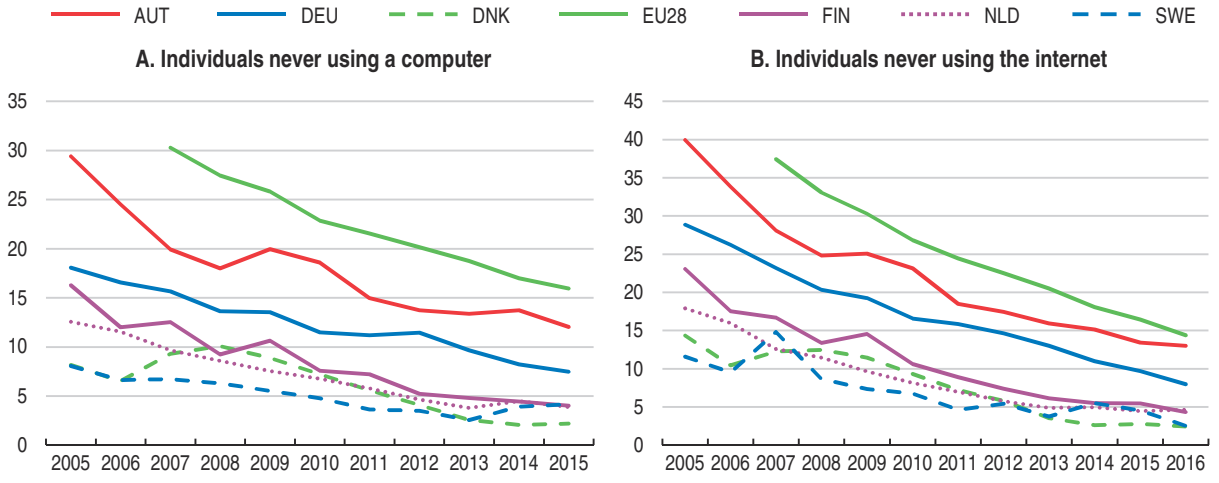
Figure 1.17. **Use of computers and internet by households**

Individuals, %



Source: Eurostat.

StatLink http://dx.doi.org/10.1787/888933536551

above the negligible share of this group in peer countries. This group has a particularly slow rate of attrition in Austria (Figure 1.17, Panel B).

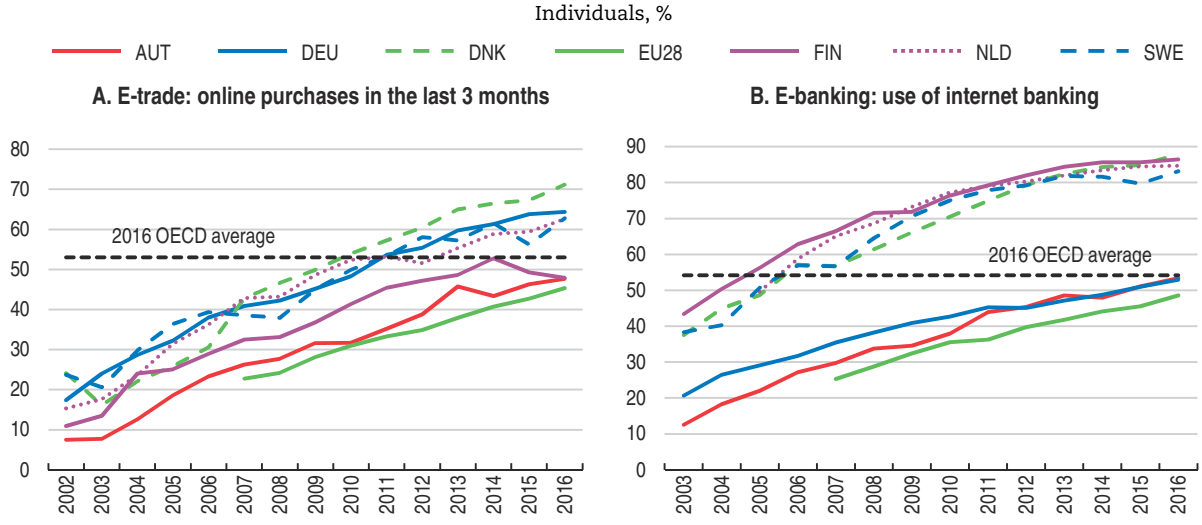
Household access to cloud computing shows a similar picture at the high end of ICT utilisation. Only 20% of Austrians used cloud services in 2015, while this share reached 40-50% in peer countries. This confirms the limited weight of high-intensity ICT users among Austrian households. There is also a gender gap: 17% of prime age women use cloud computing, against 30% of prime age men, while this share stands at 50% for both genders in peer countries. In young cohorts the gender gap has disappeared but cloud utilisation remains 20 percentage points below peer countries.

E-commerce

More than half of all individuals buy products online in OECD countries. The trend is accelerating and has unsettled the traditional distribution channels in certain sectors such as tourism and travel services. The generalisation of smartphones supports the practice and half of smartphone users now order via their mobile devices. The uptake of e-commerce by individuals varies considerably across countries, however (OECD, 2015a).

In Austria, e-commerce use by individuals grew more slowly than in peer countries. It reached a level slightly above the EU average, but well behind peer countries (Figure 1.18, Panel A). Younger Austrians have caught up somewhat but gaps remain large for the middle-age and older cohorts.

Figure 1.18. **Specific internet applications used by households**



Note: 2016 OECD estimates based on a simple arithmetic average of the available countries, and percentage of individuals who have purchased online in the last 12 months.
Source: Eurostat and OECD, ICT Access and Use database.

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E-banking

The rise of online banking is redefining market boundaries and service access channels in banking. More than half of internet users in OECD countries now use online banking, increasingly via mobile devices. The ongoing trend is that of a reduction in the number of bank branches, with 20% of local branches projected to disappear within five years in certain Member countries (OECD, 2015a).

About half of Austrians were using internet banking in 2016, far below peer countries. Uptake rates approach 90% in Denmark and the Netherlands (Figure 1.18, Panel B). The prevailing financial practices of Austrian households, where men traditionally run family finances, contribute to a gender gap: 60% of women aged 25-54 were using e-banking in Austria in 2016, against more than 90% in peer countries. There is also a gap between urban and rural areas (with uptake rates around 60% in the former and 50% in the latter, against 90% and 80% respectively in peer countries).

Factors influencing the adoption of digital innovations in households

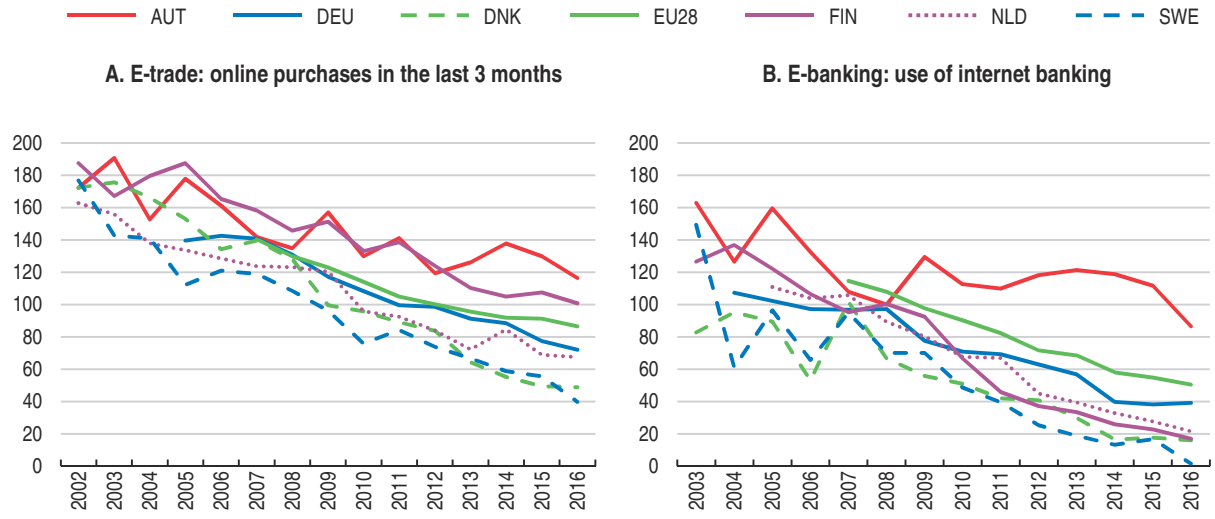
The diffusion of ICT innovations in households appears to be strongly affected by socio-economic determinants in all OECD countries (OECD, 2015a). Factors such as age, education, gender and immigration background have all an impact. These effects appear even stronger in Austria.

Age

In Austria, the influence of age on ICT use is stronger than in other EU countries, and much stronger than in peer countries. For instance, the rate of uptake of e-commerce by the 64-75 cohort is lower than the EU average (17% versus 21%) and much lower than in peer countries (30-40%). Those aged 16-24 participate more than the EU average (62% versus 54%) but less than in peer countries (70%). The gap in uptake rates between age cohorts stays high despite a decline over the past decade (Figure 1.19, Panel A).

Figure 1.19. **Influence of age**

Percentage difference between 16-24 and 65-74 year-olds



Source: Calculations based on Eurostat data.

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The impact of age is even greater in e-banking. Older Austrians are particularly hesitant to engage in internet banking. Only 22% of those aged 65-74 draw on these services, against the EU average of 26% and up to 60-70% in peer countries. As in e-commerce, younger cohorts surpassed the EU average (56% versus 43%) but remain below the coverage in peer countries (95% in the age cohort 25-34). The age gap in uptake rates is declining but only slowly (Figure 1.19, Panel B).

Education

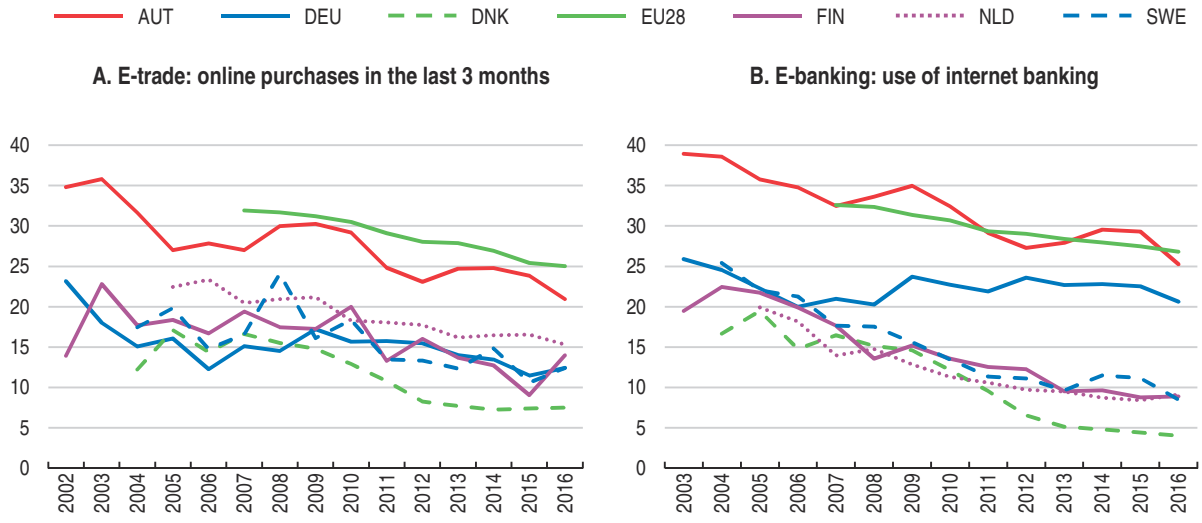
Education is the other key driver of familiarity with and proficiency in digital technologies. In the OECD area the utilisation rates of ICT applications by university-educated 65-74 year-olds are comparable to the average utilisation rates of the general population (OECD, 2015a). In some of Austria's peer countries, this rate matches even the adoption rates of the youngest cohorts.

In Austria the influence of education on ICT utilisation is particularly high. For instance 27% of Austrians with low education participate in e-commerce, against 22% in the EU, and

45-65% in peer countries. For the tertiary educated groups the rate increases to 65% in Austria, matching the EU average, but falling behind the 85-90% rate in peer countries. This gap between education groups declined only gradually over the past decade (Figure 1.20, Panel A). The same picture is found in e-banking, with even larger differences between low, medium and high educated groups. As with e-commerce, these gaps are declining slowly (Figure 1.20, Panel B).

Figure 1.20. **Influence of education**

Percentage difference between individuals with high and low formal education



Source: Calculations based on Eurostat data.

StatLink http://dx.doi.org/10.1787/888933536608

Gender

Gender gaps have long been common in the uptake of ICT innovations. However, they declined over the past decade, and, in certain countries, they have been reversed. In Sweden and Denmark for example, women are now more active than men in e-commerce as well as in e-banking.

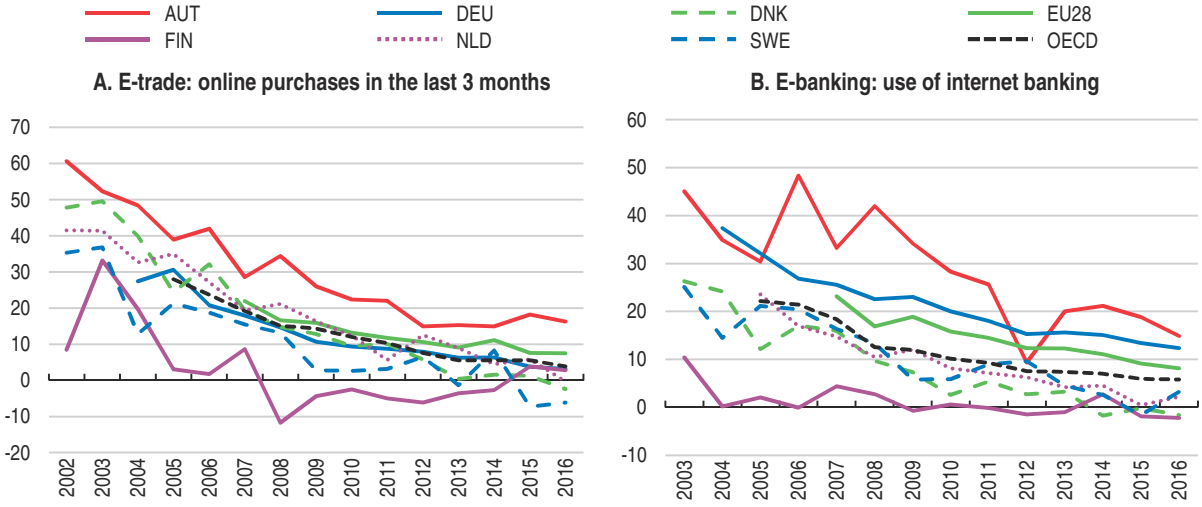
In Austria, gender gaps stay large in international comparison (Figure 1.21, Panels A and B). They may be reflecting, at least partly, the "separate gender roles" model which endures in many businesses and families (OECD, 2015b). The fact that many women stay focused on traditional tasks in workplaces and households may keep them away from ICT innovations. These gaps have declined for the tertiary educated and the youngest cohorts, however, which may herald their future erosion.

Other socio-economic factors

In all OECD countries the income level and other socio-economic characteristics of individuals also affect the adoption of ICT applications. Without multivariate models based on micro data, the respective impacts of specific factors are difficult to disentangle. Still, one variable stands out in Austria in the case of immigrants, namely their origin. Migrants from non-EU countries clearly have lower rates of uptake of ICT innovations than in peer countries. These gaps have not diminished through time (while they tended to decline in at least certain peer countries). Even if their persistence in Austria may be related to the larger educational gaps of these immigrant groups, they signal a digital divide in the making (Figure 1.22).

Figure 1.21. **Influence of gender**

Percentage difference between men and women

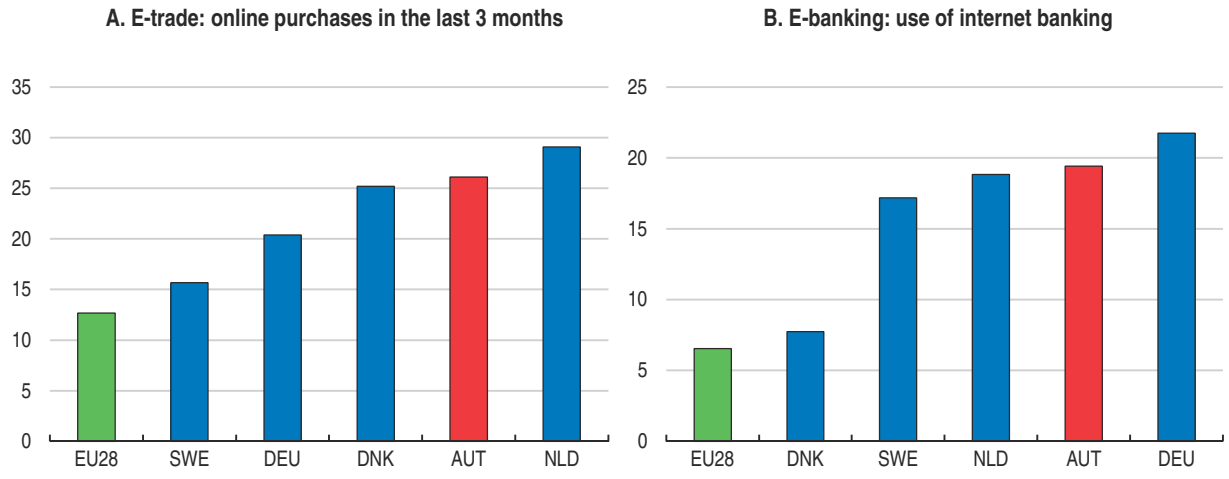


Note: OECD estimates based on a simple arithmetic average of the available countries.
Source: Calculations based on data from OECD, ICT Access and Use database and Eurostat.

StatLink http://dx.doi.org/10.1787/888933536627

Figure 1.22. **Influence of immigration origin**

Percentage difference between individuals born in the country and those born in a non-EU country, 2016



Source: Calculations based on Eurostat data.

StatLink http://dx.doi.org/10.1787/888933536646

Austria has traditionally been conservative in the adoption of new technologies by households (Tellis, 2003). The digitalisation process may be reproducing this traditional pattern. It may reflect a cultural tendency to preserve prevailing habits, and to depart from them only slowly. For example, the slow uptake of e-commerce may reflect the preference of many Austrians for face-to-face interaction with their local retailers and service providers, in particular in the small communities where local trust is strong and personal contacts are particularly appreciated. Such cultural traits were identified in recent OECD economic surveys as being part of the drivers of well-being in Austria (OECD, 2013a).

There is also other evidence suggesting that digitalisation is being driven by the same basic socio-economic forces in Austria as in the other OECD countries. Young and better

educated groups converge faster with the global lifestyles, and more swiftly adopt the new ICT goods and services. They precede other social groups, which follow with a longer lag than in comparable countries. In this process conservative preferences may be expected to gradually exert a smaller influence. The overall pace of digitalisation will result from these competing forces. The policy challenge is to raise awareness and diffuse knowledge on the benefits arising from digitalisation throughout the society, and let all citizens make use of them according to their preferences.

Public strategies to foster digital transition call for broad social support

The findings of this chapter are congruent with the broad message of two recent OECD reports on the policy implications of digitalisation (OECD, 2016c; OECD, 2017a). These reports stress that despite the rapid spread and uptake of digital technologies, adoption and use vary widely in all countries along demographic groups, industries and firm sizes. This raises challenges as to the inclusiveness of the digital transformation.

Barriers to more balanced and inclusive diffusion typically arise from a combination of lack of high-quality and affordable infrastructure, lack of trust in digital technologies, a shortage in the skills needed, service trade barriers, and high cost of financing for SMEs. These barriers play uneven roles in different countries. They should be addressed with comprehensive strategies (OECD, 2017a).

A "whole-of-government" approach is in order in all countries because many policy areas are involved, and advances in each individual area risk being offset by lack of action in others. The building blocks of a comprehensive strategy in Austria should include the elements below, many of which duly feature in Austria's recent Digital Roadmap (Box 5). The discussion below emphasises some of the most important priorities.

Recognising the employment and social cohesion challenges of digitalisation

Digitalisation has far-reaching effects on labour markets and social cohesion, through two main channels. First, digitalisation entails skill biases in employment, as it destroys and creates jobs for persons with different educational and skill backgrounds. Its impact is more significant for manual and intellectual routine activities (Chapter 2). Second, the new "asset sharing" properties of digital business models generate more fragmented and less stable activity and employment forms, which do not benefit from the same legal and social protection framework as standard employment forms. On the positive side, they also offer entirely new opportunities for persons otherwise excluded from the labour market.

Acknowledging these challenges is important for a constructive social dialogue. The process has started in Austria (Birkner et al., 2016). The quality of this dialogue will shape the degree of social consensus on digitalisation trends, and will influence policymaking as well as collective agreements. Involving workers in non-standard activities in social dialogue is not straightforward because of lack of well-established representation channels. Nonetheless, a first "workers council" of bike-delivery workers was created in Vienna in April 2017 (Metropole, 2017).

Austria's social partnership system as a "coalition of producers" (Nowotny, 1993) would in principle be supportive of digitalisation. The firms, the unions, the Chamber of Economy and the Chamber of Labour currently view digitalisation as an important source of productivity gains, provided that social cohesion is not threatened. This joint support is valuable and should continue to be cultivated.

Upgrading skills

The OECD recommends to all Member countries "to place a stronger emphasis on promoting ICT generic skills, ICT specialist skills, and ICT-complementary skills, in order to ensure that all citizens and enterprises can engage in and benefit from the digital economy" (OECD, 2017a; OECD, 2017d). Austria has shortcomings in this area and developed a Digital Skills Plan in the context of the 2015 Education Plan (see Chapter 2). This effort should also encompass the age cohorts already in the labour force, and is integrated in the Digital Roadmap. Specific time-based targets and benchmarks could be set for effective implementation.

Certain OECD countries have introduced specific policies to address the limitations of middle-aged and older cohorts. For example, Ireland's 2013 National Digital Strategy aimed at cutting the proportion of "non-liners" (people who have not yet engaged with internet) by half by 2016. In Sweden, as part of the 2011 Digital Strategy, the eGovernment Delegation developed a "Guidance on Web Development" which sets out how to meet the needs of elderly people and people with disabilities. In Denmark, two national campaigns were initiated to encourage the elderly to use ICT: the "Get Online Week" and the "Senior Surf Day". They sought to inform and motivate new users about the benefits and enjoyment of using internet and involved around 1 000 ICT centres and libraries around the country. There are already a number of information and awareness programmes in Austria directed to old-age internet users (Help.gv.at, 2017) and the Digital Roadmap foresees further initiatives.

Renewing business models

There are deep differences in ICT adoption rates between firms in all OECD countries. As documented above, they are particularly large in Austria. Firms of different types, sizes and sectors are unequally engaged in digital transitions.

Governments in all OECD countries try to accelerate convergence, in particular in SMEs (OECD, 2016c). Most of the related public programmes focus on: i) awareness raising and training, with an emphasis on ICT-related and organisational know-how, ii) financial support, and iii) social networking. Notably, Germany's "Mittelstand-Digital" programme may deserve special attention, as the diffusion of ICT innovations follows a staggered path similar to Germany's and the German initiative is considered as successful (OECD, 2016c). Austrian policymakers draw on international experience in this area and a new programme sme.digital was recently introduced to foster ICT adoption and digital change.

Austria's low start-up rates are a recognised handicap in digital transitions. Policymakers aim at stimulating the renewal of business demographics through a "Austria as a Number One Start-Up Country" initiative. Close attention to start-ups' specific policy needs is in order, as they generally lack the resources to participate in policy processes (OECD, 2017c).

Promoting more competitive digital markets

Digitalisation creates risks of closure, collusion and even monopolisation in several market areas (OECD, 2017a). Lack of open standards and fears of vendor lock-in are common. For example, in cloud computing, applications developed for one platform cannot be easily migrated to another cloud host, and users can become vulnerable to providers' strategic behaviour and price increases. Surveys have shown that the lack of such standards and the resulting fear of vendor lock-in is an important barrier to the generalisation of cloud computing (OECD, 2016c). New initiatives for developing open standards in the full range of

ICT applications have emerged, at national (the Swedish Standards Institute is a leader), European and global levels. Preserving the openness of these markets requires close policy scrutiny and, when needed, pro-competitive regulations. The public sector may act as a role model by fostering open standards and interoperable solutions in its procurement policies.

The Austrian Competition Authority has an active competition advocacy role to play to prevent collusion and monopolisation in digital markets, and has already taken initiatives in this area. It co-operates with European and international counterparts. The World Trade Organisation and the World Intellectual Property Organisation also address the interplay between intellectual property and competition law at the global level. Several competition-relevant issues associated with digitalisation, including open standards, interoperability, market access rules, and balanced use of intellectual property rights remain on the agenda. Intellectual property rights (IPRs) may support innovation by making it an attractive investment but may also generate undesirable rents. With digitalisation, IPR has become more important in a wider range of sectors and policymakers need to find a good balance between nurturing innovation incentives and preserving competition (OECD, 2016c).

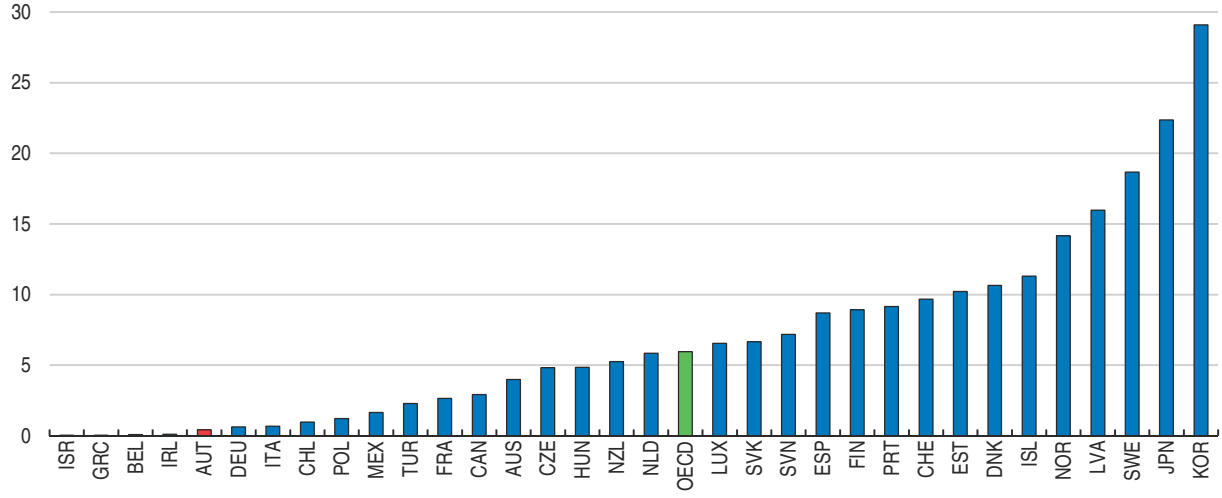
Reinforcing the broadband infrastructure

It is essential to continually invest in the development of digital infrastructure to meet existing and future demand (OECD, 2017a). Fast broadband supports the data-intensive new applications and business models and is indispensable for the implementation of Industrie 4.0 solutions.

Austria has an ambitious *Broadband Strategy 2020*, which aims at making ultra-fast broadband available to all firms and households by 2020. However, the country is currently among those with the lowest per capita investment flows in telecommunication infrastructure (Peneder et al., 2016). Three issues remain: i) the low rate of "fiber coverage" on the last mile of fixed broadband networks (Figure 1.23), which restricts opportunities for new competitors to offer services beyond those defined by the incumbent, hence limiting competition and innovation from new players; ii) the reduction of the number of mobile

Figure 1.23. **Fibre subscriptions among countries**

Subscriptions per 100 inhabitants, June 2016



Source: OECD Broadband database.

StatLink http://dx.doi.org/10.1787/888933536665

network operators (MNOs) from four to three, after a merger authorised by the European Commission (against the advice of the national competition authority), which appears to have slowed down the pace of technological renewal in mobile broadband services (OECD, 2014); and iii) significant differences in the quality of the broadband infrastructure between regions (EC, 2017a).

The OECD recommends that all Member countries establish national broadband plans with well-defined targets and update them regularly. These plans should address the existing barriers to the deployment of high-speed networks and services, and include measurable targets concerning competition and investment. These targets should include goals concerning the key technical enablers for new entrants and value-added service providers. Austria could continue to regularly update its Broadband Strategy along these principles.

Generalising e-government innovations

Austria is among the international leaders in e-government innovations but their pace of adoption by households falls behind. Certain OECD countries have accelerated the adoption of e-government innovations by making the use of public digital platforms mandatory – with opt-out provisions. To date, Austria has maintained neutrality between digital and non-digital platforms as policymakers place a strong emphasis on inclusion and freedom of choice for citizens. To encourage the use of digital platforms, a 40% reduction on fees ("online discount") was nonetheless introduced for those applying digitally for certificates, using electronic identification means. Transition to pre-filled digital tax forms has been a successful innovation and is now fairly generalised, in particular in the business sector. A recent law, applicable from 2020, will guarantee to all citizens and businesses the right to interact digitally with the administration in areas falling under federal legislative competence (except for areas not suitable for electronic interaction). Open government data is also expected to nurture the emergence of new businesses by permitting the use and free distribution of new government datasets (OECD, 2017g). Stronger incentives, including financial incentives, may nonetheless be needed to encourage households to make the transition.

Fostering bottom-up innovations

Clustering initiatives in digital activities foster the network economies typical of these sectors. There are promising experiences in Austria, for example the Hagenberg Software Park (Box 1.3). Such initiatives should continue to be encouraged, including through co-operation between the Federal and *Länder* governments. The 2017 Digital Roadmap rightly stresses the expected contributions of clusters.

Uber- and Airbnb-type innovations are also important. They make the welfare benefits of platform-based ICT innovations accessible to a wide population. Their introduction has been managed smoothly so far in Austria. Regulators have not blocked these innovations, while addressing the concerns that they have raised (Box 1.4). Preserving an enabling regulatory framework while fostering a level playing field for all participants will be essential for future innovations.

Improving trust and consumer protection

Trust reduces transaction costs in the digital economy, and facilitates the adoption of innovations. Three main dimensions pertain to cybersecurity, privacy and consumer protection (OECD, 2016c).

Box 1.4. **Airbnb and Uber in Austria: Vienna's approach to the "sharing" economy**

Internet platforms such as Airbnb and Uber, which are experiencing outstanding growth globally, have also reached Austria. The sectors of hotels and accommodation and passenger transport are directly affected. Of the current 15 000 accommodations in Austria on offer via internet platforms, Vienna accounts for just over half. In 2016, the City of Vienna set out some principles on the regulation of the "sharing economy" in a paper entitled "Turning the sharing economy into a fair economy in Vienna". The emphasis was on establishing a level-playing field between different actors. The City reiterates its priority of preserving Vienna as a high-quality and attractive tourism location. This requires openness to innovative services.

The City started with an information campaign to raise awareness of these issues. In Vienna's social housing system, which accounts for around 45% of all apartments in town, allowing third parties to use social flats is not permitted. Non-compliance may result in the termination of the tenancy agreement. On the other hand, the owners of private apartments should also act in line with a Supreme Court ruling that all private apartment owners in a building must give their consent on all issues of common interest, including the lending of apartments to temporary tenants. Therefore, the legal, regulatory and contractual framework, without prohibiting them, sets relatively strict rules for Airbnb type of services.

The City started also to adjust certain specific regulations. In September 2016 the state parliament amended the Vienna Tourism Promotion Act, and stipulated that:

- Platform operators will have new reporting obligations. The name of accommodation providers and the addresses of the apartments on offer will be regularly communicated to the Vienna Tourism Board.
- Platform operators will supply the information required by the Tourism Board (for tourism promotion purposes) upon request.
- Fines for non-compliance will be raised from EUR 420 to EUR 2 100 for flat owners who do not register their accommodations.
- Flat owners will collect the local tax from the persons hosted, and will pay it to the municipal administration.

Concerning the platform-based taxi services, Uber is the biggest provider in Vienna. It does not operate in other Austrian cities. Uber testifies that in Vienna it works only with licensed taxi and chauffeur service companies, and not with private individuals. This has secured the consensus of existing service professionals but limits the pool of potential service providers. The City government has indicated that it monitors developments and aims at reconciling innovations with high working standards.

Cybersecurity risks have increased in all OECD economies. Cybersecurity has traditionally been approached as a technical problem, but the changing scale of security incidents is driving countries to re-evaluate their strategies. In recent years, many governments and stakeholders emphasised the importance of considering digital security risk as a strategic issue, which needs to be addressed at the highest level of governance. This is the approach of the *Recommendation of the OECD Council on Digital Security Risk Management for Economic and Social Prosperity* (OECD, 2015d). It requires a culture of dialogue and co-operation among stakeholders, which is well-developed in Austria.

As digital innovation becomes more data-driven, privacy becomes a key issue. Indeed, large volumes of personal data are collected in various ICT applications, which are either

voluntarily reported by individuals themselves, or observed or collected without their knowledge. The resulting mass of information is then stored, creating risks of data theft or misuse. Other steps involve the processing of such information by data analytics, helping generate inferences even when individuals never directly share the related information. Ultimately, data-driven automated decision making, when applicable, may lead to distorted decisions. Information inferred from data analytics can serve to boost efficiency but also risks perpetuating existing stereotypes based on statistical probabilities. Individuals' and firms' capacity to secure employment, business, insurance or credit may be affected. Austria's policymakers have to tackle this entire agenda, as in all OECD countries. The Digital Roadmap rightly emphasises this priority and the *OECD Privacy Guidelines* (OECD, 2013c) provide a principles-based privacy framework to shape the approach.

The Internet economy also raises many consumer protection issues, particularly with respect to specific activities such as e-commerce, online banking, spamming and online user tracking. Like other OECD countries, Austria has legal safeguards beyond general consumer protection rules that cover e-commerce transactions. They deal with online ordering and confirmation, information disclosure about goods or services, and advertising and marketing practices (Koske et al., 2014). In Austria online advertising about tobacco, alcohol and medicinal products and by lawyers and doctors is prohibited. The selling of financial services is regulated by the EU Directive governing "distance marketing of consumer financial services". As cross-border e-commerce becomes more and more important, for both consumers and suppliers, Austria's consumer protection agency participates in international co-operation activities within the International Consumer Protection and Enforcement Network (ICPEN). The Austrian authorities can further rely on the recently revised *OECD Recommendation on Consumer Protection in E-commerce,* which has updated provisions on digital content, consumer reviews and ratings, non-monetary transactions, new payment mechanisms, and the use of mobile devices to conclude transactions (OECD, 2016i).

Digital Europe, digital world

Access to broader markets – European or worldwide – is particularly important for new market entrants in small open economies such as Austria. As "scale without mass" is becoming a core performance driver in digital markets, achieving the European Digital Single Market is crucial for small open economies (OECD 2017a). The *OECD Recommendation on Consumer Protection in E-commerce* (OECD, 2016i) provides a set of policy principles to foster the development of cross-border e-commerce: fair and transparent business and advertising practices; information about businesses, goods and services, transactions, as well as adequate dispute resolution and redress mechanisms; payment protection, and product safety. Governments and stakeholders should work together to improve consumer protection and determine what policy changes are necessary to address the special circumstances of e-commerce, including for children and vulnerable or disadvantaged consumers.

The main policy recommendations of this chapter are summarized in the following Box. Several of these recommendations are part of the strategic goals of the 2017 Digital Roadmap. Their formulation in terms of specific and quantitative objectives may facilitate their implementation and monitoring.

Recommendations to facilitate ICT diffusion

Key recommendations

- Set up a transparent monitoring system for the implementation of the Digital Roadmap, with timelines and quantitative targets.
- Integrate a Digital Skills Plan in the Roadmap, including for small firm owners and managers. Establish targets for ICT-generic, ICT-specialist and ICT-complementary skills.
- Facilitate new entries and stimulate competition in broadband services in the context of the Broadband Plan 2020.
- Ensure that competition policy responds to changing threats to competition in digital markets, including through international co-operation.
- Promote more effective data protection, cyber security and consumer protection. Improve public awareness that responsibility for risk management remains partly with firms and consumers themselves.

Further recommendations

- Develop further the social dialogue on digital transitions. Consider a joint report by social partners on the desirable labour market and social policy priorities.
- Develop further the technology transfer programmes for businesses, in particular for SMEs. These could include training and consulting activities and showcases of best-practices. Extend this support beyond manufacturing, to all service sectors.
- Further encourage the use of e-government platforms by reducing fees and/or making their use more attractive, including through specific training.
- Use public procurement to promote open access, open data and open standards.
- The authorities should work together with stakeholders in e-commerce to improve consumer protection and determine what policy changes are needed to address the special circumstances of e-commerce, including for children and vulnerable or disadvantaged consumers.
- Encourage the creation of digital clusters in all regions in Austria.
- Continue to support venture capital investment and reduce tax and other disincentives for equity investments.

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Chapter 2

Inclusive labour markets in the digital era

Digitalisation is one of the megatrends affecting societies and labour markets, alongside demographic change and globalisation. The fourth industrial revolution will redesign production processes and alter the relationships between work and leisure, capital and labour, the rich and the poor, the skilled and the unskilled. The degree of disruption induced by the technological transformation ahead largely depends on the policy framework. Digitalisation can lead to anything between soaring inequalities and widespread improvements of living and working conditions. Two main questions arise for policy makers: how to ensure equality of opportunities in the race with technology and how to find the appropriate level of redistribution of the gains associated with digitalisation to preserve social cohesion. Against this backdrop, this chapter will analyse the technology-induced transformation of labour markets, argue for a new social contract and discuss how the provision and use of skills need to adapt to the digital work environment.

The future of work

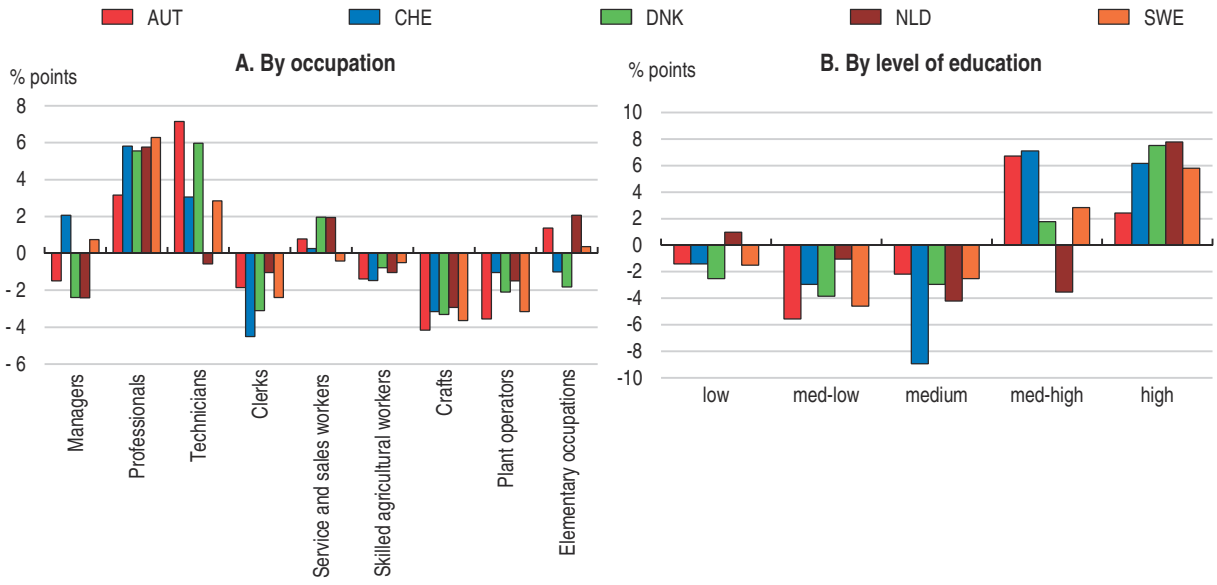
Facing automation anxiety

Against the backdrop of ever-expanding technological capabilities a lively debate on automation and on the evolution of employment has emerged in recent years. Automation anxiety has been a recurrent theme ever since the first industrial revolution. Power looms replaced hand weavers, telegraph and telephone networks made many middlemen obsolete, automated teller machines made bank tellers redundant and industrial robots replaced plant workers. Yet, employment in affected sectors generally continued to increase as innovations complemented existing jobs and productivity increases spurred aggregate demand for products (Autor, 2015). With Industry 4.0 and the emergence of increasingly capable cyber-physical systems, the spectre of automation is hovering again over our societies. Advances in machine learning, artificial intelligence or big data push the automation frontier deeper into formerly sheltered tasks including non-routine cognitive tasks. So the question is: will this time be different?

Technological progress in general and digitalisation in particular, coupled with the emergence of global value chains (GVCs), have changed the occupational structure in advanced economies. Computerisation and increasing complexity of tasks have triggered "routine-biased technical change": new technologies complement high-skilled non-routine cognitive tasks and replace mid-skilled routine tasks, while parts of the low-skilled workforce shift to service and sales occupations (Autor et al., 2003; Acemoglu and Autor, 2011; Autor and Dorn, 2013). As a result, labour markets have become increasingly polarised. Labour polarisation in Europe has primarily occurred within rather than between industries (OECD, 2017c) and technological change is identified to be the main driver behind within-industry polarisation measured as the share of low- and high-skilled over medium-skilled workers. Jobs have shifted from mid-skilled clerks, craft and plant workers towards higher-skilled professionals and technicians on the one hand and lower-skilled service and sales jobs on the other (Figure 2.1). The share of technicians is high and increasing in Austria, consistent with the prominent role of vocational education and training, and with limited deindustrialisation. Indeed, the manufacturing sector still accounts for roughly 19% of total value added in Austria in 2015, down only slightly from 20% in 2005, while it has declined by over 5 percentage points in Sweden and the Netherlands, and by over 2 percentage points in Denmark.

The impact of GVC integration on labour market polarisation mainly depends on the degree and type of specialisation of countries in global production chains (Marcolin et al., 2016). Countries specialised in routine-intensive production have seen an increase in mid-skilled routine jobs while the possibility of offshoring has amplified the process of polarisation for advanced European countries (Goos et al., 2014). Off-shoring and Chinese import competition can explain the rise in high-skilled but not the rise in low-skilled employment. The relative strength of low-skilled employment seems to be mainly driven by deindustrialisation, that is, a shift from mid-skilled manufacturing jobs to low-skilled service and sales jobs (Autor and Dorn, 2013).

Figure 2.1. **Change in employment shares between 1998 and 2015**



Note: Due to a structural break in 2010/11 in the ISCO occupational classification, the numbers refer to aggregated changes over the two sub-periods 1998-2010 and 2011-15. The illustrated quintiles in Panel B (from low to high level of education) have been obtained by ranking 3-digit occupations according to average level of education at the end of each sub-period (2010 and 2015).
Source: European Labour Force Survey.

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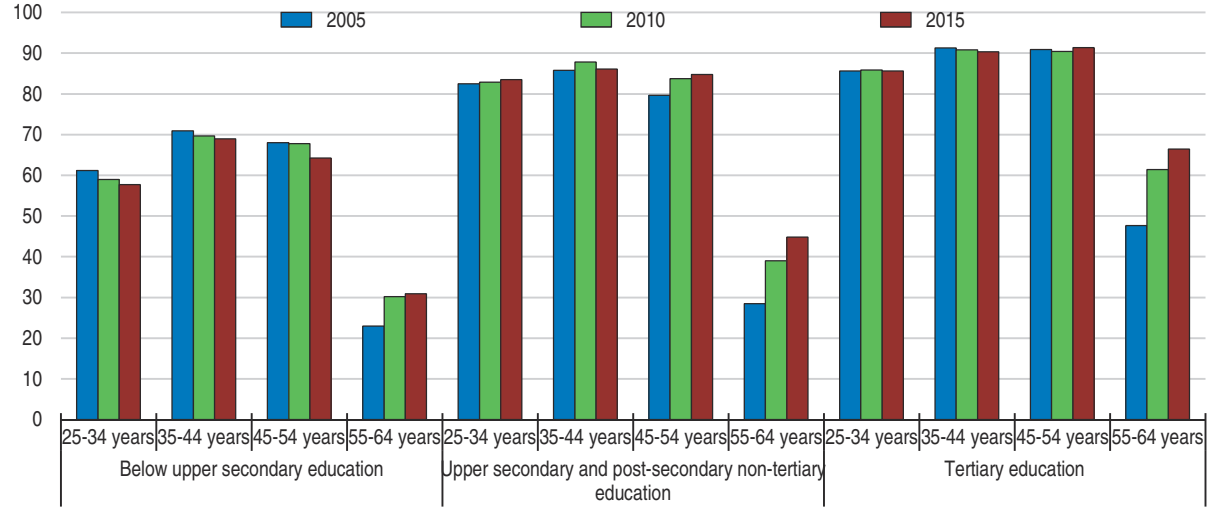
So far, the employment rate has continued to increase in Austria. It rose from 67% to 71% between 2005 and 2015. This development was backed by a growing share of highly-educated workers, who are more likely to be employed than less-educated workers. Furthermore, older workers stay longer in the work force, as pension reforms have reduced pathways to early retirement. In contrast, employment of the least educated tends to decline (Figure 2.2). In particular, young to middle-aged men with below upper secondary education saw employment rates fall by approximately 10 percentage points over the same period.

Figure 2.2. **Employment rates in Austria by age and level of education**



Source: OECD, *Education at a Glance 2016* (database).

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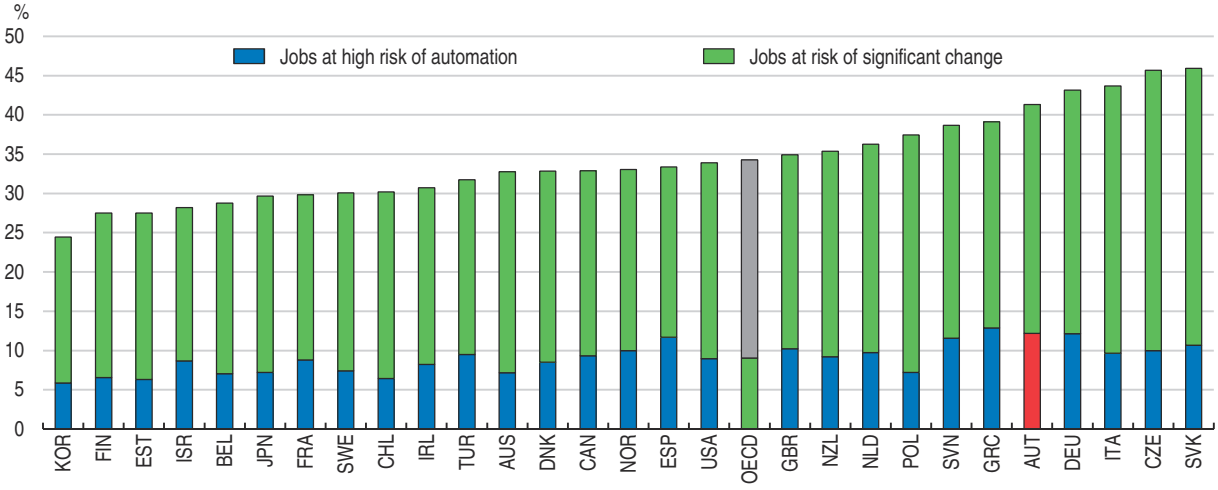
The traditional pattern of skill-biased or routine-replacing technological change may no longer apply in the context of the digital revolution. Rapid progress in artificial intelligence and machine learning is increasingly affecting non-routine tasks, including abstract ones that require problem-solving, intuition and creativity (e.g. Brynjolfsson and McAfee, 2011). On the other hand, tasks related to creative intelligence and social intelligence are less likely to be automated in the near future. Against this background, based on a mapping from the set of required abilities to the likelihood of automation, Frey and Osborne (2017) find that 47% of US jobs are found to be at high risk of automation. Bowles (2014) has applied the framework to European countries and found that 54% of jobs in Austria are at high risk of automation, against less than 50% in Denmark, Sweden and the Netherlands.

Arntz et al. (2016) relax the assumption that entire occupations are automatable and focus instead on the share of automatable tasks for each occupation. Importantly, for the same occupation, this share can differ across countries. Using the probability of computerisation from Frey and Osborne (2017) and the jobs' task-content surveyed by OECD Survey of Adult Skills (PIAAC, 2012, 2015), the authors infer each task's contribution to the probability of computerisation. They find that even occupations dominated by automatable tasks require other tasks that are hard to automate and *vice versa*. As a result, the fraction of jobs at risk, defined as those whose automatable task content exceeds 70%, is much lower (Figure 2.3) – 9% on average across OECD countries. However, a large number of additional jobs will be affected as many occupations risk being radically transformed owing to a high share (50% to 70%) of automatable tasks. For Austria, the results suggest that 12% of the jobs are at high risk of automation, which is the highest share among all countries, although not very different from Germany. A further 29% are likely to experience a significant change in tasks.

Figure 2.3. **Automation will affect a large share of jobs**



Note: Jobs are at high risk of automation if the likelihood of their job being automated is at least 70%. Jobs at risk of significant change are those with the likelihood of their job being automated estimated at between 50 and 70%. Data for Belgium correspond to Flanders and data for the United Kingdom to England and Northern Ireland.

Source: OECD calculations based on the Survey of Adult Skills (PIAAC) (2012, 2015); and Arntz et al. (2016), "The risk of automation for jobs in OECD countries: A comparative analysis", *OECD Social, Employment and Migration Working Papers*, No. 189, OECD Publishing, Paris.

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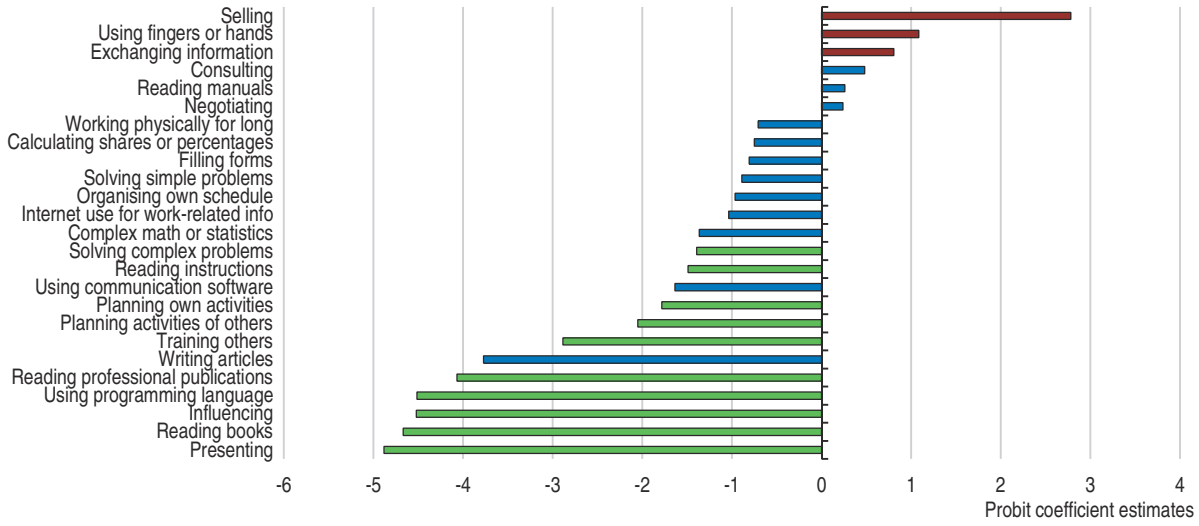
The mapping from occupations to tasks also sheds light on the determinants of job automatibility (Figure 2.4). PIAAC tasks that are found to present the strongest and most significant safeguards against automation, by declining order of significance, are "doing

Figure 2.4. **Estimated effect of skill use at work on automatibility of jobs**



Note: Green (red) colour indicates strong significance (absolute value of standardised coefficient greater than 4).
Source: Calculations based on Arntz et al. (2016).

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presentations", "reading books", "influencing people" and "reading professional publications". These tasks are reminiscent of the bottlenecks to computerisation highlighted by Frey and Osborne (2017) as they reflect the use of social and creative intelligence. Tasks at work that are identified as increasing the risk of automation include "selling", "using hands or fingers" and "exchanging information".

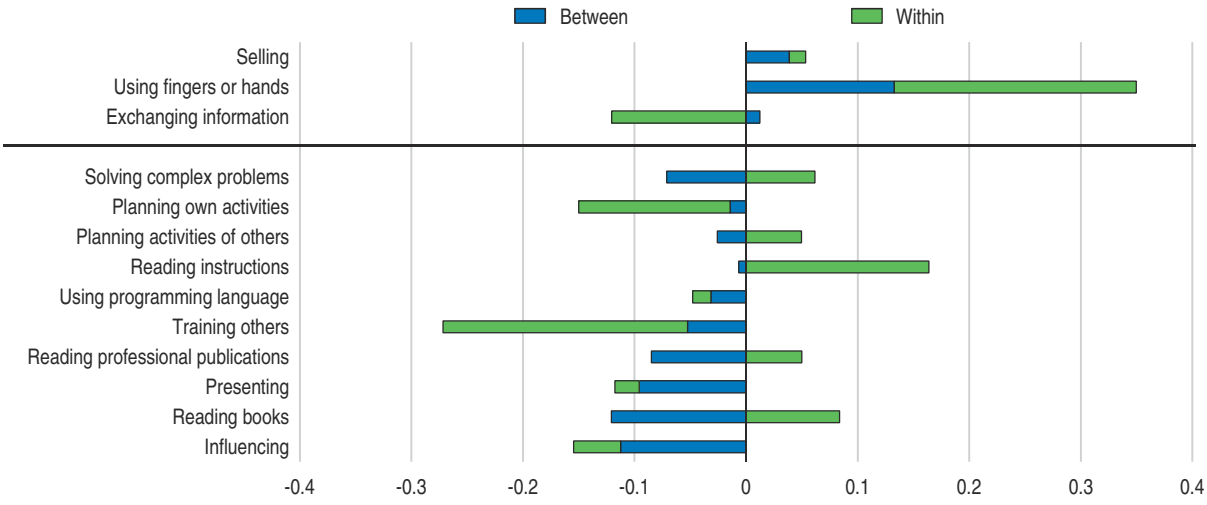
The task content of identical occupations can vary significantly between countries, pointing to potential differences in the adoption of technical change and the adjustment of workplace and management practices. Figure 2.5 shows that occupational structure largely explains Austria's higher share of workers at risk of automation. For instance, occupations with higher (lower) "influencing" content are under- (over) represented in Austria compared to peer countries. Conversely, occupations with high (low) content of "using fingers or hands" are over- (under) represented in the Austrian labour market compared to peer countries.

The differences between Austria and its peers are more mixed when it comes to the task content of given occupations. The prevalence of reading tasks and complex problem-solving is higher in Austria than in the same occupations in peer countries, reducing the risk of automation (Figure 2.5). In contrast, tasks involving training others, planning own activities or influencing others are less prevalent in Austria than in peer countries. The largest difference in task intensity between Austria and its peers is found for the use of manual activities. Both the occupational structure (between) and differences in the task structure of occupations (within) point to higher manual job content in Austria. This finding is consistent with the observation that in Austria the diffusion of ICT both at the household and business level lags behind its peers (Chapter 1). On the one hand, the lesser penetration of ICT suggests that greater occupational adjustments lie ahead as Austria catches up. On the other hand, it may reflect national preferences biased towards more conservative working practices that may or may not persist.

Digitalisation will transform certain occupations, create new ones and automate others. In the United States, the Occupational Information Network (O*NET) publishes a list of

Figure 2.5. **Differences in skills use at work between Austria and peer countries**

Intensity index as defined in PIAAC (0-5)



Note: Differences in the task intensity between Austria and peer countries are shown. "Between" refer to the contributions of the occupational structure to the overall difference (obtained by resampling Austria's occupations with average sampling weights of peer countries and computing the difference between the non-resampled and the resampled weighted average of intensities across occupations). "Within" differences refer to the contribution of differences in the intensity occupation by occupation between Austria and its peers (obtained as the sum of differences in task intensities for each occupation weighted by peer countries' average employment shares). Austria's peer countries are Denmark, the Netherlands and Sweden. The first three tasks significantly increase automation risks, the other tasks are significant bottlenecks to automation (see Figure 2.4).

Source: Calculations based on Survey of Adult Skills – PIAAC (2012, 2015).

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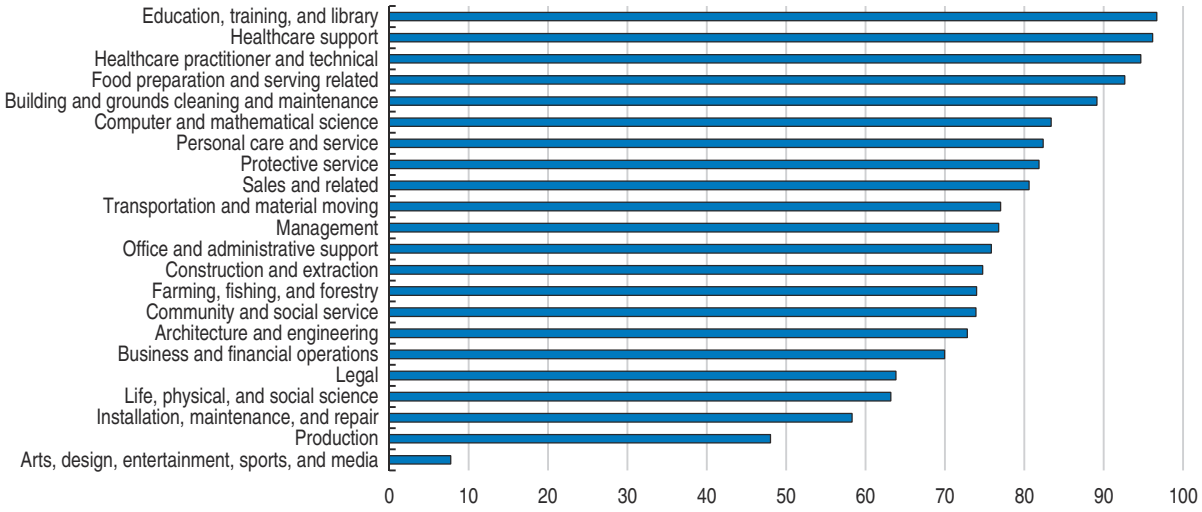
occupations that have a "bright outlook" insofar as they fulfil at least one of the three following criteria: i) a projected employment increase of 14% or more over 2014-24, ii) 100 000 or more projected job openings over 2014-24 or iii) being a new and emerging occupation in a high-growth industry. Figure 2.6 shows the share of such occupations per occupational group. Interestingly, the top four, while being heavily affected by digitalisation, are all characterised by a genuine degree of human interaction underpinning the complementarity of humans and machines in these areas. To a large extent, the list also reflects the transformations induced by demographic change as the demand for health and personal care will strongly increase with the retirement of baby-boomers. ICT specialists ("computer and mathematical scientists") rank high even though a number of jobs in this area will also disappear as some non-routine tasks involving programming are also prone to automation.

Similar forces are acting in Austria. Health care sector employment is projected to increase by 10% between 2015 and 2025 against a decline of 1.8% in manufacturing (Cedefop, 2016). Media jobs are set to decline by 10% over the same period while computer programming and information service jobs increase by 18.4% according to the projection.

Linking occupations to educational attainment suggests that the hollowing-out of mid-to-high-skilled workers will continue, at least in the near future (Figure 2.7). Indeed, the low-skilled have as bright an outlook as master's or doctorate graduates, which partly reflects the projected strong increase in the demand for health and personal care support staff. At the other end of the spectrum, professional school degrees are generally associated with occupations that have a bright outlook. Most of these jobs, which account for less than 2% of employment in the United States, are highly specialised (e.g. lawyers, judges, physicians, dentists or post-secondary teachers) and less likely to be performed by machines

Figure 2.6. **"Bright outlook occupations" in the United States**



Note: Share of bright outlook occupation in major occupational group as of November 2016.
Source: Calculations based on O*NET Resource Center and on U.S. Census Bureau and the U.S. Bureau of Labor Statistics (November 2016), Current Population Survey.

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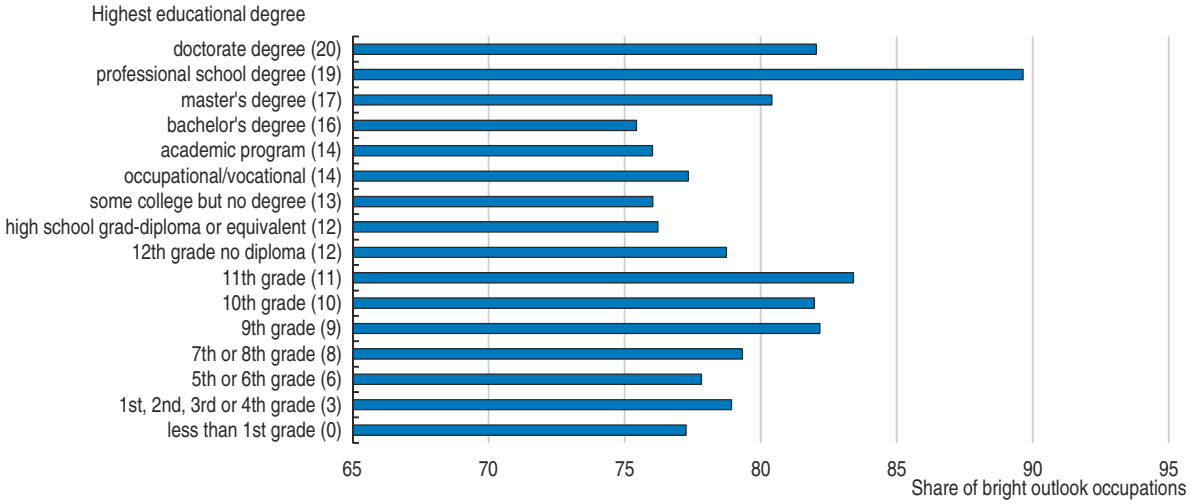
Figure 2.7. **Share of "bright outlook occupations" by educational attainment**



Note: Imputed years of schooling in parentheses.
Source: Calculations based on O*NET Resource Center and on U.S. Census Bureau and the U.S. Bureau of Labor Statistics (November 2016), Current Population Survey.

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in the near future. Holders of intermediate degrees tend to have the lowest share of bright outlook occupations. Many of these occupations are at risk: pharmacists will suffer from online selling, and real estate brokers, legal assistants and legal and office clerks face automation of routine tasks.

The discussion on automation often neglects general equilibrium aspects of ICT adoption. First, greater use of machines and ICT generates labour demand as machines and technologies need to be produced, monitored and maintained. Second, task automation nurtures demand for complementary tasks that are less likely to be automated due to their

creative and social intelligence content (Frey and Osborne, 2017). Third, falling capital costs reduce the prices of produced goods which, in turn, increases the demand for goods and labour. Fourth, increased productivity and product demand induce second-round effects as higher incomes imply additional demand for goods and services which generates new jobs. For the period 1999-2010, Gregory et al. (2016) argue that the total effect of ICT adoption on European labour demand was positive. According to their results, the labour-substituting effect (-9.6 million jobs) has been more than offset by the product demand effect (+8.7 million jobs) and second-round effect (+12.4 million jobs). However, the scale, scope and speed of the ongoing technological transformation raise unprecedented challenges (OECD, 2017d) which makes it difficult to extrapolate these results into the future.

In addition, job opportunities not only arise from changes in net employment per sector and occupation but also as a result of replacement needs. With an increasing number of retiring workers from the generation of baby-boomers in the decade ahead, many of the jobs with a declining share in the labour force will nonetheless generate numerous vacancies. As a result, Cedefop (2016) projects that total job openings will be the highest in medium-level qualification jobs between 2015 and 2025 although this result is somewhat biased by the fact that short-cycle tertiary tracks, which represent a particularly large share in Austria, are classified as medium-level qualifications while, according to the new ISCED 2011 nomenclature, these tracks are now recognised as high-qualification programmes. Congruently, despite the projected 1.8% decline of manufacturing employment, 164 000 job openings are projected for this sector between 2015 and 2025 (more than 10% of overall job openings).

Integrating new forms of work

Digitalisation has facilitated the break-up of jobs into tasks and has enabled the emergence of new forms of employment by directly linking workers to businesses and customers via online platforms or using blockchain technologies (OECD, 2016g). Labels such as "on-demand workers", "crowd-workers" or "gig-workers" are used quasi-interchangeably. These workers supply various tasks (or "gigs") ranging from low-skilled activities (Mechanical Turk) to higher-skilled ones (Freelancer, Upwork). At present, a majority of them primarily seek supplementary income and most do so by choice (McKinsey, 2016). The on-demand economy makes it easier for firms to outsource (or "crowd-source") specific tasks with a view to better match supply and demand, enables workers to supply labour flexibly and provides customers with a wider range of services, often at lower costs. A recent survey suggests that the prevalence of crowd-working is relatively high in Austria (Huws et al., 2016): 19% of the surveyed population carry out crowd-work at least once a year (against 9-10% in Sweden, the Netherlands or the United Kingdom) and 9% at least once a week (against 5% in those same peer countries). These results, however, may suffer from selection bias insofar as the survey sample is solely based on the online population. As internet use is relatively less widespread in Austria compared to its peers (Chapter 1), the results likely overstate the importance of crowd-working in Austria.

From a firm's perspective, the main benefits of crowd-sourcing are the reduction of idle production time, the optimisation of the task-related match between demand and supply of skills and the reduction in regulatory costs associated with standard employment. The costs of crowd-sourcing include search and monitoring costs when hiring a crowd-worker. Monitoring costs have been reduced substantially with the emergence of apps and review-based reputation-building. Similarly, search costs have declined substantially thanks to GPS-

based matching. In practice, the trade-off between costs and benefits will depend on the type of task at hand, the quantity and quality of outside skills supply available in due time, the firm's existing work force and the preferences of the firms' stakeholders.

From the worker's perspective, online platforms provide flexibility and broaden the potential market for their services, but at the cost of insecurity. Indeed, the legal status of crowd-workers is often somewhat ill-defined, notably with respect to longstanding labour laws and social security, and workers may even seek to waive social protection in order to increase net income. To the extent that individuals may not fully internalise the need to make provisions for pensions and against risks of invalidity or job loss, prolonged spells of crowd-working can increase the risk of poverty, in particular when making up for the bulk of gainful income. Against this backdrop, it is important to protect crowd-workers against precarious working conditions and to offer them social protection coverage without jeopardising the flexibility inherent to these new forms of employment.

From a legal perspective, these new forms of work present a formidable regulatory challenge as they combine elements of standard employer-employee relationships with elements that typically characterise independent contractors or self-employed. On the one hand, crowd- or gig-workers operate like self-employed as they are able to choose the schedule and scope of their activities and can work simultaneously for several platforms. On the other hand, the intermediary (e.g. an app- or internet-based platform) has some hierarchical relationship with the crowd- or gig-worker as it can set fees, decree standards and remove the worker from the platform. As a result, the worker's legal status is often determined case-by-case by courts based on respective personal and economic dependence. This legal status has important implications as it determines the scope of social coverage and the access to basic labour standards including minimum wages, sick leave and protection against dismissal or the right to organise and bargain wages collectively (Box 2.1). Clarifying this legal status is necessary, also to reduce legal uncertainty and the costs of legal disputes. In addition, existing regulation needs to be enforced properly to prevent employers from using legal flaws to misclassify workers in order to reduce non-wage labour costs.

Box 2.1. **Statutory differences between non-standard and standard work**

Social insurance and labour law coverage have been widened in recent years to include various types of non-standard work such as marginal part-time workers, quasi-freelancers, new self-employed, temporary agency workers and workers under fixed-term contracts. While health and pension insurance is compulsory beyond the minimum income threshold (EUR 425.70 per month in 2017), labour law coverage depends on the type of employment relationship which is mostly determined on a case-by-case basis. Statutory differences can be summarised as follows:

Labour legislation

The full provisions of the labour law only apply for dependent employment relationships which are defined by "economic dependence" and "personal dependence (determined by legal and de-facto characteristics). Under current jurisdiction, labour law coverage for non-standard workers can be summarized as follows:

- Self-employed workers are not covered by labour law.
- Freelancers, who are characterised by personal independence but economic dependence, have only limited labour law protection such as the one associated with the termination of the employment contract and the Maternity Protection Act.

Box 2.1. **Statutory differences between non-standard and standard work** *(cont.)*

- Employee-like workers who are marginally employed characterised by personal dependence but some economic independence enjoy coverage of several laws such as the Equal Treatment Act, the Employee Liability Act, the Labour and Social Act, the Foreign Employer Act or the Temporary Work Act. This jurisdiction also applies to homeworkers as long as an employee-like relationship is verified.

Whether "crowdworkers" are covered by one of these contract types depends on the type of employment as well as on the extent of economic and personal dependence, which must be examined individually.

Social security

The major differences in contributions and benefits originate from the distinction between dependent employees and self-employed. Dependent employees are subject to the provisions of the General Social Insurance Act (ASVG) whereas the self-employed are covered by the Social Insurance Act for the Self-Employed in Trade and Business (GSVG):

	ASVG (employees)	GSVG (self-employed)
Health insurance	Mandatory*	Mandatory*
• contributions	employee: 3.87%, employer: 3.78%	7.65%
• cash benefits	continued payment of wages as defined by labour law followed by sickness benefits of min 50% of gross pay and, from the 43rd day of incapacity to work onwards, 60% of gross pay (duration: between 6 months and 1 year).	sickness benefits are subject to supplementary insurance. Daily allowance of EUR 29.23 (rate for 2016) for a period of 20 weeks from the 43rd day of incapacity to work due to illness.
• benefits in kind	no co-payment	co-payment of 20% (10% beyond 3 years of self-employment)
Pension insurance	Mandatory*	Mandatory*
• contributions	employee: 10.25%, employer: 12.55%	18.50%
• benefits	Old-age pension, disability pension, survivors pension (same as GSVG)	Old-age pension, disability pension, survivors pension (same as ASVG)
Unemployment insurance	Mandatory*	Voluntary
• contributions	employee: 0-3% (income-dependent), employer: 3%	Choice between 3 monthly contributions: EUR 87.15, EUR 174.30 or EUR 261.45 per month
• benefits	55% of net income plus additional benefits for dependent family members.	EUR 23.36, EUR 37.42 or EUR 51.74 per day
Family allowances		
• childcare allowances	Choice between 5 models	Choice between 5 models
• maternity allowances (8 weeks before and after birth)	Based on net income over last 3 months plus supplements for bonus payments	Benefits in kind (temporary help) or, if not available, daily allowance of EUR 52.69

* Provided income exceeds the minimum income threshold of EUR 425.70.

From the government's or legislator's perspective, the wide range of areas and heterogeneity of crowd-workers make a one-size-fit-all solution elusive. Prassl and Risak (2017) argue that marginal adjustments to existing labour law, including refining the notion of employee and extending the scope of some individual employment rights to the self-employed, would be sufficient to regulate new forms of employment. Harris and Krueger (2015) propose to create a new status of "independent workers" as a hybrid form which provides some protection including the right to organise and collectively bargain wages but not others such as dismissal protection or overtime pay. In any case, very specific questions will need to be addressed by legislators including the portability of ratings, the monitoring power of platforms over workers via GPS and a minimum of social protection.

Redistributing the gains of digitalisation

Earlier industrial revolutions often entailed major innovations in labour relations so as to redistribute rents from firms to workers (annual leave, 40-hour work week, etc.). In addition, adverse social consequences induced by those industrial revolutions have spurred the emergence of welfare states in an attempt to reduce inequalities between winners and losers and to ensure equality of opportunity (old-age pensions, unemployment benefits, health insurance, publicly funded schools and universities). The fourth industrial revolution will likely trigger a new wave of far-reaching changes to both labour relations and the welfare state in response to new distributional challenges arising from digitalisation such as i) unstable and precarious income streams arising from new forms of work; and ii) an increasing number of displaced and redirect workers induced by the re-organisation of production.

Digitalisation has considerably reduced monitoring and transaction costs for crowd-sourcing firms. This increases the incentive to outsource various parts of production processes and shifts the risk of idle production time from firms to workers. With limited bargaining power for crowd-workers, the induced rents are likely to accrue mostly to firms, which over time could jeopardise social cohesion. In addition, income flows for crowd-workers are less stable and less predictable, which could increase the incidence of precarious living conditions. Survey results suggest that around 30% of crowd-workers participate in the on-demand economy out of necessity, and that for roughly half of them the related emoluments represent their primary source of income (McKinsey, 2016). Statutory benefits for non-standard workers need to be clarified on the basis of existing labour law or by issuing new regulation, and new forms of social protection may be necessary to ensure inclusive labour markets.

Automation of a wide range of tasks reduces the importance of labour as an input to production. In theory, the remaining work force should benefit commensurately from productivity increases as the value of complementary labour tasks increases. In practice, however, over-supply of workers providing these complementary tasks could depress wages and the rents of automation could again accrue mainly to firms. The ensuing decline in wage shares would raise the question of how to redistribute the gains in a socially acceptable way without jeopardising innovation incentives. Redistribution could occur along two dimensions: i) between employers and employees within the firm, and ii) between the firm and the rest of society.

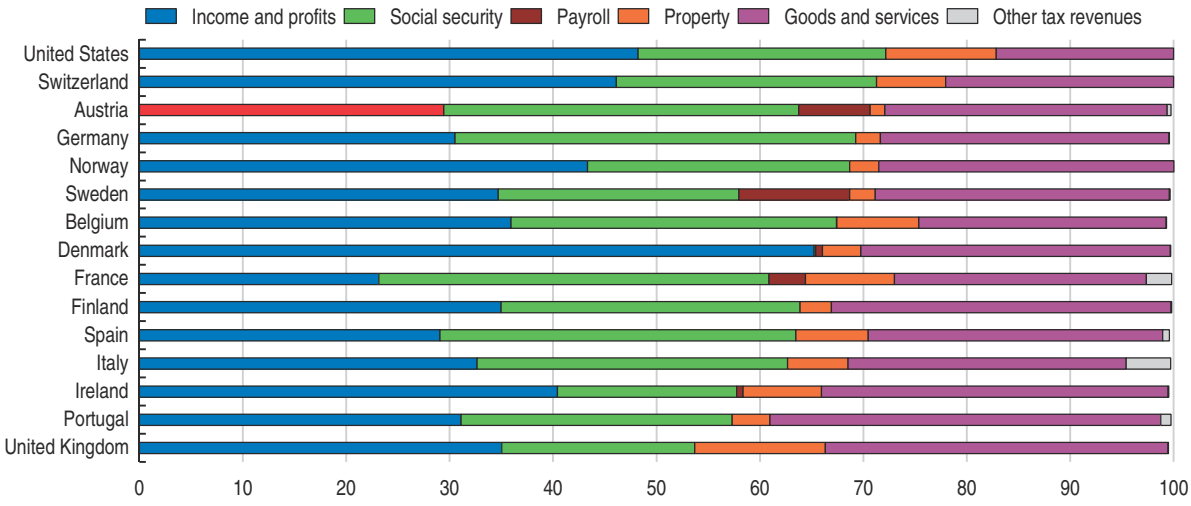
Redistribution within firms is subject to collective bargaining agreements that cover the bulk of the labour market in Austria. Profit sharing can take the form of bonuses, employee stock ownership plans or reduced working time. As for the latter, Austria has successfully experimented with the so-called leisure option that allows workers to waive pay increases against reductions in weekly working time (OECD, 2015c). The government, together with social partners, could assess the merits of a generalisation of the leisure option as an innovative salary package. The redistribution from firms benefitting disproportionally from digitalisation to other parts of the society is justified by the quest for social cohesion and the fact that digitalisation benefits are founded in part on tangible and intangible public investments (education, broadband infrastructure, etc.). One prominent idea is that of taxing machines (Ortner, 2016). Early conclusions caution against possible adverse effects on investment and on international competitiveness, in particular in the absence of international co-ordination (Schratzenstaller et al., 2016).

Like globalisation and all technical change, digitalisation generates winners and losers. Displaced workers will need to be redirected and re-trained. To preserve social cohesion, and with a view to address unequal opportunities with respect to digitalisation, new forms of transfers may become necessary. In this regard, the idea of an unconditional, uniform and universal basic income (BI) has been much discussed lately. In principle, a BI could replace most existing social transfers and thereby reduce the complexity and associated economic costs of the current system. In practice, however, a BI would give rise to important challenges (OECD, 2017b). First, it would be costly and require raising additional tax revenue. Second, some current social benefit recipients would turn out to be net losers (e.g. persons with disabilities or in maternity/parental leave) and would not prove to be an effective tool for reducing poverty and social exclusion. Third, the introduction of a BI would reduce automatic fiscal stabilisation, in contrast with unemployment benefits for example. Finally, a BI would undermine various elements of activation policies and break the "rights and responsibility nexus". The discussion and research on various forms of BI, including less ambitious ones that keep some eligibility criteria to reduce costs and maintain some intended incentives, should therefore continue, and may lead to new policy options.

Even absent new redistribution mechanisms, the declining importance of standard labour relations imperils the sustainability of Austria's social security system as taxation is heavily biased towards labour-related sources. Indeed, new forms of employment and increasingly automated production processes buttress the case for a fundamental tax reform. Direct taxes on income and profits, social security contributions and other payroll taxes account for more than 70% of government revenues (Figure 2.8), the highest share in the OECD after the United States and Switzerland, both countries with considerably less redistribution.

Figure 2.8. **Structure of general government revenues**

Per cent, 2014



Note: Sorted by share of taxes mainly related to labour (sum of income and profits, social security and payroll).
Source: OECD (2016), Government at a Glance database.

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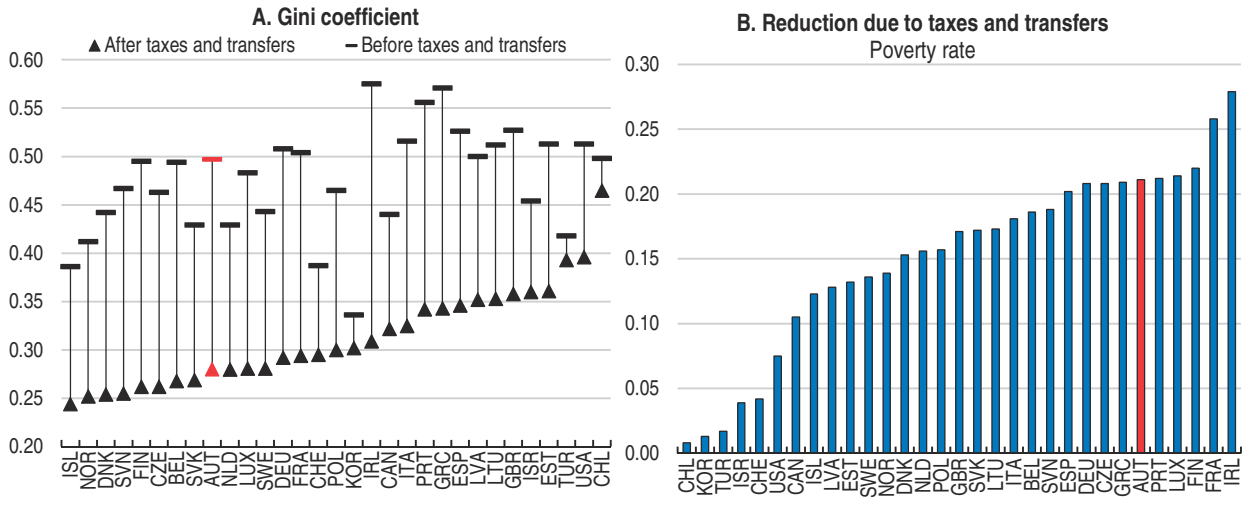
Austria is one of the OECD countries with the strongest redistribution systems. Taxes and transfers reduce market income inequality by 0.22 Gini points or nearly 44% (Figure 2.9). Their impact on poverty rates is equally potent. In 2016, social expenditures accounted for nearly 28% of GDP in Austria against an OECD average of 21% (OECD Social Expenditure

Figure 2.9. **The tax-and-transfer system is strongly redistributive**

2013



Note: The Gini coefficient has a range from zero (when everybody has identical incomes) to 1 (when all income goes to only one person).The poverty line is defined as 60% of median income.
Source: OECD database on income distribution and poverty.

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Database). Maintaining a generous redistribution system without jeopardising either competitiveness or public finances requires a shift away from labour towards property, environmental and consumption taxes, all of which are found to be less distortive than personal income or corporate income taxes (Brys et al., 2016). Property taxation is particularly low in Austria. Property taxes are not only less distortive than direct income taxes but raising them would also contribute to reducing wealth inequality and thereby foster equality of opportunity (Box 1). According to the OECD Wealth Distribution Database, as of 2010, the wealthiest 10% of Austrian households held 62% of the country's wealth, the second highest share among the 13 OECD countries for which comparable data is available after the United States (76%).

Environmentally-related taxes are relatively high in international comparison, at 2.9% of GDP in 2014 against the OECD average of 1.6%. However, only half of these taxes are raised on actual CO_2-emissions (fossil fuels). The other half stems from one-offs levies on vehicles and transport equipment (and the purchase of low-emission cars is further subsidised since 2015/16 tax reform). Increasing the share of CO_2-related taxes, in particular excise duties on fuel, would help reduce CO_2-emissions and cut incentives towards fuel tourism (OECD, 2015c).

Getting skills right

Ensuring people have adequate skills is arguably one of the key policy challenges arising from digitalisation and the associated changes in the labour market. Requirements have not only shifted towards higher and more technology-oriented skills, modern jobs also demand a higher degree of adaptability and self-direction amid rapidly changing work environments, to wit the importance of planning and organising tasks alluded to in the previous section. Furthermore, skills now become obsolete much sooner and people will have to work longer to preserve old-age incomes as life expectancy increases. This calls for co-ordinated action

across stakeholders ranging from early childhood education to vocational training, universities, firms and public employment services in order to constantly update curricula and training programmes.

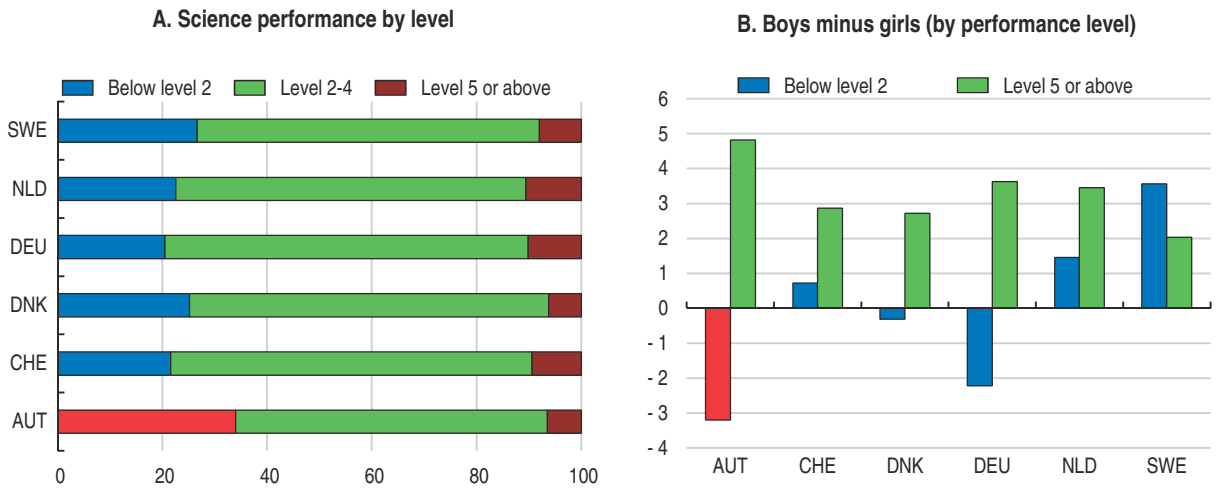
Developing basic digital skills and raising awareness of digital gaps

Digitalisation calls for a broad set of basic skills, the ones every adult should have acquired irrespective of the type of school and level of education attained. While previously the notion of basic skills referred to literacy and numeracy alone, it is now commonly agreed that digital skills need to be added to that list. The Digital Competence Framework (DigComp) of the European Commission has identified five digital skill areas: i) information and data literacy, ii) communication and collaboration, iii) digital content creation, iv) safety, and v) problem-solving. Several OECD surveys enable policy makers to gauge digital skills among students and adults depending on gender, age, level of education and socio-economic background.

Building on the OECD Programme for International Student Assessment (PISA), OECD (2015a) has tested how the shift from print to digital affects reading skills of 15-year-olds. The results suggest that performance in digital reading is below the OECD average in Austria, and lower than in print reading – in sharp contrast to good digital performers like Denmark and Sweden. One explanation may be that initiation to the internet starts much later in Austria. Less than half of Austrian 15-year-olds (46%) stated that they started using the internet before the age of 10, against 84% in Denmark and the Netherlands, 79% in Sweden and 47% in Switzerland.

More recently, the latest PISA results have shed light on the performance in science of 15 year old students (OECD, 2016c). The results suggest that science performance of 15-years old Austrian students falls behind comparable countries as a large share of pupils lack basic skills and only few achieve high scores (Figure 2.10). Gender gaps are also considerably larger than in peer countries: the share of girls lacking basic scientific skills is more than 3 percentage points higher than that of boys while the share of high-performing boys is close

Figure 2.10. **Many 15-year-olds lack basic scientific skills**



Note: Assuming that 15-year-olds not covered by the PISA sample would score below Level 2. In Panel B, the bars represent the percentage point difference in the shares of boys and girls for the respective levels.
Source: PISA 2015.

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to 5 percentage points higher than that of girls. The survey results further suggest significant underperformance of students with an immigrant background, which is only partly explained by less favourable socioeconomic conditions. Finally, variation of scientific performance across schools is also higher than in comparable countries, a phenomenon already observed for reading and numerical skills assessed in earlier surveys. Although science performance is an imperfect proxy for digital literacy and problem solving in the DigComp framework, it nevertheless can serve as an indicator of the ability to approach analytical and digital problems. Indeed, early PISA results from 2012 have already hinted at underperformance of Austrian students in digital reading and task-oriented navigation in the Internet.

One transparent and efficient way to address inequalities between schools would be to introduce more elaborate needs-based funding formulas (Nusche et al., 2016). A well-designed funding formula is, under certain conditions, the most efficient, equitable, stable and transparent method of distributing funding for current expenditures to schools (OECD, 2017a). Such formulas make it more attractive for high-performing schools to engage with a more heterogeneous student population and help adapt educational spending to social conditions. This would have to be done in tandem with efforts to increase school autonomy and strengthen school leadership, both areas where Austria lags behind peers. Greater school autonomy can, if implemented with the right checks and balances, be an important tool that allows schools to become learning-centred organisations which take responsibility for improving educational results and for reducing the impact of socio-economic background on learning.

Indeed, PISA results show that 84% of Austrian schools' principals cannot draft the school's budget and 59% of them state that there is no external evaluation of quality assurance and improvement. Both ratios are more than twice as high as the OECD average. The education reform announced in late 2015 has the potential to lift some of the bottlenecks in the governance of schools, notably by improving their autonomy with respect to the use of resources, the organisation of lessons and the selection of staff (Box 2.2). Autonomous schools need to be embedded in a comprehensive regulatory and institutional framework to prevent other inequalities between schools. Increased school autonomy needs to be accompanied by effective accountability, for instance, in the form of a reformed school inspectorate. School autonomy also requires a critical school size which could be achieved through school clusters as planned in the ongoing educational reform (Box 2.2).

School administration also suffers from a recurrent governance problem in Austria. A complex system of governing, financing and administrative responsibilities across the various levels of government hinders efficient use and monitoring of school resources. In particular the split between federal and provincial schools appears to be problematic. Federal schools comprise academic secondary schools and full-time upper-secondary vocational schools while primary, general lower-secondary and part-time vocational schools are run by the *Länder*. Low tax autonomy generates the typical problem of misalignment between spending and financing responsibilities with the associated incidents of over-spending at the sub-central level (Nusche et al., 2016). Notwithstanding this complexity and possible inefficiencies, the Federal Ministry of Education has legislative authority for school education, which limits the risk of diverging trends across regions and types of schools. Even so, the influence the nine *Länder* exert on federal policies makes policy innovation more complicated as reforms need to be quasi-unanimous, a problem heightened by the recent increase in political heterogeneity across *Länder*. In addition, for provincial schools, the

Box 2.2. **Education reform 2015**

In November 2015, the Austrian government agreed on a wide-ranging reform of the education system, comprising several packages.

The **primary school package,** which entered into force in September 2016, aims at ensuring equal opportunities in the access to primary education irrespective of background and place of residence. The measures include:

- Data exchange between kindergarten and school regarding the support of disadvantaged children.
- Schools can decide autonomously whether performance will be graded or whether grades are replaced by a description of performance.
- Schools can decide autonomously whether classes in elementary education are to be separated according to age or whether they can overlap.
- Schools can more readily accept pupils outside their school district.
- Additional language support for pupils with foreign background.
- The creation of a new profession of teaching associates to accompany individual learning in full-day schools.
- Electronic class registers, logs, records and the introduction of pupil ID cards (EDU-card).

The **school organisation package** that is to be legislated by mid-2017 establishes the Directorate for Education as a new administrative body overseeing the entire school system. In particular, it consolidates the administration of all primary and secondary schools in one institution and dissolves regional educational boards that were in charge of administrating provincial schools. The newly created advisory committees of the Directorate ensure the anchoring of the school system in the regional environment.

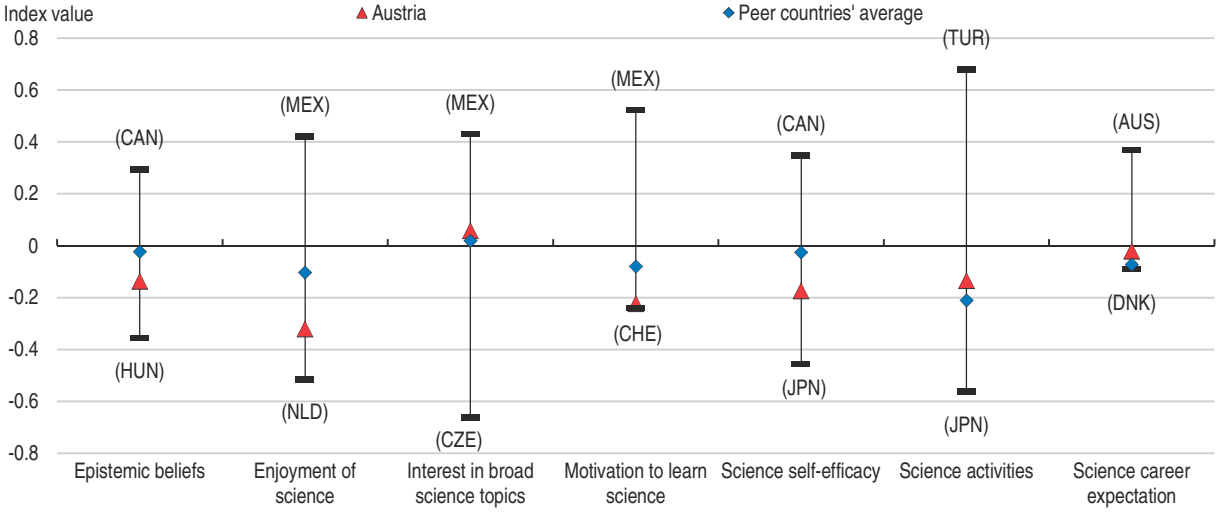
The **autonomy package** (yet to be legislated):

- The creation of school clusters and further development of school partnerships.
- Full autonomy in the organisation and design of lessons.
- Greater autonomy in the selection of teaching staff.
- Switch to demand-driven staff-training.
- Harmonisation of requirement profiles for school principals with a stronger focus on management skills.
- Greater autonomy in the use of support staff.
- Harmonisation of monitoring and co-ordination at the federal government level.
- The **elementary education package** includes a second compulsory year of kindergarten attendance. Negotiations are still ongoing and current agreements only include mandatory consultation for parents of children aged four at the start of the school year. The package also includes the provision of an "education compass" for three year olds to monitor their development early on. After a piloting stage in 50 kindergartens in autumn 2017, the compass is expected to be introduced nation-wide in autumn 2018.
- Finally, an **innovation package** aims at connecting all schools with high-speed broadband internet by 2020 (see below the digital roadmap) and foresees the creation of an education foundation that supports promising R&D and innovative projects in schools.

implementation of educational policies is the responsibility of the school departments at the Offices of the Provincial Government (which co-exist with the province school boards). This can lead to differences in the pace and scope of execution across *Länder*. The streamlining of administrative tasks for both federal and provincial schools within a new Directorate of Education (located in the *Länder*) is a welcome first step to reduce inefficiencies.

Physical investments in education are relatively high in Austria. However, greater resources may not suffice to ensure the acquisition of skills. For instance, the provision of computers, an area where Austria has made great progress (with 1.1 computer per student, the highest ratio among European countries according to PISA 2015 data), has not led to better science performance. More generally, PISA data shows that students who use computers moderately at school have somewhat better learning outcomes than students who rarely use them; but students who use computers frequently at school do much worse, even after accounting for socio-economic status and other background factors (OECD, 2015a). As a matter of fact, mastering analytical thinking and conceptual understanding requires intensive teacher-student interactions, and too much technology may distract from this. In other words, technology can amplify great teaching, but great technology cannot replace poor teaching. Furthermore, attitudes towards science are not conducive in Austria to preparing pupils adequately for science, technology, engineering and mathematics (STEM) studies (Figure 2.11). 15-year-olds typically seem to be less motivated to learn science and relatively few envisage a career in that field. Epistemic beliefs, a proxy for the comprehension of the nature of human knowledge and the origin of scientific understanding, are less developed in Austria, which certainly hinders the learning process and achievements in science subjects. These elements, though not directly linked to digital literacy, hint at more general problems in school curricula and the teaching profession that may also affect the transition to the use of digital tools in classrooms.

Figure 2.11. **Attitudes towards science**



Note: Peer countries are Denmark, the Netherlands, Sweden and Switzerland.
Source: PISA 2015.

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The attractiveness of the teaching profession is a key determinant of the quality of teaching itself. Actual salaries of teachers in Austria are almost at the level of other tertiary graduates (see EAG 2016, Table D3.2a). The new teacher service code, introduced in 2015,

raises the qualification requirement and income prospects for teachers at the start of their career and stipulates that from 2019 onwards, newly entering teachers need to hold a masters degree or, alternatively, acquire it within five years after entering teaching service. This should help raise the quality of initial teacher education (Nusche et al., 2016). However, the pedagogical approach needs to be revised in line with international best practices, with a greater focus on collaboration and peer reviewing to upgrade and professionalise teaching practices and benefit from external feedback (Nusche et al., 2016). Austria also has one of the highest proportions of teachers above 50 across the OECD (OECD, 2015b), which may be detrimental to the promotion of digital skills, at least in the medium term.

Against this background, and in order to enhance and streamline ongoing initiatives in the area of digital education, the Federal Ministry of Education has developed an overarching strategy named "School 4.0" that rests on four pillars:

1. Anchoring digital literacy in school curricula building on digi.komp modules (digi.komp4 for primary school and digi.komp8 for lower secondary school) and assessing digital skills at the end of the primary school and lower secondary school using digi.check4 and digi.check8 modules.
2. Ensuring digital competences of teachers by: i) testing their skills at the beginning of their career using a dedicated digi.check module, ii) having them take a compulsory course in "digital didactics" during their first three years in the teaching profession, iii) the requirement for each teacher to design a "digital portfolio" to reflect on own teaching practices. Provision of virtual training and peer learning using the "eEducation network" and the "mobile learning" programme (knowledge transfer from experienced pedagogues to new teachers).
3. Ensuring full coverage of broadband internet and Wi-Fi in schools including through a specific funding initiative for compulsory schools by the Federal Ministry for Education in co-operation with the Federal Ministry for Transport, Innovation and Technology. Provide all students in 5th grade (start of lower secondary schools) with tablets and all students in 9th grade (beginning of upper secondary schools) with laptops.
4. Setting up an online library (Eduthek) that provides teachers with learning tools including apps, games and innovative digital material for modern teaching practices including by promoting the use of Open Education Resources. The implementation of digital text books has started in 2016. As from school year 2017/18, e-books will be made available free of charge for secondary education in addition to printed textbooks. The introduction of interactive school books is in preparation.

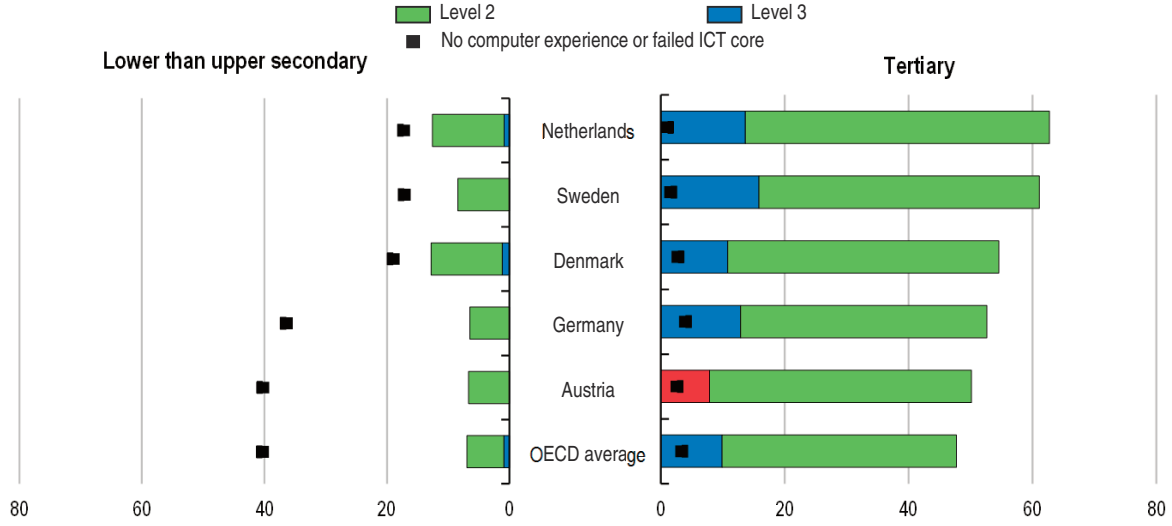
Implementation will start in September 2017 with pilot schools before being extended to all schools. Future PISA assessments will tell whether the educational reform 2015 (Box 2.2) together with the "School 4.0" initiative bring about better student performance. In general, there seems to be a glut of initiatives and strategies including from the European level and it is not clear whether and how these programmes are co-ordinated across numerous stakeholders including different ministries, in part headed by different political parties, and different levels of government. Streamlining these efforts into one global digital strategy for education, as outlined in the government's digital roadmap, and handing its monitoring to one central agency, ideally the Federal Ministry of Education, could improve synergies and promote inclusive progress in modernising teaching and learning.

A key objective of school curricula is to prepare students for the labour market. The OECD Survey of Adult Skills measures digital problem solving skills (see Chapter 1,

Figure 1.9, Panel A). It suggests that a large number of workers in Austria lack adequate skills in this domain. Indeed, more than half of workers fail the initial ICT test or score at level 1 or below in the related problem-solving test. When adding those who opted out of the computer-based assessment, the share of adults lacking ICT skills or basic skills to fulfil simple problem-solving tasks reaches 66% in Austria, far above comparable countries. In Austria, only 32% of the population demonstrated more advanced skills that enable them to evaluate and solve problems (against an average of 40% in peer countries). Similarly, gender-differences for adults' digital problem-solving skills are much starker in Austria than in peer countries (Figure 1.9, Panel B). Not surprisingly, countries exhibiting larger gender-gaps in this respect (Austria, Germany, and the Netherlands) are also those with significant gender inequalities in the labour market (OECD, 2015c).

The digital problem solving gap between skilled and unskilled adults is particularly large in Austria (Figure 2.12). This underpins the necessity of providing digital skills early on. Future generations will hopefully benefit from the intended mainstreaming of digital competencies on the back of the "School 4.0" initiative and the educational reform (Box 2.2), which could reduce the gap. Furthermore, from July 2017 onwards, a new law ("Ausbildungspflichtgesetz") stipulates that attending education and training until the age of 18 – in formal and non-formal settings – is compulsory for all young Austrians. This could reduce the number of adults affected by the gap.

Figure 2.12. **Problem-solving by educational attainment**



Source: Survey of Adult Skills (PIAAC) (2012, 2015).

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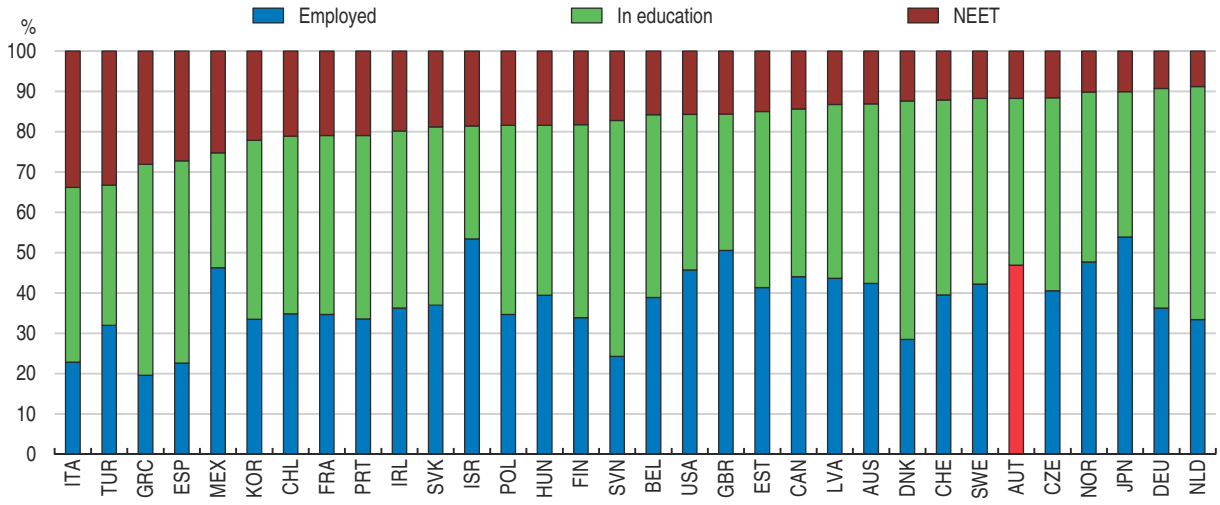
Ensuring diversity and responsiveness of educational tracks

The transformation of labour markets induced by technological progress poses a formidable challenge to the design of the educational system as matching of skills becomes increasingly difficult. As illustrated in the section "The future of work", employment growth has been, and likely will be, concentrated in professional and technical occupations, areas where the penetration of ICT and digitalisation is the strongest. Accordingly, the need for better educated but not necessarily academic-oriented workers suggests that vocational

education and training (VET) may play an even stronger role going forward. Practice-oriented learning has a long tradition in Austria and educational offers a range from apprenticeships and schools for intermediate education (ISCED 3), VET colleges that offer short-term tertiary cycles (ISCED 5) up to universities of applied sciences (ISCED 6-7). The scope and diversity of Austria's VET-oriented tracks are arguably key drivers for the country's strong performance in the transition from school to work. Drop-out rates are significantly lower than in other European countries and Austria exhibits one of the lowest shares of 20-to-24 year-olds who are neither in employment nor in education or training (NEET) and one of the highest shares of those who are already in gainful employment at this age (Figure 2.13).

Figure 2.13. **Status of the 20-24 year-olds**



Note: NEET refers to the share of those that are not in employment, education or training.
Source: OECD, *Education at a Glance 2016* (database).

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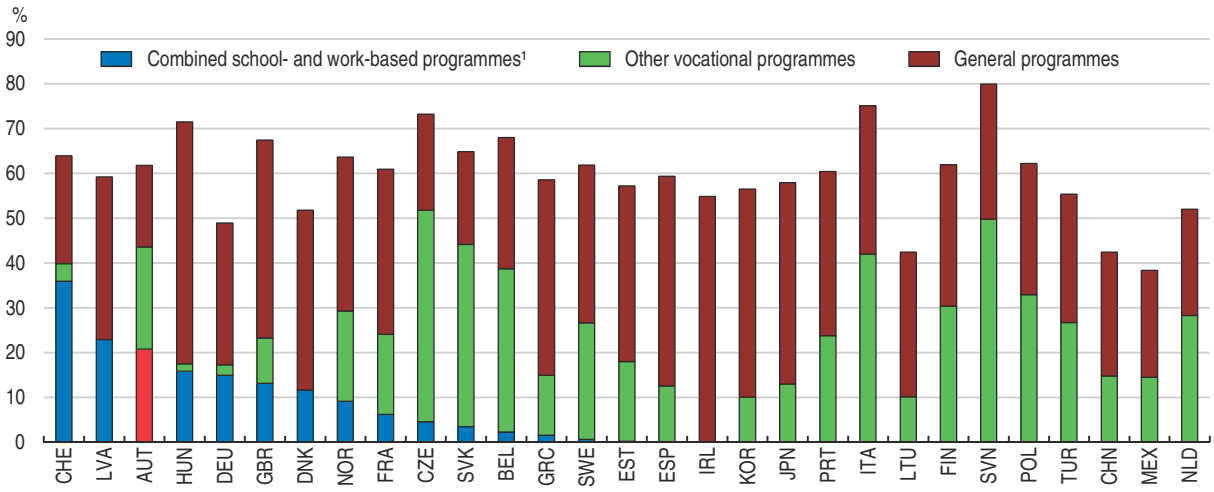
Modernising the dual apprenticeship system

In 2014, more than 70% of all upper-secondary students were enrolled in VET-based tracks in Austria, one of the highest shares across OECD countries (Figure 2.14). Roughly half of these tracks belong to the dual-apprenticeship system that combines theory and practice: 20% of the teaching is provided in vocational schools and the rest at the work-place within a company. The share of 15-year-olds enrolled in the first year of an apprenticeship has remained fairly stable since 1995 (38% in 2016) and about 35% of the Austrian work force name an apprenticeship degree as the highest educational attainment. Work-based learning directly links acquired skills to labour market needs which should increase the responsiveness of such tracks to a change in skills demand. Students gain practical experiences, including through contact with customers and with state-of-the-art equipment.

Notwithstanding these advantages, and while the dual system is becoming increasingly important in other countries, the number of apprenticeships has been falling in Austria in line with demographics. Administrative data from the public employment service suggest that the decline has been supply-driven. Indeed, the data suggest a widespread shortage of apprenticeship vacancies across various vocations where demand for apprenticeships is high and rising. The highest ratios between the number of seeking students and the number of available vacancies are observed for ICT technicians (7.7) and mechanics (5.0) while cooks

Figure 2.14. **Upper secondary enrolment rates of 15-19 year-olds**



1. Estimate based on the share of students in school- and work-based programmes over the total vocational enrolment for all ages. As a result, the enrolment rate of the 15-19 year-olds in combined school- and work based programmes is likely to be over-estimated, as these programmes often target older students.

Source: OECD (2016), *Education at a Glance*.

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and kitchen assistant apprenticeships are oversupplied (0.3-0.4). This hints at an insufficient number of apprenticeships offered in areas that are the most oriented towards and affected by digitalisation.

Cost-benefit analyses among Austrian, Swiss and German employers offering apprenticeships suggest that in some professions costs tend to exceed benefits in Austria and more so the longer the apprenticeship (Schlögl and Mayerl, 2016), in contrast to Switzerland and, to a lesser extent, Germany (Bliem et al., 2016). According to Schlögl and Mayerl (2016), the main difference between Austria, Switzerland and Germany is the extent to which apprentices are used for skilled labour in company-based training – apprentices in Austria are used more for unskilled labour and thus contribute less to the productivity of companies. Since 2005, social security contributions are reduced for both employers and apprentices, but there may be additional room to reduce costs for employers. To increase efficiency, subsidy schemes should be flexible enough to address shortages in some sectors and occupations while avoiding windfall gains in others. In addition to financial incentives, the duration of work-based learning could be adapted to the productivity profile over time to ensure that programmes remain attractive for both employers and apprentices (Mühlemann, 2016; Kis, 2016; Kuczera, 2017).

When surveyed, close to 90% of Austrian respondents declare that VET has a positive image in Austria and that enrolled students learn skills that are relevant in the labour market (EC, 2011). Few other EU countries have as high a regard for VET. However, in the same survey, Austria ranks only average with respect to VET's ability to transmit communication and team-working skills and to prepare students to set up their own business, abilities whose importance is likely to rise on the back of the ongoing transformation of the labour market induced by digitalisation and other megatrends. Between 2010 and 2016, some 56 apprenticeship professions (out of 198) were modernised or completely redesigned with a focus on operational competences for technological change that goes beyond the actual occupational requirements. The emergence of new modules such as "alternative drivetrains"

in the profession "mechatronics" or "digital selling" as part of the "retail" profession or new professions such as "process technician" reflects a good degree responsiveness to changing labour market needs.

The organisation of the dual system is complex. The split between the work-based part (regulated by the Vocational Education and Training Act (BAG) under the responsibility of the Federal Ministry of Science, Research and Economy) and the school part (regulated by the School Organisation Act (SchOG) and the School Instruction Act (SchUG) under the responsibility of the Ministry of Education) is not conducive to a strong linkage between the theoretical and practical components of training. The same applies to the mechanisms of quality assurance for these two components, which is performed by two different bodies under the auspices of the respective ministries and several other stakeholders. Streamlining responsibilities could make for greater synergies and strengthen the responsiveness of curricula to changing labour market needs.

Furthermore, some of the tracks may be defined too narrowly, which hampers the transferability of the student after graduation, a feature that becomes increasingly important in the context of rapidly changing labour skill needs (Hoeckel, 2010). Successful apprenticeship systems should strike a balance between short-term benefits for individual companies and apprentices on the one side, and benefits in terms of collective human capital accumulation and diversity on the other (Bliem et al., 2014a). In this regard, Austria has come up with some interesting innovations. First, it offers dual apprenticeship training which allows apprentices to obtain two qualifications in related fields. The duration of dual apprenticeships is capped at four years and always shorter than the combined durations of the underlying classical tracks. Second, since 2006 modular apprenticeship tracks have been created containing a base module, a main module and a special module. Both solutions address the criticism of too narrowly defined programmes as a result of an increasing specialisation of companies. Dual and modular apprenticeships also ensure the acquisition of a common base of fundamental skills that go beyond those covered by compulsory schooling, including basic digital skills. Finally, these programmes allow for synergies amid significant overlaps in a number of fields and diversify the skills of apprentices. Among the roughly 200 different programmes, only 11 are currently modular programmes. Remarkably, one of them already ranks highest in the list of vocations chosen by boys (metal technology). Meanwhile, the overall share of apprentices enrolled in modular programmes has risen to 31.4% in 2016. Given its success, and provided an in-depth evaluation confirms the expected benefits, the authorities should consider extending the system of modular apprenticeships to further branches.

Continue to strengthen higher vocational education

The success of VET in Austria goes beyond the system of apprenticeships. Schools for intermediate vocational education (VET schools, BMS) and colleges for higher vocational education (VET colleges, BHS) provide school-based vocational education at upper-secondary level and offer opportunities to pursue education at tertiary level. Roughly half of all VET school and college graduates continue their education at universities of applied sciences (UAS, *Fachhochschulen*) or through post-secondary specialised VET courses. Austria exhibits the highest share of short-cycle tertiary students among first-time tertiary graduates across the OECD (49% in 2014 against the OECD average of 16%). This is partly because VET colleges are counted as short-cycle tertiary education (ISCED level 5), which biases tertiary enrolment figures upwards compared to countries that do not offer such tracks. A large share of short-

cycle tertiary students is enrolled in engineering, manufacturing and construction programmes (32% in Austria in 2014 against an OECD average of 18%) but only 4% in science programmes (in line with the 5% OECD average).

UAS, which combine tertiary education with practical training, were introduced in 1993 and have proven extremely popular. The ratio of students at UAS over students at standard public universities exceeded 17% in 2015/16. Moreover, 50 000 additional UAS study places are foreseen in 2017/18. UAS have been deployed in all nine *Länder*, in contrast to public universities, which are concentrated in Vienna and absent in some *Länder*. As such, the UAS provide access to tertiary education for young adults who are less mobile and bring education geographically closer to the labour market. In addition, the more structured and specialised learning environment, together with remarkable programme diversity, has proven conducive to a smooth transition from university to work and has helped lower drop-out rates. The bulk of students are enrolled in technical/engineering or business administration programmes that each account for roughly 40% of total students in UAS.

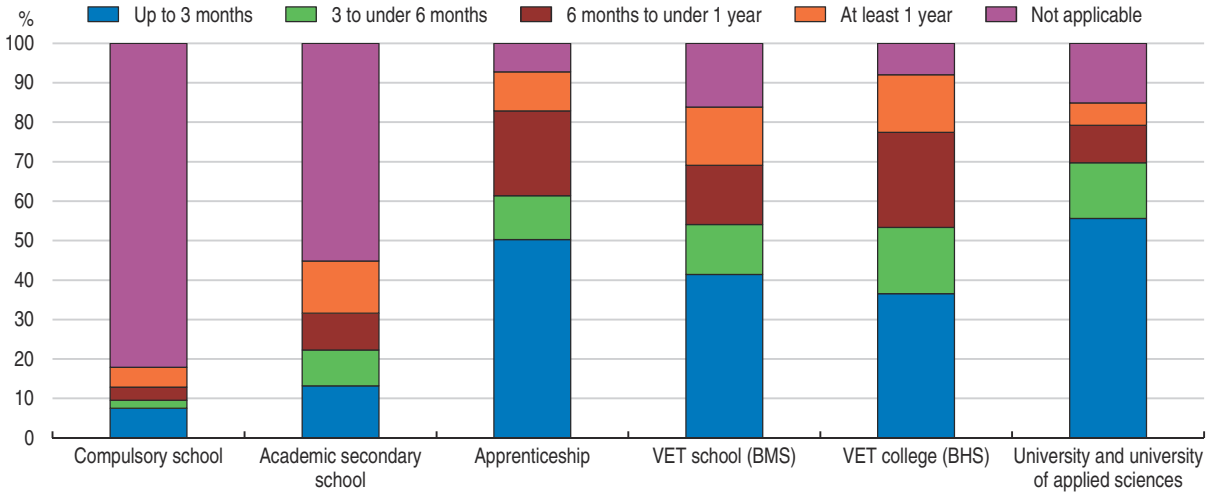
The strong labour market orientation of UAS is underpinned by the need for external accreditation and labour market orientation. Ensuing from the Act on quality assurance in higher education (HS-QSG, 2011), the Agency for Quality Assurance and Accreditation Austria (AQ Austria) was established in 2012. UAS require AQ accreditation to obtain state recognition for the delivered diploma. Four out of the 14 board members of AQ are required to have business experience and half of the board members need to be foreign citizens. This increases the likelihood that curricula and the mix of programmes reflect labour market needs and are in line with international best practices. Further, the strong involvement of social partners in designing the content and diversity of curricula contributes to a good match between programmes and labour market needs.

However, the multitude of institutions and stakeholders also calls for better co-ordination. Governance of the various systems is currently distributed across several ministries and economic chambers at different levels of government with only little collaboration. Notwithstanding the high degree of appreciation of most VET tracks, this leads to potential problems for students (ambiguity of offers and pathways), employers (difficulty to screen and rank the supply of skills) and governments (inefficient spending due to overlaps, difficulty to develop a comprehensive VET strategy). The decision-making process should be consolidated and strategic coherence and co-ordination ensured without jeopardising the system's diversity (Musset et al., 2013). The central forum for developing and implementing new training profiles and preparing proposals concerning the dual apprenticeship system in Austria is the Federal Advisory Board on Apprenticeship ("Bundes-Berufsausbildungsbeirat"), legally established by the Vocational Training Act ("Berufsausbildungsgesetz"). This board is set up by the Ministry of Science, Research and Economy and comprises experts from social partners (Austrian Federal Economic Chamber, Federal Chamber of Labour) and from school administration (for the part-time vocational schools). Similar boards are set up at the *Länder* level ("Landes-Berufsausbildungsbeirat").

Permeability between secondary and the tertiary VET institutions is rather good. Approximately 60% of the first-year students at UAS study programmes come either from a VET college (47%), a VET school or from the dual education sector. To inform stakeholders about the labour market prospects associated with the different educational tracks, Statistics Austria has developed the education-related employment career monitoring project (on behalf of the Federal Ministry of Labour, Social Affairs and Consumer Protection and of the

Public Employment Service). It tracks former students during 24 months following graduation. Indicators assessed 6, 12, 18 and 24 months after graduation include labour market status, income and time to first employment. The results suggest that the transition to work is smoother in the dual training system (apprenticeships) than in purely school-based VET tracks including intermediate and higher technical and vocational schools (Figure 2.15).

Figure 2.15. **Time to first employment by type of education**



Note: Excludes graduates who engaged in further education or training during the first two years after graduation.
Source: Statistics Austria, Monitoring of education-related employment behaviour 2016 – Graduates.

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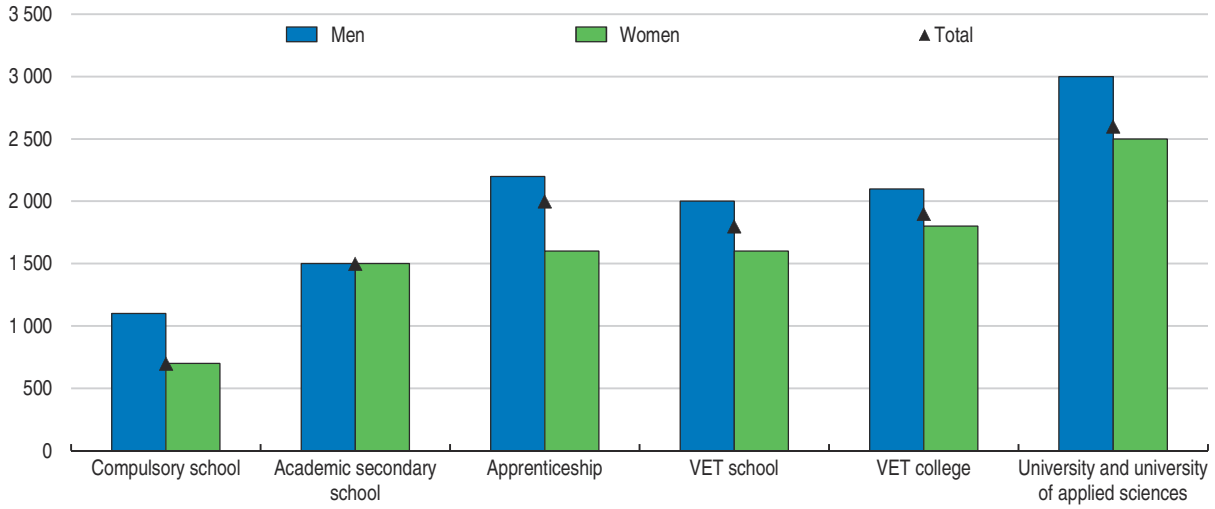
Around half of apprentices sign their first employment contract within three months after graduation, while this share drops to 41% for students in intermediate and 37% for graduates of higher technical and vocational schools who do not continue their studies. However, roughly half of VET school and college students enrol in tertiary tracks after graduating while only 5% of apprentices do so. Similarly, 92% of those who finish compulsory school continue their educational career in upper secondary education and 84% of those who graduate from academic secondary schools subsequently enrol in higher education tracks.

Male apprentices can expect higher earnings than male graduates from VET schools and colleges who do not engage in further education, in contrast to female graduates (Figure 2.16). Gender gaps appear to be somewhat higher for apprentices and university students than for VET schools and colleges. This may be related to the higher degree of specialisation in the former and the fact that women typically engage in fields with lower earnings prospects than men. While entry-level earnings for apprentices exceed those of other upper-secondary track graduates, earnings paths over the life-cycle are somewhat steeper for VET schools and colleges as well as academic upper secondary schools. Indeed, averaged over all age cohorts, graduates from these institutions earn more than apprentices (available data, however, does not allow to control for potential age composition effects).

Lower starting salaries for VET school and college graduates may be related to the lack of workplace training and a lesser degree of specialisation. Indeed, VET schools and colleges rely mostly on workshops and internships to transfer practical skills or practice firms to simulate work environments. Integrated workplace training should be mandatory

Figure 2.16. **Median monthly earnings by type of educational track**



Note: Based on dependent employed aged 30 years or younger, 18 months after graduation. Excludes graduates who engaged in further education or training during the first two years after graduation.
Source: Statistics Austria, Educational monitoring, on behalf of the Federal Ministry of Labour and Social Affairs.
StatLink http://dx.doi.org/10.1787/888933536931

not only for apprenticeships and UAS but also for VET schools and colleges (Musset et al., 2013). This would foster the acquisition of relevant interpersonal skills such as working in a team or dealing with customers and facilitate the transition from school to work. Moreover, such skills are likely to become increasingly relevant as they have been identified as potential bottlenecks to automation (see above).

Assessing and anticipating changing skill needs

To help steer education provision in the context of rapidly changing skill needs in the labour market, countries increasingly rely on national and regional strategies to assess and anticipate skill shortages. Skill assessment and anticipation (SAA) is widely used and can take very different forms in terms of method, scope (national, regional, sectoral), time horizon and frequency. Austria's public employment service (Arbeitsmarktservice, AMS) monitors the labour market outcomes and trends of 24 vocational fields through the Qualification Barometer. AMS also has a Standing Committee on New Skills through which, in collaboration with social partners, specialist groups identify short- to medium-term skill needs in professional areas to guide both on-the-job training and re-training programmes. Building on company expert consultations, the Committee has identified digital skills as a prerequisite in all occupational areas (Bliem et al., 2014b).

Recent cross-country evidence suggests that mechanisms to assess skills need to be complemented by systems and governance structures that ensure that such information is used to inform policy-making (OECD, 2016e). In this regard, many countries conduct independent regional and sectoral SAAs. In Norway and Switzerland, for instance, these are carried out by professional associations. In Australia, dedicated sector skills councils publish a "Skill Shortage List" that identifies sectors and occupations at the regional and sub-regional level that face shortages or are likely to do so in the near future. In the United States and France, regional governments or agencies conduct independent SAAs in addition to the national SAA. Given Austria's federal structure, independent regional SAAs

could help inform policy makers with a view to designing policies that can address skills mismatches and shortages more effectively.

The accreditation process for UAS requires a business survey to prove that the intended programme content matches the demand for skills. Among public universities, graduate tracking is increasingly used to update university curricula and programmes. The Ministry of Science, Research and Economy has sponsored a project to widen graduate tracking in 2016 via the "University Structural Funds". Moreover, public and private stakeholders are involved in projects such as "Shaping Higher Education Institutions for the Future" to promote the supply of educational tracks in dynamic areas. To strengthen the link between universities and labour market needs on the one hand, and international best practices on the other, self-assessments of universities should become mandatory in the process of performance agreements between higher education institutions and the Ministry of Science, Research and Economy (see *www.heinnovate.eu*).

Industry clusters can help to bridge education and businesses. Austria is currently operating 61 clusters throughout the country hosting around 7 000 companies and 825 000 workers (20% of total employment). In 2008, the Federal Ministry of Economy, Family and Youth established a National Cluster Platform (NCP) to co-ordinate cluster development and bring together national, regional and local stakeholders. Along other advantages, economies of scale in clusters make it possible to set up on-site educational institutions with dedicated programmes and tracks that match the cluster's skills demand. The University of Applied Sciences Upper Austria is a good example. Each of its four thematic campuses is located in a specific cluster and offers tracks that match the cluster's specificity: ICT and media in Hagenberg (Box 1.3 in Chapter 1); health and social sciences in Linz; management in Steyr; and engineering in Wels. Thus, students benefit from a smooth transition to work, local firms are less likely to face labour shortages and universities can adapt their curricula concurrently to changing labour market needs. The NCP should be used as a steering tool to identify and disseminate successful co-operations between industries and educational institutions.

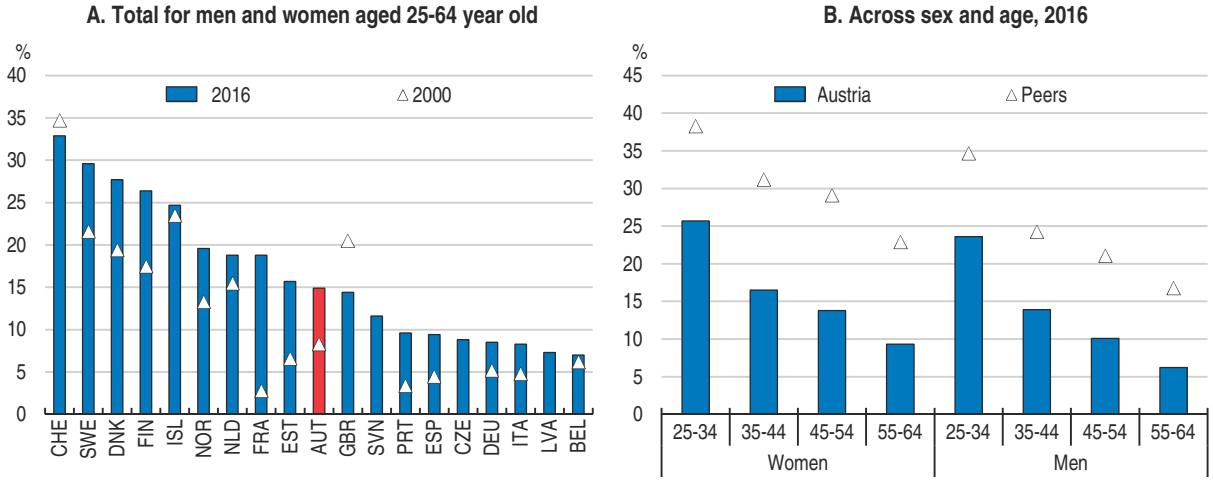
Promoting life-long learning solutions

Educating the young will not be enough to respond to the challenges arising from digitalisation. First, even if adjustments in curricula occur swiftly they will not benefit those who have already left the educational system. 10 years from now, around 43% of the working age population in Austria will be older than 45 years and more than 23% older than 55. The digital revolution has put skills to the fore that were not part of school or higher education curricula for these cohorts. As a result, digital gaps are particularly large between younger and older workers. Austria stands out as one of the countries with the poorest digital problem-solving performance for older workers across the OECD (Chapter 1, Figure 1.9, Panel D). Very few achieve top performance (level 3) in this age group and roughly a third of 55-64 year olds have no computer experience or failed the preliminary ICT core test. Germany suffers from similar patterns, in sharp contrast to Denmark, the Netherlands and Sweden. This challenge is set to heighten as people tend to extend working lives.

Second, rapid technological change induced by digitalisation also means that skills become obsolete much faster than before. This emphasises the role of life-long learning to bridge age gaps and keep the skills supply up-to-date and inclusive. The share of Austrian workers participating in continuous education and training is slightly below the EU 2020 goal of 15% (Figure 2.17, Panel A). It is alarming that those who lack skills the most, namely the

older workers, are also the ones who participate the least in training. However, this is not an Austrian specificity (Figure 2.17, Panel B). According to Eurostat's Adult Education Survey, the main obstacles to participation in Austria are family responsibilities and conflict with the work schedule, although the share of respondents reporting obstacles is generally lower in Austria than in other European countries. The latter observation coupled with low enrolment may hint at a lack of awareness for the need and benefits of life-long learning. Increasing life-long learning participation among older workers is particularly important as it would support longer working lives (Musset, 2015).

Figure 2.17. **Participation rate in education and training**



Note: The reference period for the participation in education and training is the four weeks prior to the interview. Peer countries are Denmark, Netherlands, Sweden and Switzerland.
Source: Eurostat.

StatLink http://dx.doi.org/10.1787/888933536950

Greater labour market flexibility and new forms of work shift the burden of up- and reskilling increasingly to individuals and the public sector as returns on educational investment have become less certain for firms. In small and young firms particularly this uncertainty can lead to under-investment in life-long learning solutions. Similarly, individuals may be reluctant to invest in continued education due to uncertain and sometimes distant benefits in a rapidly changing environment. From a macroeconomic perspective, the resulting under-investment in relevant skills is even more harmful in the digital era where demand for novel and updated skills is increasing. Portable and government-guaranteed personal training accounts, as included in the "compte personnel d'activité" recently introduced in France, could be a useful tool to correct these market failures.

In Austria, public adult education is largely financed and provided by the public employment service and mostly reaches the unemployed. Yet, only 4% of the low-skilled are unemployed, while most are inactive (64%) or in employment (32%) and therefore cannot be reached by such programmes. Company-based training, on the other hand, largely benefits the highly skilled. Low-skilled adults, especially beyond prime age, risk being trapped in a vicious cycle in which they do not participate in adult education and training, and their skills remain weak or deteriorate over time – resulting in even worse access to adult education and training. Public and private life-long learning solutions are therefore likely to exacerbate inequality and increase the skills gap between skilled and unskilled as well as between

young and old. To alleviate these concerns, some countries have introduced "retention and advancement" programmes that target low-skilled workers who are less likely to benefit from employer-sponsored training. In Germany, for example, these workers and those who have spent at least four years in a job unrelated to their initial training may receive funds from the government to retrain in an area with good labour market prospects.

Cost-sharing via vouchers may be an efficient way of incentivising firms and individuals to invest in life-long learning. A successful example is Singapore's SkillsFuture programme (Box 2.3). Regional chambers of labour provide vouchers in Austria, but scope and co-ordination do currently not lead to strong take-up of life-long training. Solutions should be more targeted to workers in need of reconciling work and training (via subsidised educational leaves for example). A basic set of vouchers could be earmarked to the use of language and basic ICT courses in order to close gaps in these areas. Other financial incentives practiced by several countries to incentivise life-long learning include learning and education accounts, time accounts or tax breaks (OECD, 2016e).

Box 2.3. **Singapore's SkillsFuture programme**

Since 2015, the government has been providing a S$500 (around EUR 340) adult education credit to all Singaporeans aged 25 and above with periodical top-ups to pay out-of-pocket fees. Employers are eligible for subsidies ranging from 50% to 97% of course fees. By end-2016, 18 000 eligible courses provided by over 700 training companies were available and 126 000 Singaporeans had made use of their SkillsFuture credit, 23% of which were aged 60 or older. 12% of all eligible courses are Massive Open Online Courses (MOOCs) and 6% of Singaporeans have spent all or parts of their SkillsFuture credit on MOOCs. In addition, the programme provides a mid-career enhanced subsidy to Singaporeans aged 40 years and older covering up to 90% of course fees for a total of 9000 supported courses. In 2016, 69 000 persons made use of the subsidy.

A dedicated quadripartite Council for Skills, Innovation and Productivity brings together the government, industry, unions and educational and training providers to ensure an integrated system of education, training and career development irrespective of age and educational attainment. The Council's self-reported objectives are "driving industry transformation by overseeing implementation of plans for key clusters through skills development, innovation, productivity and internationalisation strategies; and fostering a culture of innovation and life-long learning". The large scope and outreach of the programme has also led to a shift in mind-sets and raised awareness for the necessity of life-long learning among both enterprises and employers. In 2016, a total of 380 000 people attended one of the 920 000 government-funded training places, all initiatives combined.

Source: *www.skillsfuture.sg* and *www.ssg-wsg.gov.sg*.

ICT plays a major role in the promotion of distance education. The diffusion of open educational resources and massive open online courses (MOOCs) are examples of online tools that give access to education to those who are excluded from professional continuing training or other life-long learning solutions. They also respond to the increasing demand for specific skills to be acquired and constantly renewed (e.g. micro-credentials or nano-degrees). But, just like other solutions, MOOCs can increase inequalities as, for instance, those who lack basic digital skills cannot participate. Quality and commitment are also more difficult to ensure when compared to traditional classroom-based courses. Recent

studies have shown that commitment increases substantially if courses are subject to a fee or if the course is a mandatory part of students' bachelor or master degree. For instance, Khalil et al. (2016) document that certification rates for a specific course were at 80% for university students but only 11% for external participants. Allowing for fees while integrating MOOCs into a voucher-based life-long learning system could increase quality and quantity of supply, increase take-up and reduce dropout rates.

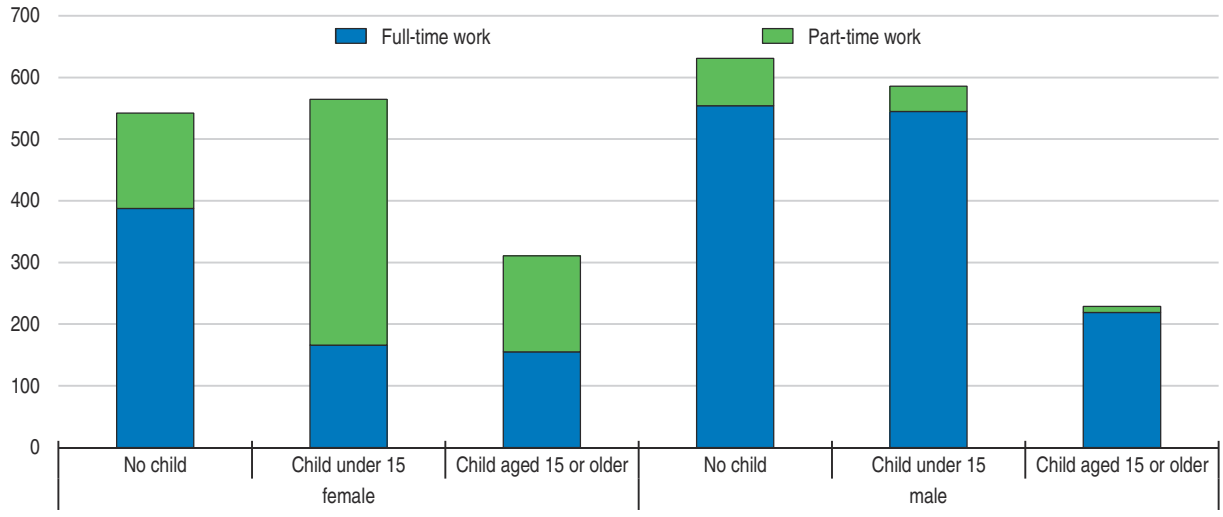
Using skills effectively in the labour market

Activating and retaining skilled people

As documented in the 2015 *Economic Survey of Austria*, a majority of women withdraws, fully or partially, from the labour market with the arrival of their first child while employment rates of men are not affected. Part-time employment rates reach more than 70% for prime-age women with a child below 15 years old in the household (Figure 2.18). Even as children grow and eventually leave the household, female part-time employment rates remain high. This so-called 1½ earner-model is supported by a wide range of factors including fiscal incentives to work part-time, a lack of full-day child care facilities and full-day schools, family-unfriendly workplace practices and general perceptions geared towards gender-imbalances in the shares of paid and unpaid work.

Figure 2.18. **Employment by gender and age of youngest child in household**

Thousand employed persons aged 25-54 years old, 2016



Source: Statistics Austria.

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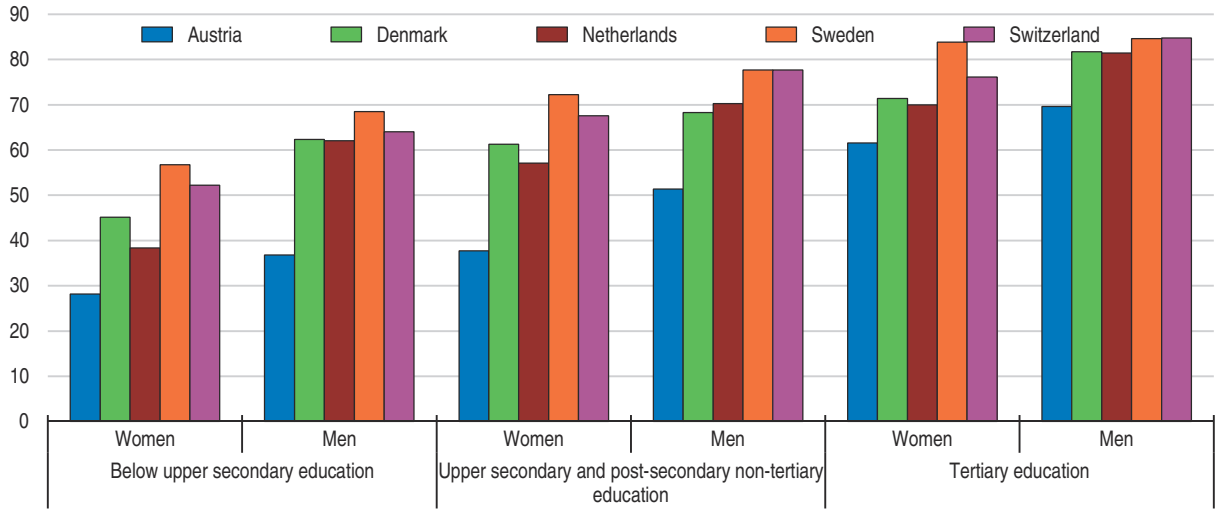
The implications for aggregate human capital are manifold. First, due to the incompatibility of work and family lives, well-educated women postpone the birth of their first child in order to pursue their career. The rate of childless women aged 40-44 has increased from 7.6% in 1996 to 21.5% in 2010 and Austria exhibits the highest rate of definitive childlessness in the OECD. Second, many well-educated young mothers either leave the work force or work part-time, which reduces human capital as part-timers participate less in training and benefit less from on-the-job learning. Third, available human capital in the form of well-educated women is under-used in the labour market.

The 2015 *Economic Survey of Austria* identified three policy areas to reconcile work and family lives and promote gender equality in Austria: i) make the tax-and-benefit system less gender-role biased; ii) reconcile work and family lives by extending the service infrastructure; and iii) encourage more flexible workplace practices. Actions taken since are rather limited except for a new paternity leave and a second compulsory year in pre-school which concerns the four-year-olds (see Table 4). Expansion of all-day schooling is an important focus of the government and an awareness-raising campaign on its benefits could help bring parents on board more rapidly.

Austria does considerably less well than most other countries in retaining elderly people in the work force. Employment rates of 55-64 year olds are well below the ones in peer countries irrespective of gender or educational attainment (Figure 2.19). Several reforms have already limited access to invalidity pensions and early retirement but more needs to be done. The effective retirement age has increased from 58.2 years in 2010 to 60.2 years in 2015 but the gender gap has remained unchanged at two years. For old-age pensions alone, the gap is even larger as men retired at 63.6 years on average in 2015 and women at 60.2 years, largely reflecting the difference in statutory retirement age between men (65 years) and women (60 years). The harmonisation of the statutory retirement age for men and women will affect actual retirement age too, subsequently decreasing the gap between women and men. Starting in 2024, the statutory retirement age for women will be raised by six months each year. This process will be completed by 2033.

Figure 2.19. **Employment rates of 55-64 year olds**

Per cent, 2015



Source: OECD, *Education at a Glance 2016*.

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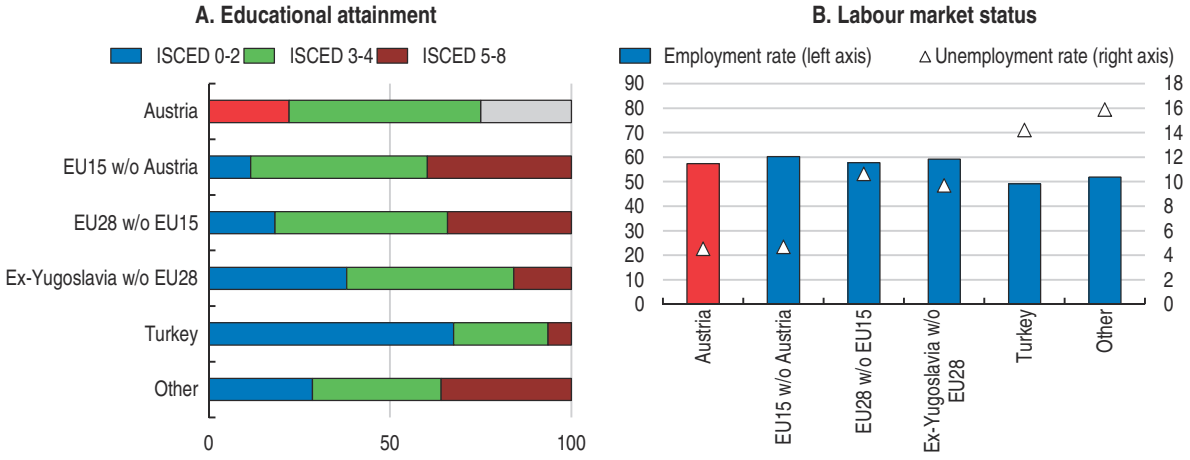
A third source of additional labour supply is skilled immigration. Until the early 2000s, net inflows were dominated by less well-educated immigrants from Turkey and ex-Yugoslavia. From 2006 to 2010, the net influx declined markedly and the bulk of immigrants came from EU-member countries. Since 2010, net immigration from new EU-member countries (members since 2004) has accelerated markedly. Their qualifications are substantially higher, on average, than those of the Austrian-born (Figure 2.20, Panel A). Nonetheless, their unemployment rates are twice as high (Panel B). Overly restrictive entry

regulations in some professions may explain the relatively poor labour market performance of the foreign-born, although some progress has been made in particular regarding the recognition of foreign qualifications.

Figure 2.20. **Educational attainment and labour market status by place of birth**

Per cent, 2015



Note: ISCED 0-2: below upper secondary education; ISCED 3-4: upper-secondary and post-secondary non-tertiary education; ISCED 5-8: tertiary education.
Source: Statistics Austria.

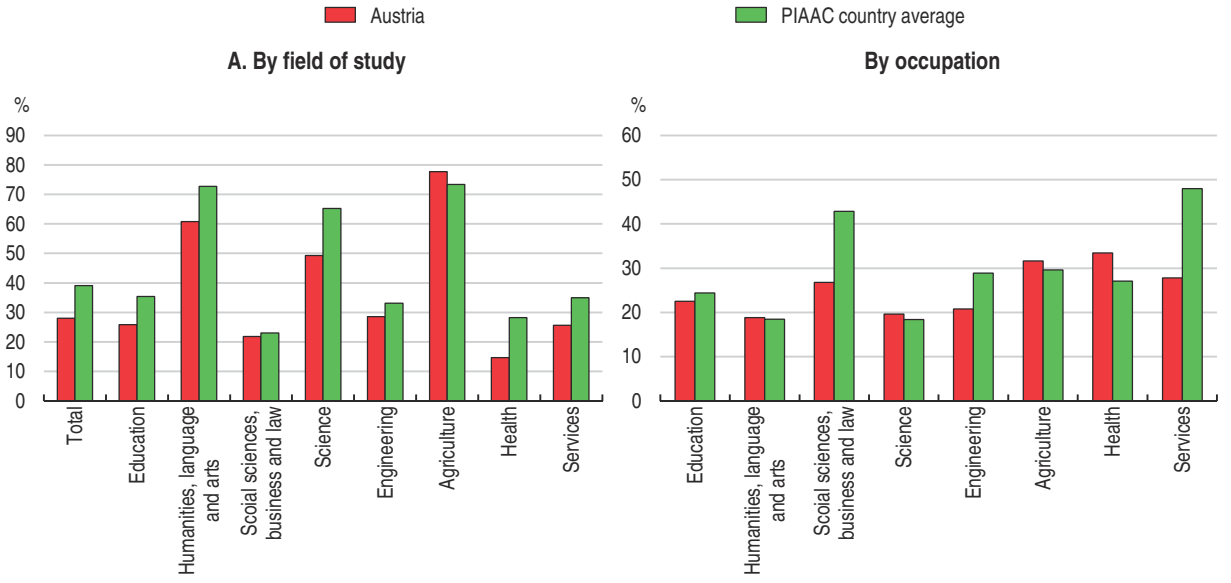
StatLink http://dx.doi.org/10.1787/888933537007

For non-EU citizens, Austria has implemented a criteria-based system since 2011 to target specific types of workers. The so-called red-white-red card, which delivers work and settlement permits to non-EU citizens for a period of 12 months, is attributed according to a specific point system to very highly qualified workers, skilled workers in shortage occupations, other key workers and graduates of Austrian universities and colleges of higher education. Shortage occupations are updated every year by the Federal Ministry of Labour. Among the current 11 professions on the list, six are in engineering. A general condition for the issuance of the card is that no other qualified person registered as a job-seeker can be placed in the vacancy. The scope of the card is rather limited. In 2015, 1 300 persons immigrated in Austria via the red-white-red card (or the complementary EU-blue card), against 91 600 immigrants from the European Union (and Switzerland), 88 300 asylum seekers or 14 900 persons through family reunion.

Reducing skill mismatches

Providing workers with adequate skills is a necessary but not sufficient condition for efficient labour markets. Proper matching of supply and demand of skills is also key. The OECD survey of adult skills (PIAAC 2012, 2015) sheds light on various dimensions of potential mismatches between workers and jobs (Box 2.4). The results suggest that 28% of Austrian workers are employed in a field that does not match their studies, which is below the OECD average of 39% and below Austria's peers (30% in the Netherlands and 34% in Sweden and Denmark). Like in other countries, the highest incidence of field-of-study mismatch occurs among "agriculture and veterinary" graduates followed by "humanities, languages and art" graduates and, to a lesser extent, science graduates (Figure 2.21, Panel A). The distribution of mismatched workers across occupational groups is somewhat more even (Panel B).

Figure 2.21. **Field-of-study mismatch by field and occupational group**



Source: Montt, G. (2015), "The causes and consequences of field-of-study mismatch: An analysis using PIAAC", *OECD Social, Employment and Migration Working Papers*, No. 167, OECD Publishing, *http://dx.doi.org/10.1787/5jrxm4dhv9r2-en*.

StatLink *http://dx.doi.org/10.1787/888933537026*

Employees in "Social sciences, business and law" and "Services" are considerable better matched than on average across PIAAC countries. "Health" and "agriculture" stand out as more strongly affected by mismatch.

Comparing the number of graduates from a specific field to the number of employees working in occupations that are associated with this field of study can shed light on the saturation of educational fields (Box 2.4). In the case of Austria, PIAAC results suggest a sizeable degree of under-saturation for the field of science, mathematics and computing while the index for engineering, manufacturing and construction signals strong over-saturation (Montt, 2015). This may suggest that too many students are channelled to engineering-oriented VET tracks and too few engage in tertiary STEM tracks. This seems to be consistent with reported shortages as recruitment difficulties are particularly widespread in the field of technical and STEM occupations (Schmid et al., 2016).

A field-of-study mismatch does not *per se* translate into inefficient job-matches. Indeed, educational tracks transmit skills that are more or less transferable to areas outside their traditional vocational domain. Skill transferability varies across fields-of-study and across countries (Montt, 2015). Overall, the share of well-matched workers in terms of skills and qualification among all field-of-study mismatched is roughly 40% in Austria, somewhat below the PIAAC country average of 49%. This may hint at a higher level of specialisation in Austria which eases the transition to work for those who are field-of-study well-matched but represents an obstacle to those who work outside their domain.

The prevalence of over-qualification (21% in Austria against 21.7% on average across the OECD) has increased in most countries and partly reflects rapidly rising tertiary attainment rates. Over-qualification is particularly prevalent among female migrants. The main reason seems to be insufficient language skills (OECD/EU, 2014). Small firms often find it hard to cope with the necessity of providing language courses which makes it difficult for workers, even skilled ones, to upgrade their language skills on the job. Taking up a job at the cost of

Box 2.4. **Labour market mismatch: evidence from PIAAC**

Field-of-study mismatch: Educational degrees are classified in nine fields. The pool of PIAAC observations is then used to map ISCO-08 three-digit occupations to one or more of these fields in order to gauge the required education for each occupation. If a worker's educational field does not match the field that his occupation typically requires, the worker is considered as field-of-study mismatched.

Field saturation: The index is defined by the number of graduates from a field divided by the number of workers who work in occupations associated with this field (see Montt, 2015). The index is standardised across fields and countries (mean 0, standard deviation of 1).

Qualification mismatch: Based on PIAAC respondents' answers to the question "If applying today, what would be the usual qualification, if any, that someone would need to get this type of job?" a distribution for each occupation's required education, translated into years of schooling, is obtained. If the worker's education falls above the 95th percentile of that distribution he or she is considered as over-qualified. If the worker's education falls below the 5th percentile of that distribution he or she is considered as under-qualified. If the worker's education falls between the 5th and the 95th percentile of that distribution he or she is considered as well-matched in terms of qualification.

Skills mismatch: Based on PIAAC respondents' self-assessed skills match, the distribution of proficiency scores of all self-reported well-matched is obtained. If the worker's proficiency score falls above the 95th percentile of that distribution he or she is considered as over-skilled. If the worker's proficiency score falls below the 5th percentile, he or she is considered as under-skilled. If the worker's proficiency score falls between the 5th and the 95th percentile, he or she is considered as well-matched in terms of skills.

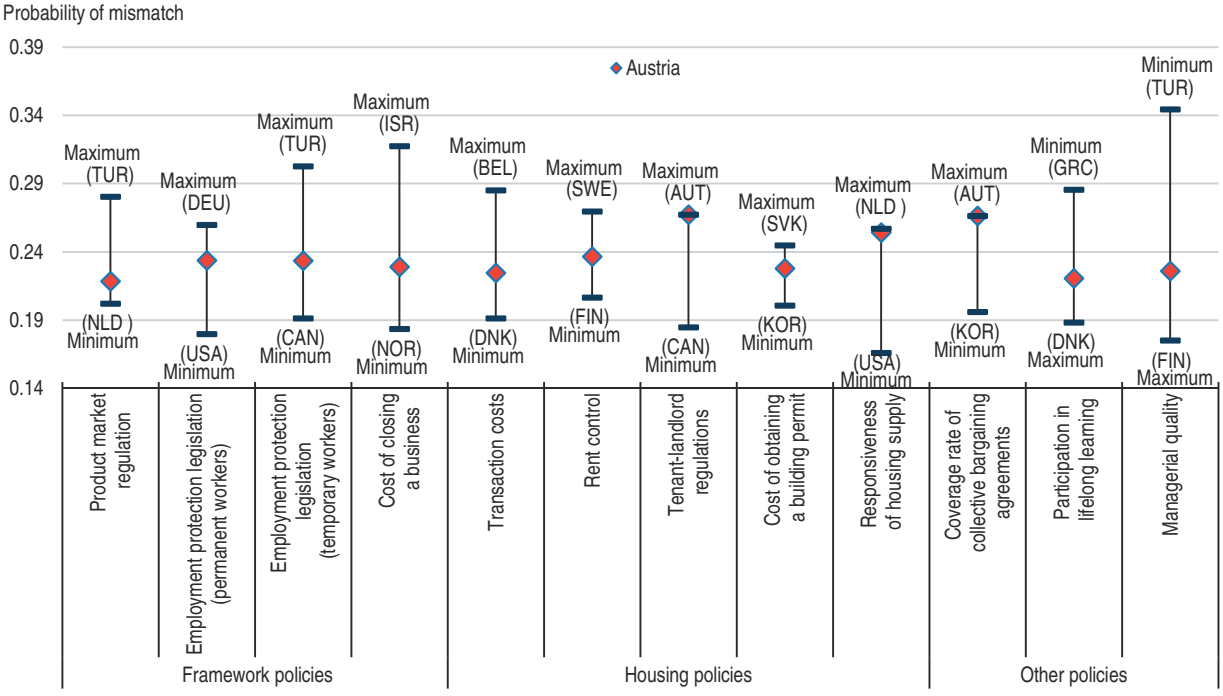
Skill transferability: The index gauges the ability of workers to fulfil qualification and skill requirements outside their field of study, thereby shedding light on the transferability of their acquired skills. It is defined as the ratio of those who are field-of-study mismatched but well-matched in terms of qualification and skills over all field-of-study mismatched (Montt, 2015).

reducing efforts to learn German may harm long-term career prospects and hinder integration in society (OECD, 2015d). Public employment services should step in and provide language course vouchers to persons in need, including those in employment.

A sizeable part of over-qualification and field-of-study mismatches can be attributed to excess enrolment in tertiary education, in particular universities, in recent years. Student intake procedures can ensure that students who are admitted are ready for higher education. In Austria, an introductory and orientation period (StEOP) has been introduced in 2011/12 requiring students to obtain a certain number of credits in the first semesters. Students must successfully complete the introductory and orientation period in order to continue their study programme. From an efficiency and fairness standpoint, StEOP appears superior to entry examinations as it allows students to discover the actual study contents, adjust and develop learning processes and compete in a level-playing field. While early evaluation results suggest that StEOP has not significantly altered students' choices in terms of changing or quitting programmes, it may still be too early to draw conclusions on its effectiveness in channelling students to tertiary tracks that best fit their skills and interests (Unger et al., 2015). The government should continue to evaluate StEOP in close co-operation with all stakeholders.

Despite a relatively low share of field-of-study mismatches and an average prevalence of qualification mismatches in Austria (21%), the incidence of over-skilling is among the highest across all countries (17.9% against the average of 10.5%). PIAAC results suggest that the particularly high incidence of part-time work is one of the major drivers for over-skilling in Austria. Accordingly, being in a full-time job reduces the probability of over-skilling by around 11 percentage points. The results further suggest that over-skilling especially affects young cohorts. After controlling for individual and job characteristics, Adalet McGowan and Andrews (2015b) gauge the effect of policy on the probability of skills mismatch (Figure 2.22). Two policy areas seem to stand out in driving Austria's high share of over-skilled workers. First, overly restrictive housing policies, in particular rent controls, impede worker mobility, although this needs to be balanced against other social objectives of housing policies including the fact that Austrians may have a preference for stability of living places (OECD, 2013). The fact that family benefits and social services are bound to the main residence further hinders mobility. Second, the broad coverage of collective bargaining agreements may reduce wage differentials between well-matched and mismatched workers and therefore reduce incentives for better job-skill matches.

Figure 2.22. **Policy reforms can reduce skills mismatch**



Note: Skill mismatch probabilities are regressed on policy variables using logit regression techniques. The regressions control for individual characteristics such as age, marital and migrant status, gender, level of education, firm size, contract type, a dummy for working full-time and working in the private sector. The graph plots predicted skill mismatch probabilities for Austria as well as for the country yielding the lowest and highest predicted probability for the respective policy.

Source: Adalet McGowan, M and D. Andrews (2015), "Skill mismatch and public policy in OECD countries", OECD Economics Department Working Papers, No. 1210. *http://dx.doi.org/10.1787/5js1pzw9lnwk-en.*

StatLink *http://dx.doi.org/10.1787/888933537045*

Early tracking, besides the fact that it leads to social segregation, can contribute to skill mismatches. At the age of 10, and based on performance, pupils are separated into low-track secondary schools (NMS) and high-track secondary schools (AHS). Four years later, a vast majority of AHS pupils (93%) choose a track that ultimately leads to university

entrance qualification while only 45% of NMS students choose that route (Statistics Austria, 2016). While it is difficult to determine the optimal age for tracking, 10 or 11 year-olds are likely not to be in a position to make the best choices about their future. Delaying tracking to the age of 15 has delivered positive results in Poland and other countries have opted for such a solution (OECD, 2012). At a minimum, permeability between tracks should be increased, not least to foster equality of opportunity.

School counselling is an effective tool to reduce labour market mismatches. In Austria, school counselling and guidance is widely available and includes: i) a "career guidance" lecture as part of school curricula in grades 7 and 8, ii) school counsellors available for students in all schools, iii) school psychology services offering professional individual career counselling within or outside the school (complemented by PES services if necessary). In addition, the "Youth Coaching Programme" provides guidance and support to young people at risk of exclusion with the aim of empowering them to take appropriate decisions regarding their continuing training or education after completion of compulsory schooling. Many universities use graduate surveys to inform future students on the employment situation, competences and labour market experiences of graduates. The PES provides further information platforms (e.g. AMS-Qualifikationsbarometer, Karrierekompass). Universities have also undertaken collective efforts to bridge the gap between academia and labour markets. For instance, Career Services Austria links 10 of the largest universities with the business sector by organising recruitment fairs, conducting surveys among students and former graduates and providing career counselling.

Adapting work organisation and management practices

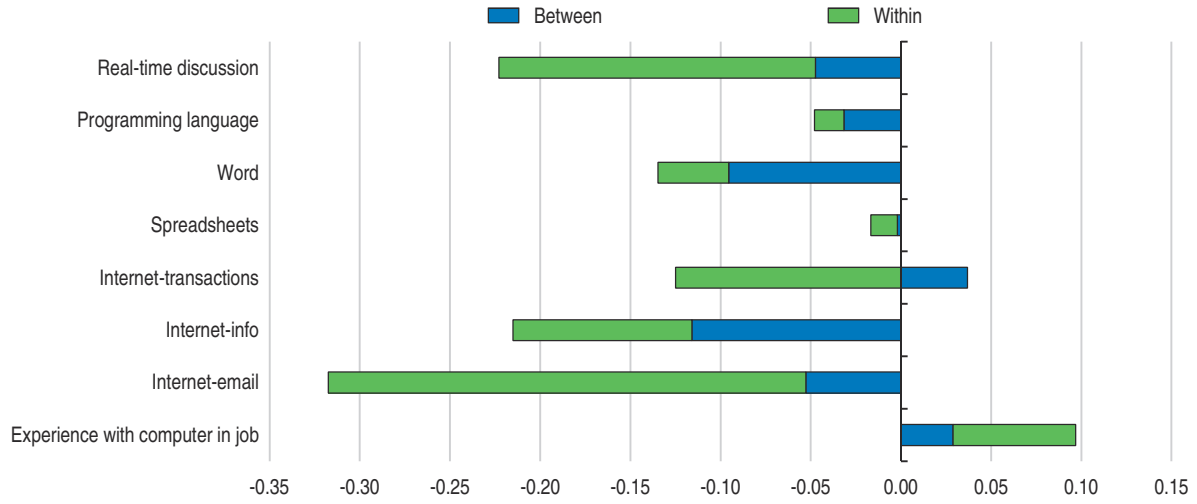
In Austria, the penetration of ICT use at work falls far behind peer countries, except for experience with a computer in the job, signalling a less diverse and comprehensive use of computers and ICT (Figure 2.23). The differences are particularly striking for tasks related to the internet such as real-time discussions, emailing or executing transactions online. They reflect both that the occupational structure is tilted towards sectors that rely less on ICT and that for similar jobs the use of ICT is less important in Austria than in peer countries. Pairwise correlations between skills used show that reading, influencing and horizontal interactions are strongly correlated with generic ICT activities such as the use of internet, spreadsheets or word processing (OECD, 2016d). Accordingly, broadening the penetration of ICT at work places will foster the use of skills that are identified as bottlenecks to automation (see above) and thereby help offset the substitution effect associated with digitalisation.

Work organisation and employee motivation are important drivers for the degree of ICT adoption and the efficient use of ICT competences. Evidence from PIAAC suggests that the use of so-called high-performance work practices (HPWP) proxies the external motivation for workers to make more and better use of skills at work (OECD 2016a, 2016c). HPWP include aspects of work organisation such as team work, autonomy, task discretion, mentoring, job rotation, applying new learning, and aspects of management practices such as employee participation, incentive pay, training practices and flexibility in working hours. While flexibility in sequencing tasks and organising working hours and modalities seems rather high in Austria, work arrangements do not seem to be conducive to learning from co-workers and supervisors or to encourage workers to keep up to date on best working practices (Figure 2.24).

New generations of workers bring a new culture of work. While previous generations were inclined to separate work strictly from private life, the so-called digital natives tend

Figure 2.23. **Differences in the use of ICT at work**

Intensity index as defined in PIAAC (0-5)



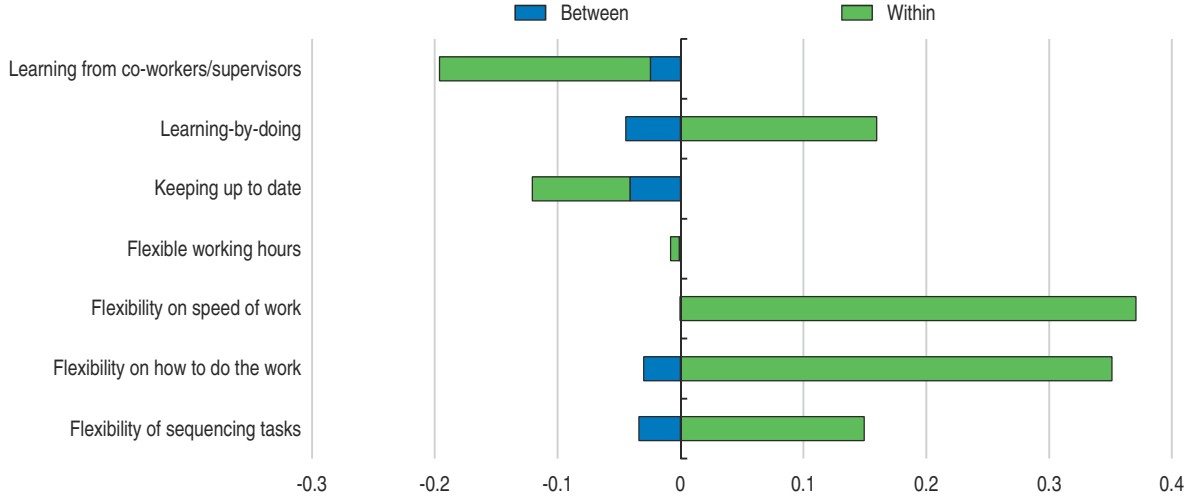
Note: Differences in task intensity between Austria and peer countries are shown. "Between" refer to the contributions of the occupational structure to the overall difference (obtained by resampling Austria's occupations with average sampling weights of peer countries and computing the difference between the non-resampled and the resampled weighted average of intensities across occupations). "Within" differences refer to the contribution of differences in intensity by occupation between Austria and its peers (obtained as the sum of differences in task intensities for each occupation weighted by peer countries' average employment shares). Austria's peer countries are Denmark, the Netherlands and Sweden.

Source: Calculations based on PIAAC (2012, 2015).

StatLink http://dx.doi.org/10.1787/888933537064

Figure 2.24. **Difference in the prevalence of learning and flexibility at work**

Intensity index as defined in PIAAC (0-5).



Note: Differences in the characteristics between Austria and peer countries are shown. "Between" refer to the contributions of the occupational structure to the overall difference (obtained by resampling Austria's occupations with average sampling weights of peer countries and computing the difference between the non-resampled and the resampled weighted average of characteristics across occupations). "Within" differences refer to the contribution of differences occupation by occupation between Austria and its peers (obtained as the sum of differences in characteristics for each occupation weighted by peer countries' average employment shares). Austria's peer countries are Denmark, the Netherlands and Sweden.

Source: Authors' calculation based on PIAAC (2012, 2015).

StatLink http://dx.doi.org/10.1787/888933537083

to mix work and leisure time more. For many, the burden of availability outside office hours is outweighed by increased flexibility in organising one's work, for instance, *via* tele-working or flexible working time arrangements. According to the 2015 European Labour Force Survey, only about 12% of Austrian employees occasionally work from home against 18% in Denmark, 21% in the Netherlands and 26% in Sweden. The government should engage in a dialogue with social partners to raise awareness and define a regulatory framework for a modern work environment that may also include a right to disconnect as recently introduced in France.

The European Working Conditions Survey suggests that the job strain is higher in Austria than in peer countries. Time pressures as well as the lack of work autonomy and learning opportunities stand out in this regard. Against this background, easing working hour agreements could help improve the quality of the work environment as it would provide more flexibility to organise tasks, reduce time pressures and allow for more autonomy. Statutory daily working time is currently restricted to eight hours with only few exceptions most of which are limited in time and scope. Including overtime, maximum working time is limited to 10 hours per day in most collective agreements. Yet, within the existing Working Hour Act there is ample room to introduce more flexible working time arrangements while respecting the European working time directive. Increased working time flexibility and autonomy would also enable many employees to achieve a better balance with family life.

Recommendations for inclusive labour markets in the digital era

Key recommendations

- Adapt labour law and social institutions to enhance representation and protection of platform workers on the basis of ongoing consultations with social partners. Ensure the portability of ratings for platform workers.
- Continue to modernise ICT-related curricula and teaching methods in schools.
- Ensure that vocational education and training as well as tertiary education systems adjust to changing needs through both decentralised innovation and professional co-operation.
- Enhance incentives for businesses to offer apprenticeship positions, in particular in professions affected by digitalisation.
- Further develop special life-long learning schemes focussing on digital skills.

Further recommendations

- Align financing and spending responsibilities of school funding across levels of government and increase the transparency of resource flows through better monitoring and reporting.
- Introduce needs-based funding formulas for schools and enhance autonomy as planned.
- Re-evaluate early tracking in schools and enhance permeability between secondary schools.
- Consider a generalisation of modular VET tracks and adapt the duration of work-based learning to the productivity profile by type and field of apprenticeships.
- Actively promote a new culture of working including tele-working and other flexible work arrangements that may also include a right to disconnect.

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Austria's transition to a digital economy and society is progressing but is slower than in the most advanced economies. A whole-of-government approach should help embrace change and facilitate the flourishing of innovative businesses, work practices and lifestyles throughout Austria. Digitalisation will redesign production processes and alter the relationships between work and leisure, capital and labour, the rich and the poor, the skilled and the unskilled. Under the aegis of the "Digital Roadmap" they issued earlier in 2017, policy makers will need to ensure equality of opportunities in the race with technology, and find the appropriate level of redistribution of the gains associated with digitalisation to foster social cohesion.

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