

TOWARDS THE IMPLEMENTATION OF THE G20 ROADMAP FOR DIGITALISATION: SKILLS, BUSINESS DYNAMICS AND COMPETITION

*Report prepared at
the request of the 2017
G20 German Presidency*

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FOREWORD

In 2017, in Düsseldorf, G20 Ministers responsible for the digital economy agreed to a forward-looking work plan for the G20 on the digital transformation and jointly adopted *A Roadmap for Digitalisation: Policies for a Digital Future* (the “Roadmap”) as part of the G20 Digital Economy Ministerial Declaration (“Düsseldorf Declaration”). In Hamburg, G20 leaders laid out their actions to support sharing the benefits of globalisation (“G20 Leaders’ Declaration: Shaping an Interconnected World”), where leaders stated that the *G20 Roadmap for Digitalisation* will help guide future work to harness digitalisation.

The Roadmap was an important step towards action, building upon recent discussions in the G20 that had identified the digital economy as a critical policy area for G20 countries to address. Notably, in Antalya in 2015, G20 leaders observed that we are living in a digital age and that the effective use of digital technologies is an important driver for efficiency-enhancing and economic structural optimisation. In Hangzhou in 2016, G20 countries agreed to the G20 Digital Economy Development and Cooperation Initiative, which proposed some common principles and key areas of development and cooperation for the digital economy.

The Roadmap identifies 11 policy areas as focal points for action, ranging from improving access and adoption of digital technologies, to expanding infrastructure and supporting SMEs, to enhancing trust in the digital era. The selection of these policy areas was informed by the OECD study *Key Issues for Digital Transformation in the G20*, which was presented at a joint G20 Presidency – OECD conference in Berlin on 12 January 2017 and served to inform the debate within the Digital Economy Task Force under the German Presidency.

In order to support G20 countries in their efforts to implement the Roadmap, at the request of the 2017 G20 German Presidency, the OECD has produced this report, which focuses on three key areas for policy action identified in the Roadmap. The overall purpose of the work is to strengthen the evidence base in support of G20 discussions on these critical policy areas and to help inform future policy actions.

The first chapter focuses on Action 7 of the Roadmap: “Enable all people to adapt to and excel in the digital economy and society”. It sheds light on how the digital transformation is changing the demand for skills, and what role digitalisation and skills formation can play in narrowing the gender wage gap. It also shows the extent to which rewards (or returns to skills) differ depending on the extent to which industries have been penetrated by digital technologies, and offers evidence about the extent to which returns to skills differ by gender. This analysis provides concrete elements to support the designing and promotion of effective strategies across G20 countries on digital literacy and skills development for the digital economy and could help guide any desired collective action to address the transition from current to future skills and training needs.

The analysis in the second and the third chapters aims at supporting the implementation of Action 4 of the Roadmap: “Foster competition in the digital economy”, which also noted the possibility to “consider reviewing the OECD Competition Assessment Toolkit in light of digitalisation”. To support G20 countries in shaping effective policies to follow-up and implement their commitment, Chapter 2 looks at the evolution of business dynamics and competition across industries and countries, and its relation to the degree of digital intensity of the industries in which firms operate. By contributing to the evidence base, it aims to inform G20 discussions on how best to promote favourable conditions for the development of the digital economy and foster entrepreneurship, investment and innovation through effective contestability of markets. Chapter 3 then summarises a survey of national and local regulatory policies that affect digitalisation, with a view to informing discussions on how regulatory structures may need to evolve over time, taking account of technical conditions and policy priorities.

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CHAPTER 1

SKILLS AND GENDER IN THE DIGITAL TRANSFORMATION

Digitalisation is driving structural change, leading to the creation of new sectors and new sources of growth for traditional industries, but also the demise of others. It offers opportunities for countries to leapfrog, to deepen engagement in global value chains, and to boost the inclusiveness of societies, but it also exposes countries to risks which need to be managed. In particular, digitalisation is changing labour markets across the G20 countries: some jobs are lost due to automation, others will change in their nature and task content, while new jobs will also emerge as the digital revolution unfolds. As the content and nature of jobs change, so do the skills required to perform them, shaping labour supply and demand, employment patterns and the demand for skills associated with existing as well as newly emerging jobs. While the digital transformation in the form of computerisation has thus far mainly affected jobs that entail the performance of routine tasks, new technological developments such as Artificial Intelligence (AI), the Internet of Things (IoT) or big data may trigger even more uncertainty about the future as they may be affecting non-routine tasks as well, and the demand for the skills of workers currently performing such tasks.

At the G20 Digital Economy Ministerial Conference in Düsseldorf on 6-7 April 2017, G20 Members agreed to a forward-looking work plan for the G20 on the digital transformation and jointly adopted “A Roadmap for Digitalisation: Policies for a Digital Future” (the “Roadmap”). The Roadmap noted the importance of enabling all people to adapt to and excel in the digital economy and society. In particular, G20 members agreed to encourage and promote effective strategies on digital literacy and skills development (Action 7), to enable all women and men, and underrepresented or disadvantaged groups, to successfully adapt to the requirements of a digital economy and society. This important commitment by the G20 Ministers responsible for the Digital Economy takes into account and builds on the G20 Initiative to Promote Quality Apprenticeships, the G20 Skills Strategy, and the target to reduce the gender gap in labour market participation by 25% by 2025, towards which important progress has been made as reported in the OECD-ILO report “Women at work in G20 countries”¹.

To support G20 countries policy making in these areas, the present report sheds light on three key issues. The first is how the digital transformation is changing the demand for skills, and what role digitalisation and skills formation can play in narrowing the gender wage gap. To this end, the report provides evidence about the extent to which labour markets reward workers’ cognitive skills (i.e. skills acquired through education such as literacy and numeracy), as well as non-cognitive skills (i.e. skills that are generally only partially learnt at school and that relate to people’s attitudes) and personality traits. It further shows the extent to which rewards (or returns to skills) differ depending on the extent to which industries have been penetrated by digital technologies. Finally, it offers evidence about the extent to which returns to skills differ by gender. In particular, it shows the extent to which labour market returns to women and men differ and whether (or not) wage gaps change when skills are taken into account.

The fact that some industries may be willing to pay relatively higher wages to workers endowed with certain types of skills signals that such skills are in relatively higher demand (or, equivalently, in relative shortage). Hence, analysing returns to skills provides important information about which types of skills are (more) needed for the digital transformation and how the demand for the different types of skills is met by labour market supply. Also, it is reasonable to expect that skills that are more complementary to digital technologies than others (e.g. Goldin and Katz, 1998; 2008) represent an important complement to the deployment of digital technologies in the workplace. As such, they will command higher returns, especially in sectors featuring relatively higher levels of generation and adoption of digital technologies. Understanding this is essential for the design of effective and forward-looking education, skills and employment policies, as well as efforts to address the gender divide.

Training is the second key issue addressed in this report. Understanding which types of workers get trained is important given that training empowers people by building human capital and by aligning skills' supply and demand on the labour market. To this end, attention is devoted to identifying the types of workers that most benefit from job-related training programmes, to assess whether these are also the workers that would need training the most, in light of the digital transformation. The focus here is on how engagement in and the duration of on-the-job training relates to workers' cognitive skills (e.g. literacy, numeracy) and the intensity of their jobs in routine tasks. The analysis further highlights how these relationships change if workers are employed in a digital intensive industry, as compared to less-digital intensive sectors, or depending on workers' gender. Results suggest that governments need to re-think and better target current training programmes to ensure that the least skilled workers and those working in jobs at a relatively higher risk of automation are equipped to face the challenges posed by the digital transformation.

A final section of the report uses the results of a purposely implemented survey to benchmark policies, such as training or mentoring, aimed at improving people's skills to effectively navigate the digital transition, especially for disadvantaged segments of the population. Policy plays an important role in providing assistance to disadvantaged groups, as well as women and girls, by creating access to the tools needed to develop the necessary skills for the digital economy and thereby contributing to reduce the digital divide. Some conclusions and technical annexes complete the report.

1.1. A stronger evidence base for policies on skills in the digital economy

This first section of the report briefly presents the data sources used for the analysis and provides descriptive evidence on the skills that workers need to cope with the digital transformation. Most of the analysis in this report is based on worker-level information from the OECD Survey of Adult Skills, as well as on a wide array of OECD data sources used to measure the degree to which the digital transformation is permeating different industries.

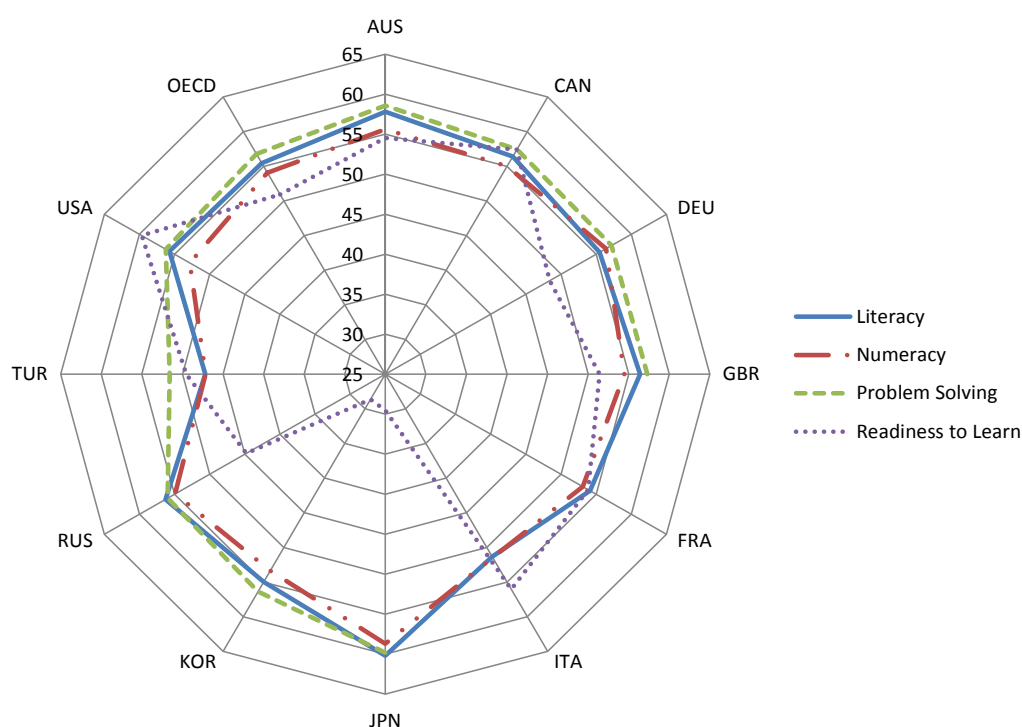
The OECD Survey of Adult Skills performed in the context of the Programme for the Assessment of Adult Competencies (PIAAC) is an extensive survey that covers 31 OECD countries and partner economies, including eleven G20 countries. It is representative of the population between the age of 16 and 65 and provides a wealth of information about the workers' themselves (e.g. education, age and gender), their cognitive skills, the tasks that they perform on the job, and their workplace, among others. The analysis presented here relies on the two rounds of PIAAC for which data are available: the first PIAAC data collection completed in 2011-12 and covering 22 OECD countries and the Russian Federation (OECD, 2013), and the second collection finalised in 2014-2015 in 6 OECD countries, plus Singapore and Lithuania (OECD, 2016).²

The OECD Survey of Adult Skills tests the cognitive skills of adults along three dimensions: literacy, numeracy and problem solving in technology rich environments. In addition, it provides information on the frequency with which workers perform several tasks. These on the one hand relate to reading and writing, as well as numeracy, ICT and problem solving, and thus partially match the set of cognitive skills assessed through the tests. On the other hand, they relate to the performance of management, communication, organisation and planning, and physical tasks. Also, PIAAC provides information on workers' attitudes towards learning, trust and health, among others, based on self-reported assessments.

The analysis in this chapter relies on the three measures of cognitive skills assessed through tests in PIAAC, and on the six skill-related task-based indicators detailed in Grundke et al. (2017),³ which capture the key cognitive, non-cognitive and social skills that workers are endowed with. These six task-based skill indicators mirror: information and communication technologies (ICT)-related skills; science, technology, engineering and mathematics (STEM) and quantitative skills; marketing and accounting skills; non-cognitive skills such as managing and communication and self-organisation; and socio-emotional skills such as readiness to learn and creative problem solving.

Figure 1.1 shows some stylised facts about the average skill endowment of cognitive skills and readiness to learn for the working population of eleven G20 countries and the average of the OECD countries in the sample. To enable comparisons, the skill indicators considered are rescaled between 0 and 100. Doing so allows appreciating the heterogeneity in skills endowment that exists within G20 countries. Compared to the other G20 countries considered, Japan, Korea and Russia display relatively higher values for cognitive skills, but do not perform as well, on average, in terms of readiness to learn and creative problem solving. The United States, Canada and Italy display the highest readiness to learn and creative problem solving skills among the countries in the sample.

Figure 1.1. Average skill levels for selected G20 countries, 2012 or 2015



Note: Skill indicators are rescaled between 0-100. OECD averages are calculated across the 28 OECD countries that participated in PIAAC, namely: Australia, Austria, Belgium (Flanders), Canada, Chile, the Czech Republic, Germany, Denmark, Estonia, Finland, France, Greece, Ireland, Israel, Italy, Japan, Korea, the Netherlands, New Zealand, Norway, Poland, the Slovak Republic, Slovenia, Spain, Sweden, Turkey, the United Kingdom (England and Northern Ireland), the United States. Equal weights are given to all countries. Italy, France and Spain did not take part in the PIAAC assessment tests for problem solving in technology rich environments. The data for the Russian Federation excludes the metropolitan area of Moscow.

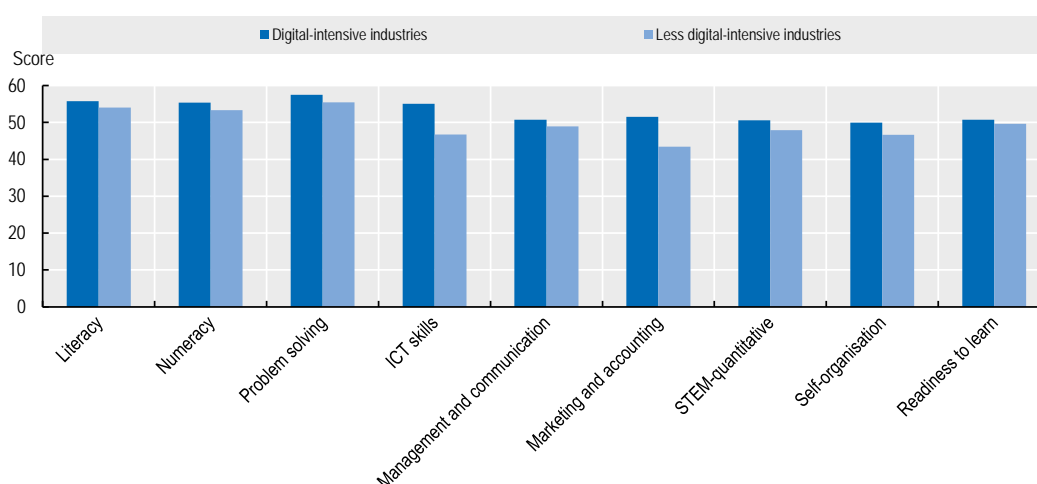
Source: OECD calculations based on PIAAC.

To investigate which skills are needed for the digital transformation and to assess how the digitalisation of industries shapes the demand for different types of skills – both cognitive and non-cognitive skills – this report builds on recent OECD work proposing a taxonomy of digital intensive sectors. The taxonomy reflects the degree to which sectors have been permeated by the digital transformation and takes into account some of the many facets that the digital transformation may take. These include digitalisation’s technological component (proxied by a sector’s intensity in ICT investment, purchases of intermediate ICT goods and services, and robots); its human capital requirements (i.e. ICT specialists); and one of the new forms characterising market access in the digital era, namely e-commerce.⁴ A single metric combining all these aspects and mirroring the extent to which industries have been digitalising is used to rank 36 two-digit ISIC⁵ sectors and to subdivide them in two groups. Depending on whether they rank above or below the median, industries are grouped into two subsets, namely “digital intensive” and “less digital intensive” industries. Examples of digital intensive industries are *Transport Equipment* and *Telecommunications*, whereas *Chemicals and chemical products* as well as *Basic pharmaceutical products and pharmaceutical preparations* feature among less digital intensive industries (see Table 1.A1.2 in the Annex 1.A1 for details).

1.2. Which skills for the digital transformation?

Consensus exists about the fact that generating and adopting new technologies, including digital ones, requires workers to be endowed with certain (set of) skills allowing them to cope with and thrive in the digital transformation. However, little is known about which skills are most needed and whether and to what extent workers in digital intensive industries differ from workers in less digital intensive ones in terms of skills endowment. Also, as the digital transformation will ultimately affect all industries, including those that at present are less digital intensive, it is important for policy to understand which skills to invest in, and how to help adapt the skills of workers to the opportunities and challenges imposed by the digital transformation.

Figure 1.2. Average skill levels in digital and less digital intensive industries, 31 OECD countries and partner economies, 2012 or 2015



Note: Skill indicators are rescaled between 0 and 100. Averages across countries are computed given the same weight to each country. All differences in skill means between digital and non-digital industries are significant at the 5% level. The sample covers the following 31 countries: Australia, Austria, Belgium (Flanders), Canada, Chile, the Czech Republic, Germany, Denmark, Estonia, Finland, France, Greece, Ireland, Israel, Italy, Japan, Korea, Lithuania, the Netherlands, New Zealand, Norway, Poland, the Russian Federation (excluding Moscow), Singapore, the Slovak Republic, Slovenia, Spain, Sweden, Turkey, the United Kingdom (England and Northern Ireland), the United States.

Source: OECD (2017c).

Figure 1.2 shows the average levels of workers' skills observed in digital and less digital intensive industries, across 31 countries. Workers in digital intensive industries on average exhibit a greater endowment of all types of skills, i.e. cognitive as well as non-cognitive and social skills. Differences are especially pronounced in the case of ICT skills and of marketing and accounting skills.

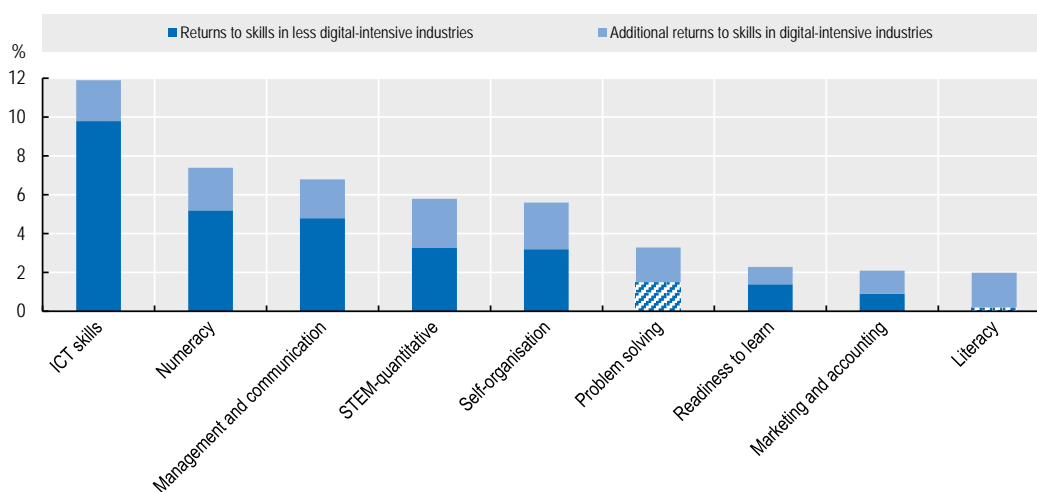
The differences portrayed in Figure 1.2 may relate to some observable characteristics of the workers, such as their educational achievement, occupation, experience or age. Also, they may result from a self-selection process whereby (relatively more) skilled workers to work in firms operating in (relatively more) digitally intensive sectors, as they may be (relatively more) innovative and/or (relatively more) productive, and thus pay relatively higher salaries. Also, it may reflect a relative advantage of firms operating in digital intensive sectors to attract the best human capital available on the job market.

Uncovering the relationship that exists between working in digital intensive industries and workers' labour market outcomes, and understanding which skills are in short supply (and/or high demand) and command a wage premium in digital vs. less-digital industries is another way to answer the question of which skills are important for the digital transformation. To this end, the present study uses PIAAC to estimate individual level wage regressions and investigate how different types of skills, i.e. cognitive as well as non-cognitive skills and personality traits, are rewarded by labour markets. It further sheds light on whether these rewards (or returns to skills) differ between industries that are more digitally intensive, as compared to those that have undergone the digital transformation to a lesser extent.⁶

The rich set of individual-level information available in the Survey of Adult Skills makes it possible to estimate the role of skills in determining wages, with greater accuracy than in the past.⁷ Thanks to the PIAAC-designed assessment, information is available about workers' cognitive abilities in literacy and numeracy – a rare feature of individual wage regressions. In addition, the tests make it possible to limit possible mismeasurement issues. Lastly, using the six task-based skill indicators in Grundke et al. (2017), light can be shed on how other types of skills relevant for performance on the job and for firm performance are rewarded. These include cognitive and non-cognitive and social skills, as well as some personality traits. The present report therefore proposes first-time estimates of the returns to these task-based skills using rich cross-country data and taking into account country, industry and occupation specificities as well as the cognitive skills of workers.

Figure 1.3 shows that for a number of skills that are important for performance on the job and for firm performance, labour market returns are higher in digital industries than in less-digital industries. Among them, ICT skills, numeracy and STEM-quantitative skills, as well as self-organisation and management and communication skills seem to be especially important in digital intensive industries. This may be due to the fact that workers in digitally intensive industries may need to operate in a more independent and decentralised fashion (e.g. through telework), perform relatively more non-routine tasks, or have to deal with continuously changing settings for which technical skills coupled with communication and organisational skills are increasingly important.

Figure 1.3. Additional labour market returns for various types of skills in digital intensive industries, 31 OECD countries and partner economies, 2012 or 2015



Note: Labour market returns to skills are based on OLS wage regressions (Mincer equations) using data from the OECD Survey of Adult Skills (PIAAC) and the pooled set of 31 OECD countries and partner economies. The skill measures are based on PIAAC and are taken from Grundke et al. (2017). Digital industries are defined using a new measure for digital penetration developed by the OECD. The figure shows the percent changes in wages for an increase in skills by one standard deviation. Shaded bars signal that the coefficient is not significant at the 5% level.

Source: OECD (2017c).

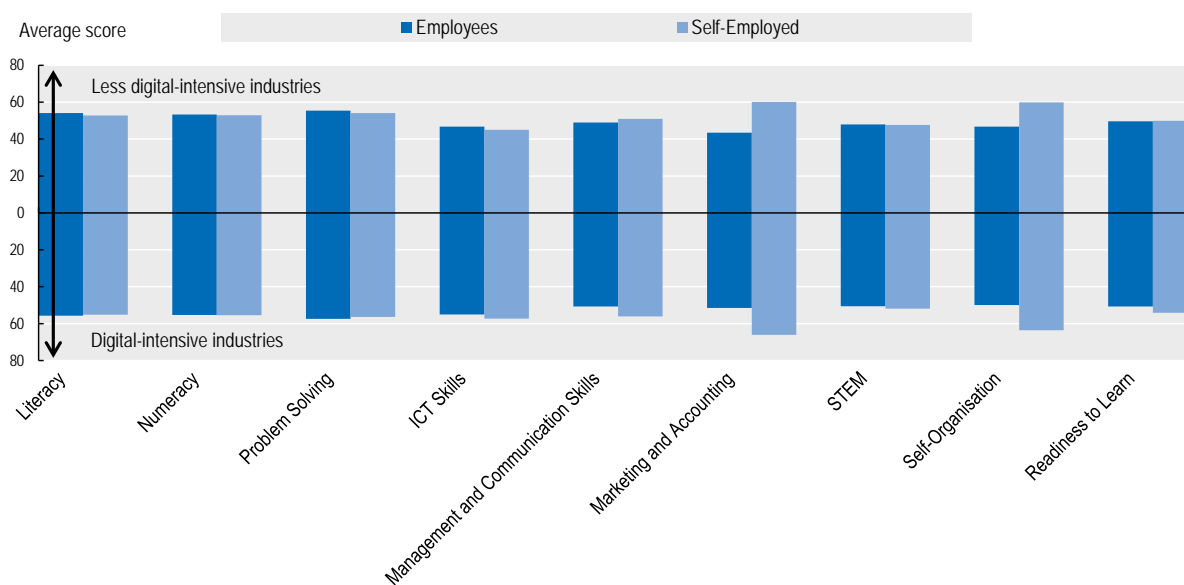
The results shown in Figure 1.3 are not driven by the observable characteristics of workers generally known to relate to higher wages or higher skill levels, as workers' years of education, age and gender are taken into account when performing the estimations. Also, wages are net wages and the results take into account the skills and the specific occupation in which workers are employed. This is done as the occupational composition of digital intensive industries may differ from that of less digital intensive ones, and could thus influence the wage premia that workers' skills command. The same is true for the industry in which individuals work, as industries differ in average productivity, capital or innovation intensity, and these may in turn shape wages and thus returns to skills.

The additional skill premium earned in working in digital intensive industries suggests that skills and digital technologies are complements in the production process. Hence, in light of the progressive digital transformation of production, it is important to (continue to) invest in the skills required to cope with the opportunities and challenges of going digital. Policy needs to (re)consider how to best equip people with the wide range of skills needed to cope with and thrive in the digital transformation, and continue doing so over time: as digital technologies evolve, so will the skills needed to work and live in this new technological paradigm. This is true not only for cognitive skills, especially quantitative ones, but also for socio-emotional skills, and for combinations of these skills.

The analysis above has thus far only considered employees and has excluded self-employed individuals. It may nevertheless be interesting to see whether and to what extent the skills of employees differ from those of the self-employed, to shed some light on the skill endowment of entrepreneurial individuals as well as individuals employed in “non-standard work” including part-time, temporary and freelance work. Employees and self-employed in fact need not display the same skills level, nor be equally well equipped for the digital transformation.

Figure 1.4 presents the average skills of employees and self-employed working in digital and less digital intensive industries across 31 OECD countries and partner economies. Self-employed individuals show slightly lower levels of cognitive skills in both digital and less-digital intensive industries. This might relate to the fact that entrepreneurs, who are included in the self-employment category together with other forms of independent labour (e.g. sub-contractors or freelancers), may leave the education system slightly earlier than other workers to start their enterprise. It may also be due to freelancing requiring proportionally higher levels of non-cognitive skills, and to the possible depreciation of the acquired knowledge that results from spending proportionally more time in tasks related to e.g. management or business planning. While speculative in nature, these arguments seem to some extent be supported by evidence: self-employed are generally better equipped with managing and communication, marketing and accounting as well as self-organisation skills. These skills, which are especially important to run a business, are acquired to a lesser extent at school than cognitive skills.

Figure 1.4. Average skill levels for self-employed and employees in digital and less digital intensive industries, 31 OECD countries and partner economies, 2012 or 2015



Note: Skill indicators are rescaled to the interval 0-100. Averages across countries are computed giving the same weight to each country. All differences in skill means between self-employed and employees are significant at the 5% level, except for numeracy in digital intensive industries, and STEM and readiness to learn in less digital intensive industries. The sample covers 31 countries, namely: Australia, Austria, Belgium (Flanders), Canada, Chile, the Czech Republic, Germany, Denmark, Estonia, Finland, France, Greece, Ireland, Italy, Israel, Japan, Korea, Lithuania, the Netherlands, New Zealand, Norway, Poland, the Russian Federation (excluding Moscow), Singapore, the Slovak Republic, Slovenia, Spain, Sweden, Turkey, the United Kingdom (England and Northern Ireland), the United States.

Source: OECD calculations based on PIAAC.

One caveat to the figures shown is that, due to the PIAAC categorising both entrepreneurs and sub-contractors or freelancers as self-employed, the present analysis cannot provide in-depth evidence on which skills are most needed for entrepreneurship.

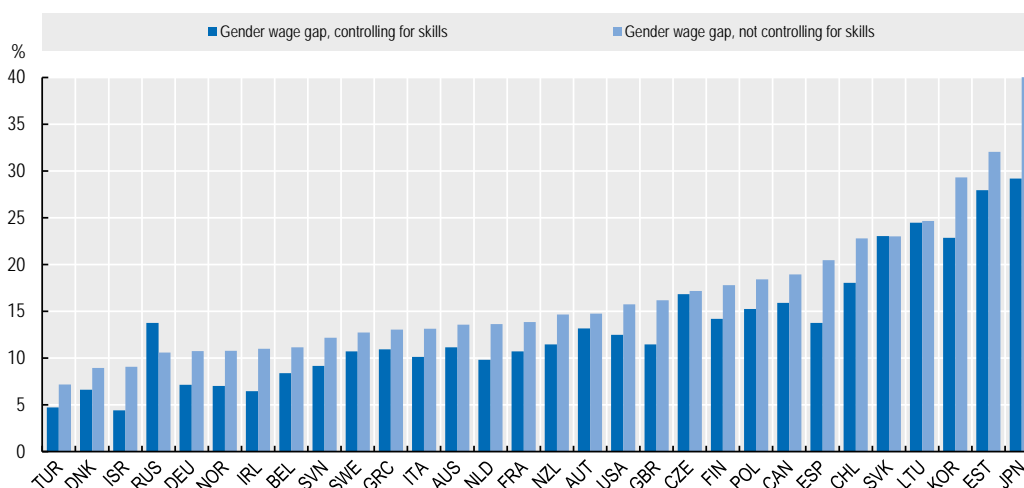
Finally, based on the results shown above and guided by the skills complementarity hypothesis, whereby skills may be even more important when bundled together, one may ask whether a certain type of skill gets rewarded not only because of its intrinsic usefulness in production, but also because of its synergies with other skills. Future work could analyse the complementarities between different types of skills by considering skills “in bundles” rather than taken in an individual fashion. Such line of work would inform G20 countries about the sets of key skills their citizens might need to succeed in the digital era. Such information would be extremely valuable for the design and implementation of education and training programmes, as well as to enhance labour market participation and workers’ performance.

1.3. Digitalisation and skill formation as a chance to narrow the gender wage gap?

Performing an analysis similar to the one shown above helps shed light on the challenges that various parts of the population, including women and disadvantaged individuals, may face. Descriptive evidence suggests that women often earn significantly less than men, even after considering many individual and job-related characteristics, including age, educational attainment, and sector of activity.

Results of econometric analysis confirm the existence of a gender wage gap and show that the skills endowment of male and female workers explains part of the gender wage gap that emerges across countries, but does not tell the whole story. Figure 1.5 plots the association between a worker’s gender and her wage, holding other individual characteristics constant. Differences in wages for men and women get reduced when one takes into account possible differences in skills endowment. However, a big part of the gender wage gap remains. Hence, while differences in skill endowments between male and female workers do explain an important part of the gender wage gap, other sources of wage inequality emerge. These may include firms’ organisational choices and employees’ unobservable characteristics, as well as other social, industry and job-related factors, or even discrimination.

Figure 1.5. Gender wage gap by country (in %)



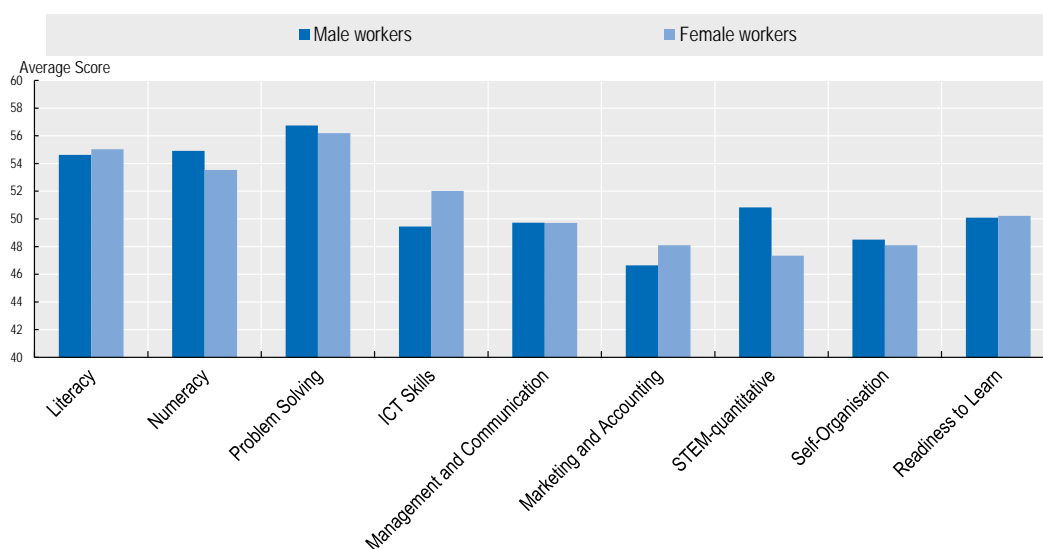
Note: The figure shows the differences in hourly wages for men and women in % (controlling vs. not controlling for various types of skills). The estimates for the gender wage gap are based on OLS wage regressions (Mincer equations) using data from the OECD Survey of Adult Skills (PIAAC). The skill measures are based on PIAAC and are taken from Grundke et al. (2017).

Source: OECD (2017c).

The evidence shown so far sheds light on the extent to which women and men at work differ in their endowment of cognitive and non-cognitive skills and on the wage premium that accrue to workers of different gender, given their skill sets. The differences that emerge in terms of wages beg a number of policy-relevant questions. Are women paid less because they are less frequently displaying the type of skills commanding (relatively) higher premia (e.g. STEM-quantitative skills)? Or do labour markets reward skills in a different way in the case of male and female workers, net of any other observable difference between men and women? And, is this the case for all types of skills? Given the substantial investments that governments make in education and training, and their interest in ensuring that the generated human capital is leveraged for productivity and societal well-being, it is important to understand whether wage differences reflect genuine differences in skills endowments or are rather triggered by some of the above-mentioned determinants.

Figure 1.6 shows the average skill levels of male and female workers across 31 developed and developing countries. While female workers appear to be generally equipped with relatively better literacy skills, ICT skills and marketing and accounting skills, male workers display greater endowments of numeracy and STEM-quantitative skills, and slightly better problem solving and self-organisation skills. Given that the considered skills are significantly and positively related to labour market returns, the part of the gender wage gap that is explained by skills mainly reflects men's greater endowment of numeracy and STEM-quantitative skills. This might to some extent be explained by women's relatively lower propensity to pursue STEM-related studies. Women in fact account for only 35% of tertiary graduates in natural sciences or engineering, and for 20% of those in computer science (OECD, 2015).

Figure 1.6. Average skill levels for male and female workers, 31 OECD countries and partner economies, 2012 or 2015



Note: All skill indicators are rescaled to the interval 0-100. Averages across 31 OECD countries and partner economies are computed giving the same weight to each country. All differences in skill means between male and female workers are significant at the 5% level, except for Management and Communication and Readiness to Learn.

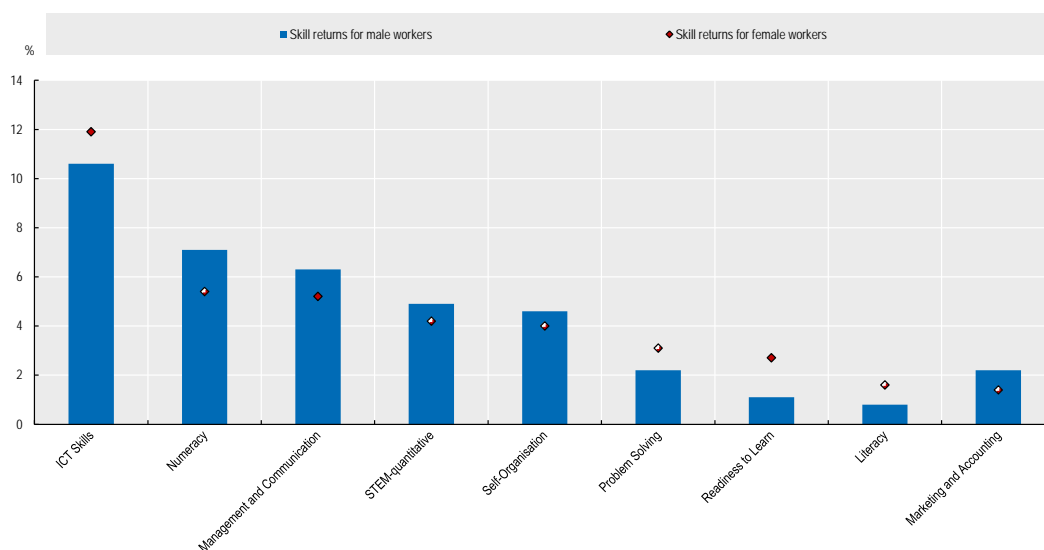
Source: OECD calculations based on PIAAC.

Additional insights can be gained by looking at whether labour markets reward skills in a different way in the case of male and female workers. Figure 1.7 presents selected estimates of the wage returns to skills by gender across 31 countries, and does so following an approach similar to the one proposed in the previous section.⁸ As it is well known that some occupations may display a higher proportion of female employees (e.g. nurses) or male employees (e.g. construction workers), and that wages differ across industries, these very features (and other observable characteristics) are taken into account when calculating the returns to skills by

gender (as done for Figure 1.3). Hence, the evidence presented in Figure 1.7 is not driven by the occupation or the sector that surveyed workers are employed in, nor by differences in the age or education profiles of the men and women in the sample.

The graph shows that for most skills, wage returns do not differ between men and women. However, while men have higher returns to management and communication skills, the returns to ICT skills and readiness to learn are higher for women. This suggests that women may find themselves better off in a digital world, which increasingly demands ICT skills, and is willing to reward them proportionally more.⁹

Figure 1.7. Labour market returns to skills by gender across 31 OECD countries and partner economies, 2012 or 2015

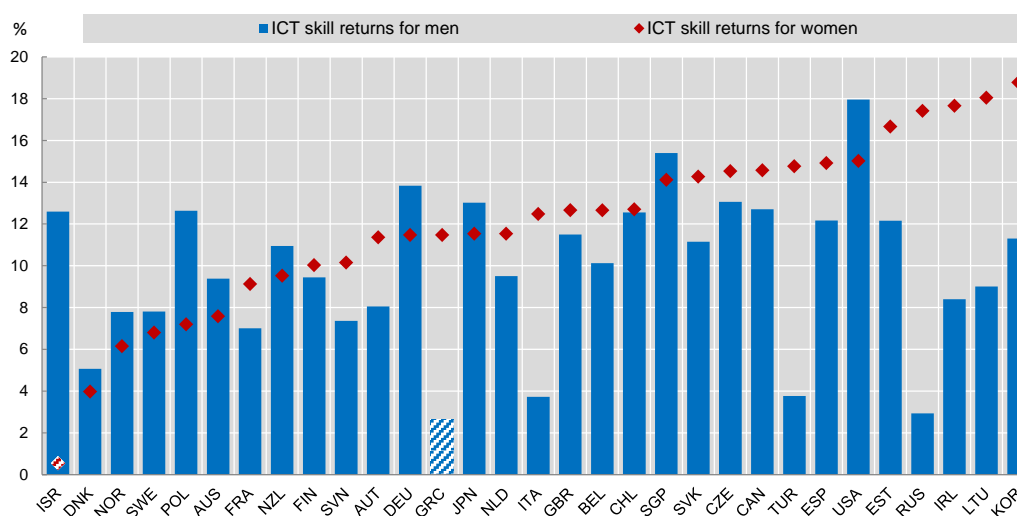


Note: Labour market returns to skills are based on OLS wage regressions (Mincer equations) using data from the OECD Survey of Adult Skills (PIAAC) and using data from 31 OECD countries and partner economies. Skill measures are based on PIAAC and are taken from Grundke et al. (2017). The estimates by gender are obtained through including an interaction term of the skill variable and the gender variable. The figure shows the percentage changes in wages determined by an increase in skills by one standard deviation. Shaded diamonds indicate that the difference between man and women is not significant at the 5% level.

Source: OECD calculations based on PIAAC.

Differences in the returns to ICT skills between women and men, however, do not emerge in all countries. Figure 1.8 shows the returns to ICT skills for men and women separately, for each country in the sample, for an increase of ICT skills of one standard deviation for the average individual. The increase in earnings of female workers related to an increase in their ICT skills ranges from approximately 4% (Denmark) to 19% (Korea) and is on average 12%, holding other observable characteristics of the individual constant. The average return for male workers is slightly lower (10%), but the cross-country dispersion in returns is essentially the same between the male and female workers' sample. This cross-country dispersion in estimates can reflect differences in the net demand for ICT skills in the sample of female vs male workers across countries, as well as cross-country differences in the way labour markets reward talent.

The provision of greater ICT skills for women could actually be a policy lever to narrow the gender wage gap at least in the short term, before the labour market adjusts to the increased supply of ICT skills. Narrowing the gender wage gap may thus require policies aimed to equip female workers with better numeracy, STEM-quantitative skills and ICT skills, to encourage them to pursue STEM-related studies and, more generally, to promote equal earning opportunities for all problem solving or self-organisation skills.

Figure 1.8. Labour market returns to ICT skills, by gender and country, 2012 or 2015

Note: The estimates for the labour market returns to skills are obtained from the OLS estimation of country-specific individual level wage regressions (Mincer equations) using PIAAC data. Skill measures are based on PIAAC and are taken from Grundke et al. (2017). The figure shows the percentage changes in wages determined by an increase in skills by one standard deviation. Shaded bars and diamonds indicate estimates which are not significant at the 5% level.

Source: OECD calculations based on PIAAC.

1.4. Training in the digital era

The digital transformation is changing labour markets and the nature of jobs in ways that will require more and more systematic updating and enhancement of workers' skill sets. Adult learning, by allowing for smoother transitions of individuals between occupations and sectors, or between self-employment and salaried employment, may represent a fundamental policy tool to help people reap the benefits of the digital transformation and minimise its social costs.

The analysis which follows here below (Figure 1.9), however, suggests that the individuals displaying the lowest cognitive skills and the highest routine content of their job, i.e. those jobs exposed to the highest risk of automation, are also those who engage in training the least. This evidence focuses on one type of adult learning, i.e. training on the job,¹⁰ and investigates its determinants, to understand which workers' and jobs' characteristics influence the probability of receiving training and the length of the training received. The analysis further explores whether the association between cognitive skills and the routine content of tasks, and the individual's engagement in training, differ between digital intensive and less-digital intensive industries.

Recent analysis highlights that training has been used to further upskill medium and high-skilled workers. On average, across countries, only approximately 25% of workers receiving training in 2012 or 2015 displayed low skills, with the notable exception of Turkey.¹¹ The frequency with which individuals engage in on-the-job training, however, need not be related to the duration of such training. Several features of the economy (e.g. industry in which workers operate) and of the workers themselves (e.g. age and cognitive skills of surveyed workers) can influence the probability of training and its duration. For these reasons, and more generally to assess the relationship between skills and training net of other possible confounding mechanisms, an econometric analysis is performed.¹²

The main characteristics of interest are the degree to which individuals carry out routine tasks on the job and workers' cognitive skills, i.e. literacy and numeracy. The indicator accounting for the routine task content of jobs is taken from Marcolin et al. (2016) and reflects how codifiable and, ultimately, automatable a worker's tasks are. If routine workers are more likely to be substituted away by labour-saving technologies such as robotisation or computerisation, countries may need to invest in the training of such workers for them to get

the skills needed to find other jobs and to help them better align with production in the digital era. Indicators of workers’ cognitive abilities are taken from PIAAC and mirror the results of test-based assessments. While more skilled individuals may need less training than less skilled individuals to perform the same job, skilled individuals may also be those benefitting the most from training, as this may, for instance, increase their marginal productivity (and salary) on the same job, or help them transition to better paid jobs. Also, it is known that training is often used as a way to reward the performance of (the best) workers.

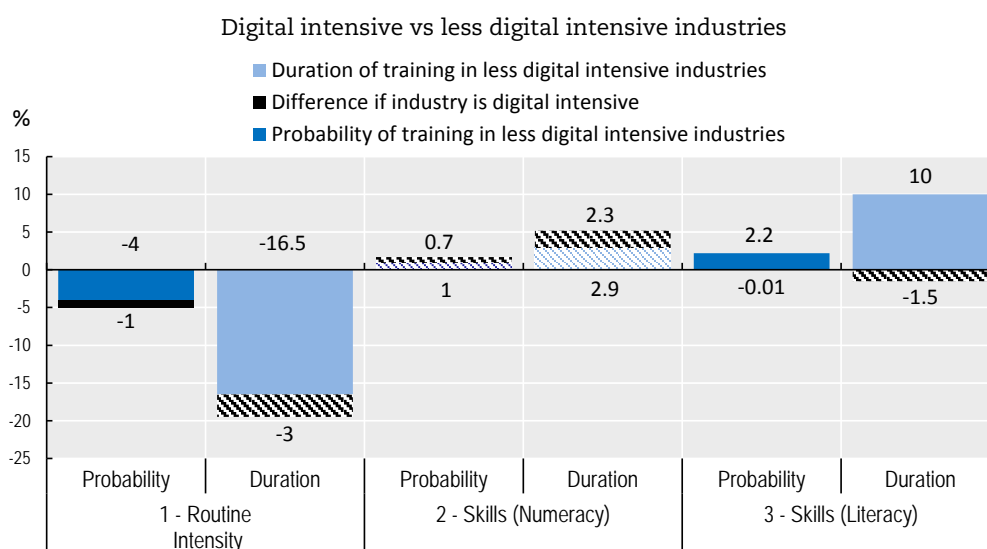
The propensity and duration of training may also be associated with other observable characteristics of individuals. Some of them, including individuals’ years of schooling and working experience, are expected to display a positive association to training outcomes. Others, including workers’ age, being employed part time or not, or working in small firms, are likely to exhibit a negative association with training, once all other characteristics are taken into account. Also, the propensity and duration of training may differ across industries, either in light of the type of production characterising the industry, or because of special institutional provisions defined at the industry level (e.g. mandatory training included in collective agreements). Similarly, certain occupations may require more training than others (e.g. ICT engineers vs taxi drivers), for workers to stay up-to-date with the frontier of knowledge or the requirements of their profession. Lastly, some countries in the sample may have a long tradition of training provision in firms, or have already established policies in support of on-the-job training.

The correlations between training and the variables of main interest shown here are “net of” the role of all these unobservable country-, industry- and occupational features, which are controlled for in the empirical analysis.

Working in digital intensive industries

Figure 1.9 reports a first visualisation of these results, in particular about the relationship between training and the cognitive skills and the routine intensity of tasks that workers perform on the job. The bars represent the hypothetical percentage change in the probability of receiving training (“Probability”) and the duration of this training (“Duration”) a worker would experience, were they to increase the routine content of their job or their cognitive skills by one standard deviation, every other observable characteristics held constant.¹³ The height of the bar differentiates what the change would be for an individual working in less digital intensive industries (blue bars) as compared to more digital intensive ones (sum of the blue and black bars).

Figure 1.9. How is training associated with skills and routine task intensity?



Note: Shaded bars highlight insignificant coefficients at the 5%. Weighted OLS regressions use senate weights on a sample of 104 250 workers across 31 countries. Errors are clustered at the country level.

Source: OECD calculations based on PIAAC data, November 2017.

The estimates suggest that a higher routine intensity of jobs is associated with a lower probability of being trained and to fewer hours of training, everything else held constant (part 1, on the left-hand side of Figure 1.9). Hence, workers employed in routine jobs may be even less well equipped than other workers to face the challenges of the digital transformation, and of automation in particular. If going digital brings about further automation and current training patterns persist, individuals with the highest risk of displacement may be offered the fewest options for on-the-job training and for acquiring the skills needed to transit towards new or different existing jobs.

A similar picture can be seen for workers with lower cognitive skills, who appear to be less likely to get training than their relatively higher-skilled colleagues (parts 2 and 3 of Figure 1.9, middle and right hand side of the figure).¹⁴ The recent wave of computerisation has not only affected low-skill jobs, but also hollowed out middle-skilled jobs. If these trends were to continue, and the digital transformation were to enhance the demand for new and higher skills, policy makers may need to reflect on the (re-)design of adult education and lifelong training policies, so that the focus is on those needing them the most.

In the sample across 31 countries, individuals employed in less digital intensive industries are engaging in on-the-job training as frequently as individuals employed in digital-intensive industries, but their training spells are 4.5% shorter.¹⁵ Nevertheless, these figures may be driven by the characteristics of the workers employed in these sectors, rather than the fact that these workers are employed in more or less digital intensive industries. Also, workers' cognitive skills and the frequency with which routine tasks are performed on the job may lead to different training outcomes when workers are embedded in more digital intensive environments.

As a consequence, Figure 1.9 separately estimates the different relationship between training and the workers' skills and routine intensity between digital intensive and less intensive industries (blue bars vs the sum of blue and black bars). Overall, working in a more or less digital intensive industry does not seem to influence the response of training outcomes to changes in the routine content of jobs or the worker's cognitive skills, once all other individual observable characteristics associated with training are also taken into account. However, the expected decrease in the probability of receiving training after a standard deviation increase in the routine content of a worker's job is higher if a worker is employed in a more digital intensive industry (part 1 of Figure 1.9: -5% vs -4%).

The role of gender

As shown, women and men differ in the frequency and duration of training. On average across the 31 countries considered, the proportion of women engaging in training is higher than the proportion of men engaging in training, but this difference is statistically insignificant or reversed when training is carried out "only" or "mostly during working hours", or when workers engage only in on-the-job training. Similarly, women in PIAAC report engaging in longer hours of training (as a proportion of total hours worked) than men, but this difference is five times lower when training is carried out "only" or "mostly during working hours". These differences are related to, among other factors, the proportion of women and men working in industries and occupations which are more intensive in training, or to the different propensity of men and women to work part time.

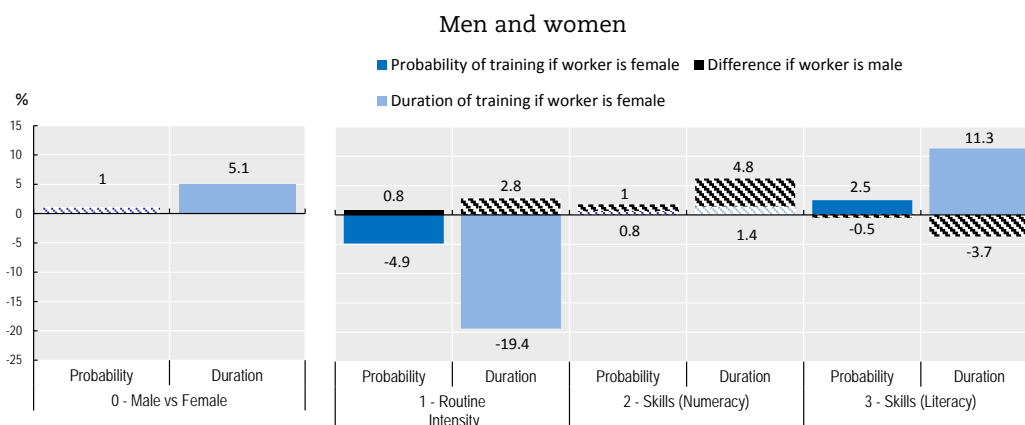
Figure 1.10 reports selected results from an analysis investigating whether the probability and duration of training are associated to a worker's gender. The estimated model is similar to the one in the previous section, and therefore controls for workers' industry and occupational title, and whether she is employed part time or full time, among other determinants. The full specification is described more in detail in the Methodological Annex II.

The resulting evidence suggests that while the probability of receiving training does not change with gender, the duration of training does. Once individual, industry or country characteristics are taken care of, estimates show that men receive 5.1% longer training than women in a year. Furthermore, low-skilled women do not receive significantly less training than men in the same situation (see Figure 9, "Difference if worker is male").

However, increasing the routine content of jobs by one standard deviation reduces the probability of engaging in training more for women (-4.9%) than for men (-4.1%).

This first analysis of the association between training on the one hand, and skills and the routine task intensity of jobs on the other hand, can inform the G20 debate on policies and actions at national and international level aimed at enhancing the inclusiveness of training programmes. The analysis suggests the need to re-think current training programmes to ensure that the least skilled workers and those working in jobs at (relatively) higher risk of automation are not left behind, as the digital transformation unfolds.

Figure 1.10. How is training associated with skills and routine task intensity?



Note: Shaded bars highlight insignificant coefficients at the 5%. Weighted OLS regressions use senate weights on a sample of 104 250 workers across 31 countries. Errors are clustered at the country level.

Source: OECD calculations based on PIAAC data, November 2017.

1.5. Adapting to the changing digital paradigm: The role of policy

In an effort to better understand the role that policy can play in enabling adaptation to the changing digital paradigm, the German G20 Presidency invited G20 countries, along with partner countries,¹⁶ to respond to a survey that collected information on policies targeted at helping disadvantaged groups, including women and girls. Recognising both the opportunities that digitalisation is providing for economic empowerment, and the challenges of ensuring that the benefits of the digital transformation are shared by all, G20 Ministers responsible for the Digital Economy in their 2017 *A Roadmap for Digitalisation: Policies for a Digital Future*¹⁷ (further referred to as “the Roadmap”), committed to enable all people to adapt and excel in the digital economy and society.

More specifically, in Section 7 “Enable all people to adapt to and excel in the digital economy and society” of the Roadmap, Ministers agreed to “Encourage and promote effective strategies on digital literacy and skills development for the digital economy enabling citizens, especially underrepresented or disadvantaged groups, to successfully adapt to the requirements of the digital economy and society”. G20 Ministers also highlighted the need to address the digital gender divide and recognised in Section 11 of the Roadmap that women face skills, participation and leadership gaps which prevent them from fully participating in the digital economy. Whether digitalisation will close or widen gender gaps in the labour market will, to a large extent, depend on policy.

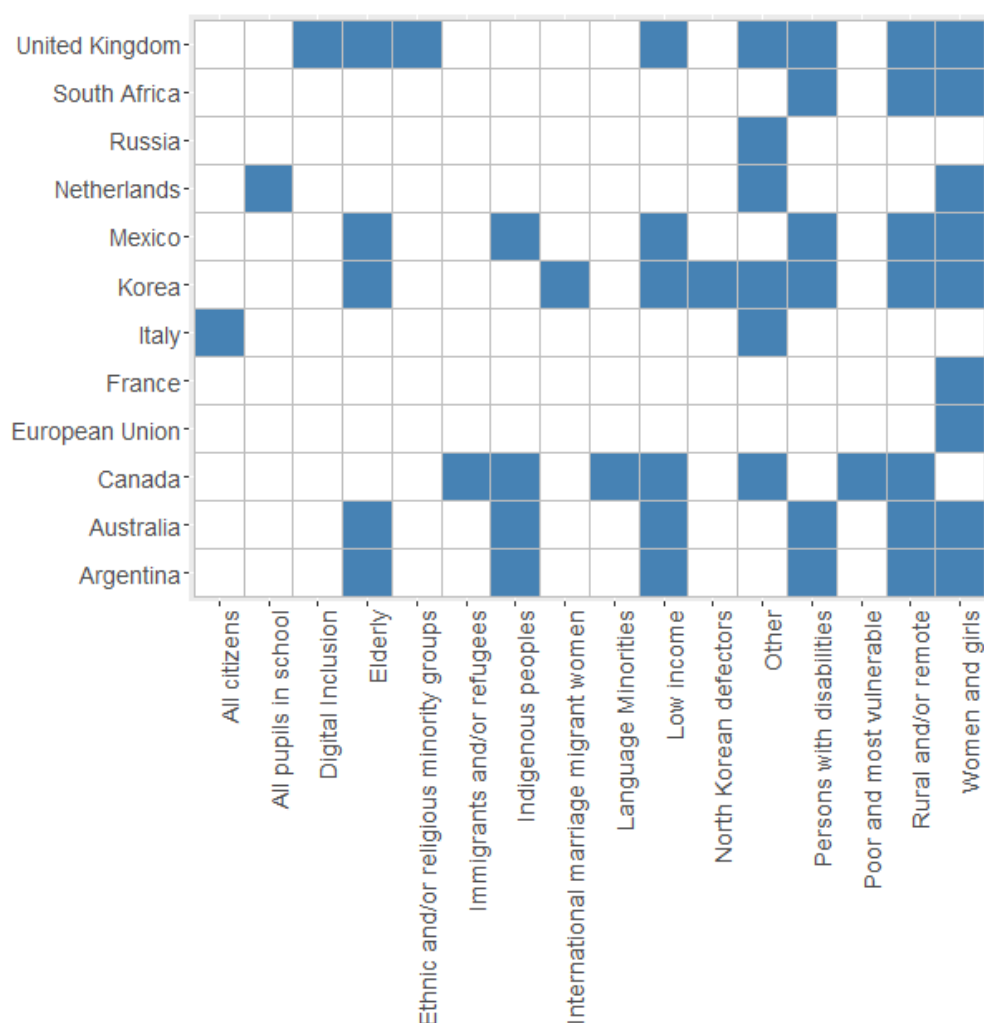
The survey aimed to collect specific information from countries on policies targeted at helping these disadvantaged groups by means of programmes aimed at improving skills, such as training or mentoring and therefore aligns with commitments made by Ministers in the Roadmap. The survey, however, did not look at skills acquired through formal education and therefore policies related to skills developed through education will not be addressed in this section. Responses were submitted by Argentina, Australia, Canada, the European Union, France, Germany, Italy, Japan, Korea, Mexico, Russia, South Africa, the United Kingdom and the Netherlands. The rest of this section will focus on the results of the survey and provide examples of policy measures G20 countries have introduced to create a more inclusive digital world.

Results from the G20 Survey on policies targeted at helping disadvantaged groups

Policy plays an important role in providing assistance to disadvantaged groups, as well as women and girls, by creating access to the tools needed to develop the necessary skills for the digital economy and thereby contributing to reduce the digital divide. To date, policy responses to bridge digital divides have aimed for the most part at addressing a number of specific areas including: access to digital technologies (including the internet), basic digital literacy, STEM education and employment, entrepreneurship, financing and leadership. Given the diversity of those that make up the digital divide, many policy responses are targeted at one group e.g. low income, women and girls, the elderly, etc.

The G20 survey found that more than half of the countries who responded have a national strategy, policy or plan that includes efforts to reduce the digital divide, as shown in Figure 1.11. The groups most commonly targeted were: women and girls, people in rural and remote areas followed by low income and people with disabilities – which had the same number of responses. Several countries, such as Italy and Russia, had initiatives that targeted all citizens equally. Just under half of the respondents indicated they have regional, state or provincial strategies, policies or plans that include efforts to reduce the digital divide targeted at these same groups.

Figure 1.11. Countries having national plans aimed to reduce the digital divide and targeted groups



Source: OECD calculations based on G20 survey.

The most commonly cited forms of support were: web portals or apps that provide online resources, public information and awareness-raising campaigns, mentoring programmes, technology camps and online courses or training. Only slightly less popular were competitions (e.g. hackathons), though their use increases when initiatives are targeted at girls – for example Australia’s Programming Challenge for Girls (PC4G) in Adelaide. Examples of the types of initiatives countries are experimenting are presented in Box 1.1.

BOX 1.1. EXAMPLES OF COUNTRIES’ EFFORTS TO REDUCE THE DIGITAL DIVIDE

Argentina’s National Plan for Digital Inclusion includes a training programme to provide the most vulnerable sectors of the population with the necessary skills, motivation, and confidence to use new technologies for their own benefit.

Canada’s Digital Literacy Exchange programme aims to provide funding for non-profits to teach basic digital literacy skills to Canadians with a focus on under-represented groups (e.g. seniors, indigenous peoples, newcomers to Canada) to support their participation in the digital economy.

South Africa’s Broadband Plan, Connect: Creating Opportunities, Ensuring inclusion has an objective to develop a strong national skills base so that South Africa can perform as a proficient and globally competitive knowledge economy including developing a national digital literacy project aimed at those marginalised from ICT services. This will be addressed through national youth employment programmes and a programme such as “each-one-teach-one”.

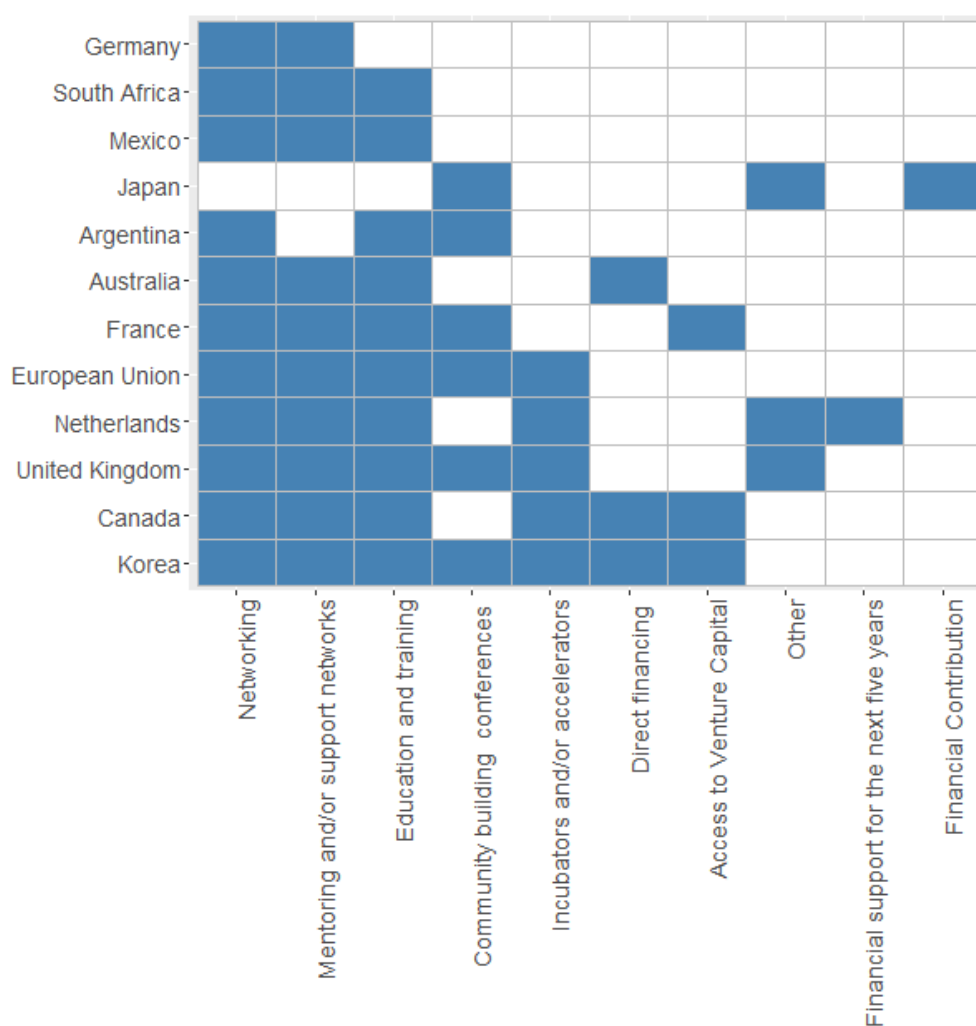
The United Kingdom’s Digital Strategy, Chapter 2: Digital Skills and Inclusion published in March 2017 outlines the UK Government’s plans to address the digital divide, and support public, private and charity sector organisations delivery of digital skills training. The UK Government is already working with industry and the voluntary sector, to increase the digital capability of those who are digitally excluded, as well as those who are online but lacking the confidence and knowledge to make the most of it. For example, over GBP 9.5 million has been spent to support almost 800 000 people to gain basic digital skills, through the Future Digital Inclusion and Widening Digital Participation programmes; and a further GBP 2.5 million will be invested to support over 150 000 more people.

Adapting and upgrading the skills and competences of those already in the labour market also requires urgent policy action. Workers who are most exposed to the risk of automation are the least likely to participate in training: only around 40% of them participate in training each year, compared to 70% of those who are at low risk of automation – with little difference between men and women (OECD, 2017d). Efforts already underway in the G20 include Australia’s Career Transition Assistance Program which is part of the Government’s AUD 110 million Mature Age Employment Package announced in the 2017-18 Federal Budget. This programme provides more opportunities for mature age people to reskill and access training. The first stage will be a short, intensive course consisting of skills assessments, exploration of suitable occupations, research of local labour markets, and learning resilience strategies. This will be followed by digital literacy training, based on the needs of the individual. The programme will start in five trial regions in July 2018, before being rolled out nationally from July 2020.

The survey also looked at entrepreneurship skills, which have become even more necessary in a world where digital technology offers the possibility for a greater number of people to start their own business. In the Roadmap, G20 Ministers responsible for the Digital Economy acknowledged the need to, “encourage digital start-ups through a more entrepreneurial friendly environment as vehicles for innovation, entrepreneurship, employment opportunities and inclusive economic growth.” Traditional policy actions to foster entrepreneurship skills include entrepreneurship training, coaching and mentoring programmes, workshops, business counselling and support in building entrepreneurial networks (OECD, 2017d, from OECD/EC, 2017; OECD, 2014a).

In particular, many G20 countries are focusing their efforts on increasing policy support for female entrepreneurship (OECD, 2017d). G20 survey respondents indicated that networking, mentoring and education and training were the most common approaches used by countries to support female entrepreneurs. In addition to such policy tools, the OECD has found that women entrepreneurship loan guarantee schemes are also frequently used. For example, in October 2017 France introduced a new partnership between the Group bank *Caisse d'épargne*, the agency *Caisse des dépôts* and the State for the development of women's entrepreneurship to increase the rate of women entrepreneurs in France by at least 40% in 2020 and Germany's *Frauenunternehmen* encourages women to consider entrepreneurship/self-employment as a viable career option by providing them with role models (see Figure 1.12 for a synthesis of the measures implemented).

Figure 1.12. Measures aimed to support female entrepreneurship



Source: OECD calculations based on G20 survey.

There is also a need to recognise skills acquired outside formal channels. While not aimed at digital skills, India's 'Recognition of Prior Learning' scheme across construction sites in five states (Haryana, Telangana, Odisha, Chhattisgarh and Delhi) aims to certify the skills acquired by workers in unorganised sectors through traditional, non-formal learning channels. Similar programmes could be considered for digital sectors as well, for example, testing coding skills for those that have no formal education or certification. In 2016 the OECD began looking at these issues and noted that a number of regional initiatives have emerged in Spain within the framework of the Digital Agenda for the Basque Country. The Government of the region launched Ikanos, a digital competency project, whose main objective is to promote the adoption of DIGCOMP,¹⁸ new ways of

learning and innovative certification systems (Ikanos 2015). Ikanos implemented a free online testing tool and assessment reporting on individual's level of digital skills for employability based on DIGCOMP (OECD, 2016).

The OECD Skills Strategy: A proposed policy response

The OECD has developed a comprehensive Skills Strategy that can help G20 countries identify the strengths and weaknesses of their national skills systems, benchmark them internationally, and develop policies that can transform better skills into better jobs, economic growth and social inclusion. The OECD Skills Strategy provides a useful approach to address the opportunities and challenges for skill development in the digital economy (OECD, 2016 – see Box 1.2).

BOX 1.2. THE OECD SKILLS STRATEGY

The OECD Skills Strategy provides a framework that can help G20 economies identify the strengths and weaknesses of their national skills systems, benchmark them internationally, and develop policies that can transform better skills into better jobs, economic growth and social inclusion. The Skills Strategy is based on three pillars; developing relevant skills; activating skills supply; and putting skills to effective use. G20 economies and societies need to perform well across all three pillars if they are to realise the full benefits of skills for economic prosperity and social inclusion (Figure 1.13, reproduced from OECD, 2012c). The Skills Strategy also emphasises that getting better outcomes requires adopting a systematic and comprehensive approach to skills policies that needs to engage all relevant ministries, all levels of government and all relevant stakeholders in working together to identify and take ownership of the country's skills challenges and to develop and implement joined-up strategies and actions to address them.

Figure 1.13. The OECD Skills Strategy



Source: OECD (2012c).

The Skills Strategy provides a useful approach to address the opportunities and challenges for skill development in the digital economy. This approach consists of three main steps. First, identify more precisely the kind of skills required in the digital economy, through the definition of an agreed framework for digital literacy, further cross-country analysis of existing datasets and the development of new surveys. Second, examine how these changes may translate into curriculum reform, teacher training and professional development. Third, leverage ICTs to improve the access to and the quality of education and training, e.g. through online courses, new learning tools at school and adequate recognition of skills acquired through informal learning.

Source: OECD (2017e), "Key Issues for Digital Transformation in the G20".

Annex 1.A1. Data and methodology

Data

Table 1.A1.1. Indicators of job-related task and skill requirements

Indicator of job related skill requirements	Items included in the construction of the indicator
ICT skills	G_Q05e Frequency of excel use G_Q05g Frequency of programming language use G_Q05d Frequency of transactions through internet (banking, selling/buying) G_Q05a Frequency of email use G_Q05c Frequency of simple internet use G_Q05f Frequency of word use G_Q05h Frequency of real-time discussions through ICT Computer G_Q01b Frequency of Reading letters, emails, memos G_Q02a Frequency of Writing letters, emails, memos G_Q06 Level of Computer Use required for the job F_Q06b Frequency of working physically over long periods
Readiness to learn and creative problem solving	I_Q04j I like to get to the bottom of difficult things I_Q04m If I don't understand something, I look for additional information to make it clearer I_Q04h When I come across something new, I try to relate it to what I already know I_Q04b When I hear or read about new ideas, I try to relate them to real life situations to which they might apply I_Q04d I like learning new things I_Q04l I like to figure out how different ideas fit together
Managing and communicating	F_Q04b Frequency of negotiating with people (outside or inside the firm or organisation) F_Q03b Frequency of planning activities of others F_Q02b Frequency of instructing and teaching people F_Q02e Frequency of advising people F_Q04a Frequency of persuading or influencing others
Self-organisation	D_Q11a extent of own planning of the task sequences D_Q11b extent of own planning of style of work D_Q11c extent of own planning of speed of work D_Q11d extent of own planning of working hours
Marketing and accounting	G_Q01g Frequency of Reading financial invoices, bills etc. G_Q03b Frequency of Calculate prices, costs, budget G_Q03d Frequency of using calculator F_Q02d Frequency of client interaction selling a product or a service
STEM-quantitative skills	G_Q03f Frequency of preparing charts and tables G_Q03g Frequency of Use simple algebra and formulas G_Q03h Frequency of Use complex algebra and statistics

Source: Grundke et al. (2017a), based on PIAAC.

Table 1.A1.2. Classification of 36 ISIC rev.4 sectors in digital intensive vs less-digital intensive, based on 2011-12 information

ISIC rev.4	Industry description	Digital intensity
1-3	Agriculture, forestry and fishing [A]	Less digital intensive
5-9	Mining and quarrying [B]	Less digital intensive
10-12	Food products, beverages and tobacco [CA]	Less digital intensive
13-15	Textiles, wearing apparel, leather and related products [CB]	Less digital intensive
19	Coke and refined petroleum products [CD]	Less digital intensive
20	Chemicals and chemical products [CE]	Less digital intensive
21	Basic pharmaceutical products and pharmaceutical preparations [CF]	Less digital intensive
22-23	Rubber and plastics products, and other non-metallic mineral products [CG]	Less digital intensive
24-25	Basic metals and fabricated metal products, except machinery and equipment [CH]	Less digital intensive
35	Electricity, gas, steam and air conditioning supply [D]	Less digital intensive
36-39	Water supply; sewerage, waste management and remediation activities [E]	Less digital intensive
41-43	Construction [F]	Less digital intensive
49-53	Transportation and storage [H]	Less digital intensive
55-56	Accommodation and food service activities [I]	Less digital intensive
68	Real estate activities [L]	Less digital intensive
85	Education [P]	Less digital intensive
86	Human health activities [QA]	Less digital intensive
87-88	Residential care and social work activities [QB]	Less digital intensive
16-18	Wood and paper products, and printing [CC]	Digital intensive
26	Computer, electronic and optical products [CI]	Digital intensive
27	Electrical equipment [CJ]	Digital intensive
28	Machinery and equipment n.e.c. [CK]	Digital intensive
29-30	Transport equipment [CL]	Digital intensive
31-33	Furniture; other manufacturing; repair and installation of machinery and equipment [CM]	Digital intensive
45-47	Wholesale and retail trade, repair of motor vehicles and motorcycles [G]	Digital intensive
58-60	Publishing, audiovisual and broadcasting activities [JA]	Digital intensive
61	Telecommunications [JB]	Digital intensive
62-63	IT and other information services [JC]	Digital intensive
64-66	Financial and insurance activities [K]	Digital intensive
69-71	Legal and accounting activities, etc [MA]	Digital intensive
72	Scientific research and development [MB]	Digital intensive

73-75	Advertising and market research; other professional, scientific and technical activities; veterinary activities [MC]	Digital intensive
77-82	Administrative and support service activities [N]	Digital intensive
84	Public administration and defence; compulsory social security [O]	Digital intensive
90-93	Arts, entertainment and recreation [R]	Digital intensive
94-96	Other service activities [S]	Digital intensive

Source: OECD calculations based on Annual National Accounts, STAN, ICIO, PIAAC, International Federation of Robotics, World Bank, Eurostat Digital Economy and Society Statistics, national Labour Force Surveys, US CPS, INTAN-Invest and other national sources. For more information on the methodology used, see Calvino et al. (forthcoming).

Methodological Annex I

This analysis assesses the returns to different types of skills, i.e. cognitive as well as non-cognitive skills and personality traits, by estimating individual level wage regressions (so-called Mincer regressions) on data from PIAAC. To answer the question on what skills are needed for the digital transformation, it further investigates whether these returns to skills differ between industries that are digitally intensive, as compared to those that have undergone the digital transformation to a lesser extent. Moreover, it also focuses on differences in skill returns by gender to shed light on how skills policies might help in closing the gender wage gap and preparing more disadvantaged groups of the population for the challenges posed by the digital transformation.

Differently from Hanushek et al. (2015) and Falck et al. (2016), the present study is the first to include measures of task-based skills from Grundke et al. (2017). This is important for two reasons, one policy-related, the other technical. On the one hand, markets reward cognitive as well as non-cognitive skills, and policy makers need information about labour market returns to non-cognitive skills to be able to design suitable education and training policies. On the other hand, the presence of an extra set of controls reduces the extent to which possible omitted variables may bias our estimates. The estimated Mincer regressions investigate whether the following skills are complementary to the digitalisation of the workplace: the cognitive skills numeracy and literacy (as well as, in robustness checks, problem solving in technology rich environments¹⁹); the task based skills ICT, managing and communication, marketing and accounting, self-organisation and STEM-quantitative skills; and the personality trait readiness to learn and creative problem solving.

The empirical hypothesis underlying the analysis is that sectors that are digital intensive should reward workers' skills differently, and possibly more (assuming equal supply of skills across sectors), than sectors that have been penetrated to a lesser extent by the digital transformation (conditional on other worker-specific observable characteristics, and other controls which are specified below). Such a hypothesis has its roots in the "canonical" model of human capital in Goldin and Katz (2008), where technological progress raises the demand for skills. As some of the above-mentioned skills are easier to supply than others, the returns to skills in the whole economy are expected to vary with the type of skill considered. If one assumes that STEM-quantitative skills are harder to shape than, e.g. managing and communication ones, or if they are rarer among workers, one should expect the market to offer a higher premium for STEM-quantitative than for managing and communication skills.

In addition, workers with different skills may be carrying out different tasks, which in turn may have different degrees of complementarity with technology (e.g. Acemoglu and Autor, 2012). While it would be natural to expect that digital intensive sectors reward the same skill more than less digital intensive ones,²⁰ a task-based perspective would allow for the existence of non-linearities in the way skills are rewarded relative to the technological endowment of firms and sectors. Occupational polarisation, for example (Autor et al., 2006; Acemoglu and Autor, 2010), is well-known to have raised the wages of individuals, both at the top and bottom of the skill distribution, because both these types of workers carry out tasks which cannot be substituted by computers. Given all the above, the sign of the difference in skill returns between digital and less digital intensive sectors remains *ex-ante* ambiguous.

These hypotheses are tested on the pooled sample of the working population of all 31 PIAAC countries,²¹ based on the following empirical specification, for each individual i :

$$\log(\text{wage})_i = \alpha_0 + \alpha_1 \text{DigInd}_i + \alpha_2 \text{skill}_i + \alpha_3 \text{DigInd}_i * \text{skill}_i + \mathbf{x}'_i \boldsymbol{\beta} + \boldsymbol{\mu}_c + \boldsymbol{\sigma}_{\text{Tiva18}} + \boldsymbol{\rho}_{\text{isco08}} + \mathbf{u}_i \quad (1)$$

The dependent variable is the log of the gross hourly wage in USD (including bonus payments)²². The dummy variable *DigInd* indicates whether an individual i works in a digital intensive industry. Two-digit ISIC rev.4 industries are defined as digital intensive if they display a higher digital intensity than the median among all 36 industries (across countries²³). The dummy variable for digital intensive industry is interacted with only one of the skill variables (skill_i) namely: numeracy, literacy, ICT, managing and communication, marketing and accounting, self-organisation, STEM-quantitative skills, or readiness to learn and creative problem solving. Accordingly, specification (1) is separately estimated for each of these eight skill variables, whereby all eight specifications control for general ability of the individual by including literacy and numeracy in the vector of control variables (\mathbf{x}).²⁴

The coefficient of interest is α_3 . A positive and significant coefficient indicates that individuals working in a job in a digital intensive industry are additionally rewarded by labour markets for the specific skill under consideration, compared to the same jobs being performed in less digitalised industries. This would imply that the use of digital technologies and the skill under consideration are complements in the production process and signal the need for workers to acquire those skills to cope with the increasing digitalisation of their workplaces.

The vector \mathbf{x} includes additional covariates at the worker's level, namely: age, age squared, years of education and gender as well as the cognitive skills literacy and numeracy to control for general individual ability. Fixed effects for countries ($\boldsymbol{\mu}$), for 18 aggregated industries ($\boldsymbol{\sigma}$) (TiVA 18 industry list)²⁵ as well as for ISCO 08 one-digit occupations ($\boldsymbol{\rho}$) are also included to control for unobserved wage determinants at the country, industry and occupation level.²⁶ In further robustness checks, two dummy variables for the size of the firm the individual works in (either medium sized firm, defined as having 51-250 employees; or large firm, having more than 250 employees, the comparison group being small firms, defined as firms with up to 50 employees²⁷), a dummy variable for whether the individual works less than 21 hours a week (to account for possible part-time-related patterns), as well as two dummy variables for the state of health of the individual (good and very good health, the comparison group being poor health) are additionally included as control variables and results do not change in a significant manner.²⁸ All specifications are estimated by weighted OLS using individual senate weights, which are based on the population weights included in the PIAAC data set and ensure that each country is given the same weight in the regression. Standard errors are clustered at the country level. All skill variables are standardised to mean zero and variance one for the pooled sample using senate weights to weight observations from single countries.

While advancing the returns to skills discussion in many ways, the present analysis nevertheless remains within the tradition of the Mincer equations, and does not treat the endogeneity of sectors explicitly, i.e. the bias of the coefficients that arises due to the selection of individuals into digital intensive sectors based on other unobservable individual characteristics. However, the high degree of consistency of results across specifications buttresses the importance of selected cognitive and non-cognitive skills for wage determination, and how these differ between digital and less digital intensive sectors.

Regarding the analysis of the returns to skills by gender, the empirical specification is the same then described above, but the dummy variable for working in a digital intensive industry (*DigInd*) is replaced by a dummy variable for being male (taking the value 1 if the individual is male and 0 if female). Accordingly, the gender variable is excluded from the vector of control variables (\mathbf{x}).

Methodological Annex II

Figures 1.8 and 1.9 report selected results of estimating the association between an individual's participation in and duration of on-the-job training on the one hand, and a number of observable characteristics of the worker and of the firm and industry where they are employed on the other hand. For each individual i who works in industry j and country c , the empirical model reads:

$$y_i = \alpha_0 + \alpha_1 \text{Routine}_i + \alpha_2 \text{Literacy}_i + \alpha_3 \text{Numeracy}_i + \alpha_4 \text{DigInd}_j + \alpha_5 \text{DigInd}_j * \text{Routine}_i + \alpha_6 \text{DigInd}_j * \text{Literacy}_i + \alpha_7 \text{DigInd}_j * \text{Numeracy}_i + \mathbf{x}'_{i,c} \boldsymbol{\delta} + \boldsymbol{\mu}_c + \boldsymbol{\sigma}_j + \boldsymbol{\rho}_o + \mathbf{u}_i \quad (2)$$

where y can be either (1) a dummy variable for whether the worker participated in on-the-job training or not in the last year; or (2) the number of hours of training received by the individual in the year. All regressions are estimated with OLS regressions, and taking into account that each individual is representative of a greater proportion of the population in their country of employment.²⁹ The final sample contains 104 250 employees displaying the full information and living in 31 countries.

The analysis mainly focuses on the degree to which the worker carries out routine tasks on the job (*Routine*) and their cognitive skills (*Literacy*, *Numeracy*). As highlighted in the text above, these characteristics may lead to different training outcomes when the individual is working in a digital intensive industry. As a consequence, model 2 also estimates the interaction term of these individual characteristics with the dummy variable *DigInd*. Similar to what is reported in Methodological Annex I, *DigInd* indicates whether an individual i works in an industry j which is digital intensive across countries. The coefficients of interest are therefore α_5 to α_7 , which are graphed in Figure 1.9. A positive and significant coefficient would indicate that individuals working in a digital intensive industry are likely to receive additional training if they perform more routine tasks on the job or if they display higher skills than the average individual, once every other observable correlate of training has been taken into account.³⁰

The specification further controls for occupation-, industry-, and country- specific unobservable correlates of training, respectively: $\boldsymbol{\mu}_c$, $\boldsymbol{\sigma}_j$ and $\boldsymbol{\rho}_o$. The industry dummies are perfectly collinear with *DigInt*, hence a separate coefficient for *DigInt* is not estimated. The dummies for occupational classes are defined at the one-digit ISCO disaggregation level.

Lastly, vector \mathbf{x} contains other observable individual characteristics which may be associated with the propensity and duration of training. These are: the worker's gender, age, years of schooling, overall working experience and experience in the particular company where the individual is employed, a dummy for whether the worker is employed part time and one for whether the worker is employed in a small firm or public entity (up to 50 employees).

The second part of the analysis on training takes particular interest in one of these features, the worker's gender. Figure 1.10 reports the results of estimating specification 1, where the *DigInd* dummy is substituted by a dummy having value 1 if the individual is male and 0 if female. As variation in gender across individuals is not perfectly absorbed by any other observable characteristics, it is possible to estimate the direct correlation between the worker's gender and her engagement in on-the-job training. The rest of the empirical model remains the same.

Notes

1. OECD-ILO (2017) “Women at work in G20 Countries”, Paper prepared for the G20 Labour and Employment Ministers Meeting 2017. See www.ilo.org/wcmsp5/groups/public/---dgreports/---inst/documents/publication/wcms_558551.pdf.
2. The database contains information on 208 620 individuals of which 138 605 were employed at the time of the interview. The present analysis excludes unemployed individuals and individuals who did not report information on the main outcomes of interest, i.e. wages and skills. This reduces the sample size to 104 296 individuals. Unless otherwise specified, all descriptive statistics and estimates are re-weighted using country-specific population weights.
3. These represent the pillar of the analysis contained in the 2017 OECD Skills Outlook (OECD 2017a). The items of the PIAAC background questionnaire on which these indicators build are detailed in Table 1.A1.1 in Annex 1.A1.
4. Due to data constraints, this taxonomy at present does not rely on information about e.g. industries’ reliance on frontier technologies such as 3D printing or machine learning. However, the complexity and comprehensiveness of the information set underlying this exercise should suffice to provide a faithful representation of how sectors are being transformed by digitalisation.
5. International Standard Industrial Classification of All Economic Activities, Rev.4. See <https://unstats.un.org/unsd/cr/registry/isc-4.asp>.
6. For further details about the empirical framework, see Methodological Annex I.
7. The PIAAC Survey also gathers information on the salaries and bonuses earned by individuals in the year prior to the survey year, as well as information on the industry, occupation and size of the firms individuals works in, as well as a number of socioeconomic background characteristics for these individuals (e.g. educational attainment, age, gender, etc.). Individual gross hourly earnings are expressed in purchasing power parity terms. For some individuals with missing hourly wages, a value is imputed on the basis of the reported monthly gross salary and bonuses and the number of hours worked by the individual in the last month. Outliers in both hours worked and hourly wages have been addressed by trimming the top and bottom 1% of their respective distribution.
8. More details of the empirical methodology are proposed in the Methodological Annex I.
9. ICT skills relate to the use of programming languages, emails, word processing software or spreadsheets, or to the processing of transactions through the internet.
10. On-the-job training in PIAAC encompasses different forms of training ranging from seminars and workshops, to on-the-job training periods, extra courses or private lessons, and open or distance education courses. They are usually planned and organised in nature, but not in the context of a formal education degree; they might but need not take place at work, nor be exclusively relevant for a specific firm. This is by far the most common form of training reported by individuals in the PIAAC survey: 72% of individuals involved in any formal or on-the-job training only engaged in on-the-job training, and 16% engaged in both formal and on-the-job training (OECD 2017c).
11. OECD (2017c) Figure 1.40. Note, however, that the figure reported in OECD (2017c) considers both formal and on-the-job training, contrary to the present analysis.
12. The full description of the empirical model is reported in the Methodological Annex II.
13. The results are based on OLS regressions which further take into account the individual’s age, schooling, working experience, tenure on the current job, part time or full time status, type of employment contract, one-digit occupation, size of the establishment of employment and its sector. The estimations use data from the OECD Survey of Adult Skills (PIAAC) covering 31 OECD countries and partner economies – see Methodological Annex II.
14. In light of the high correlation between the two measures of cognitive abilities, it should not come as a surprise that one of the two yields statistically insignificant correlations with training outcomes, when both literacy and numeracy are simultaneously included in the estimates.
15. Differences are significant, based on T-test on the annual number of hours of training by digital intensive vs less-digital intensive sector of employment, on the pooled sample of all countries.
16. Netherlands, Norway, Singapore and Spain.
17. See https://www.de.digital/DIGITAL/Redaktion/EN/Downloads/g20-digital-economy-ministerial-declaration-english-version.pdf?__blob=publicationFile&v=3.
18. DIGCOMP is the EU framework for developing and understanding digital competence in Europe.

19. Problem solving in technology rich environments is not included in the baseline specification as this variable is not available for France, Italy and Spain (as these countries did not participate in the test, the sample would decrease by almost 30 000 observations) and suffers from non-response problems in the other countries. In robustness checks where this cognitive skill measure is included, results do not change.
20. The higher level of technology adoption in digital intensive sectors can make individuals more productive for each level of skill endowment, and this productivity is rewarded in the form of salaries (e.g. to motivate workers). Firms in digital intensive sectors may also invest more in their internal organisation, so as to react flexibly to changes in the production environment, and may therefore be better at matching workers with the job tasks that suit them the best. They may also be better at monitoring workers thanks to the technology embedded in production.
21. The sample covers the following 31 countries: Australia, Austria, Belgium (Flanders), Canada, Chile, the Czech Republic, Germany, Denmark, Estonia, Finland, France, Greece, Ireland, Italy, Israel, Japan, Korea, Lithuania, the Netherlands, New Zealand, Norway, Poland, the Russian Federation (excluding Moscow), Singapore, the Slovak Republic, Slovenia, Spain, Sweden, Turkey, the United Kingdom (England and Northern Ireland) and the United States.
22. In a second specification, the dependent variable log of the monthly wage is used and results do not change. Results can be obtained from the authors upon request.
23. In robustness checks, a digital industry is defined as an industry with a higher digital intensity than the 75th percentile for all 36 considered industries (results can be obtained from the authors upon request).
24. In the specifications for literacy and numeracy the respective skill is then excluded from the vector of control variables.
25. These 18 industries are aggregates of the 34 industries used in the OECD TiVA database, and include two resource extraction sectors, nine manufacturing sectors and seven services sectors. The complete list can be found at https://www.oecd.org/sti/ind/TIVA_2015_Guide_to_Country_Notes.pdf.
26. In robustness checks, combined fixed effects for countries and 18 aggregated industries (TiVA 18) are included and results do not change (results can be obtained from the authors upon request).
27. The size classes are so-defined in the PIAAC dataset itself.
28. The results can be obtained from the authors upon request. Because the sample size is significantly reduced when including the additional controls, the baseline analysis excludes these controls.
29. In other words, the regressions are estimated using the sampling weights reported in the PIAAC survey, but rescaling them so that each country has equal weight in the estimation, independently on its overall population (senate weights). Standard errors are clustered at the country level. For the specifications where the dependent variable is the individual's probability of engaging in on-the-job training, a logit model was also estimated, yielding qualitatively very similar results than the ordinary least square model.
30. All continuous controls are standardised, i.e. display mean equal to zero and variance equal to one, for the pooled sample using senate weights.

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CHAPTER 2

BUSINESS DYNAMICS AND COMPETITION IN THE DIGITAL ECONOMY

Digital technologies are transforming the way firms produce, upscale and compete. They allow firms to leverage ever larger networks of consumers, access multiple geographical and product market almost instantaneously, and exploit increasing returns to scale from intangible assets.

For instance, as shown in Andrews et al. (2016), against a broad context of slowdown in productivity, frontier firms, and especially those in the ICT service sector, have significantly increased their productivity relative to other firms in the market. These firms are on average larger and more capital intensive, more likely to be part of multinational corporations; comparatively file more patents and own larger stocks of patents (OECD, 2015a). Non-frontier firms, and in particular SMEs, may have not been able to fully exploit the potential of digital technologies, because they often lag behind in terms of adoption and may lack the technical personnel and required digital skills. More recently, Bessen (2017) shows evidence that the share of revenue captured by the top-firms in a sector is highly correlated with IT adoption (proprietary IT systems, proxied by share of IT workers) even after taking into account mergers and acquisitions or entrepreneurship activity.

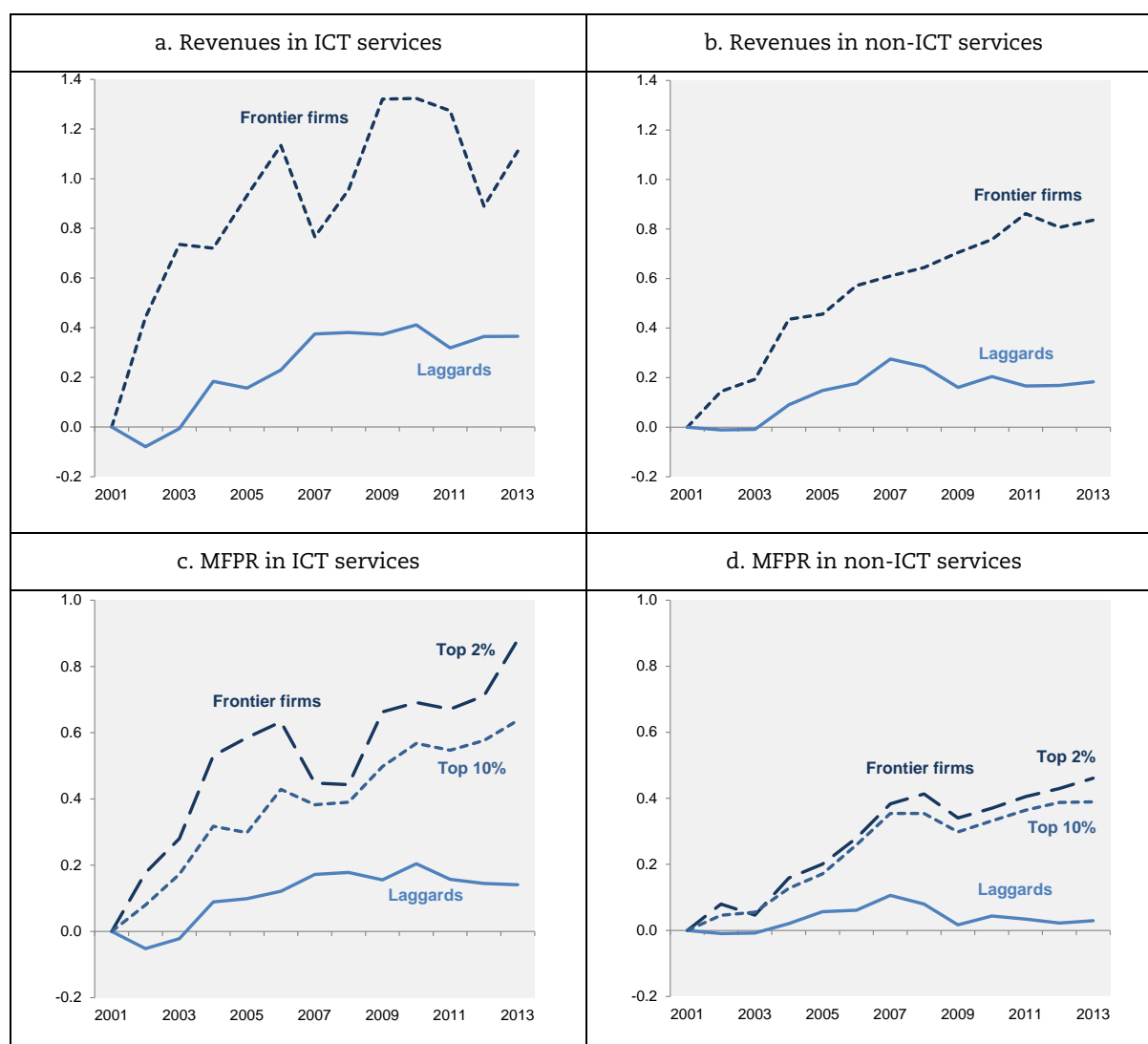
While it is to be expected that some firms will be early adopters of digital technologies and thus more quickly experience its impacts on productivity, successful digital transformation will require that many more firms adopt the technologies and transform their business model. Competition is key to ensuring this dynamic, as it forces firms to adopt new technologies and helps successful firms grow and enhance their market share.

At the G20 Digital Economy Ministerial Conference in Düsseldorf on 6-7 April 2017, G20 Members agreed to a forward-looking work plan for the G20 on the digital transformation and jointly adopted *A Roadmap for Digitalisation: Policies for a Digital Future* (the "Roadmap"). The roadmap noted the importance of fostering competition in the digital economy, noting that "*Digitalisation creates new opportunities to increase consumer choice and provide innovative new products and services. The lines between offline and online business models are becoming increasingly blurred, and there are new competitive dynamics.*" In particular, G20 members agreed to (action 4) encourage the exchange of best practices to foster competition, including on how to expand innovation and prevent anti-competitive restrictions.

To support G20 countries in shaping effective policies to follow-up and implement their commitment, this chapter, requested by the 2017 German Presidency, looks at the evolution of business dynamics and competition across industries and countries, and its relation to the degree of digital intensity of the industries in which firms operate. By improving the evidence base, the analysis aims to contribute to the G20 discussions on how best to promote favourable conditions for the development of the digital economy and foster entrepreneurship, investment and innovation through effective contestability of markets. Section 2.1 of this chapter outlines the issue to be discussed – essentially, how is the competitive environment changing over time and how does this relate to digital technology use? Section 2.2 briefly describes the approach used for the analysis (with further detail available in Annex 2.A1), and Section 2.3 highlights the key results. Section 2.4 concludes with a discussion of the findings and ideas for future work to bolster the evidence base on this important issue.

2.1. The issue: business dynamics and competition in the digital era

The last decades have seen the emergence of both a change in the competitive landscape and the business dynamism of economies, and the unfolding of the digital transformation.

Figure 2.1. Divergence in revenues and multifactor productivity between frontier and laggard firms

Note: ICT services includes information and communication sector (NACE Rev. 2.0 section J) and postal and courier activities (NACE Rev. 2.0 sector 53).

Source: Andrews, Criscuolo and Gal, 2016.

The digital transformation, with its proliferation and integration of digital technologies into the fabric of economies and societies, can have multiple possible effects on the business environment. On the one hand, digital technologies can lower the cost of operations and of entry in a market, even across borders, thus potentially increasing competition among firms. This would occur, for instance, if digital technologies allowed for tighter monitoring of suppliers and higher propensity to outsource, cheaper business experimentation, easier sharing of ideas, lower barriers to entry, and easier access to a broader international market. For instance, access to online platforms such as E-bay is already enabling SMEs to engage in cross-border trade, and transform them in micro-multinational enterprises (Lendle et al., 2013), by reducing the cost of exploring new markets and of linking to an international production chain (OECD, 2016). Furthermore, monopoly positions may be harder to sustain in the longer term, given the speed with which innovation takes place and market boundaries change in a digital context. The internet has been playing a key role in connecting economic agents and enhancing the sharing of knowledge and the diffusion of innovation (OECD, 2016). Historically, the emergence of new business models involving digital technologies, such as platforms, has also increased competition in other, non-digital markets, such as in the case of Airbnb and the hotel industry or

Amazon in the retail sector. The question however remains: how much of the observed changes in the competitive environment can be attributed to the digital transformation?

Existing evidence over the 1990s (Brynjolfsson et al., 2008) suggests that US industries that become more ICT intensive (which implies that knowledge transfers and replication of business processes become easier and cheaper), also display increasing market concentration, hinting that the two may be related. Previous OECD work (Andrews et al., 2016) confirms that over the first decade of the twenty-first century, frontier firms (top 2%) in ICT services experienced a significantly higher growth in productivity and in market share not only vis-à-vis non-frontier firms, but even within the group of best performing firms (top 10%) in the ICT services sector (see Figure 2.1). These differences in firm performance translate into the ability of frontier firms to pay higher wages than non-frontier firms, even for similar workers who are employed in the same occupation. Berlingieri et al. (2017) document an increasing divergence in wages and productivity among firms, even within narrowly defined industries (IT sectors).

McKinsey (2015a,b) show that media, finance and professional services industries, which are identified as the most digitalised sectors, are characterised by significantly higher profitability than others, and that this trend has increased over the last 30 years. Furthermore, increasing disparities in profitability are evident between most digital companies and all other companies, even within digitalised sectors.

These economic relationships highlight the importance of studying the evolution of the competitive environment over time, and of relating it to changes in the use of digital technologies at the sector level.

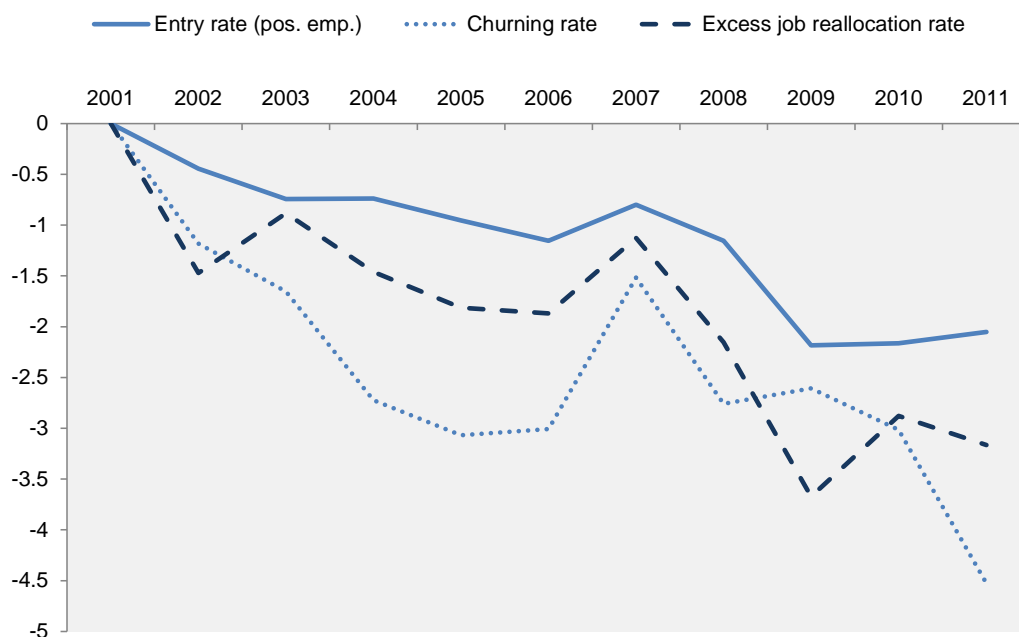
2.2. Approach of this study

Digitally intensive firms are very innovative and may benefit from combinatorial innovation (one innovation builds on another like big data analytics which lead to machine learning which in turns spurs advances in artificial intelligence); much of the know-how may be protected by intellectual property rights that provide legal protection that limits diffusion; and new digital business models rely on the intensive use of knowledge assets, which can be re-used with a marginal cost to replicate that is often close to zero, allowing digital companies to scale up faster and more easily, and generate increasing returns to scale. As Shapiro and Varian (1999) highlighted, “positive feedback makes the strong get stronger and the weak get weaker, leading to extreme outcomes”. In addition, digital industries are typically characterised by: (i) network effects, both direct and indirect; (ii) economies of scope in data collection and analysis, and, thanks to this information; (iii) high and increasing levels of price and product differentiation thanks to the pervasive power of data analytics (OECD, 2015b). Over time, these characteristics may help industry leaders sustain and advance their position, if they represent an additional obstacle to the entry of new players, and slow down the growth of competitors.

There are different ways of characterising the competitive environment and the dynamism of a sector and its changes over time. Recent evidence by the OECD uses entry and exit rates of businesses, as well churning rates and excess job reallocation rates,¹ to proxy for business dynamism. As shown in Figure 2.2, business dynamism has decreased according to the three measures across a group of 20 countries. In addition, the same data shows that this decline has been stronger in IT and telecommunication manufacturing and services (Figure 2.3). Further evidence is provided by ongoing OECD research (Calvino and Criscuolo, forthcoming): depending on which of the different dimensions of the digital transformation the analysis focuses on (e.g. access to e-commerce; automation etc.), the digital transformation translates in more or less dynamism of the economy.

A decline in business dynamism can also be reflected in an increase in concentration.² Bessen (2017) shows that, in the US, the use of proprietary IT systems is strongly associated with industry concentration across a wide range of sectors. However, measures of concentration or business dynamism based on entry and exit rates might suffer from misreporting and mismeasurement biases. This is the case when the analysis cannot rely on Census data, as pointed out by Ali et al. (2013). Measurement issues aside, industries with high concentration, for instance, can be very competitive, if the threat of entry is high, among other reasons (Griffith and Harrison, 2006).

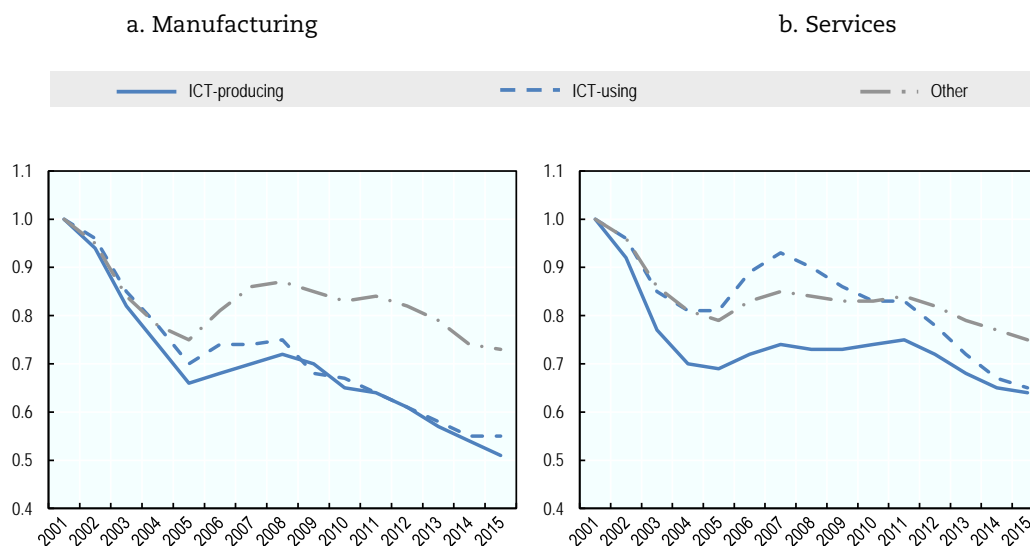
Figure 2.2. Decline in business dynamism



Note: The reported graphs depict year dummies, with 2001 as baseline year, estimates from within country sector regressions of the variables entry rate, churning rate and excess job reallocation rates. Years before 2001 and after 2011 are excluded due to the more limited data coverage. Estimates are based on 20 countries (AUT, BEL, BRA, CRI, DNK, ESP, FIN, FRA, GBR, HUN, ITA, JPN, LUX, NLD, NOR, NZL, PRT, SWE, TUR, USA).

Source: OECD calculations using the DynEmp v.2 database, 2017.

Figure 2.3. Declining entry rates in ICT producing, ICT using and other sectors



Note: entry rates are defined as number of entering units over number of entering and incumbent units. The focus is on firms with one or more employees. ICT-producing sectors are defined as “IT and other information services” and “Telecommunications” from the services sector and “Computer, electronic and optical products” from the manufacturing sector. ICT-using sectors are defined as “Publishing, audiovisual and broadcasting activities”, “Legal and accounting activities” and “Scientific research and development” from the services sector and “Electrical equipment”, “Machinery and equipment” and “Chemicals and chemical products” from the manufacturing sector. See OECD (2017b) for additional methodological details. Figures report three-year moving averages, conditional on the availability of data. A coverage table is enclosed. The time period under consideration ranges between 2001 and 2015. The first available year is set as the index year. Owing to methodological differences, figures may deviate from officially published national statistics. Data for all countries are still preliminary.

Source: OECD 2017(b), based on DynEmp3 Database, <http://oe.cd/dynemp> (accessed in July 2017).

The present chapter assesses the relationship between changes in competitive environment and the digital transformation in yet a different way, i.e. focusing on changes in mark-up pricing. This analysis complements a suite of work that the OECD is undertaking that seeks to provide a coherent picture of the role of digital change for the business environment. The aim of this broader analysis, looking at business dynamism, mark-ups and mergers and acquisitions, is to provide evidence from different data sources, using different methodologies and looking at different aspects of business dynamism, innovation and the competitive environment, to help explore the growth and persistence of the productivity gap and decline in diffusion.

Several measures of market power have been used in previous studies, including firms' profits, returns on investment or, for listed firms, dividends and market capitalisation. For example, McKinsey Global Institute (2015a) show that variance in corporate profits has increased in time, both within industries – where the best companies enjoy ever-increasing growth in profits relative to their competitors – and between industries, with some industries leaving others significantly behind in profitability.

Market power can also be proxied by mark-ups, i.e. the difference between the price a firm charges for its output on the market and the cost the firm incurs to produce one extra unit of output (i.e. its marginal cost). In a perfectly competitive market, no actor has the power to affect market prices; firms enter until positive profits can be made and firms price their products at their marginal cost as a consequence. In such a market, mark-ups, defined as the ratio of unit price over marginal cost, are equal to unity. If markets instead are not perfectly competitive, firms can charge consumers a price higher than the marginal cost, leaving a positive wedge between them and a mark-up greater than unity.

However, although high mark-ups may be a sign of market power, they can also be related to other factors prevailing in an industry. For instance, as discussed in detail in previous OECD work (Martins et al., 1996), large fixed costs, a high degree of innovation or a high value of embedded intangibles may give rise to mark-up pricing. The same is true for international linkages, which can also affect market power (e.g. De Loecker and Warzynski, 2012).

Martins et al. (1996) analyse the impact of imperfections in product markets on the price setting of firms, and estimate mark-ups extending the methodology first proposed by Hall (1986), and later modified by Roeger (1995). They relate mark-ups with the structure of the industry and explore the evolution of mark-ups over the business cycle across 14 OECD countries for manufacturing and selected services sectors for the 1980-92 period. They show that departures from perfect competition are very common in the manufacturing sector, but even more in service sectors. Moreover, although high mark-ups might be a sign of lack of competition, they may also be related to the market structure prevailing in an industry. More recently, but also drawing on Hall (1986), De Loecker and Eeckhout (2017), estimate mark-ups over a long time horizon for publicly-traded companies in the US and report a significant increase in mark-ups since the 1960s.

This study follows the same methodology and exploits cross-country firm annual balance sheets and income statements across 26 countries for the period 2001-14. The report estimates firm-level mark-ups as proposed in the work of De Loecker and Warzynski (2012), who build on Hall (1986). This methodology enables taking a first step in the investigation of the dynamics of the competitive environment over time, as well as correlating it with technological changes at the sectoral level due to the digital transformation, among other correlates such as innovativeness and international linkages. By making use of firm-level data, the analysis also allows for a differential analysis by mark-ups along the distribution and across firms of different characteristics, such as size or age. The study takes into account several dimensions of the digital transformation, and in particular its technological component (ICT investment and services, robots), human capital requirements (ICT specialists), and new forms of market access (e-commerce). More information on the methodology and data are provided in Annex 2.A1.

2.3. Results

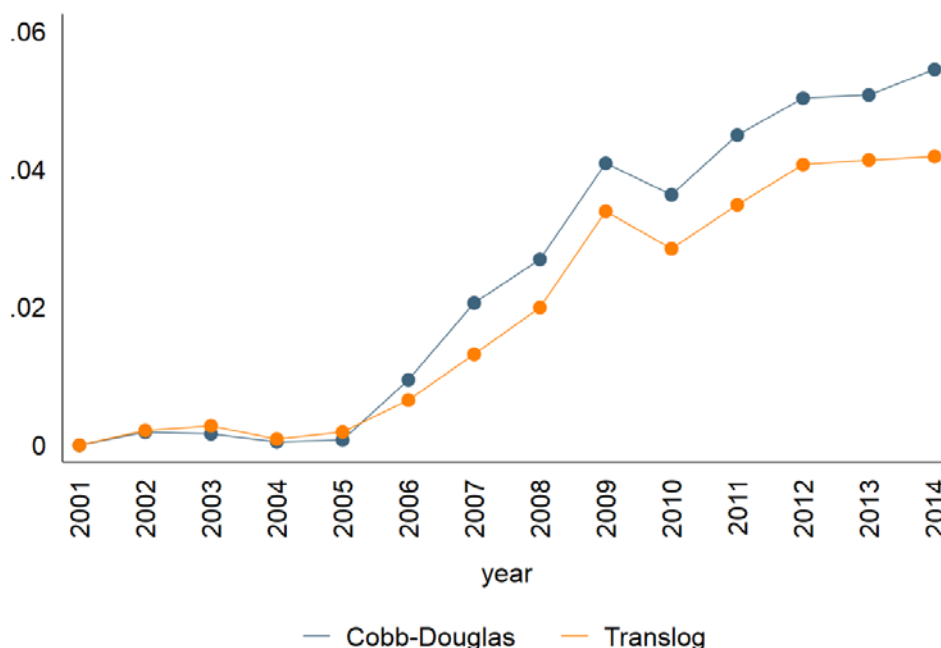
Evidence on rising mark-ups

The analysis shows that mark-ups have been increasing over time over the period 2001-14 in the sample. Figure 2.4 plots the average growth rate of mark-ups over time, for both production function specifications used in the analysis (see Annex 2.A1). The figure shows that mark-ups have been increasing by around 6% (4%) over the period considered when using a Cobb-Douglas (Translog) production function. A similar increase is also reported in a recent study by De Loecker and Eeckhout (2017), who estimate mark-ups over a longer time horizon for publicly-traded companies in the United States. Reassuringly, the two production functions exhibit very similar patterns over time.³

Interestingly, once firms are grouped by their mark-up levels,⁴ the average growth in mark-ups appears to be mainly driven by those firms that enjoy the highest level of mark-ups (i.e., firms in the top decile of the mark-up distribution). Note that deciles of the distribution are defined relative to the rest of the firms in each particular year. This choice is explained by the aim of describing changes in the business environment over time rather than focusing on changes for specific firms. In fact, the analysis investigate to what extent differences between firms in business today vs. firms in business a decade ago can be attributed to the digital transformation. Thus the firms included in the top decile may change from year-to-year.

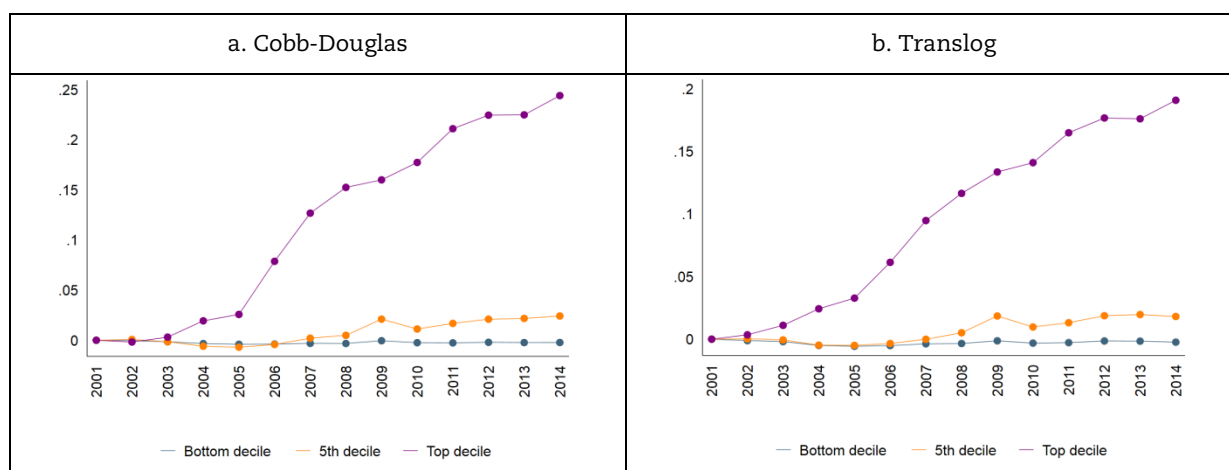
Figure 2.5 plots average growth rates of mark-ups over time in the top, the bottom and the median decile of the mark-ups distribution (in the left panel the underlying production function is a Cobb-Douglas, whereas in the right panel a Translog). In both cases, while the bottom and the median decile exhibit a flat trend, the top decile increases over time by around 20%. This analysis suggests that it is the case that firms with the highest levels of market power enjoy increasingly larger mark-ups vis-à-vis firms belonging to rest of the mark-up distribution. The average mark-up growth depicted in Figure 2.4 seems, therefore, to be mainly driven by firms exhibiting the highest mark-ups.

Figure 2.4. Average firm log mark-up: growth 2001-14



Note: Unconditional averages of firm-level log mark-ups, for all firms in the manufacturing and non-financial market service sectors included in the sample. The figure plots log-mark-ups and indexes the 2001 level to 0, hence the vertical axes represent log-differences from the starting year which, given the magnitudes, approximates well for growth rates.

Source: Author's estimations on Orbis data.

Figure 2.5. Log Mark-up growth over time (2001-2014) in different parts of the distribution

Note: Unconditional averages of firm-level log mark-ups in the chosen part of the distribution of mark-ups. All firms in the manufacturing and non-financial market service sectors included in the sample. The figures plots log-mark-ups and indexes the 2001 level to 0, hence the vertical axes represent log-differences from the starting year panel (a) is based on a Cobb-Douglas production function, whereas panel (b) on a Translog production function.

Source: Author's estimations on Orbis data.

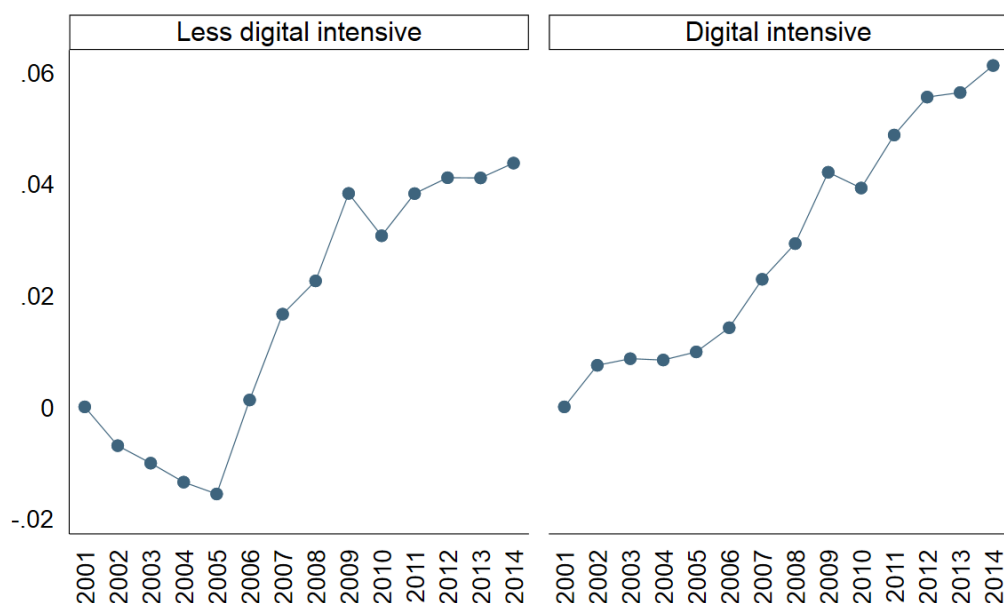
To sum up, looking at trends of mark-ups over time: i) on average, mark-ups are increasing over the period 2001-14; ii) this result seems to be driven by those firms that enjoy the highest level of mark-ups, the bottom half of the mark-ups distribution exhibiting essentially a flat trend over time. One of the potential criticisms to the analysis might be that the trends depicted above hinge upon the inclusion of single countries. Robustness checks performed eliminating the US from the sample show the same patterns.

The digital transformation and market power

Do mark-ups differ between sectors defined as digitally-intensive and less digitally-intensive? Figure 2.6 suggests that firms operating in sectors which are defined as digitally-intensive at the beginning of the period (right hand side of the figure) display by the end of 14 years a higher average growth in mark-ups than firms operating in less digitally-intensive sectors. The growth differential is larger when a Translog production function is considered (Figure 2.A1.2).⁵

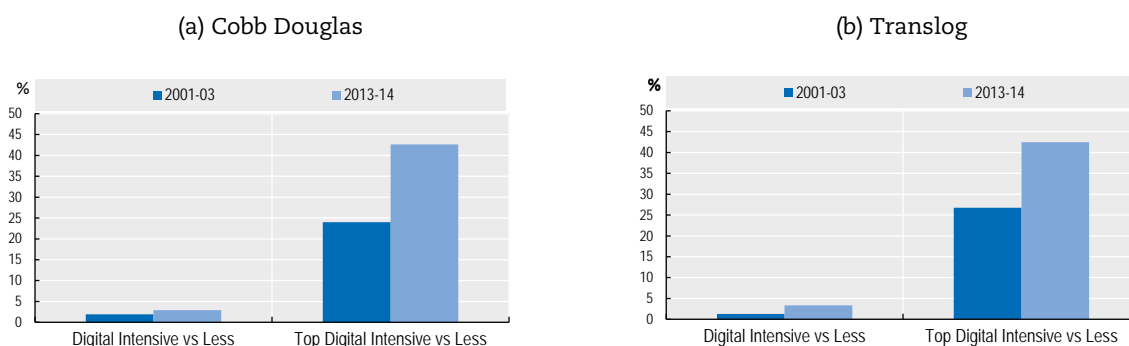
These descriptive facts, however interesting, may be driven by other factors which differ across digital intensive and less digital intensive sectors, and which are related to mark-ups themselves. Some of these factors are taken into account below, where the econometric analysis aims at teasing out the “true” relationship between a sector’s digital intensity and firms’ mark-ups from other confounding factors. Two main trends emerge: first, firms in the top-digital sectors are found to display on average higher mark-ups than firms operating in low-digital sectors. Second, the gap in mark-ups between the average firm in a top-digital vs bottom-digital sector is larger in 2013-14 than in 2001-03, suggesting that this positive correlation between mark-ups and digitalised sectors is stronger nowadays than in the past.⁶

These facts are presented in Figure 2.7 (see the corresponding Table 2.A1.1 in Annex 2.A1), which reports differences in mark-ups for firms operating in digital intensive sectors relative to less digital intensive sectors conditional on other firm characteristics, such as age, size, and country-year of operation. Sectors are classified as “digital”, if their digital intensity is above the median of all sectors (e.g. publishing, audiovisual and broadcasting activities; wholesale and retail trade, repair of motor vehicles and motorcycles; and computer, electronic and optical products) and as “top-digital” if they are in the top quartile of the sector distribution in terms of digital intensity (e.g. telecommunications and IT and other information services).⁷ Differences between Translog and Cobb-Douglas coefficients are not driven by differences in the sample composition.⁸

Figure 2.6. Mark-up growth over time (2001-14) in digitally intensive vs less digitally intensive sectors

Note: The distinction between digital intensive sectors (resp. less digital intensive sectors) rank above (resp. below) the median sector by digital intensity, as calculated jointly over all indicators of digitalisation in Calvino et al. (forthcoming). This graph fixes the ranking of sectors to the initial period (2001-03), and shows only mark-ups estimated assuming a Cobb-Douglas production function.

Source: Author's estimations on Orbis data.

Figure 2.7. Average percentage differences in mark-ups between firms in less digital intensive and in digitally intensive sector at the beginning and at the end of the sample period

Note: The graphs report the estimates of a pooled OLS regression explaining firm log-mark-ups in the period, on the basis of the company's size, age and country-year of operation, as well as a dummy variable with value 1 if the sector of operation is digitally intensive vs less intensive (specifications on the left in the graph), or if the sector of operation is among the top 25% of digital-intensive sectors vs not (specifications on the right in the graph). Panel (a) estimates mark-ups based on a Cobb Douglas production function, panel (b) on a Translog production function. Standard errors are clustered at the company level. All coefficients are significant at the 1% confidence level.

Source: Author's estimations on Orbis data.

The estimates suggest that firms operating in a "digital intensive" sector enjoy a 2 to 3% higher mark-up than firms operating in less digital intensive sectors, and that this gain is substantially higher (up to 43%)⁹ if a firm is operating in one of the top digital sectors. Second, Figure 2.7 compares these differentials over time: not only the magnitude of the gains in mark-up grows over time (dark blue vs light blue bar) but the extent to which this gap has increased over time is much more significant for firms in sectors that are most digital intensive. The results hold and are quantitatively very similar when mark-ups are estimated assuming a Cobb Douglas or a Translog production function, as reported in panel (b) of the figure.

To summarise, four basic results have been presented from an initial analysis of mark-ups in firms from 2001 to 2014. Looking at mark-ups generally, two trends emerge: (i) average mark-ups are increasing over time; (ii) these trends are mainly driven by a steep increase in mark-ups of the top decile of firms. Distinguishing between digital intensive and less digital intensive sectors, it is observed that: (iii) mark-ups are higher in digital intensive sectors than in less digital intensive sectors; (iv) mark-up differentials between digital intensive and less digital intensive sectors have increased significantly over time.

These facts seem to suggest that market mechanisms in the considered economies may have been changing relative to the paradigm of free-markets. Other recent studies suggest similar findings, starting from the mentioned De Loecker and Eeckhout (2017), Bessen (2017), Gullon et al. (2015) and McKinsey Global Institute (2015a).

2.4. Discussion and conclusions

Markets rarely correspond to the theoretical textbook case of perfect competition where prices equalise firms' marginal costs and no market power exists. This is especially the case when products are heterogeneous, i.e. multiple varieties exist for the same product, and consumers can perceive them as at least slightly different one from the other. A high level of product differentiation (and customisation to the client's needs) is typical of services, which nowadays account for the majority of GDP in more developed countries.

Second, some temporary restriction of competition, e.g. the one granted to innovators by patents, might be needed ex-ante to strengthen innovators' incentives for investment. Third, some market power may be generated by products of higher quality, and the branding strategies of firms.

More generally, the balance between fostering ex-ante the introduction of new products and new services, which could satisfy consumers' preferences and promote economic growth, and concerns of lack of competition ex-post, has always been difficult to strike. This is all the more true in the digital economy because of network effects.

The present analysis focuses on one aspect of the competitive environment, i.e. the dynamics of firm mark-ups, using a rich set of firm-level data and a flexible methodology that allow for analysis of mark-ups along the distribution and across firms of different characteristics, such as size or age. It finds increasing mark-ups on average across all firms in the sample, and further shows that mark-ups are higher and have grown more in digitally-intensive sectors than in less digitally-intensive sectors over the 2001-14 time period.

That said, further refinements of the mark-up measures and additional robustness tests could be part of a future research agenda. For example, the proposed taxonomy of sectors by digital intensity is an imperfect proxy of the phenomenon, which includes a broader array of attributes than those considered in the taxonomy. The analysis could benefit from (i) consideration of how intensive sectors are in homogeneous or heterogeneous goods and services; access to information on (ii) technology adoption at the firm level; (iii) the importance of network effects at the sectoral level and (iv) at the firm level; and finally, (v) the role of intangible assets in explaining the observed patterns in mark-ups. A second extension of the present analysis could control for the firm's innovation output (patents), which is likely to be a well-established source of market power. Martins et al. (1996), for instance, correlate average industry mark-ups with the R&D intensity of the sector.

It is also possible that some firm- and industry-level characteristics which are not explicitly treated in our empirical model are both generating higher mark-ups, and allowing for a sector to leap ahead in the digital transformation. One such dimension is indeed the firm's ability to innovate. A second such dimension would be the level of exposure of the sector to international competition. Technology adoption, innovation and international linkages are all linked to a firm's productivity.

The analysis revealed associations that should not be interpreted causally. If higher mark-ups generate higher profits, and if firms' investment is at least partially funded through cash flows, firms with higher mark-ups may be more digital intensive because they can afford the investment in new technologies. This concern, however,

is partly reduced in this analysis by the consideration of multiple dimensions of the digital transformation, some of which may not rely too heavily on the availability of high market power to be embedded in production (e.g. the hiring of an ICT specialist). Furthermore, the digital taxonomy is defined at the sectoral level, which should lessen the scope for the reverse causality, which might be more of a concern if the measure of digital intensity was expressed at the firm level.

Lastly, as mentioned, mark-ups are but one possible measure of market power, albeit a very meaningful one used widely in the literature. Future work could expand the analysis of the competitive environment by looking at other proxies of imperfect competition aside from mark-ups, such as profits, market concentration and M&A activities.

Annex 2.A1. Methodology and data

Methodology

The methodologies used by De Loecker and Warzynski (2012) and Hall (1986), followed in this analysis, estimate mark-ups with a so-called “production approach”, as no assumption is required on the shape of demand faced by companies and on how firms compete. The methodology requires “only” a panel of firm-level output and input data, and the assumptions that (i) at least one input of production can be adjusted without frictions, and that (ii) firms produce by minimising their costs. Furthermore, although an explicit treatment of the production function is needed, the methodology is very flexible in that it can retrieve mark-ups when output is expressed as a function of inputs in many different ways. Lastly, while Hall (1986) and its follow-up in Roeger (1995) could only retrieve average mark-ups at the industry level given data limitations, thus restricting the analyses and policy discussions which could rely on the methodology, De Loecker and Warzynski (2012) can estimate firm-specific mark-ups.

Mark-up is defined as the ratio between output price, p_{it} , over its marginal cost, c_{it} . In this framework, mark-up is derived from the first order condition of the firm’s cost minimisation problem with respect to the flexible input, and corresponds to the ratio between the elasticity of output with respect to the flexible input (i.e. how much output grows when the variable input is increased by one unit), OE_{it}^m , and the cost of the variable input as a share of the firm’s revenue, IS_{it}^m :

$$\mu_{it} = \frac{p_{it}}{c_{it}} = \frac{OE_{it}^m}{IS_{it}^m}. \quad (1)$$

Intermediates (as opposed to labour) are assumed to be flexible inputs. The assumption of a fully flexible input seems, indeed, more realistic for intermediate goods and services than for labour, especially in consideration of labour market rigidities (e.g. firing costs) that characterise some countries relatively more than others in the sample.

While IS_{it}^m is observed in the data, OE_{it}^m requires estimating a production function, i.e. the relationship between a firm’s output and its inputs of production. Two specifications have been considered for the firm-specific production function, both based on gross output and three inputs (labour, capital, and intermediates): a Cobb-Douglas production function and a Translog production function. Therefore, for a given firm in a specific industry, the following production functions have been considered:

$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \omega_{it} + \varepsilon_{it} \quad (2)$$

in the case of a Cobb- Douglas production function, and

$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \beta_{ll} l_{it}^2 + \beta_{mm} m_{it}^2 + \beta_{kk} k_{it}^2 + \beta_{lm} l_{it} m_{it} + \beta_{lk} l_{it} k_{it} + \beta_{mk} m_{it} k_{it} + \omega_{it} + \varepsilon_{it} \quad (3)$$

in the case of a Translog production function. In both cases, y_{it} is the log of deflated firm level gross output and l_{it}, m_{it}, k_{it} are, respectively, (log) labour, intermediates, and, capital, while omega is productivity and epsilon is the error term. The Cobb-Douglas can be considered a special case of the Translog, when all the higher order and the interaction terms are equal to zero.

Both production functions have strengths and weaknesses when used to estimate mark-ups. For the Cobb Douglas production function no variation in output elasticities exists across firms within the same industry and,

consequently, variation in mark-ups over time and producers is driven by that of revenue shares. The Translog production function, instead, retrieves firm-level output elasticity estimates and, consequently, mark-ups variation is given by firm-level variation in both revenue shares and output elasticities. The output elasticity of interest is, indeed, given by the first derivative of (2) and (3) with respect to the intermediate input. In the first case, this is simply $\hat{\beta}_m$, which is common to all firms of a given sector; in the second case, instead, the derivative with respect to intermediates is $OE_{it}^m = \hat{\beta}_m + 2\hat{\beta}_m m_{it} + \hat{\beta}_{lm} l_{it} + \hat{\beta}_{mk} k_{it}$, which is firm specific. A firm specific value for the output elasticity implies that each firm is likely to combine inputs of production in a different way. However, the estimates obtained with the Cobb-Douglas are simpler to estimate and, as a consequence, generally considered more stable in the literature than those obtained through the Translog.¹⁰ Using expression

(1) and the estimates for output elasticity, mark-ups can therefore be computed.¹¹

Firm data

The analysis carried out in this paper requires two types of information: accounting data on firms, and a measure of digital penetration in sectors. The firm-level data are sourced from the commercial dataset Orbis by Bureau van Dijk (BVD). It provides information on firms' localisation, annual balance sheet and income statements, although the number of observations per country can vary significantly. It covers the period 2001-14 for 26 countries: Australia, Austria, Belgium, Bulgaria, Denmark, Estonia, France, Finland, Hungary, Germany, Indonesia, India, Ireland, Italy, Japan, Republic of Korea, Luxembourg, the Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, Turkey, the United Kingdom and the United States.

BVD sources these data from a variety of suppliers, from credit rating agencies to national central banks. A number of steps are required to make the dataset suitable for economic analysis, including ensuring comparability of nominal values across years and countries (by deflating with industry-level PPP), estimation of key economic variables (mainly, Multi Factor Productivity), and extensive cleaning to net out the influence of measurement error and extreme values in the analysis.¹² As sampling strategies and reporting threshold vary across the underlying data sources, concerns over the representativeness of the dataset at the economy level over time may arise. To limit such concerns, only firms displaying on average at least 20 employees over the period were considered in the analysis. Many countries included in Orbis, indeed, report exclusively data for firms with more than 20 employees or only a limited sample for firms under this threshold. Therefore, the exclusion of firms under this threshold guarantees a better homogeneity and comparability across countries. Current analysis comparing administrative data sources and Orbis confirms indeed that for the group of firms employing more than 20 workers, Orbis covers a larger portion of the population of firms than for the sample including firms of all sizes (for a technical paper examining the representativeness of Orbis, see Bajgar et al., forthcoming). In addition, as mark-ups are generally increasing with firm size (see for example De Loecker and Eeckhout, 2017), this restriction on the sample should not affect the qualitative conclusions of the analysis.¹³ Further concerns on the accuracy of Orbis data may relate to differences in the reporting units and accounting requirements across countries. For instance, Orbis reports mostly consolidated data for US firms, and both consolidated and unconsolidated data for European ones. While this results in a less satisfactory coverage of the US vis-à-vis European countries, the proposed analysis only exploits consolidated data, which fits the object of the analysis and limits the scope of biases in cross-country comparisons.

The final sample was further restricted to manufacturing and non-financial market service sector firms, for which the estimation of Multi Factor Productivity can be carried out on the basis of the reported financial information. Utilities (ISIC rev. 4 industries 35 to 39), construction (41 to 43), and real estate activities (68) were also excluded. A more detailed account of the industries included in the analysis is reported in the next section of the Annex.

Table 2.A1.1 reports selected summary statistics for the variables used to compute the production function and, finally, mark-ups. Only those observations reporting all the necessary variables to compute productivity were kept. As per standard practice in such analyses, the top and bottom 3% of the distribution of mark-ups were trimmed, in order to be sure that the estimates are not affected by outliers.¹⁴

Table 2.A1.1. Summary statistics in 2005 industry-level USD PPP, overall

Variable	Mean	Median	Standard Deviation (SD)	Number of firms
Real Gross Output	51 300 000	11 700 000	411 000 000	2 508 619
Real Value Added	13 400 000	2 988 442	139 000 000	2 508 619
Real Intermediates	27 100 000	5 495 232	192 000 000	2 508 619
Number of employees	178	50	1 341	2 508 619
Real Capital Stock	21 200 000	1 902 758	374 000 000	2 508 619
Log Mark-up (Cobb-Douglas)	0.30	0.22	0.30	1 803 377
Log Mark-up (Translog)	0.97	0.89	0.28	2 152 650

Source: Author's estimations on Orbis data.

Measurement of digital intensity by sector

The second fundamental source of information is the degree of digital intensity of sectors. As the digital transformation unfolds, it affects sectors differently, depending on their rate of adoption of the new technologies and business practices. Recent OECD work (Calvino et al., forthcoming) benchmarks sectors by their degree of digital intensity over the period 2001-15. It looks at digitalisation in its various manifestations, and in particular its technological components (here: tangible and intangible ICT investment, purchases of intermediate ICT goods and services, robots), the human capital it requires to embed technology in production (ICT specialists intensity), and the way it changes the interface of firms with the output market (online sales). 36 ISIC rev. 4 sectors (as in the OECD Structural Analysis dataset) are thus ranked by their intensity in these dimensions. Figure 2.A1.1 displays these sectors by quartile of digital intensity for the period 2013-15, for each of the considered indicators. It shows that some sectors lag behind in the extent to which they have undergone the digital transformation, no matter the type of indicator used to measure such a transformation (agriculture, mining, real estate), while others rank consistently at the top of the distribution (telecom and IT services).

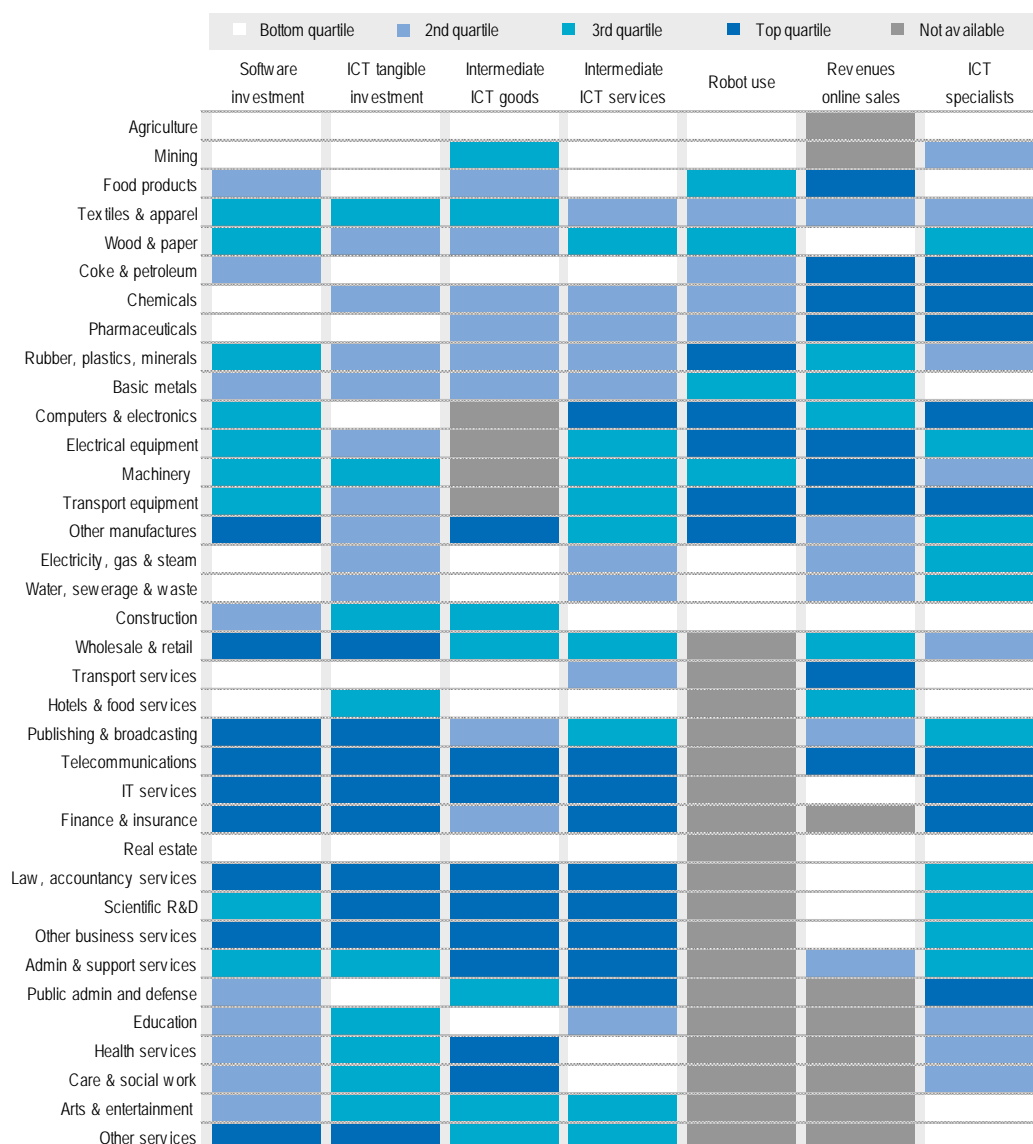
For the purposes of this analysis, each sector gets attributed a single value across all the considered dimensions, and a quartile of the digital intensity distribution as a consequence. This is done for the end period of the sample (2013-15) and the starting period (2001-03), to capture changes in the digital intensity of sectors over time.

The taxonomy of sectors can be used to assess whether market power is different across digitally intensive and less digitally-intensive sectors. It remains, however, an approximate picture of the penetration of digitalisation in the economy, as the phenomenon has more dimensions than are captured by the taxonomy. Importantly, a characterisation by industrial sector fails to capture the within-sector heterogeneity in adoption of digital technology. Unfortunately, Orbis data do not report sufficient information on the technologies firms embed in production, thus making a within-industry analysis impossible.

In Table 2.A1.2 the same summary statistics as in Table 2.A1.1 are reported, but dividing the sample into digitally intensive and less-digitally intensive sectors, for the two periods for which the digital binary variable is available (2001-03 and 2013-14). On average all variables have increased from the initial to the final period, both in the intensive and less-intensive digital sectors. Moreover, firms belonging to digitally-intensive sectors are on average bigger (in terms of number of employees, real value added, or real gross output) and exhibit

higher mark-ups. Finally, the difference in average mark-ups of firms belonging to digitally intensive and less intensive sectors has increased over time.

Figure 2.A1.1. Taxonomy of sectors by quartile of digital intensity, 2013-15



Note: All underlying indicators are expressed as sectoral intensities. For each indicator, the sectoral values are averages across countries and years. The taxonomy is based on information for the following countries: Australia, Austria, Denmark, Finland, France, Italy, Japan, the Netherlands, Norway, Sweden, the United Kingdom, the United States, for which values for all indicators in all considered sectors and years are non-missing, with the exception of robot use and online sales, where some sectors are not sampled.

Source: OECD (2017), OECD Science, Technology and Industry Scoreboard 2017: The digital transformation, OECD Publishing, Paris (<http://dx.doi.org/10.1787/9789264268821-en>), based on OECD Annual National Accounts, STAN, ICIO, and PIAAC; International Federation of Robotics; World Bank; Eurostat Digital Economy and Society Statistics; national Labour Force Surveys; INTAN-Invest; and other national sources.

Table 2.A1.2. Summary statistics 2005 industry-level USD PPP, by digital intensity

Variable	2001-03, less digitally intensive				2001-03, digitally intensive			
	Mean	Median	SD	N.	Mean	Median	SD	N.
Real gross output	32 600 000	8 934 993	306 000 000	147 103	52 300 000	12 300 000	406 000 000	237 782
Real value added	9 292 477	2 625 201	109 000 000	147 103	13 400 000	2 864 154	147 000 000	237 782
Real intermediates	15 800 000	3 785 000	132 000 000	147 103	29 200 000	6 027 000	213 000 000	237 782
Number of employees	137	47	1 492	147 103	193	48	1,379	237 782
Real capital stock	13 700 000	2 224 703	176 000 000	147 103	18 000 000	1 453 074	478 000 000	237 782
Mark-up (Cobb-Douglas)	0.27	0.23	0.20	120 791	0.29	0.20	0.29	189 798
Mark-up (Translog)	0.94	0.91	0.16	140 050	0.96	0.87	0.29	225 637
Variable	2013-14, less digitally intensive				2013-14, digitally intensive			
	Mean	Median	SD	N.	Mean	Median	SD	N.
Real gross output	45 400 000	8 363 919	539 000 000	131 268	70 300 000	14 300 000	534 000 000	217 449
Real value added	12 000 000	2 525 048	202 000 000	131 268	17 900 000	3 555 146	169 000 000	217 449
Real intermediates	23 000 000	4 100 410	227 000 000	131 268	38 000 000	7 066 093	264 000 000	217 449
Number of employees	154	50	1 470	131 268	219	56	1 457	217 449
Real capital stock	27 300 000	2 458 770	569 000 000	131 268	31 100 000	1 776 850	485 000 000	217 449
Log Mark-up (Cobb-Douglas)	0.31	0.26	0.26	103 797	0.34	0.21	0.36	167 776
Log Mark-up (Translog)	0.97	0.93	0.20	122 068	1.01	0.88	0.35	202 830

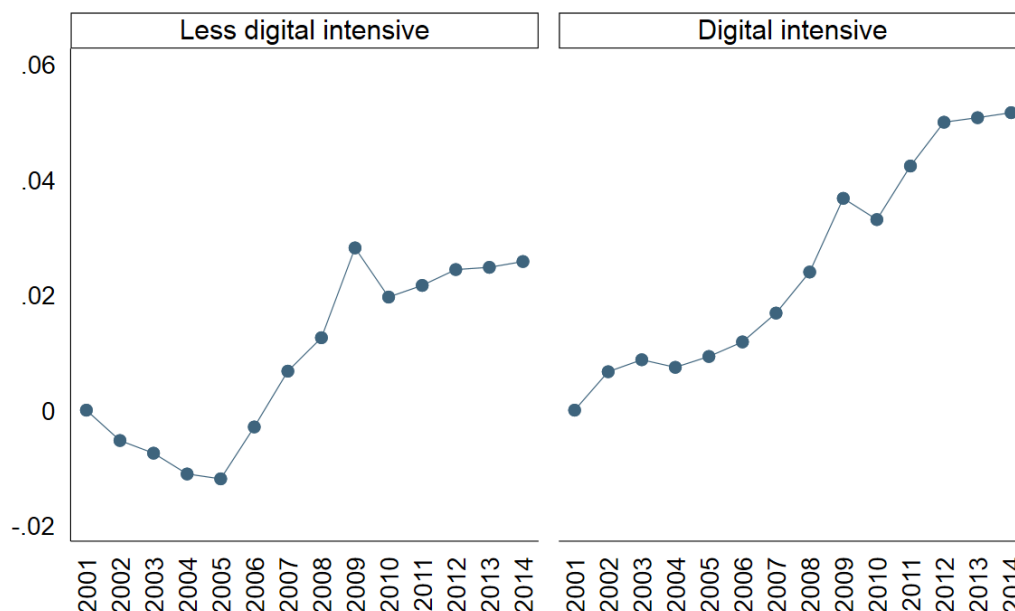
Source: Author's estimations on Orbis data.

Table 2.A1.1. Baseline regressions

	2001-03				2013-14			
	Cobb Douglas		Translog		Cobb Douglas		Translog	
Digital intensive	0.019*** (0.001)		0.013*** (0.001)		0.029*** (0.001)		0.033*** (0.001)	
Top digital intensive	0.215*** (0.002)		0.237*** (0.002)		0.355*** (0.002)		0.354*** (0.002)	
Log(Age)	-0.054*** (0.001)	-0.035*** (0.001)	-0.050*** (0.001)	-0.030*** (0.001)	-0.086*** (0.001)	-0.047*** (0.001)	-0.076*** (0.001)	-0.038*** (0.001)
Log(L)	0.037*** (0.001)	0.024*** (0.001)	0.072*** (0.001)	0.056*** (0.001)	0.044*** (0.001)	0.019*** (0.001)	0.076*** (0.001)	0.049*** (0.001)
Observations	308 157	308 157	363 027	363 027	266 624	266 624	319 685	319 685
R-squared	0.060	0.184	0.094	0.254	0.088	0.473	0.106	0.441

Note: Results of estimating OLS regressions where the dependent variable is a firm's log-mark-ups. "Digital intensive" is a dummy variable with value 1 if the sector is above the median of all 36 considered sectors by digital intensity, as ranked in Calvino et al. (forthcoming). "Top digital intensive" is a dummy variable with value 1 if the sector is in the top quartile of digital intensity instead. Errors are clustered at the company level. *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's estimations on Orbis data.

Figure 2.A1.2. Mark-up growth over time (2001-14) in digital intensive vs less digital intensive sectors using Translog specification

Note: The distinction between digital intensive sectors (resp. less digital intensive sectors) rank above (resp. below) the median sector by digital intensity, as calculated jointly over all indicators of digitalisation in Calvino et al. (forthcoming). This graph fixes the ranking of sectors to the initial period (2001-03), and shows only mark-ups estimated assuming a Translog production function.

Source: Author's estimations on Orbis data.

Notes

1. Entry rate is defined using number of units with positive employment (number of entering units with positive employment over total number of units with positive employment). Churning rate is gross job creation rate + gross job destruction rate. Excess job reallocation rate is churning rate minus the absolute value of the net employment growth rate. Specifically, excess job reallocation in a given period is defined as total job reallocation less the absolute value of net employment growth for the period. Excess job reallocation thus reflects the job reallocation that occurs over and above the minimum necessary to accommodate the net employment changes for the sector in question.
2. A recent OECD study provides preliminary evidence that in the course of the last ten years there has been an increase in concentration, as proxied by the share of sectoral sales accounted for by the largest firms in terms of sales. Gullon et al. (2015) produce similar evidence for the concentration of public companies in the US over the last two decades, which is found to have increased in 90% of industries, together with profit margins and stock returns.
3. De Loecker and Eeckhout (2017) observe a difference in the level of mark-ups computed through the Cobb-Douglas and the Translog production functions of very similar magnitude to the one presented here above for the same period. They also stress that “The only difference is in the actual level of the mark-up, which is not direct interest, while the change over time is again very similar”.
4. In each one-digit sector, firms were divided into 10 deciles over the mark-up distribution. For example, the 10% of firms with the highest mark-ups belong to the “Top decile”, whereas the 10% of firms with the lowest mark-ups belong to the “Bottom decile”. In Figure 2.5, the average across all countries and sectors is plotted year by year for the top, the median, and the bottom decile of the distribution.
5. In unreported analysis, available upon request, a regression was run with log mark-ups as dependent variable on year dummies and year dummies interacted with the digital (top digital) dummies. The interacted terms were all positive and statistically significant (with the exception of that for 2009 for the digital sample, where the coefficient is significant only at the 13% level). This confirms the difference in trends shown in Figure 2.6.
6. This conclusion is drawn from comparing the point estimates of interaction terms and their statistical significance.
7. It means that the “top-digital” sectors are also included in the “digital” category; in particular, sectors above the median in the “digital” category are also classified as “top-digital”. A further robustness specification checks whether differences in mark-ups for firms operating in digital intensive sectors relative to less digital intensive sectors are mainly driven by: (i) the top quartile relative to the third quartile; (ii) the top decile of sectors. The results are indeed driven by the top quartile sectors. Moreover, including a dummy for the top decile separately from the rest of the top quartile sectors yields significantly larger coefficients for the very “top” group, while both terms remain statistically significant. These results are available upon request.
8. Further omitted robustness checks retrieve qualitatively similar pattern for the samples: (i) excluding the United States; or (ii) G20 vs non-G20 countries. Another specification investigates the robustness of the results to possible omitted variables including in the baseline a firm-level and sectoral-level capital intensity.
9. $43\% = \exp(1+0.36) - 1$. See Halvorsen and Palmquist (1980).
10. The parameters of the production function are estimated econometrically at the firm-level using the Akerberg, Caves and Frazer (2006) control function approach (known as the ACF approach), while relying on material demand to proxy for productivity. This is a two-stage approach in which all parameters are estimated in the second stage. This point is particularly important when estimating more flexible production functions, such as the Translog, since the identification of the labour coefficient in the first stage relies heavily on the assumptions underlying the control function. For a detailed discussion of control function approaches, see Akerberg et al. (2007).
11. As discussed in De Loecker and Warzynski (2012), the expenditure share for intermediates, IS_{it}^m , has to be corrected for measurement error in output, $\hat{\varepsilon}_{it}$, obtained in the first stage of the ACF procedure. This correction is meant to eliminate any variation in IS_{it}^m that comes from variation in output not related to variables impacting input demand, i.e., unanticipated shocks to production which are unknown to the firm when it decides on how to optimise input use.
12. Negative values for gross output, value added, labour and intermediates were removed. The 1% tails of the distributions of the same variables were also removed, as well as the industries with less than 500 observations over the whole period.

13. As shown later in the chapter, the average increase in mark-ups uncovered in the analysis reflects mostly an increase in mark-ups of the top decile of the mark-ups distribution. In unreported analysis, available upon request, the probability of being in the top decile was related to the size of the firm in terms of employment. Two alternative specifications were tested. In the first specification, firm size was included log-linearly, while in the second size was expressed as categorical variable, where the categories are: 20-49; 50-99; 100-249; 250-499, 500-999, 1000+. In both specifications, a higher firm size is linked to a significantly higher probability of being in the top decile of the mark-up distribution.

14. The analysis excludes outliers in the top and bottom 3rd percent of the mark-up distribution to ensure that the results are not driven by outliers following for example De Loecker et al., (2016), see their footnote 50. However, exactly as they suggest, the results of the present analysis were found robust to alternative trimming choices (top and bottom 1% or 5%). More generally, in studies using firm level data it is common practice to delete outliers. See for example Hall and Mairesse (1995) or Hsieh and Klenow (2009).

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CHAPTER 3

OVERVIEW OF FINDINGS FROM A SURVEY OF REGULATIONS AFFECTING COMPETITION IN LIGHT OF DIGITALISATION

Introduction

A constant priority and challenge for policymakers is to ensure a level playing field exists for companies to compete, as new technological and business model possibilities emerge.¹ The challenge to ensure a level playing field is all the greater in light of digitalisation. The need for regulatory structures to evolve over time, taking account of technical conditions and policy priorities, is well recognised. The OECD has previously developed a methodology to help evaluate policies for ensuring regulations can achieve the economic benefits of competition, known as the *Competition Assessment Toolkit*.² The Toolkit approach remains relevant and merits review. At the G20 Digital Economy Ministerial Conference in Dusseldorf on 6-7 April 2017, the G20 Members agreed to a Roadmap for digitalisation with a call to “Foster competition in the digital economy” and noting the possibility to “consider reviewing the OECD Competition Assessment Toolkit in light of digitalisation”.³

The ongoing digitalisation of the economy deeply affects how existing markets and sectors operate. New products and services can deliver important consumer benefits and moving to a digital economy is widely seen as “a necessary condition for boosting more inclusive and sustainable growth and enhancing overall well-being” (OECD, 2017).⁴ In the fast-moving reality of digitalisation, existing regulatory frameworks designed for traditional products and services may not be suitable for the digital economy. In some cases, they may even prevent or slow down the development of new digital products and services. Conversely, new policy measures might be needed to enable digitalisation.⁵

3.1 Digital economy and competition policy

The survey of regulations summarised in this chapter is part of wider work by the OECD Competition Committee on the digital economy. The discussions of the Committee, especially in the last couple of years, have often concerned the challenges for enforcement and advocacy brought by digitalisation.⁶ The topics are organised around a number of work streams, including:

- Challenges posed to prevailing antitrust tools and approaches: this stream looks at the suitability of existing antitrust tools and techniques for dealing with the digital economy and innovative disruption. For instance, competition authorities are considering how the multi-sided nature of some of the innovative markets can be dealt with in competition enforcement and how to take account of specific characteristics of digitalisation (e.g. how to define markets and dominance when no money transactions occur, such as on search engines).⁷
- Detailed industries and sectors: under this stream, the Committee has already looked at specific industries or sectors being disrupted or affected by the digital economy (such as transportation, legal services and electricity).
- Review of regulations: this stream considers how governments should review and revise existing regulations to avoid undue harm to competition, entrepreneurship and innovation while ensuring government policy objectives are met.

The survey described in this chapter is part of this work stream and will be complemented by an expert workshop in 2018. The workshop will include two focus areas: (i) experiences with existing regulations that have proved restrictive for digitalisation, or with the challenges posed by lack of regulations; and (ii) a discussion on how the most common issues can be dealt with by a standard competition assessment methodology, such as the OECD toolkit, or whether modifications and examples are necessary.⁸

3.2 Overview of the Survey

In order to collect examples of such regulations, the OECD has contacted the members and participants in its Competition Committee, the competition authorities of G20 countries, and representatives of the business community, through the Business and Industry Advisory Committee to the OECD (BIAC).⁹ This information has been complemented by desk research by the OECD Secretariat and by the material prepared for a number of Competition Committee sessions on the digital economy in the period 2015-17. This chapter aims at summarising the results of the initial information collection.¹⁰ The purpose is not to identify nor to focus on problematic regulation, but rather to review the national and local regulatory policies that exist and that are contemplated with an impact on digitalisation. Ultimately we will consider whether they follow the principles of the OECD's Competition Assessment Toolkit.

The sharing economy is at the centre of the debate on digitalisation and regulation, with many countries considering changes to applicable legislation in the accommodation and the transport sectors. Financial services, e-commerce, healthcare, professional services and electricity are among the other sectors where regulatory changes are sometimes necessary in light of digitalisation. In these cases, legislation was sometimes drafted at a time where some products or services did not exist, with a number of potential implications. For instance, it may not be clear whether the new products and services fall under the existing legislation or the legislation may include requirements that are harder for new economic operators to comply with. Another development, related to the sharing economy, is that the regulation of economic activities often is not directly applicable to transactions between private individuals, or if applicable, treats private individuals in the same way as large enterprises. It has been noted that some traditional business models at risk of displacement by innovation have lobbied domestic regulators for “adoption of regulations that can stop or delay such innovations.”¹¹

Moving beyond the regulation of specific sectors, relevant developments have been identified in other areas such as data protection and consumer protection. Horizontal legislation is an enabler of online transactions and contributes to building trust in the digital environment. In some cases, amendments to existing legislation may be necessary (e.g. consumer protection, data protection); in other cases, additional regulations may need to be issued to regulate new areas enabling digital transactions, e.g. digital signatures. Finally, the digital transformation has implications that go beyond product market regulation or enabling legislation. For instance, the rise of the sharing economy has led to a debate on labour law and tax compliance, which are beyond the scope of the current analysis.¹²

The remainder of the chapter provides examples of regulations affecting digitalisation, as well as considerations on the methodology that could be used to assess their impact on competition. Section 3.3 provides examples of regulations affecting digitalisation in the following sectors: (i) rental and accommodation; (ii) transport; (iii) financial services; (iv) e-commerce; (v) healthcare; and (vi) legal services. Section 3.4 reviews some enabling legislation in the areas of: (i) consumer protection; and (ii) data protection and localisation. Section 3.5 concludes by outlining how the methodology of the OECD's Competition Assessment Toolkit can be applied to such regulations.

3.3.Examples of regulations by sector

Rental and accommodation

In the accommodation market, most countries have seen the fast development of platforms that allow peer-to-peer rentals of private homes and of hotel booking websites, enabling users to compare prices of a number of properties and book more easily.

In order to accommodate the former type of services, traditional licensing rules for touristic accommodation have often been challenged. In some countries, individuals were not allowed to rent out properties unless they were registered as a touristic business. New legislation has been enacted in some countries to define the requirements for peer-to-peer rentals.¹³ Some regulations that could prevent peer-to-peer activities have been amended in some countries, such as regulations identifying a minimum number of nights for which a property had to be rented¹⁴ or prohibiting renting individual rooms, as opposed to the entire property.¹⁵ Other requirements found in legislation include limitations to opening hours, minimum floor spaces, maximum numbers of rooms, as well as a general classification between professional activities above a certain threshold (e.g. revenues during one year) and non-professional activities below the threshold.¹⁶ Some countries, however, are moving in the direction to increasingly restrict peer-to-peer rentals, such as France, by reducing the number of days that an apartment or bedroom can be rented and requiring a permit for such rental (thus allowing control and reduction in rental stock).

Some cities or countries have a policy of controlling many aspects of housing rental policy due to perceived housing shortages, such as Paris and New York. The result of rent-control or preventing short-term rental policies is to limit ability of owners to earn a return on their investments; policy alternatives include creating an environment that ensures permits to construct are available for extensive new building and allowing conversion of other types of buildings (e.g. offices, hotels) to short-term rental. Some parts of cities may have particularly high shares of residential housing devoted to short-term rentals, and wish to restrict such rentals on the grounds that they change the character of the city, as in Barcelona.

Some countries have also considered how the new services could be accommodated within tax legislation. In one example, rental income is tax exempt if the owner lives in the property and only rents out less than half of the property. If rental exceeds specific thresholds, it may qualify as commercial activity and taxed at a higher rate.¹⁷ Another government is considering the possibility of requiring those letting their properties using online services to obtain a licence and pay a levy.¹⁸

Challenges in relation to booking websites have more often arisen in competition law enforcement than in regulation. Booking websites tend to make pricing agreements with the properties advertised on their platforms, in particular a guarantee that the price available through the website would be the lowest available for that property – including when booking directly with the property. The concern that these agreements may not be in the interest of consumers have prompted investigations by a number of competition authorities.¹⁹ In some EU countries,²⁰ they have also led to legal changes preventing commitments by hotels not to undercut online booking websites.

Transport

The digitalisation process in the transport sector includes the application of Information and Communication Technologies (ICT) to transport networks and vehicles, the trend towards vehicle automation and the growth of applications enabling vehicle sharing and / or taxi booking.²¹

For example, deploying ICT technologies can enable different transport operators to offer customers door-to-door services, regardless of transport mode: users can travel on a single ticket which can be “stored” on a smartphone, instead of on physical support. One basic enabler for these services is the availability and disclosure of information, to ensure open information and payment interfaces among different transport companies.²²

Ride-sharing applications have spread across many countries, often challenging the regulation of traditional taxi services.²³ In some countries,²⁴ ride-sharing services have been prohibited altogether. One of the controversies, at least in Europe, has been whether these platforms can be considered transport services, subject to the applicable licences and authorisations, or information society services.²⁵ An alternative approach has been to amend the definition of transport services to encompass the new services.²⁶

It has been noted that the same rules may not be applicable to different type of providers, e.g. street hailing vs. pre-booked services, and that legislation should aim at creating a level playing field.²⁷ Legislation has tried in some cases to limit the number of cars that can provide ride-sharing services.²⁸ In other cases, regulation that is stricter than the one applicable to traditional services has been introduced (e.g. requirement to own the cars used to provide the service, maximum age of the vehicles, minimum value, financial guarantees).²⁹ The different set of rules applicable to taxis and to private hire vehicles may already apply to the offline world (e.g. requiring drivers of car for hire to return to the garage in between rides, territorial restrictions).³⁰ There are also examples of regulations that have been amended so that the traditional service providers, in this case taxis, could compete on a level-playing field with private cars for hire. For instance, in some countries taxis are now allowed to negotiate set prices, e.g. for transfers to and from airports, and this new development allows them to compete with private cars for hire.³¹

Even booking services relying on licensed taxis have sometimes found existing legislation challenging. For instance, a competition authority challenged regulations imposed on taxi booking applications, including a minimum number of taxi licences, having physical presence, keeping a log of booked services and regulations limiting price competition and preventing discounts.³²

Finally, the disruption of existing activities has led to discussion in some countries (e.g. Australia, Brazil, Italy) of whether there should be any form of compensation for incumbents.³³

Financial services

Disruptive innovation in the financial sector has affected a wide range of services, such as those where technological change has expanded the range of possibilities (e.g. virtual currencies, mobile payments) or services for which margins are typically high (e.g. peer-to-peer lending and currency exchanges).³⁴

The offer of innovative services involving the collection of funds from the public, such as crowdfunding, by entities that do not hold a banking licence has been made possible by a series of exceptions to the general rules.³⁵ A number of countries have reviewed the licensing requirements applicable to the new services, with a view to limiting barriers to entry. A common approach has been to provide so-called “regulatory sandboxes”, for instance by setting a period in which a financial services licence would not be needed. This period, say 12 months, would allow the company to experiment with FinTech applications.³⁶ Another alternative is to allow smaller entities, up to a certain threshold of funds held, to operate without a banking licence and this would grant them some flexibility in accepting deposits from the public.³⁷ The duration of crowdfunding campaigns is affected by how long funds can be held in non-interest bearing accounts. Increasing the maximum number of days allowed by the legislation can therefore facilitate the new services.³⁸

A potential barrier to expansion for new providers could be created by rules restricting investment in the FinTech industry. An example of such regulation could be the requirement for financial institutions to obtain regulatory approval before investing in FinTech companies.³⁹ Conversely, including peer-to-peer loans among the investments enjoying tax benefits could boost their development and help to avoid undue advantages accruing to incumbent products.⁴⁰

As a more general point, it has been noted that financial services are often governed by a complex and fragmented regulatory framework, where regulators have varying mandates and perspectives, e.g. in respect

to consumer protection, anti-money-laundering (AML), stability and safety of the financial system. An industry consultation into regulatory barriers to innovation has also highlighted that some requirements discourage a greater use of digital services in the financial sectors.⁴¹ Examples include specific rules on what constitutes a “durable medium” for providing information to consumers and AML regulations, which discourage the use of digital and mobile solutions for the purposes of Customer Due Diligence (CDD).⁴² The local interpretation of know-your-customer rules and what types of services are bound by such rules may have a substantial impact on what services are offered, and can implicitly require physical presence.⁴³ One of the responses received through BIAAC notes that the requirement for Payment Service Providers to adopt strong (customer) authentication creates barriers to a virtual account opening process.⁴⁴ The same response points to the European Union’s Payment Systems Directive 2 (PSDs), which requires banks to allow third-parties to access customers’ accounts for providing information services and/or payment initiation services, and calls for this requirement to apply to all Payment Service Providers. Sometimes special rules may be developed for smaller transactions with an effect of promoting digital commerce.⁴⁵

E-commerce

Product market regulation sometimes contains requirements on whether a specific product or service can be sold online. This may be the case, for instance, for alcoholic beverages and may be underpinned by consumer protection concerns.⁴⁶ Similar concerns may also explain the restrictions on online gaming in some countries, be it on the time spent⁴⁷ or the money spent online.⁴⁸ Another example in the context of services concerned online travel agents, that were not allowed to provide all the range of services, including vacation packages, as brick-and-mortar travel agents.⁴⁹

Some regulations have been designed for brick-and-mortar traders, and were in some cases developed long before the development of e-commerce. Even so, they may also be applicable to purely online traders. For instance, some regulations may require online traders to have a physical presence.⁵⁰ These may result in higher costs for new entrants that do not already have an established presence in the market. In some cases, the policy maker’s objective to monitor cash payments and reduce tax evasion may result in requirements with which e-retailers find it difficult to comply. For instance, one country has obliged retailers to register sales and to send the corresponding payment information to the tax administration.⁵¹ E-shops obtained an exemption to register the payment only when they are informed the payment has taken place (but no later than at the time of the delivery).

As the sharing economy spreads, some new regulations are being developed in order to separate occasional transactions from professional activities. In addition to the examples from the accommodation and the transport market, some countries are considering introducing limits to the sale of homemade food, by setting a maximum number of meals or maximum revenues per year.⁵²

In addition to product market regulation, legislation in other areas, such as customs and postal services, also has the potential of affecting e-commerce. Examples include tax provisions setting limits on how much consumers can buy from abroad, without being considered professional importers.⁵³ These regulations may be explained, for instance, by attempts to limit outflows of hard currency. However, they also limit cross-border trade. As for postal services, the European Commission has identified cross-border parcel deliveries among the key actions to facilitate e-commerce and create a Digital Single Market (DSM). At regulatory level, measures have been proposed to improve transparency, such as a requirement to publish domestic and cross-border prices for some basic services.⁵⁴

Healthcare

Innovation in the digital economy can improve quality and access to healthcare and “can be particularly important in rural and remote areas by enabling innovative models of care delivery, such as by telemedicine and mobile health” (OECD, 2017; page 18).

The legal framework sometimes needs amendment in order to allow the electronic exchange of test results and other medical documents⁵⁵ or to enable consultation over the phone or the Internet.⁵⁶

One of the benefits of allowing telemedicine services is to increase their supply, hence improving access and price of medical care for patients. This was the motivation mentioned by a competition authority in its opinion on state legislation allowing licensed physicians located within the state and outside the state to offer their services on the same terms.⁵⁷ Regulations allowing telemedicine may still require that the initial evaluation of the patient is conducted in person. In some cases, this may be considered restrictive, as in an opinion on speech/language pathologists, audiologists and hearing aid dispensers⁵⁸ and on dietetics/nutrition experts.⁵⁹ Allowing health professionals to provide prescriptions remotely is another legal change that can improve access and lower the cost of healthcare.⁶⁰

The ability to purchase medicines online could also help improve access and affordability, and the legislation often tries to balance these aims with safety concerns about the abuse of medical substances. The sale of prescription drugs online is allowed in some countries, under certain conditions.⁶¹ Pharmacies often have to be licensed in the same country where the prescription is being made and where it is dispensed.⁶² In order to be able to sell online, pharmacies are often required to have a brick-and-mortar establishment in the first place, since this makes their monitoring and control by health and licensing authorities easier and more effective.

In one country,⁶³ the official list of prescribable medications is a physical book that has exclusive authority as a list of available medicines. This book is only published every two years. As a result, entry by a new medication can be slowed by as much as two years if it misses the publication deadline for a new book. An electronic book, available over the internet, could eliminate this time delay on entry.

Legal services

Innovative services in this area include, for instance, online service delivery by professionals or content supplied by unlicensed providers, e.g. such as platforms offering “access to open-source legal documents for both consumers and legal professionals” (OECD, 2016).⁶⁴ Dispute resolution services are also available online, in areas ranging from municipal taxation to parking tickets to e-commerce transactions.⁶⁵

Automation is emerging as an important innovation in this sector. For instance, professionals can use software tools for document review and for searching information more quickly. Moreover, there are software programmes that can be used by the public to generate documents, such as wills and rental agreements.

One of the key questions arising from the development of innovative services is whether these services are considered legal advice that can only be provided by legal professionals. One example concerns an online legal document platform. On the one hand, these applications could help consumers to access legal services at lower cost. On the other hand, they may raise concerns since consumers may not fully understand the documents and whether they would need legal advice by a professional. In some cases, legislation has been amended to allow these applications while providing safeguards to protect consumers, such as disclosure requirements.⁶⁶ More generally, the regulatory challenges posed by innovation in legal services seem to be related to the extensive regulation of legal professions currently in place in many countries.

3.4.Examples of horizontal legislation

*Consumer protection*⁶⁷

Clear rules enhancing consumer trust are important to further develop e-commerce and, more generally, encourage the digital transformation. Consumer protection legislation typically applies also to transactions held on the Internet. For instance, in some countries consumers have the right to return the product bought within a certain number of days, should they change their mind, as is the case when they make purchases in a brick-and-mortar shop.⁶⁸

One of the challenges of consumer protection legislation is to ensure that it takes into account the characteristics of online transactions and of new players. In the context of the review of consumer protection legislation carried out by the European Commission, “some concerns were raised regarding the application of the CRD [Consumer Rights Directive] provisions to online platforms, particularly concerning the assessment of whether platforms can be qualified as traders under the CRD and are therefore subject to comply with” its obligations.⁶⁹ One response received through BIAC points to the fact that some requirements were devised for e-commerce taking place on websites and not through a chatbot with limited space.⁷⁰ Other larger questions may relate to who, in a platform-based environment, has to comply with the law, potentially being the platform, the peer provider, etc.

As is the case in other areas of legislation, consumer protection rules may be adapted to reflect the needs of the sharing economy. The revised OECD Recommendation on Consumer Protection in E-Commerce notes this development: “[c]urrent e-commerce business models increasingly blur the boundaries between consumers and businesses, with consumers playing a participatory role in product promotion and development, and entering into transactions with other consumers”.⁷¹ Consumer protection legislation typically requires sellers and/or manufacturers to provide a guarantee against defects. The way the obligation is worded may inadvertently be applicable to consumer-to-consumer transactions involving second-hand goods, even though the policy maker may wish to impose a lighter requirement on those transactions.⁷² More generally, in some countries, consumer protections may depend on whether the seller they face is considered an individual or a professional trader. The ongoing consultation on consumer law in the European Union addresses these issues.⁷³

*Privacy and data security*⁷⁴

The digital transformation is accompanied by the production of increasing amounts of data, including personal data. For instance, online activities generate data which, in turn, have enabled the provision of “free” services to consumers.⁷⁵

Most countries already have in place privacy and data security laws.⁷⁶ UNCTAD (2015) reports that 55% of countries worldwide had issued privacy and data security laws by 2014, with the percentage increasing to 98% in the case of developed countries.⁷⁷ However, even when these frameworks exist, as noted in OECD (2017), “the effective implementation of [privacy and other consumer] rights is challenging in an era of data abundance and in which data flows and business interactions are characterised by a high level of complexity”.

Countries have responded to these concerns in different ways. The European Union, for example, has revised its data protection framework in light of the changes brought by digitalisation. The new General Data Protection Regulation (GDPR), which is scheduled to come into effect in 2018, provides for data portability (i.e. “the right for a data subject to receive the personal data concerning them”⁷⁸), transparency (e.g., consumers’ right to know how their data are being used), data breach notification and the so-called “right to be forgotten”.

Some privacy and data security laws restrict the flow of data across national boundaries. For example, the GDPR contains limitations on data flows from the EU. In other countries, concerns about data protection and digital security sometimes drive regulations restricting the use of cloud computing⁷⁹ or preventing businesses from locating data centres abroad.⁸⁰ These include “data localisation” laws, requiring localisation of various types of data, e.g. health, financial, tax, which, while common, also raise concerns with regard to the potential to create non-tariff barriers, barriers to competitive entry and to cause productivity reductions.⁸¹ Responses received through BIAC welcome regulatory initiatives reducing differences across countries and regions.

3.5. Competition assessment of regulations

In its report for the G20 German presidency conference, OECD (2017) notes that “countries should develop mechanisms to periodically review their legal frameworks and, where appropriate, update them to ensure that they are well-suited to the increasingly digitalised world”.⁸²

An integral part of this review would concern whether legislation has the potential to restrict competition in the marketplace, in light of the new developments brought in by digitalisation. Similar reviews, in ‘brick-and-mortar’ sectors as well as on regulations affecting new services, are already being conducted by competition authorities and other government bodies. The OECD has developed a methodology, the Competition Assessment Toolkit,⁸³ to assess if laws and regulations unduly restrict new entry, consumer choice or business strategies. The toolkit and other similar methodologies developed by national competition authorities and other bodies, are already used in a number of countries.⁸⁴ These methodologies can be applied to proposed new legislation, as well as to existing regulations. There are advantages in both an ex-ante and an ex-post approach. The former allows intervening before a restrictive regulation has had a harmful impact on competition and it is also typically easier to modify legislation while it is still at a draft stage. When the assessment is performed on existing legislation, there will sometimes be some available information on its actual impact on competition, even though this information may not be necessarily quantitative information.

Especially when the assessment is conducted on existing legislation, selecting the focus of the analysis, e.g. a sector, may not be straightforward. This choice requires making a preliminary assessment of factors, such as the economic importance of the sector, information from stakeholders on potential restrictions of competition, etc. Once the sectors have been selected, the next question is how to define the scope of the assessment. For instance, this may be carried out in line with the economic definition of the sector, say for statistical purposes. Identifying the relevant legislation applicable to the selected sector tends to be challenging in some countries, while in other cases the competent line ministries may already have a complete list of legislation ready. When this is not the case, and the team conducting the assessment must collect the legislation, national legal database are a good starting point, but input should also be solicited from industry or consumers associations, as well as from the relevant line ministries.

As a first step, the review of the legal framework is conducted by screening the existing provisions (or the proposed legal provisions) through the lens of the so-called checklist questions, e.g. whether the regulation raises significantly the cost of entry (see Annex 3.A1).⁸⁵ The regulations answering “yes” to one of those questions could potentially restrict competition. As such, the first question is whether in-depth analysis is necessary. This initial assessment helps to prioritise resources, but performing it requires some basic knowledge of the markets affected by the regulation in question. For instance, an in-depth analysis would generally be conducted when the regulation affects activities that are important in economic terms or when it restricts an important competitive dimension, such as innovation in high-technology markets. Conversely, in-depth analysis may not be required when the restrictive regulation is motivated by overarching public policy objectives, such as a ban on household use of products carrying severe health and safety risks.

When in-depth analysis is considered to be necessary, the process starts by investigating the objective of the regulation in question. Exploring the intention of the policy maker is essential in order to understand, should the regulation be found to be restrictive, how it could be amended while still achieving the initial policy objective. Regulations are often put in place to address market failures, but other reasons, such as the promotion of local products, may also play a part.

Identifying feasible alternatives to a given regulation requires a good understanding of the regulation, as well as substantial industry expertise. International experience, ideally from comparable countries, is an important source of alternative ways of achieving a policy objective. It is valuable also in lending more weight to proposed changes to existing legislation.

The reviewing team should also actively consult stakeholders, as these have a good knowledge of the sectors and of what alternatives can and cannot be implemented. Once feasible alternatives have been identified, they must be compared. The baseline case is the status quo, which is compared with one or more alternative ways of achieving the policy objective. In practice, most decisions about which options to prefer are qualitative. Relevant data for a quantitative comparison is not always available and, even when available, may not be

amenable to analysis. The choice between qualitative and quantitative methods also depends crucially on the time available for the review. It should be also noted that, while efforts will be made to identify more than one option, in some cases there may be only one reasonable option.

This process leads to recommendations to amend the regulation, if applicable, or to keep the status quo, depending on the outcome of the analysis. When making recommendations, the review team will typically consult the policy maker before finalising those recommendations. In addition, it is important to provide the necessary information for the policy maker to understand the recommendation and its rationale.

Concluding remarks

The OECD survey has highlighted that the regulations that have been subject to debate or review are often those that set different requirements for businesses supplying similar products or services. One of the underlying objectives of competition assessment is precisely to identify and review regulations that impose a differential treatment on competitors. Other types of regulation that particularly merit review are those potentially blocking new and innovative business models. In diverse sectors, ranging from transport to electricity, one of the challenges has been to understand how new players fit in the existing regulatory framework and what the consequences are. In the context of the digital transformation, regulations creating barriers to entry can have adverse effects on competition and innovation. More frequent, and possibly regular, reviews of legislation may be called for, as the pace of change in the digital economy risks making legislation obsolete. Some responses received through BIAAC note that businesses face regulatory uncertainty with respect to digital products, due to factors such as an outdated regulatory framework and obligations set out in many scattered pieces of legislation

Some of the key principles underpinning the competition assessment of laws and regulations also hold in the context of digitalisation. For instance, it is worth considering if regulations set minimum quality standards that are unnecessarily high, as may be the case in the sectors more affected by the sharing economy. The responses to the OECD survey and the opinions by competition authorities often call policy makers for careful consideration of how best to ensure consumer protection or safety without imposing unnecessary burdens. Consumer protection concerns may also be alleviated by the reliance of innovative services on consumer feedback.⁸⁶ Other regulations that should be reviewed are those limiting the information available to consumers or their ability to switch suppliers. In the digital world, switching is sometimes linked to the possibility of carrying data generated by consumers' behaviour.⁸⁷

Going forward, the framework for competition assessment of laws and regulation may need to be enriched with similar new additions, in light of digitalisation, to ensure its ongoing relevance.

Annex 3.A1. Checklist on competition assessment

Further competition assessment should be conducted if the proposal has any of the following four effects:

(A) Limits the number or range of suppliers

This is likely to be the case if the proposal:

1. Grants exclusive rights for a supplier to provide goods or services
2. Establishes a licence, permit or authorisation process as a requirement of operation
3. Limits the ability of some types of suppliers to provide a good or service
4. Significantly raises cost of entry or exit by a supplier
5. Creates a geographical barrier to the ability of companies to supply goods services or labour, or invest capital

(B) Limits the ability of suppliers to compete

This is likely to be the case if the proposal:

1. Limits sellers' ability to set the prices for goods or services.
2. Limits freedom of suppliers to advertise or market their goods or services.
3. Sets standards for product quality that provide an advantage to some suppliers over others or that are above the level that some well-informed customers would choose.
4. Significantly raises costs of production for some suppliers relative to others (especially by treating incumbents differently from new entrants).

(C) Reduces the incentive of suppliers to compete

This may be the case if the proposal:

1. Creates a self-regulatory or co-regulatory regime.
2. Requires or encourages information on supplier outputs, prices, sales or costs to be published.
3. Exempts the activity of a particular industry or group of suppliers from the operation of general competition law.

(D) Limits the choices and information available to customers

This may be the case if the proposal:

1. Limits the ability of consumers to decide from whom they purchase.
2. Reduces mobility of customers between suppliers of goods or services by increasing the explicit or implicit costs of changing suppliers.
3. Fundamentally changes information required by buyers to shop effectively.

Notes

1. We thank respondents to the survey, BIAC and members of BIAC, and OECD colleagues.
2. The *Competition Assessment Toolkit* is available in 17 languages at: www.oecd.org/daf/competition/assessment-toolkit.htm.
3. See “G20 Digital Economy Ministerial Declaration, Annex Paper 1, A ROADMAP for Digitalisation Policies for a Digital Future.” <https://www.de.digital/DIGITAL/Redaktion/EN/Downloads/g20-digital-economy-ministerial-declaration-english-version.pdf?blob=publicationFile&v=3>.
4. OECD (2017), Key issues for digital transformation in the G20, *Report prepared for a joint G20 Germany Presidency / OECD conference*, www.oecd.org/internet/ieconomy/key-issues-for-digital-transformation-in-the-g20.pdf.
5. A number of countries have launched policy initiatives to promote digitalisation, such as the Netherlands (<https://www.government.nl/documents/reports/2017/04/11/digital-agenda-for-the-netherlands-innovation-trust-acceleration>) and Denmark (<https://www.digst.dk/ServiceMenu/English/Policy-and-Strategy/Digital-Strategy-2016to2020>). As noted in the response from Denmark, it “aims to promote digitalisation both in the public and the private sector. As to the public sector, the strategy explains for example how the use of specific online identification mechanisms, digital communication systems and accounts has become mandatory for citizens”.
6. The OECD Competition Committee has selected the digital economy as a long-term theme, i.e. it has chosen to focus on a number of related topics consistently since 2016. This builds on earlier discussion on issues such as disruptive innovation in financial markets and vertical restraints in on-line sales. The list of topics and corresponding materials are available at oe.cd/249.
7. See the Competition Committee Hearing on “Rethinking the use of traditional antitrust enforcement tools in multi-sided markets” at www.oecd.org/daf/competition/rethinking-antitrust-enforcement-tools-in-multi-sided-markets.htm.
8. The workshop will take place at the OECD headquarters on 31 January 2018. More information will be made available at oe.cd/249.
9. To date, about 30 countries have submitted responses to the OECD questionnaire in addition to companies via BIAC.
10. Our review focuses primarily on product market regulation and does not cover the regulation of the Information and Communication (ICT).
11. See submission of Competition Commission of India re: Survey of Regulations Affecting the Digital Economy.
12. Official Norwegian Report (NOU) 2017: 4 Sharing Economy – Opportunities and challenges, Chapter 1.2, https://www.regjeringen.no/contentassets/1b21cafea73c4b45b63850bd83ba4fb4/en-gb/sved/nou_2017-4_chapter_1.pdf. The response from Belgium also notes ongoing developments in labour law.
13. For instance, in Japan “the Home-Sharing Business Act was enacted in June 2017 based on discussions at Council for Regulatory Reform established in Cabinet Office which is responsible for regulatory reform, and Ministry of Health, Labour and Welfare (MHLW) and Tourism Agency, which are responsible for the Inns and Hotels Act” (Japan response to OECD survey).
14. An opinion by the Spanish competition authority challenged a local regulation setting a minimum number of five days for touristic rentals, see <https://www.cnmec.es/expedientes/la052014>. As noted in the Spanish submission to the OECD survey, the “Superior Court of Justice of Madrid has upheld CNMC’s request, supporting in so doing the sharing economy”.
15. For instance, this was the case for Decree 113/2015 of the Canary Islands, published on 28 May 2015, as described in the Spanish submission to the OECD survey.
16. See the following opinion of the Italian competition authority: AGCM opinion n. AS1239, in Bulletin n. 47/2015, available at: www.agcm.it/bollettino-settimanale/8005-bollettino-47-2015.html.
17. Official Norwegian Report (NOU) 2017: 4 Sharing Economy – Opportunities and challenges, <https://www.regjeringen.no/en/dokumenter/nou-2017-4/id2537495/>. The approach suggested by the committee on the sharing economy was to tax all short-term rental income, regardless of whether it concerns a part or the entirety of a property.
18. As mentioned in the Australian response to the OECD survey, this proposal concerns one of the Australian states.

19. See the material prepared for the OECD Competition Policy Roundtable on parity clauses at www.oecd.org/daf/competition/competition-cross-platform-parity.htm.

20. This is the case in Austria (<https://app.parr-global.com/intelligence/view/1469406>), France (<https://app.parr-global.com/intelligence/view/1265290>) and Italy (<https://app.parr-global.com/intelligence/view/1582721>).

21. See the material prepared for the OECD Competition Policy Roundtable on “Competition and innovation in land transport”, www.oecd.org/daf/competition/competition-and-innovation-in-land-transport.htm.

22. This change was introduced, for instance, in Finland, as highlighted in the country’s response to the OECD survey. See also <https://www.lvm.fi/en/goodandflexibletransportsthroughanewact933165> and the country contribution to the OECD Roundtable on land transport.

23. For instance, the Competition Bureau published a white paper calling for the modernisation of Canada’s taxi regulations to allow taxis and ride sharing services to compete on an even playing field, available at <http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/04007.html>.

24. For example Germany, Korea, Japan and Turkey. The response from Japan states that “a fare-paying transportation service with a private car” is not allowed except under strict conditions, e.g. “the service is operated by local government or Non-Profit Organisation”. Similarly, the submission from Norway notes that “providing passenger transport for reward without a licence (e.g. connecting via an app) is illegal at the moment. Changes are being proposed by a report on the sharing economy”. Ireland notes that “paid journeys in private cars would not be compliant with primary legislation in Ireland”.

25. See case C-434/15 Asociación Profesional Elite Taxi v Uber Systems Spain, Opinion of AG Szpunar, where it is considered that Uber falls within the field of transport, rather than information society services. The response from Colombia raises similar issues: “Decree 2297 of 2015, for example, dictates that only the companies registered for the provision of transportation services may provide the public service of individual land transportation of passengers in taxi vehicles”. The response from India suggests the Motor Vehicles (Amendment) Bill, 2016 “mandates obtaining of a license by an aggregator” while the Parliamentary Standing Committee on Transport, Culture and Tourism notes and recommends, in Report No. 243, also notes that regulation of transport is the “exclusive domain of State Governments”.

26. For instance, in the Mexican state of Puebla, an amendment to the Law defined a new category of transport called “Executive Service” as suggested by the competition authority (COFECE) in its opinion on the matter.

The Australian response to the OECD survey mentions that in the State of Queensland, restrictions were imposed “on drivers of ride-sharing services similar to those imposed upon taxi drivers, and required ride-sharing drivers to be licensed and pay annual licence fees”.

27. Portuguese Autoridade da Concorrência, “Report on Competition and Regulation of Public Passenger Transport Services by Car Hire”, December 2016, available at www.concorrenca.pt/vEN/Estudos_e_Publicacoes/Estudos_Economicos/Other/Documents/2016%20-%20Study%20on%20Public%20Passenger%20Services%20by%20Car%20Hire%20-%20Dec%202016_vf.pdf. In Latvia, as noted in the country’s response to the OECD survey, draft legislation regulating ride sharing is being discussed in Parliament (Law On Carriage by Road - http://vvc.gov.lv/export/sites/default/docs/LRTA/Likumi/Law_On_Carriage_by_Road.pdf). One of the distinguishing features of the service is that “the service is offered, requested and accepted by electronic communications services”, while other requirements (e.g. safety) are the same as for traditional taxis.

28. For instance, the Mexican state of Guanajuato: <http://imug.guanajuato.gob.mx/wp-content/uploads/2017/05/Ley-de-Movilidad-del-Estado-de-Guanajuato-y-sus-Municipios.pdf>.

29. As noted in the contribution by Mexico, taxi vehicles are not required to meet any such requirements. See Yucatan’s Transportation Law: www.ordenjuridico.gob.mx/Documentos/Estatal/Yucatan/wo98475.pdf.

The contribution by France refers to the example of financial guarantee, which was not a requirement for taxis, and the Autorité de la Concurrence advocated removing the differential treatment.

30. Similar rules are applicable in Italy and France, for instance.

31. As noted in the French submission.

32. See the opinion by the Spanish competition authority at https://www.cnmec.es/sites/default/files/editor_contenidos/Notas%20de%20prensa/2017/20170622_NP_INF_Decreto_Taxi.pdf. In the US, the FTC commented on new regulations in the area of passenger motor vehicle

transportation. For instance, the District of Columbia Taxicab Commission (DCTC) issued draft regulation of smartphone software applications that could potentially restrict competition. The FTC comments covered, among others, provisions that restricted “the ways that applications and operators [could] associate with each other”, for example a requirement that a branded taxicab fleet already provided dispatch services for its vehicles. Source: https://www.ftc.gov/sites/default/files/documents/advocacy_documents/ftc-staff-comments-district-columbia-taxicab-commission-concerning-proposed-rulemakings-passenger/130612dctaxicab.pdf.

33. In Australia, a bill before the Victorian Parliament proposes “to legalise ride-sharing services, impose a levy on all “commercial” trips provided by ride-sharing drivers to establish an industry compensation fund for the buy-back of existing taxi licenses” (response by Australia). For Italy, see AGCM opinion n. AS1354, in Bulletin n.9/2017, available at: www.agcm.it/bollettino-settimanale/8663-bollettino-9-2017.html.

34. See the material prepared for the OECD Competition Policy Hearing on “Disrupting innovation in the financial sector”, www.oecd.org/daf/competition/competition-and-disruptive-innovation-financial-markets.htm.

35. The responses by Latvia and Lithuania highlight that, as in other countries, the regulatory framework covering new services is very recent. In Lithuania, the Law on Crowdfunding came into force on 1 December 2016 (<https://www.lb.lt/en/operators-of-a-peer-to-peer-lending-platform>). In Latvia, the Co-financing Services Law is under discussion.

36. The Australian response to the OECD survey notes that “the Australian Securities and Investment Commission can issue class waivers to allow eligible fintech businesses to test certain specified services for up to 12 months without an Australian financial services or credit licence”.

According to the submission by Mexico, a similar approach is also contemplated in a draft bill in Mexico (<https://static1.squarespace.com/static/58d2d686ff7c50366a50805d/t/5949bda446c3c4c8af13c386/1498004906287/Anteproyecto+de+Ley+de+Tecnolog%C3%ADa+Financiera.pdf>).

37. This is possible under new regulations in Switzerland, see <https://www.lexology.com/library/detail.aspx?g=c03fbc7e06f64db99ae0013c23b72ed8> (accessed on 7 July 2017).

38. The maximum number of days was recently increased by new regulations in Switzerland, see <https://www.lexology.com/library/detail.aspx?g=c03fbc7e06f64db99ae0013c23b72ed8> (accessed on 7 July 2017).

39. According to the submission by Mexico, a similar approach is also contemplated in a draft bill in Mexico (<https://static1.squarespace.com/static/58d2d686ff7c50366a50805d/t/5949bda446c3c4c8af13c386/1498004906287/Anteproyecto+de+Ley+de+Tecnolog%C3%ADa+Financiera.pdf>).

40. This has been the case in the UK, for instance (see <https://www.ft.com/content/011088d6-f2d2-11e6-95ee-f14e55513608>).

41. The Competition Bureau in Canada is currently conducting a market study on technology led innovation and emerging services in the Canadian Financial Services Sector (the report will be published in 2017) www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/04087.html. In this context, the Bureau held a one-day workshop to examine the intersection of competition, innovation and regulation in Canada’s financial services sector ([www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/FinTech-Report-Workshop-Eng.pdf/\\$file/FinTech-Report-Workshop-Eng.pdf](http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/FinTech-Report-Workshop-Eng.pdf/$file/FinTech-Report-Workshop-Eng.pdf)).

42. The UK Financial Conduct Authority (FCA) published a “Call for Input: Regulatory barriers to innovation in digital and mobile solutions”, <https://www.fca.org.uk/publication/feedback/fs16-02.pdf>.

43. One of the responses received through BIAC notes that financial institutions operating internationally face the difficulty to verify the Customer Identity Data, given that there are different sources in different countries, not always “certified” and “public”. Moreover, some countries still require financial institutions to identify physically the customer (for instance in Hungary) to meet the legal requirements set in Customer Due Diligence and Anti Money Laundering legislations.

44. The requirements apply to remote credit card transactions as well as for e-mandates, eWallets, stored value cards, and credit transfers.

45. The submission of India’s Competition Commission on Survey of Regulation Affecting the Digital Economy notes that the Reserve Bank of India, encourages digital transactions by cutting merchant discount rates on payments made via debit card and eliminating levies on small transactions through mobiles phones and internet.

46. “Under the Liquor Tax Act, selling all kinds of alcoholic beverages except for traditional liquors is prohibited in Korea” (response to OECD survey).

47. Restrictions on time spent are being under considerations in the People's Republic of China, according to news reports. See <https://www.theguardian.com/world/2017/jul/04/chinese-internet-giant-limits-online-game-play-for-children-over-health-concerns>.
48. This is being discussed in Korea, for instance. See <http://mengnews.joins.com/view.aspx?ald=3032061>.
49. Source: OECD Competition Assessment Reviews: Greece (2014); Law 393/1976, Art. 4, par. 5.
50. Example of wholesale trade of pesticides. Source: OECD Competition Assessment Reviews: Greece (2017); Circular 4016/2014 (chapter 3.1) in conjunction with Presidential Decree 159/2013.
51. The response by the Czech Republic describes the requirements imposed by Act on Registration of Sales No. 112/2016 Coll.
52. The response by Italy to the OECD survey mentions AGCM opinion n. AS1365, in Bulletin n. 13/2017, available at: www.agcm.it/component/joomdoc/bollettini/13-17.pdf/download.html. The draft law n. 2647, currently under review of the Senate, is available at: <http://www.senato.it/japp/bgt/showdoc/17/DDLPRES/1000674/index.html>.
53. In 2014, according to Argentinian legislation “consumers were allowed to purchase USD 25 worth of goods from abroad, otherwise they had to be registered as importers, face a 50% import tax and collect the items from customs facilities”. This restriction was subsequently lifted. <http://postandparcel.info/59698/news/regulation/argentina-imposes-tight-restrictions-on-cross-border-e-commerce/print/>.
54. https://ec.europa.eu/growth/sectors/postal-services/parcel-delivery_en.
55. As is the case of a recent legal amendment described in the response by the Russian Federation:
56. For instance, the response by Estonia notes that at the moment “the practice of remote counselling is considered in breach of regulation”. In Brazil, telemedicine is allowed only when doctors are present at both ends (source: <https://www.rvo.nl/sites/default/files/2017/01/Brazil%20Healthcare%20-%20Guilherme%20Hummel.pdf>). Telemedicine is also not allowed yet in Korea (source: <https://qz.com/752609/why-the-worlds-most-tech-obsessed-nation-is-resisting-virtual-doctors-visits>).
57. The regulation covers physicians licensed by the State of Alaska. See FTC Staff Comment: Alaska Legislature Should Consider Potential Benefits to Consumers of Expanding Access to Telehealth Services, March 2016, <https://www.ftc.gov/policy/policy-actions/advocacy-filings/2016/03/ftc-staff-comment-alaska-state-legislature-regarding>.
58. FTC Staff Comment to the Delaware Board of Speech/Language Pathologists, Audiologists and Hearing Aid Dispensers Regarding Its Proposed Revisions To Its Telecommunication and Telehealth Regulations, November 2016, <https://www.ftc.gov/policy/policy-actions/advocacy-filings/2016/11/ftc-staff-comment-delaware-board-speechlanguage>.
59. FTC Staff Comment to the Delaware Board of Dietetics/Nutrition Regarding Its Proposed Telehealth Regulation, August 2016, <https://www.ftc.gov/policy/policy-actions/advocacy-filings/2016/08/ftc-staff-comment-delaware-board-dieteticsnutrition>.
60. DOJ Response to a Letter from a Michigan State Senator Concerning Proposed Legislation Providing for the Regulation of Telehealth, November 2016, <https://www.justice.gov/atr/page/file/913876/download>.
61. Some countries do not allow the sale of prescription drugs, e.g. India ([https://content.next.westlaw.com/Document/I910e2c5a3b8d11e598dc8b09b4f043e0/View/FullText.html?contextData=\(sc.Default\)&transitionType=Default&firstPage=true&bhcp=1](https://content.next.westlaw.com/Document/I910e2c5a3b8d11e598dc8b09b4f043e0/View/FullText.html?contextData=(sc.Default)&transitionType=Default&firstPage=true&bhcp=1)). In other countries only Over-the-Counter (OTC) medicines, i.e. not requiring a medical prescription, can be sold online. This is the case, for instance, in Italy (<http://www.salute.gov.it/LogoCommercioElettronico/CercaSitoEComm>) and in Spain (<https://distafarma.aemps.es/farmacom/faces/inicio.xhtml>). Other countries, such as Germany and the United Kingdom, allow also the sale of prescription drugs online.
62. This is the case in Australia, Brazil, the United States and the United Kingdom. For more examples of countries allowing the sale of prescription drugs, see https://www.legitscript.com/wp-content/uploads/2016/06/Country_by_Country_-_Internet_Pharmacy_Regulations_-_3-23-15.pdf.
63. Mexico. Source: OECD Competition Assessment Reviews: Mexico (forthcoming); Medicines / row 68. The catalogue is the “Cuadro básico y catálogo de insumos del sector salud”.
64. See the material prepared for the OECD Policy Roundtable on “Disruptive innovation in legal services” and specifically the background paper, <http://www.oecd.org/daf/competition/disruptive-innovations-in-legal-services.htm>.

65. Some platforms are provided by legal professionals themselves, such as French national Chamber of Court Bailiffs (see France’s submission to the OECD Policy Roundtable on “Disruptive innovation in legal services”).

66. Federal Antitrust Agencies Submit Joint Statement to the North Carolina General Assembly on Legislation Regarding Online Legal Forms, June 2016, <https://www.ftc.gov/policy/policy-actions/advocacy-filings/2016/06/joint-comment-federal-trade-commission-staff>

67. For a more comprehensive treatment of consumer protection issues, see Chapter 9 (“Consumer rights in the digital era”) of OECD (2017), *Key issues for digital transformation in the G20, Report prepared for a joint G20 Germany Presidency / OECD conference*, www.oecd.org/internet/ieconomy/key-issues-for-digital-transformation-in-the-g20.pdf.

68. As in the example reported by Korea in its response to the OECD survey.

69. Note that the CRD harmonises consumer protection rules for internet and other distant transactions, including digital content transactions, mainly related to pre-contractual information requirements and the right of withdrawal. For details, see European Commission, *Evaluation of the Consumer Rights Directive*, Commission Staff Working Document, Brussels, 23.5.2017, SWD(2017) 169 final, page 27, http://ec.europa.eu/newsroom/just/item-detail.cfm?item_id=59332.

70. The response contrasts purchases through a chatbot with limited space as opposed to traditional eCommerce channels such as websites and/or apps. It notes that one of the main problems here is the volume of pre-contractual information that needs to be presented to the consumer through that channel.

71. OECD (2016), *Consumer Protection in E-commerce: OECD Recommendation*, OECD Publishing, Paris, page 4, <http://dx.doi.org/10.1787/9789264255258-en>.

72. The Greek consumer protection legislation is being amended to this effect. A two-year legal guarantee (i.e. against product defects) is at the moment compulsory on second-hand goods too, hence impacting consumer-to-consumer sales. See OECD Competition Assessment Reviews: Greece (2017), Annex B - E-commerce / row 3.

73. See <https://ec.europa.eu/eusurvey/runner/ConsumerLawReview>. In particular, “in a case leading to a reference for a preliminary ruling at the Court of Justice of the European Union, a consumer buying on a platform was denied the right to withdraw from the contract under the Consumer Rights Directive. Only then did the consumer learn that the seller was claiming not to be a trader (Case C-105/17 Kamenova)”.

74. For a more comprehensive treatment of data protection and digital security, see Chapter 6 (“Digital security”) of OECD (2017), *Key issues for digital transformation in the G20, Report prepared for a joint G20 Germany Presidency / OECD conference*, www.oecd.org/internet/ieconomy/key-issues-for-digital-transformation-in-the-g20.pdf.

75. One of the responses received through BIAC highlights that businesses have to process large amounts of personal data for internal purposes too, e.g. labour, social security. The response notes that these requirements may “collide” with privacy requirements at national level.

76. See UNCTAD (2015), *Information Economy Report: Unlocking the Potential of E-commerce for Developing Countries*, http://unctad.org/en/PublicationsLibrary/ier2015_en.pdf, Table V.1., page 65.

As reported by Brazil in its response to the OECD survey, work on this subject is ongoing in the Brazilian Congress: “it has been elaborated since 2015 in accordance with the Presidential proposal submitted to the public query by the Ministry of Justice. At this moment, there are two bills regarding this subject pending approval in Congress”.

77. See the definition in UNCTAD (2015), *Information Economy Report: Unlocking the Potential of E-commerce for Developing Countries*, http://unctad.org/en/PublicationsLibrary/ier2015_en.pdf, Note on page ii.

78. See <http://www.eugdpr.org/>.

79. In Korea, financial institutions have limitation for using cloud computing. Although regulations was amended to allow financial institutions to use cloud computing for non-critical information processing systems, there exist still many obstacles for using cloud computing in financial markets. Source: <https://www.microsoft.com/en-sg/apac/trustedcloud/korea-financial-service.aspx>.

80. Indonesian regulations expressly restrict placing data centre overseas. As a result, cloud servers must be located within the territory of the Republic of Indonesia. Source: <https://iclg.com/practice-areas/data-protection/data-protection-2017/indonesia#chaptercontent11>.

In Italy, providers wishing to hold prize draws have to do so in Italy, i.e. may have to store the information in Italy (Decreto del Presidente della Repubblica, 26 ottobre 2001, n. 430. Art. 1, par. 6).

A response received through BIAC comments favourably on regulatory developments in Brazil, where “the Marco Civil da Internet” which initially required the processing of personal data of Brazilian citizens to take place in Data Processing Centers established in Brazil was amended so this obligation was removed.

81. Source: <https://itif.org/publications/2017/05/01/cross-border-data-flows-where-are-barriers-and-what-do-they-cost>.

82. OECD (2017), Key issues for digital transformation in the G20, *Report prepared for a joint G20 Germany Presidency / OECD conference*, <http://www.oecd.org/internet/ieconomy/key-issues-for-digital-transformation-in-the-g20.pdf>, page 134.

83. The Competition Assessment Toolkit was developed by the Working Party No. 2 of the Competition Committee with the input of other OECD bodies with an interest in these areas. See www.oecd.org/daf/competition/assessment-toolkit.htm.

84. India’s competition authority has, for example, formulated “Competition Commission of India (Competition Assessment of Economic Legislation and Policies) Guidelines, 2017”. Many other competition authorities or government institutions have done the same.

85. If a provision falls under one or more of the checklist questions, it may potentially harm competition and, for this reason, it deserves further analysis, e.g. understanding the objective of the policy maker, investigating the effect on the market and on consumers.

86. For instance, see World Tourism Organization (2014), *Online Guest Reviews and Hotel Classification Systems – An Integrated Approach*, <http://europe.unwto.org/publication/online-guest-reviews-and-hotel-classification-systems-integrated-approach>, and Harford, T. (2017), How seller feedback helped build eBay, Uber and AirBnB, <http://www.bbc.com/news/business41188461>.

87. Data portability can increase competition also because it “reduces information asymmetry between individuals and providers” and “potentially reduces barriers to entry” (OECD, 2017; page 130).

www.oecd.org/ieconomy

www.oecd.org/going-digital

www.oecd.org/sti/dynemp.htm

www.oecd.org/sti/ind/multiprod.htm

www.oecd.org/competition/assessment-toolkit.htm

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