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# INCLUSIVE LABOUR MARKETS IN THE DIGITAL ERA: THE CASE OF AUSTRIA

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## ABSTRACT/RÉSUMÉ


### Inclusive labour Markets in the digital era: the case of Austria

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 working paper 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.

This working paper relates to the *2017 OECD Economic Survey of Austria* (www.oecd.org/eco/surveys/economic-survey-austria.htm).



JEL Classification: J21, J23, J24, J31, K31, O33, O35

Keywords: future of work, technological change, digital skills, platform workers


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### Marchés du travail inclusifs dans l'ère numérique: le cas de l'Autriche

La numérisation est une des mégatendances affectant les sociétés et les marchés du travail, parallèlement au changement démographique et à la mondialisation. La quatrième révolution industrielle repensera les processus de production et modifiera les relations entre le travail et les loisirs, le capital et le travail, les riches et les pauvres, les travailleurs qualifiés et les non qualifiés. Le degré de perturbation induit par la transformation technologique à venir dépend largement du cadre politique. La numérisation peut mener quelque part entre les inégalités croissantes et l'amélioration généralisée des conditions de vie et de travail. Deux questions principales se posent aux décideurs politiques: comment assurer l'égalité des chances dans la course à la technologie et comment trouver le niveau approprié de redistribution des gains associés à la numérisation pour préserver la cohésion sociale. Dans ce contexte, ce document de travail analysera la transformation des marchés du travail induite par la technologie, plaidera pour un nouveau contrat social et examinera la manière dont la fourniture et l'utilisation des compétences doivent s'adapter à l'environnement de travail numérique.

Ce document de travail se rapporte à l'*Étude économique de l'OCDE de l'Autriche 2017* (www.oecd.org/fr/eco/etudes/etude-economique-autriche.htm).



Classification JEL: J21, J23, J24, J31, K31, O33, O35

Mots clefs: avenir du travail, changement technologique, compétences numériques, travailleurs de plateformes

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## The future of work

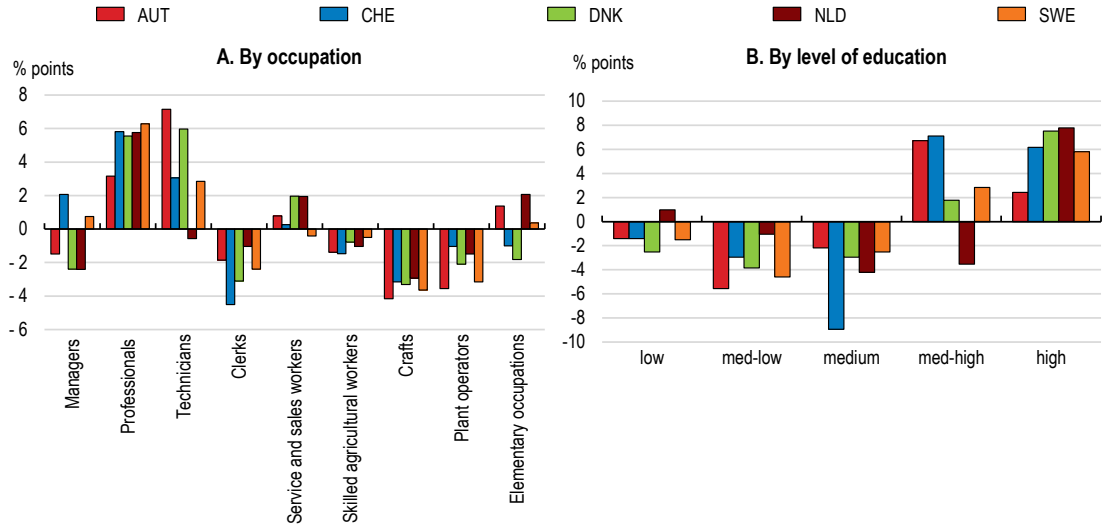
### *Facing automation anxiety*

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 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.

1. The author works as economist at the OECD Economics Department. He is grateful to Austrian officials and members of the Economic and Development Review Committee for valuable comments and inputs. Special thanks are due to Rauf Gönenç and Vincent Koen for their guidance and inspiration, to Jon Pareluissen for useful comments and suggestions to Béatrice Guérard for statistical and graphical inputs as well as to Sisse Nielsen for excellent editorial assistance (all members of OECD's Economics Department). The document has benefited from numerous contributions from other OECD directorates; Andrew Wyckoff, Dirk Pilat and Vincenzo Spiezia from the Directorate for Science, Technology and Industry (STI); Pauline Musset and Thomas Radinger from the Directorate for Education and Skills (EDU); Angelica Salvi Del Pero, Herwig Immervoll and Paolo Falco from the Directorate for Employment Labour and Social Affairs (ELS) and Bert Brys from the Centre for Tax Policy and Administration (CTP).

**Figure 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 2011-2015. 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).

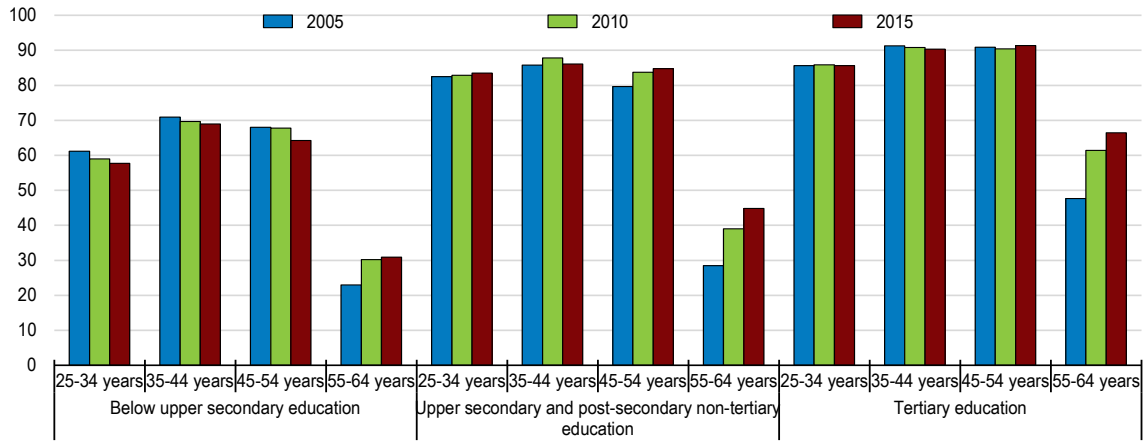
*Source*: European Labour Force Survey.

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).

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). 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.

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.

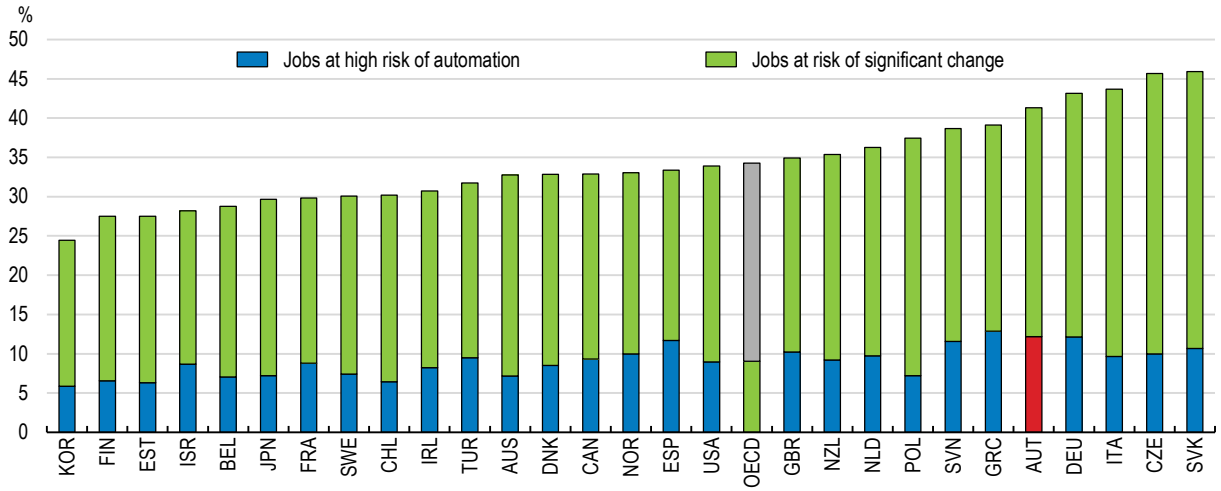
**Figure 2 - Employment rates in Austria by age and level of education**




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

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 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 3 - Automation will affect a large share of jobs**

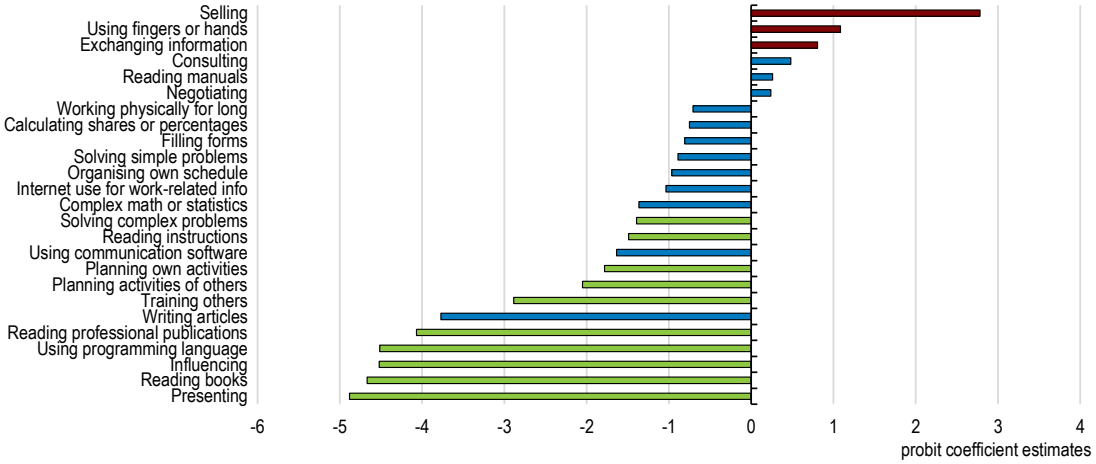



*Note*: Jobs are at high risk of automation if the likelihood of their job being automated is at least 70%. Jobs at risk of significant change are those with the likelihood of their job being automated estimated at between 50 and 70%. Data for Belgium correspond to Flanders and data for the United Kingdom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

The mapping from occupations to tasks also sheds light on the determinants of job automatibility (Figure 4). PIAAC tasks that are found to present the strongest and most significant safeguards against automation, by declining order of significance, are "doing 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".

**Figure 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).

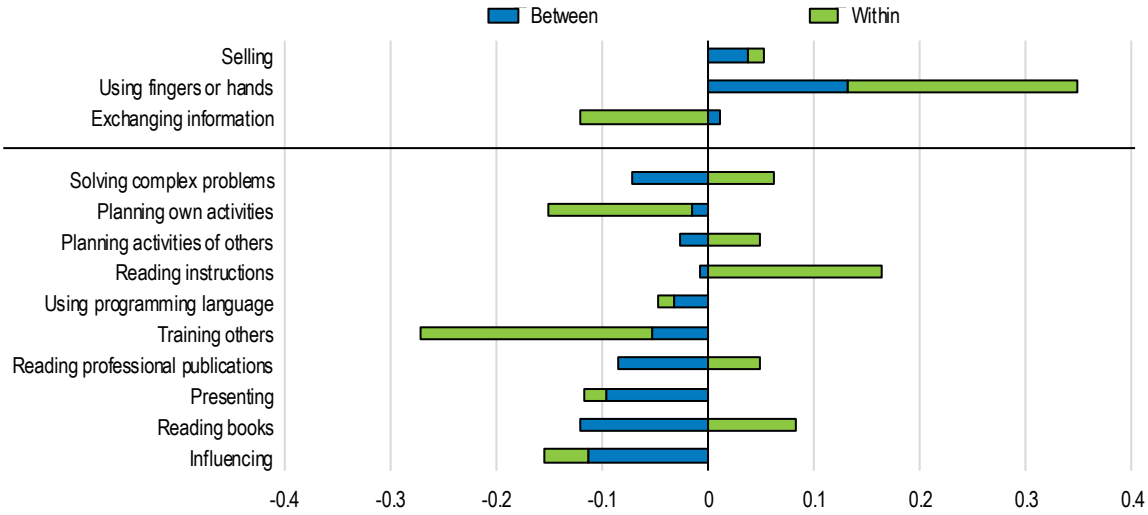
*Source*: Calculations based on Arntz et al. (2016).

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 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 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 (Gönenç and Guérard, 2017). 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.

**Figure 5 - Differences in skills use at work between Austria and peer countries**

Intensity index as defined in PIAAC (0-5)



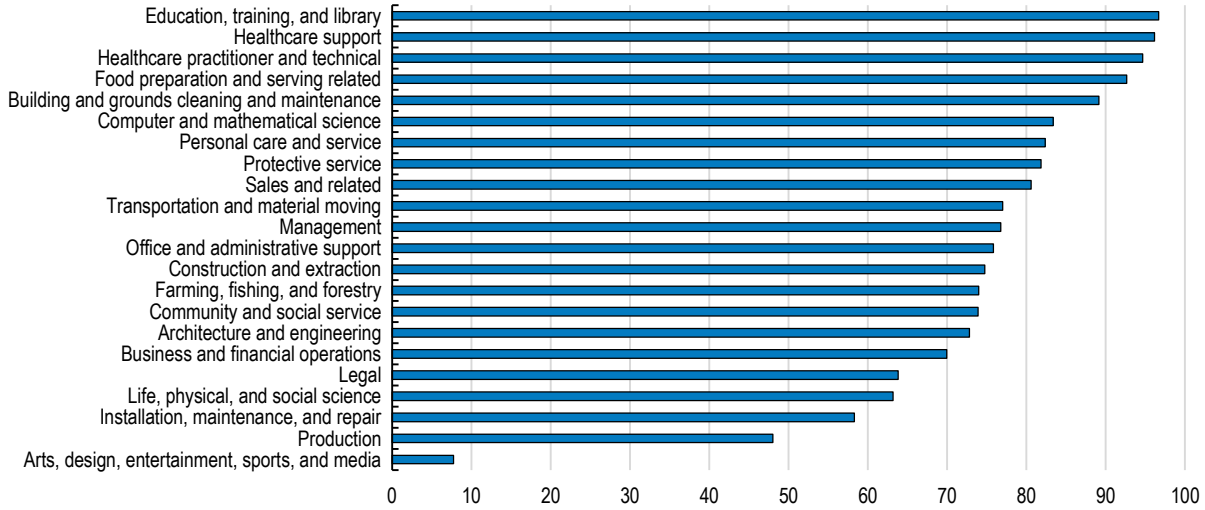

*Note*: Differences in the task intensity between Austria and peer countries are shown. "Between" refer to the contributions of the occupational structure to the overall difference (obtained by resampling Austria's occupations with average sampling weights of peer countries and computing the difference 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).

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 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 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.

**Figure 6 - "Bright outlook occupations" in the United States**

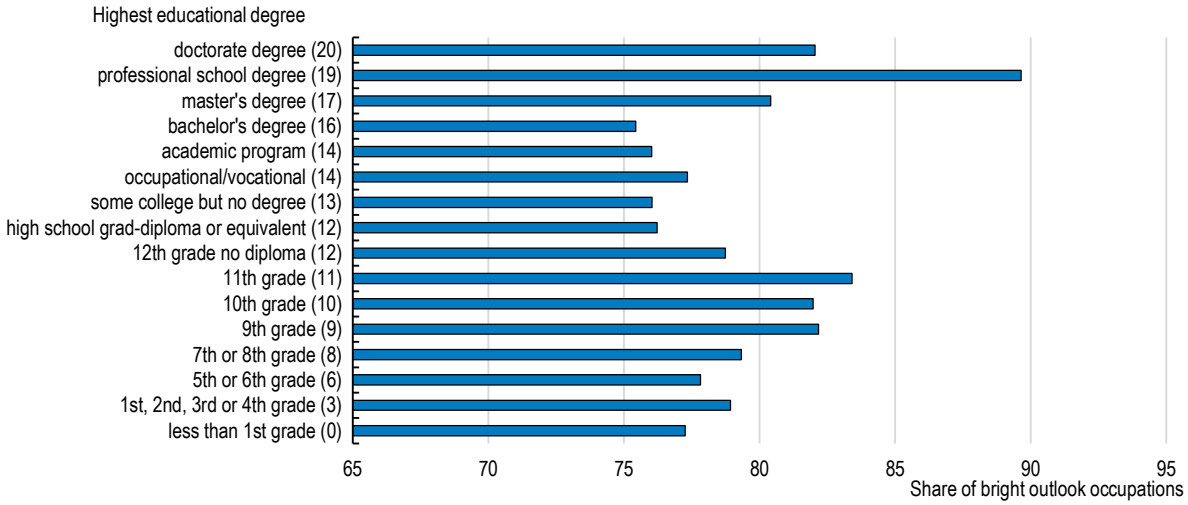



*Note*: Share of bright outlook occupation in major occupational group as of November 2016.

*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.

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 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 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.

**Figure 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.

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 (DSTI/CDEP/GD(2017)4) 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 (Gönenç and Guérard, 2017), 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 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.

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.

**Box 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 (€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.
- 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 €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: €87.15, €174.30 or €261.45 per month |
| - benefits | 55% of net income plus additional benefits for dependent family members. | €23.36, €37.42 or €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 €52.69 |

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

### *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.

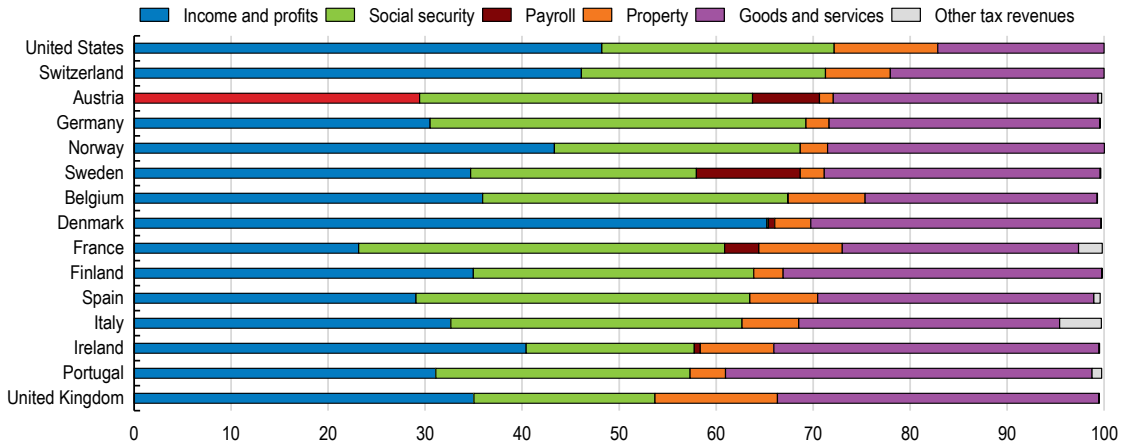
Redistribution within firms is subject to collective bargaining agreements that cover the bulk of the labour market in Austria. Profit sharing can take the form of bonuses, employee stock ownership plans or reduced working time. As for the latter, Austria has successfully experimented with the so-called leisure option that allows workers to waive pay increases against reductions in weekly working time (see *2015 Economic Survey of Austria*). 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 coordination (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 8), the highest share in the OECD after the United States and Switzerland, both countries with considerably less redistribution.

**Figure 8 - Structure of general government revenues**

Per cent, 2014



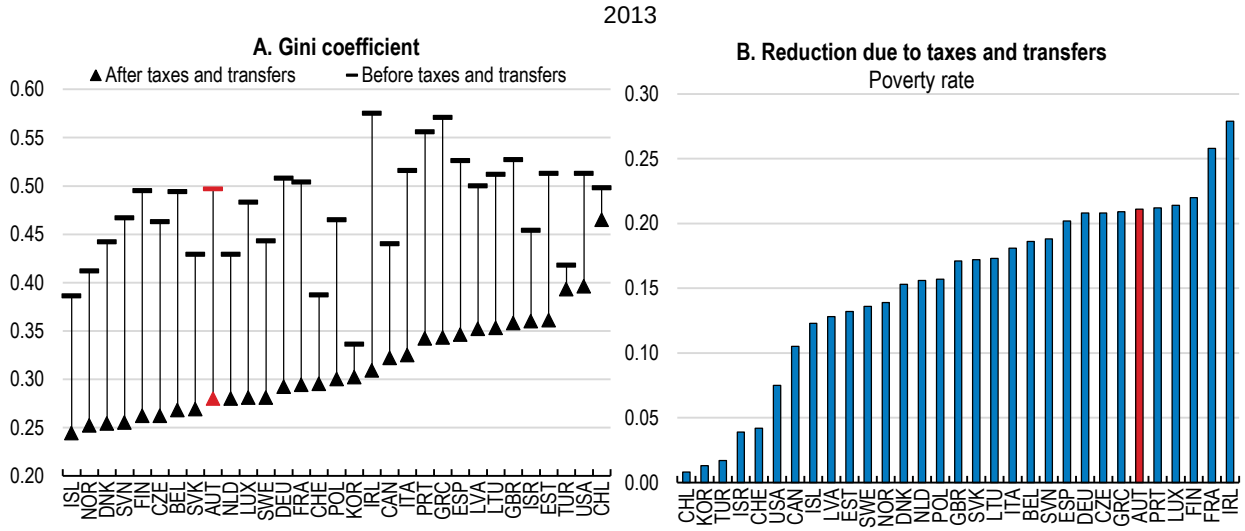

Note: Sorted by share of taxes mainly related to labour (sum of income and profits, social security and payroll).

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

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 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 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%).

**Fiigure 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.

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 coordinated 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.

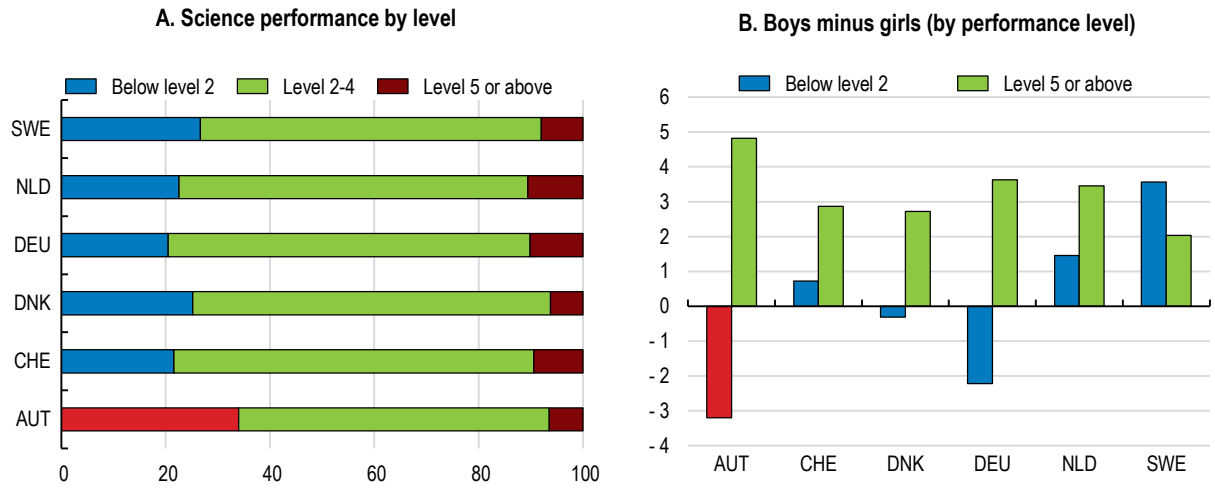
Building on the OECD Programme for International Student Assessment (PISA), OECD (2015a) has tested how the shift from print to digital affects reading skills of 15-year-olds. The results suggest that performance in digital reading is below the OECD average in Austria, and lower than in print reading – 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 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 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.

**Figure 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

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). 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).

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 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.

**Box 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):

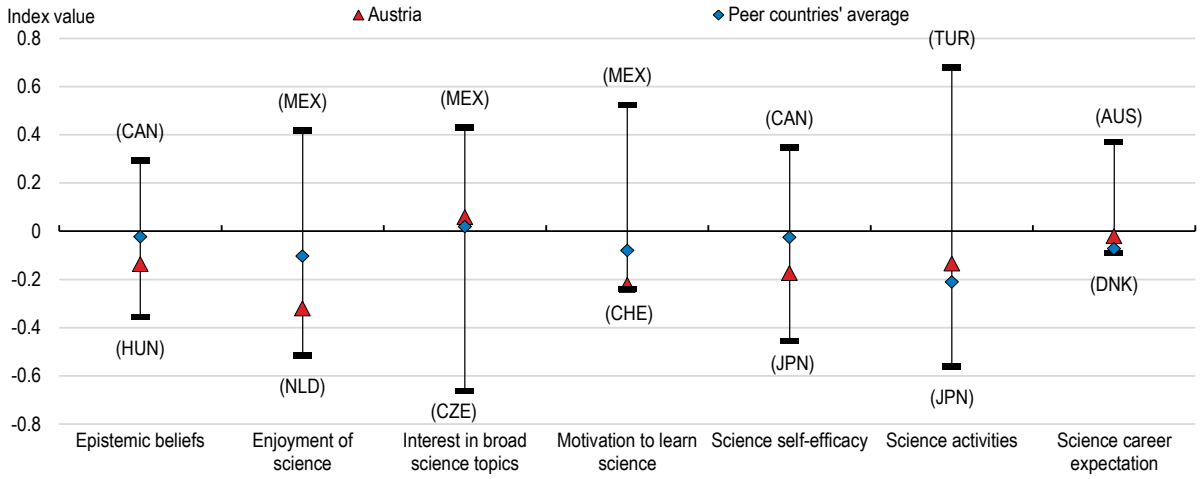
- The creation of school clusters and further development of school partnerships.
- Full autonomy in the organisation and design of lessons.
- Greater autonomy in the selection of teaching staff.
- Switch to demand-driven staff-training.
- Harmonisation of requirement profiles for school principals with a stronger focus on management skills.
- Greater autonomy in the use of support staff.
- Harmonisation of monitoring and coordination 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.

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 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 11 - Attitudes towards science**




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

*Source*: PISA 2015.

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 cooperation with the Federal Ministry for Transport, Innovation and Technology. Provide all students in 5$^{th}$ grade (start of lower secondary schools) with tablets and all students in 9$^{th}$ 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.

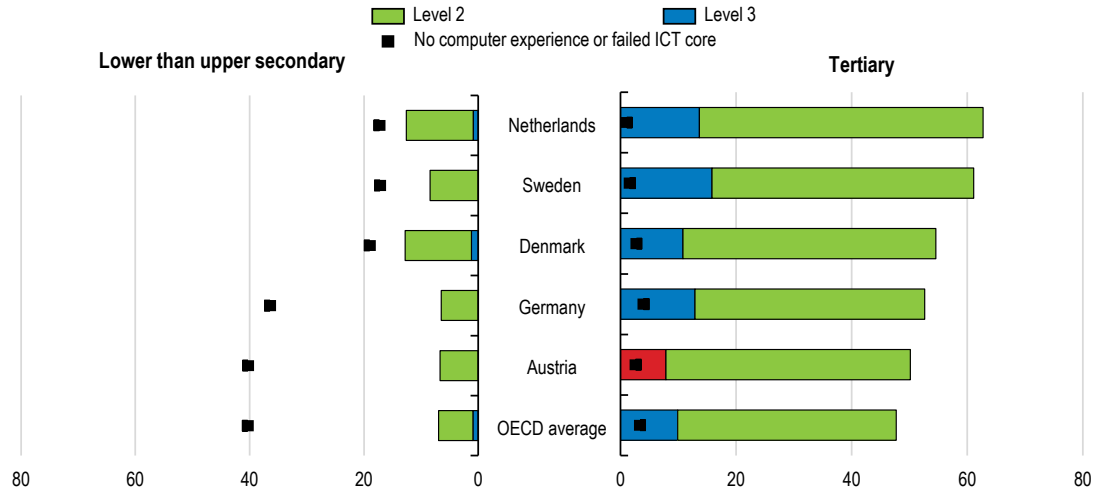
Implementation will start in September 2017 with pilot schools before being extended to all schools. Future PISA assessments will tell whether the educational reform 2015 (Box 2) together with the "School 4.0" initiative bring about better student performance. In general, there seems to be a glut of initiatives and strategies including from the European level and it is not clear whether and how these programmes are coordinated 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 Gönenç and Guérard, 2017, Figure 7, 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 7, 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 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), 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 12 - Problem-solving by educational attainment**

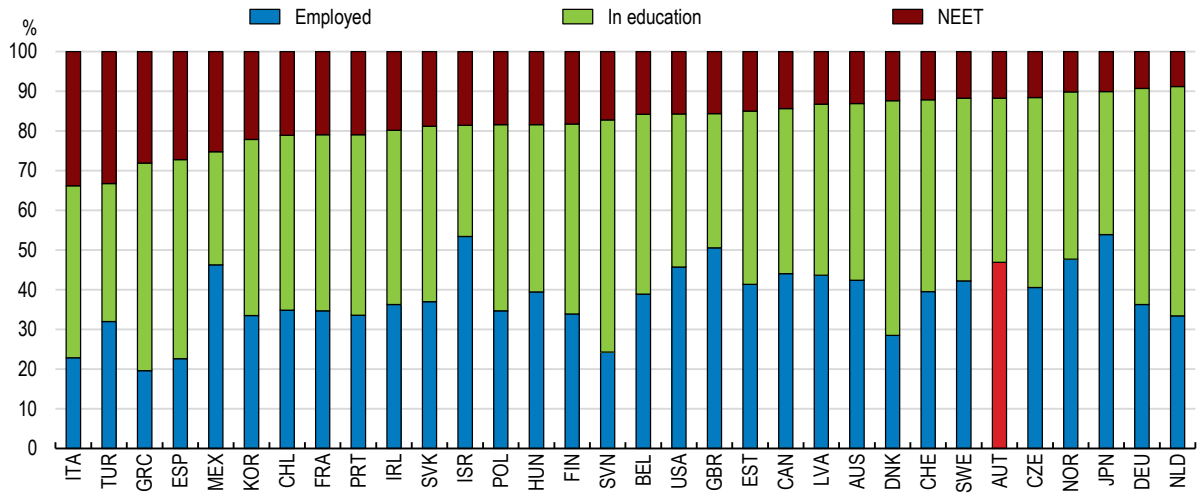



*Source*: Survey of Adult Skills (PIAAC) (2012, 2015).

### *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 13).

**Figure 13 - Status of the 20-24 year-olds**




Note: NEET refers to the share of those that are not in employment, education or training.

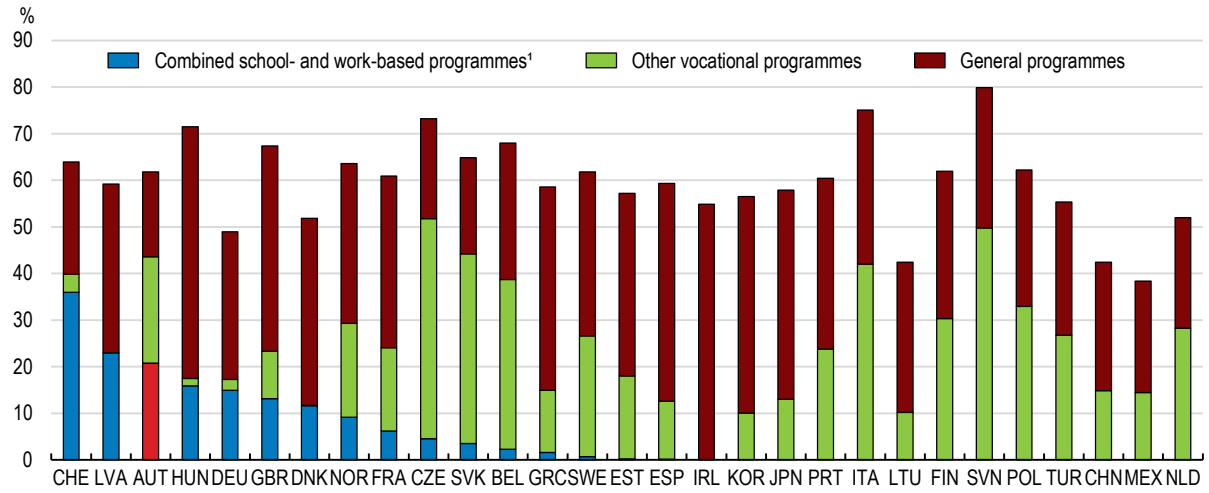
Source: OECD, Education at a Glance 2016 (database).

*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 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 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.

**Figure 14 - Upper secondary enrolment rates of 15-19 year-olds**




Note: 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.

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.

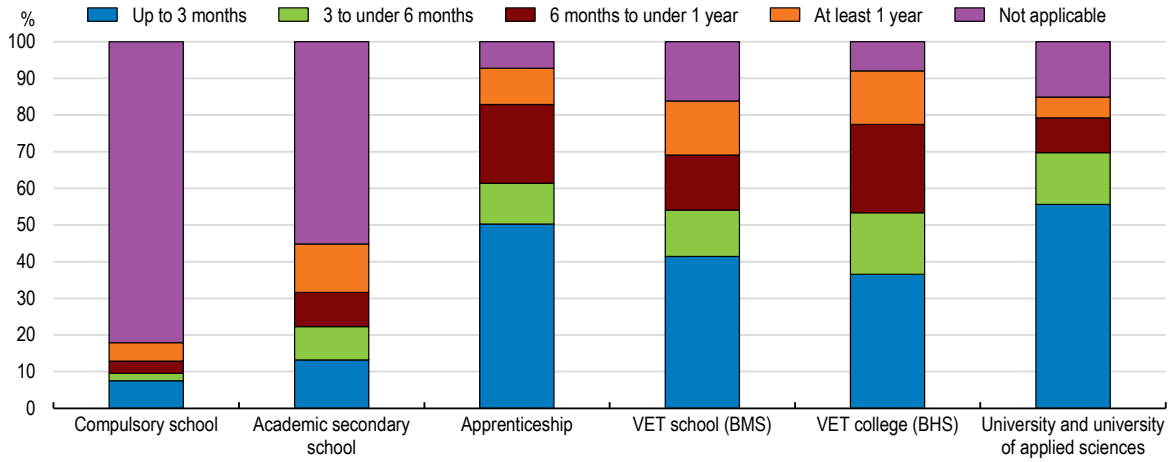
The strong labour market orientation of UAS is underpinned by the need for external accreditation and labour market orientation. Ensuing from the Act on quality assurance in higher education (HS-QSG,

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 15).

**Figure 15 - Time to first employment by type of education**



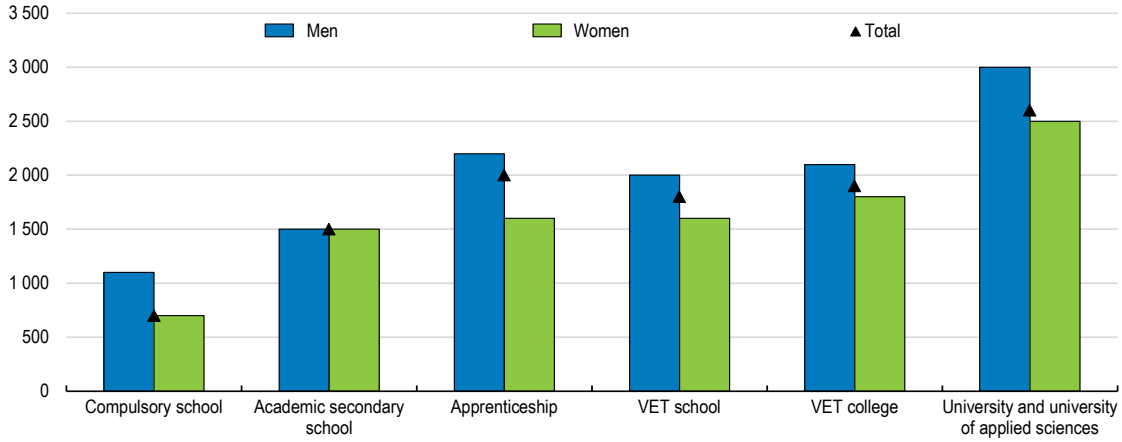

Note: Excludes graduates who engaged in further education or training during the first two years after graduation.

*Source*: Statistics Austria, Monitoring of education-related employment behaviour 2016 - Graduates.

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 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).

**Figure 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.

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 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 7000 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 coordinate 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 2 in Gönenç and Guérard, 2017); 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.

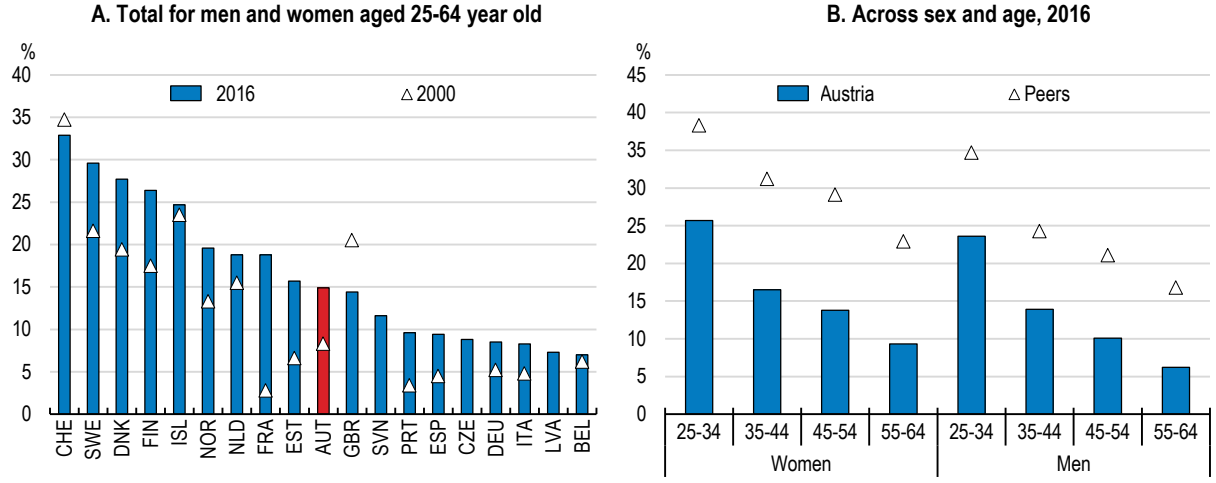
***Promoting life-long learning solutions***

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 (Gönenç and Guérard, 2017, Figure 7, 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 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 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 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.

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 3). Regional chambers of labour provide vouchers in Austria, but scope and coordination 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 3 - Singapore's SkillsFuture programme**

Since 2015, the government has been providing a S$500 (around €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.

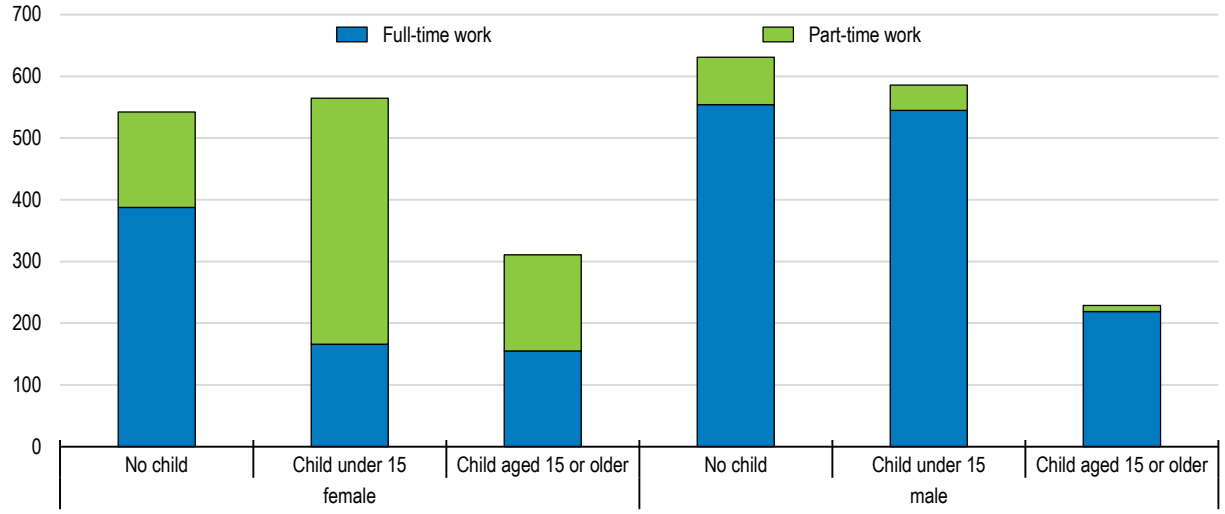
## Using skills effectively in the labour market

### *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 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 18 - Employment by gender and age of youngest child in household**

Thousand employed persons aged 25-54 years old, 2016




*Source*: Statistics Austria.

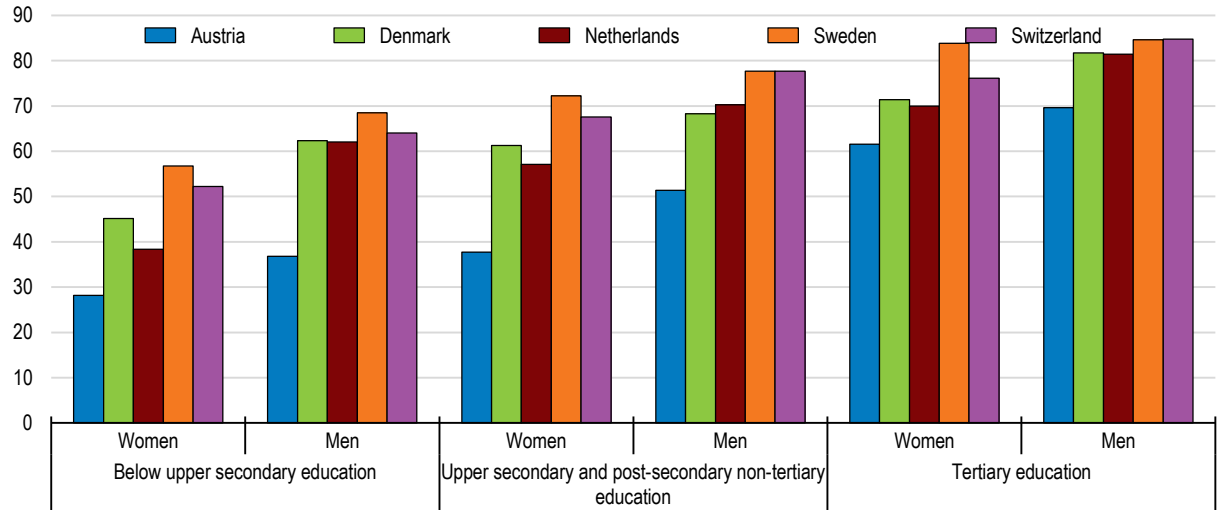
The implications for aggregate human capital are manifold. First, due to the incompatibility of work and family lives, well-educated women postpone the birth of their first child in order to pursue their career. The rate of childless women aged 40-44 has increased from 7.6% in 1996 to 21.5% in 2010 and 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 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 19 - Employment rates of 55-64 year olds**

Per cent, 2015

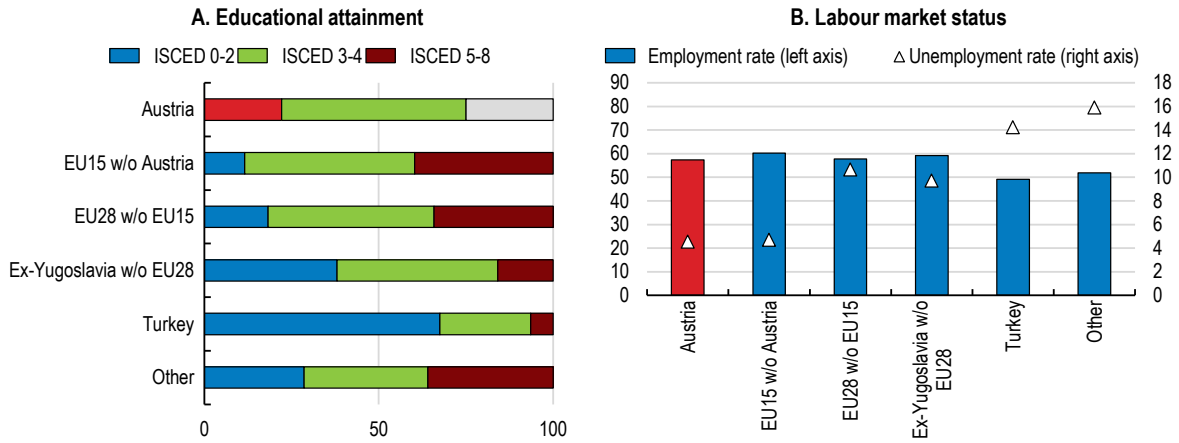



*Source*: OECD, Education at a Glance 2016.

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 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 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.

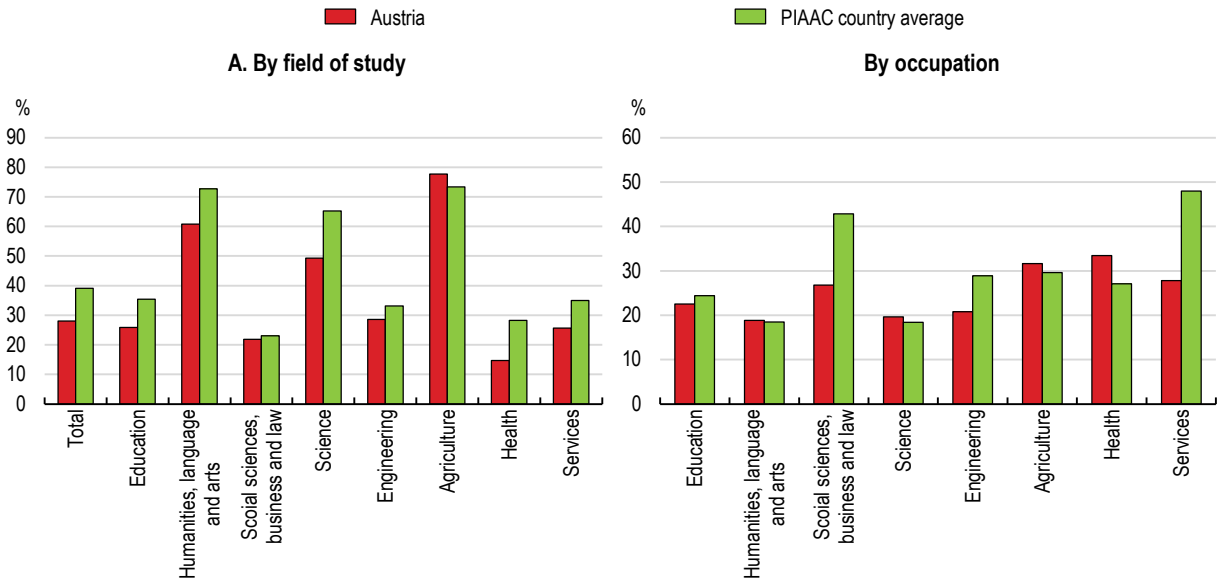
*Source*: Statistics Austria.

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 3). 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 21, Panel A). The distribution of mismatched workers across occupational groups is somewhat more even (Panel B). 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.

**Figure 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. DOI: http://dx.doi.org/10.1787/5jrxm4dhv9r2-en.

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 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 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 cooperation with all stakeholders.

**Box 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 95$^{th}$ percentile of that distribution he or she is considered as over-qualified. If the worker's education falls below the 5$^{th}$ percentile of that distribution he or she is considered as under-qualified. If the worker's education falls between the 5$^{th}$ and the 95$^{th}$ 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 95$^{th}$ percentile of that distribution he or she is considered as over-skilled. If the worker's proficiency score falls below the 5$^{th}$ percentile, he or she is considered as under-skilled. If the worker's proficiency score falls between the 5$^{th}$ and the 95$^{th}$ percentile, he or she is considered as well-matched in terms of skills.

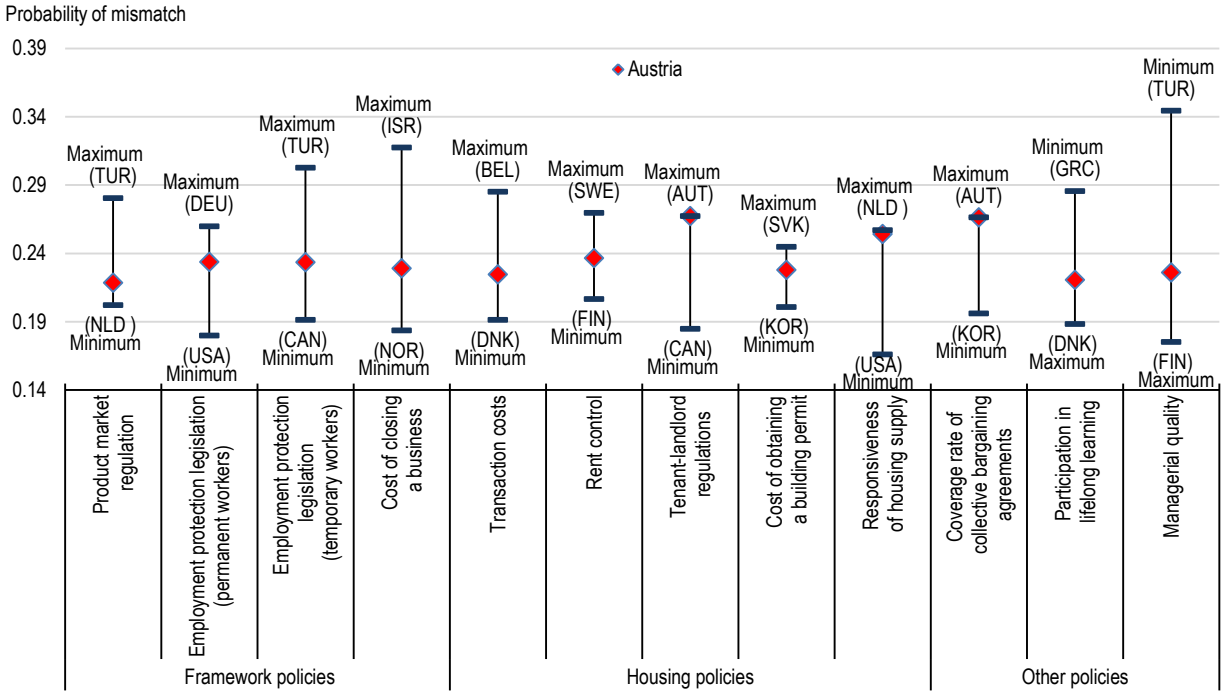
**Skill transferability**: The index gauges the ability of workers to fulfil qualification and skill requirements outside their field of study, thereby shedding light on the transferability of their acquired skills. It is defined as the ratio of those who are field-of-study mismatched but well-matched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

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 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.

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.

**Figure 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.

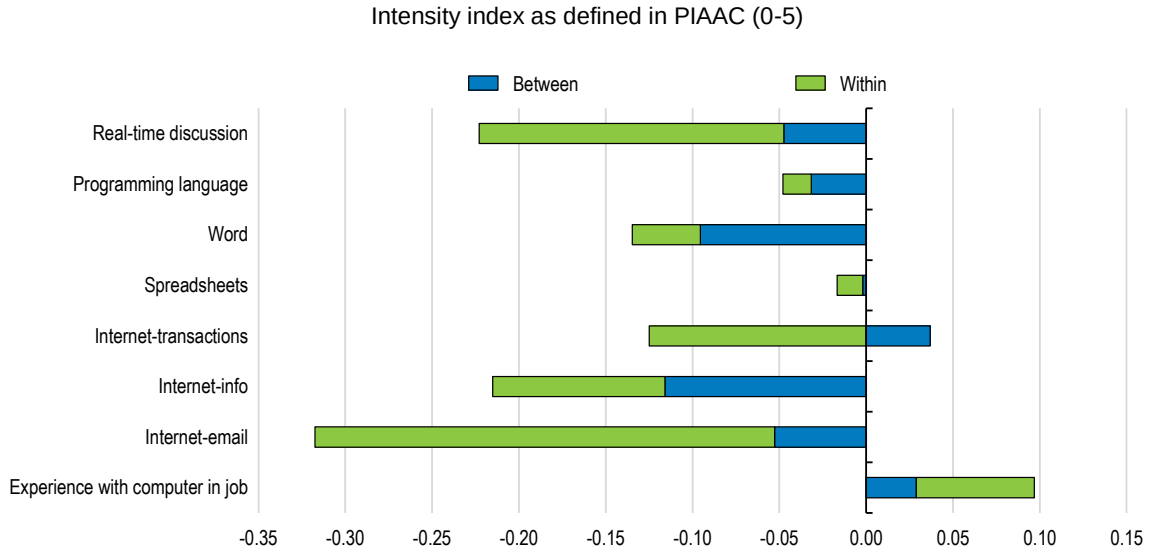
School counselling is an effective tool to reduce labour market mismatches. In Austria, school counselling and guidance is widely available and includes: i) a "career guidance" lecture as part of school curricula in grades 7 and 8, ii) school counsellors available for students in all schools, iii) school 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 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.

**Figure 23 - Differences in the use of ICT at work**




*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.

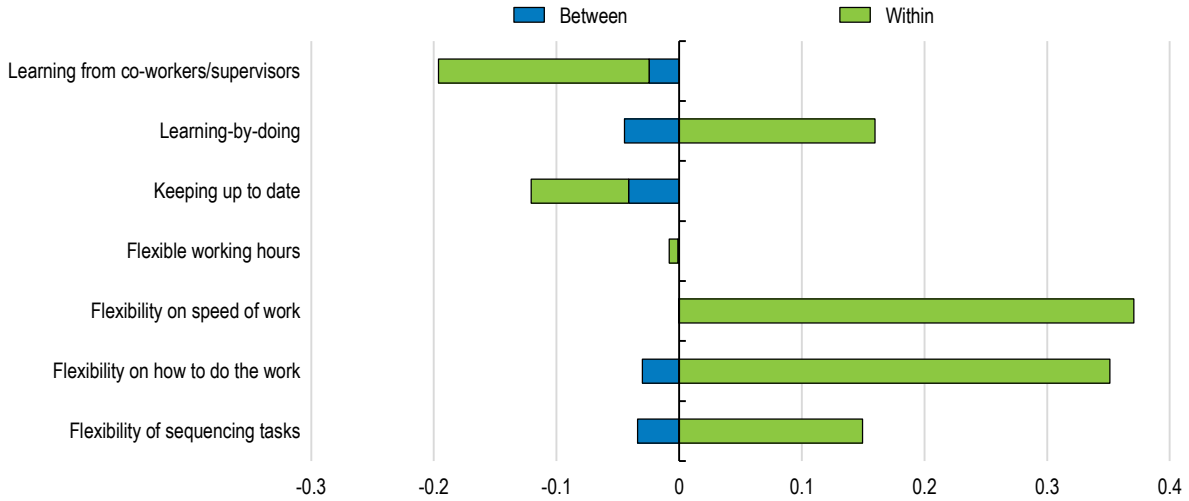
*Source*: Calculations based on PIAAC (2012, 2015).

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 24).

**Figure 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).

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 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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