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Can productivity still grow in service-based economies? Literature overview and preliminary evidence from OECD countries

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CAN PRODUCTIVITY STILL GROW IN SERVICE-BASED ECONOMIES? LITERATURE OVERVIEW AND PRELIMINARY EVIDENCE FROM OECD COUNTRIES

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Stéphane Sorbe, Peter Gal, Valentine Millot

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ABSTRACT/RÉSUMÉ

Can productivity still grow in service-based economies? Literature overview and preliminary evidence from OECD countries

Services employ an ever-increasing share of workers in all OECD countries. This trend is likely to continue as it reflects deep structural forces, such as increasing consumption of services with rising incomes and population ageing and the growing role of intangible assets. Services are very diverse, but overall tend to have weaker productivity levels and growth rates than manufacturing. As a result, the shift to services entails a moderate but persistent drag on productivity growth. Still, there are reasons to hope for a pick-up in service productivity in the future, including thanks to new technologies (e.g. digital platforms, artificial intelligence). This concerns both "knowledge intensive" services (e.g. information and communication) and less knowledge intensive ones (e.g. personal transport). Harnessing this productivity potential requires adjusting policies to foster innovation and efficient use of new technologies, enhance competitive forces by reducing information asymmetries, barriers to entry and switching costs, and increase the tradability of services within countries and across borders.

JEL classification codes: E24, L80, O40
Keywords: productivity; services; structural change; automation; online platforms; measurement

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La productivité peut-elle encore augmenter dans les économies de services? Vue d'ensemble de la littérature et premiers résultats pour les pays de l'OCDE

Les services emploient une part toujours croissante de la main d'œuvre dans tous les pays de l'OCDE. Cette tendance devrait se poursuivre car elle reflète des forces structurelles profondes, telles que la consommation croissante de services lorsque les revenus augmentent et que la population vieillit et le rôle croissant des actifs incorporels. Les services sont très divers, mais ils tendent dans l'ensemble à avoir de plus faibles niveaux et taux de croissance de productivité que ceux de l'industrie. En conséquence, la transition vers une économie de services engendre un frein modéré mais persistant à la croissance de la productivité. Il existe néanmoins des raisons d'espérer une accélération de la productivité des services à l'avenir, notamment grâce aux nouvelles technologies (plates-formes numériques, intelligence artificielle, par exemple). Cela concerne à la fois les services « à forte intensité de connaissance » (par exemple, information et communication) et ceux à moindre intensité de connaissance (par exemple, le transport de personnes). Pour exploiter ce potentiel de productivité, il est nécessaire d'adapter les politiques pour favoriser l'innovation et l'utilisation efficace des nouvelles technologies, affermir les forces concurrentielles en réduisant les asymétries d'information, les barrières à l'entrée et les coûts de changement de fournisseur, et accroître les possibilités d'échanger des services au sein des pays et entre pays.

Code de classification JEL : E24, L80, O40
Mots-clés : productivité; services; changement structurel; automatisation; plates-formes en ligne; mesure

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Can productivity still grow in service-based economies? Literature overview and preliminary evidence from OECD countries

By Stéphane Sorbe, Peter Gal, Valentine Millot[1]

Executive summary

Services employ an ever-increasing share of workers. In the average OECD country, more than 70% of them work in services, 10 percentage points more than in 1995.

This trend is likely to continue, implying that the performance of the services sector is increasingly crucial for overall growth and inclusiveness. As productivity tends to be lower in services than in manufacturing, the shift to services has been a moderate but persistent drag on aggregate productivity growth.

Productivity is lower in services because they tend to be less standardised than goods and some of them have to be delivered in person. This hinders automation and economies of scale and dampens competitive pressures as many services are sold on small local markets. In addition, the national and sometimes local nature of service regulation reduces their tradability within countries and across borders, while certain regulations can also create unjustified barriers to entry and mobility of labour.

However, ongoing technological advances offer vast potential to boost productivity in the future, if combined with the right policies, both in growing "knowledge intensive" service sectors (e.g. information and communications technologies), whose productivity performance is comparable to manufacturing, and, importantly, in less knowledge intensive ones, which represent a large share of employment.

For example, artificial intelligence and advanced robotics are becoming increasingly able to automate routine cognitive tasks typical of service activities (e.g. driving a vehicle). Digital platforms and rating systems offer new possibilities to enhance competition between service providers by reducing information asymmetries and barriers to entry in certain activities. Communication technologies increase service tradability by enabling a growing range of traditional and digital services to be delivered at a distance.

These technological advances also come with challenges. For example, automation may lead to local job losses and increasing skill mismatches. The increasing market power of certain firms may hinder the diffusion of innovation. Digital platforms are subject to

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winner-takes-all dynamics and pose new challenges for competition, labour market, data privacy and tax policies.

Policies need to be adjusted to reap the full productivity potential of new technologies and address related challenges. This involves:

- fostering innovation as well as diffusion and efficient use of new technologies and enabling the associated reallocation of labour and capital, including by upgrading skills and addressing skill mismatches;
- reducing information asymmetries and barriers to entry and labour mobility in service provision by reassessing "traditional" regulations in the context of the rise of digital platforms and developing policies to maximise the economic benefits from the platforms;
- reducing regulatory obstacles to the tradability of services within countries and across borders to enhance specialisation, knowledge spillovers and competition.

The measurement of productivity in services poses specific challenges due to the difficulty of disentangling volumes and prices and measuring changes in service quality. Most recent work in this area suggests that mismeasurement, albeit significant, does not alter the assessment of overall productivity trends.

The importance of non-market services (e.g. education, health) has grown over the past decades. Measuring and improving their productivity poses broader challenges, mainly related to the absence of market prices and the definition of government objectives and government efficiency.

Both topics (measurement challenges and non-market services) are discussed in boxes in this paper.

1. Introduction

1. The size of the service sector has been rising steadily over at least the past half-century in OECD countries. As services have on average lower productivity levels and growth rates than manufacturing, the shift to services raises concerns for aggregate productivity performance. The shift to services pre-dates the global productivity slowdown of the past decade and is not the main factor explaining it. Nevertheless, the current environment of weak productivity growth makes these concerns more pressing.

2. The secular trend towards services is likely to continue and is mostly driven by exogenous factors largely beyond the reach of economic policy. This implies that achieving higher overall productivity growth more than ever requires stronger productivity in services. The performance of the service sector is also crucial for inclusiveness since services employ the bulk of the workforce. Only robust productivity growth in services can permit sustained wage growth for the majority of workers, while future employment trends will largely be determined by the capacity of the service sector to create new jobs.

3. Despite the relatively weak productivity performance of the service sector in the past, there are some causes for optimism:

- services are very diverse, and certain knowledge intensive services such as information and communication technology (ICT) services have relatively high productivity levels and growth rates, even compared to manufacturing;
- ongoing technological advances (ICT, big data, digital platforms, artificial intelligence) offer considerable potential to improve productivity in services in the future, including in less knowledge intensive activities (e.g. personal transport), but they also pose new challenges to policymakers;
- cross-country analysis shows that the weak average productivity of services is not only due to inherent characteristics, but may also be related to differences in policy settings.

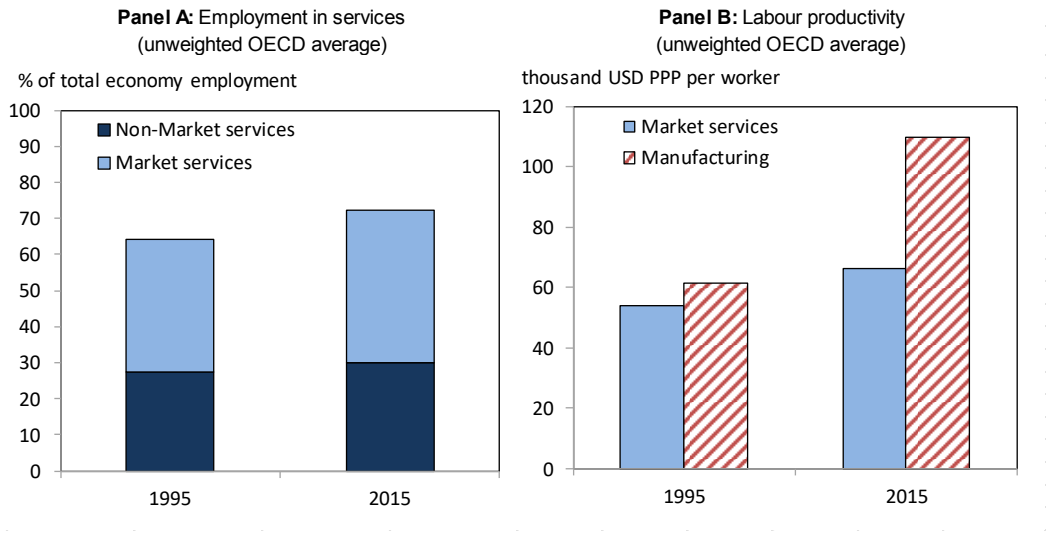
4. This paper describes the fundamental reasons why services have weak average productivity and the implications of the shift to services, which is likely to continue (section 2). It then assesses the potential for a pick-up in service productivity, including from new technologies (section 3). Finally, it outlines the main policy areas to support productivity in services (section 4).

2. Services have weak average productivity and their share is increasing

5. Labour productivity is about 40% lower in market services than in manufacturing on average across OECD countries (Figure 1). Productivity growth is also historically less dynamic in market services than in manufacturing. Labour productivity growth averaged 1.3 % per year over the past three decades in market services, against 3.0 % in manufacturing (Figure 2, panel A). Over this period, multi-factor productivity (MFP) growth was also lower in services, averaging 0.7 % per year against 1.4 % in manufacturing (panel B). In recent years, these differences have vanished due to a sharp slowdown in manufacturing productivity. This slowdown is more pronounced in the United States, where it mainly reflects slower productivity in semiconductor and computer equipment production, and to a lesser extent oil refining and pharmaceutical production (Brill, Chansky and Kim, 2018[1]). Labour productivity in services has also slowed across OECD

countries, but less abruptly than in manufacturing. Across OECD countries, the main sectors contributing to slowing service productivity have been finance, retail and ICT (Figure 3).[2]

Figure 1. Services are growing but have weaker labour productivity than manufacturing

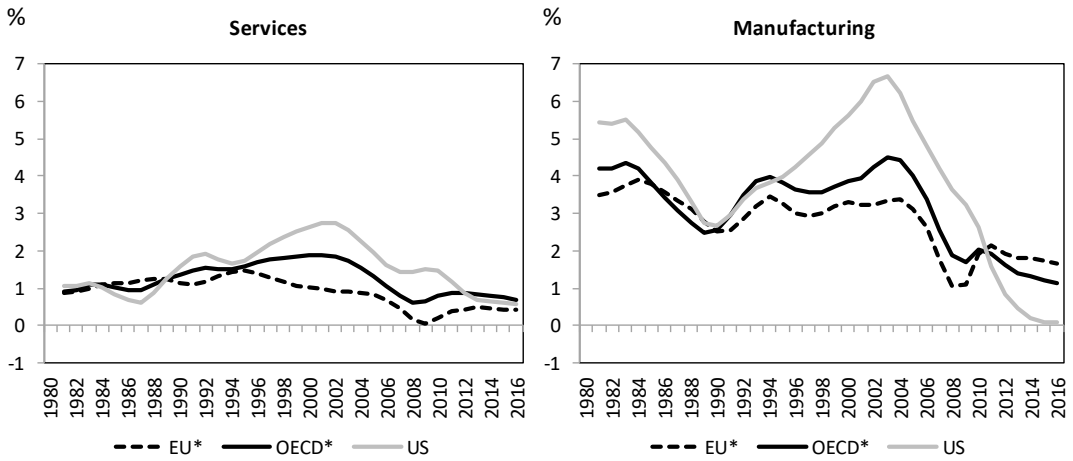


Note: Unweighted averages across 21 OECD countries. Labour productivity is computed as value added per person engaged, in constant USD PPP (base year 2005). Real estate is excluded as imputed rents can distort productivity measures in this sector. Non-market services include for example education, health, general public services (i.e. codes O to U of the ISIC4 classification). The average number of hours worked per person is lower in market services than in manufacturing, but this explains only a small part of the observed labour productivity difference (about 10% of the difference in 2015 on average across the countries with available data).
Source: OECD STAN database.

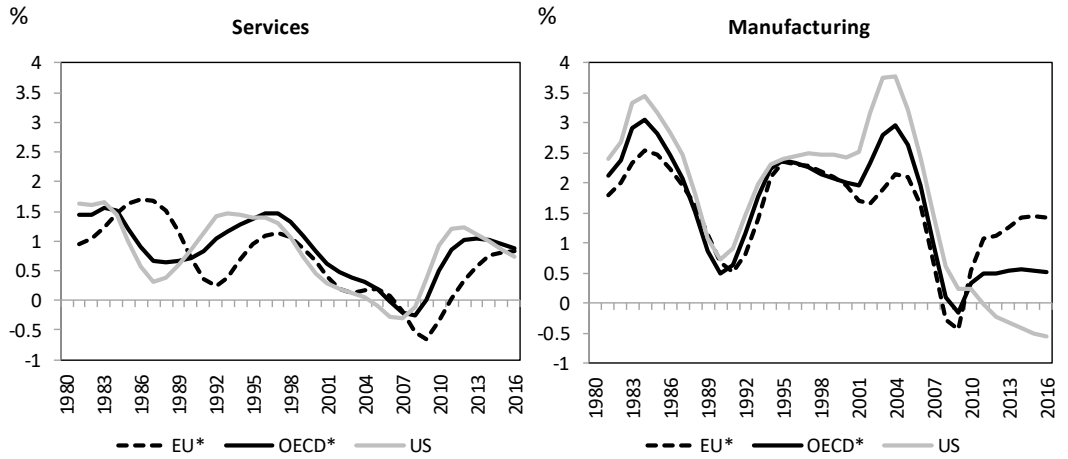
[2] For a more detailed overview of productivity trends by industry, see OECD (2018[39]).

Figure 2. Productivity growth has been stronger in manufacturing than services

Panel A: Labour productivity, annual growth rate (HP-filtered)



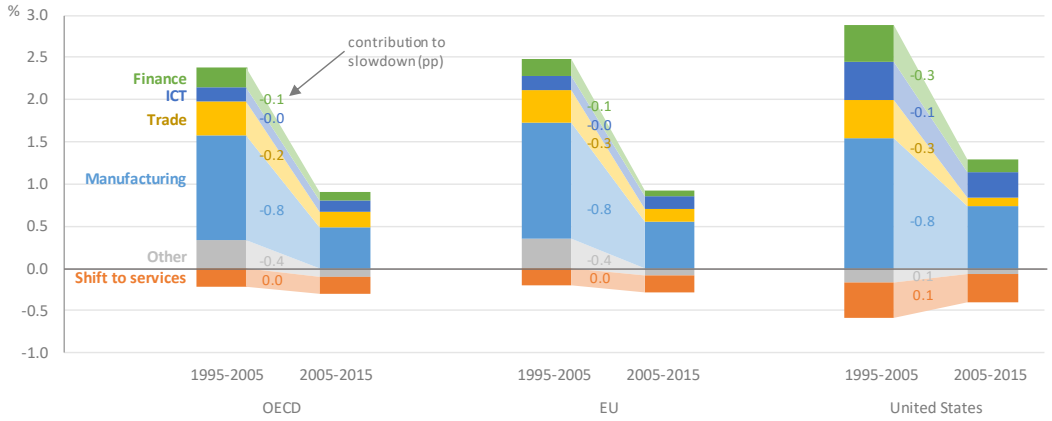
Panel B: Multi-factor productivity (MFP), annual growth rate (HP-filtered)



Note: Manufacturing includes mining and utilities (NACE Rev.2 sectors 5 to 39). Services correspond to all market services (NACE Rev.2 sectors 45 to 82). Labour productivity is computed as value added (in thousands of US $ 2005 PPP) per person employed. The MFP measure corresponds to a Solow-residual from a value added production function at the industry-level, using industry-year-specific but country-invariant factor shares. It is calculated as: $\ln(MFP) = \ln\left(\frac{VA}{N}\right) - (1 - ls) \times \ln\left(\frac{K}{N}\right)$, where VA, N and K denote real value added, number of persons engaged and capital stock, respectively, and ls is the ratio of labour costs to nominal value added at the industry-year-level (using a moving average of the ratio over time). Trends in labour productivity and MFP growth are obtained by smoothing productivity level annual time series with a HP filter (lambda=6.25).
* EU aggregate is based on 20 countries in 1995-2015, 8 countries before 1995 and 14 countries in 2016 (due to data limitations). OECD aggregate is based on 28 countries in 1995-2014, 12 countries before 1995, 27 countries in 2015 and 18 countries in 2016. MFP is weighted by value added for aggregation across countries.
Source: OECD STAN database, OECD calculations.

Figure 3. Contributions to the global productivity slowdown

Average contributions to annual labour productivity growth

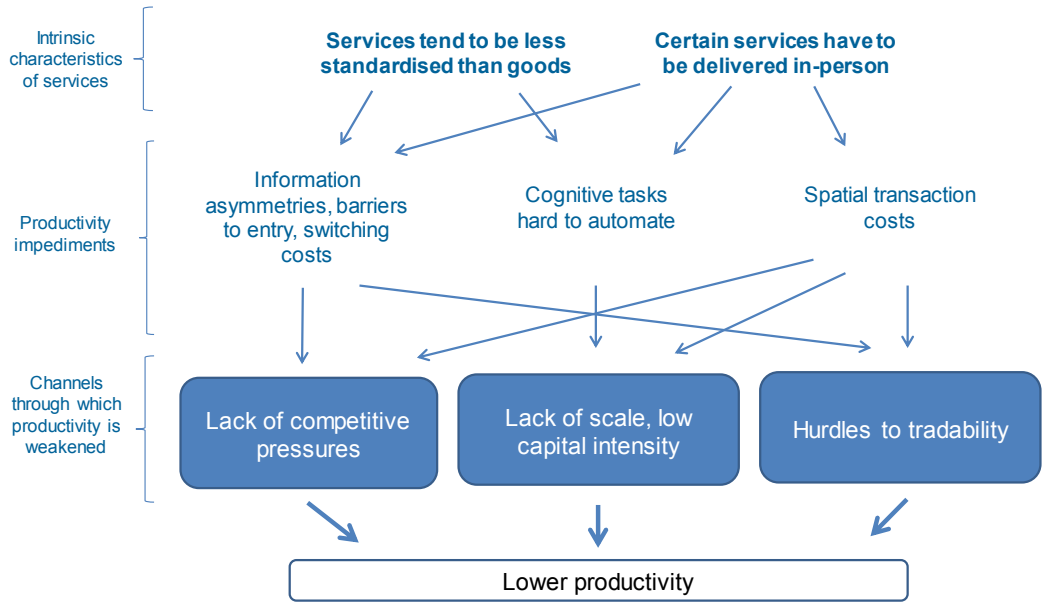


Note: The contribution of an industry is computed as its average labour productivity growth over the period multiplied by its share in total employment at the beginning of the period. Sectors are constructed based on 1-letter categories of the NACE Rev.2 classification. "Manufacturing" includes utilities and construction (sectors 5 to 39 of the NACE Rev.2 classification). "Trade" includes retail and wholesale trade. "ICT" corresponds to the information and communication industry. "Finance" includes financial and insurance activities. The contribution of the "Shift to services" is computed as in Figure 7 below (and the related caveats are discussed in section 2.3). The contribution of "Other" includes the other industries with lower individual contributions (agriculture, construction, other market services as well as non-market services, but excluding real estate) and other sectoral shifts. OECD and EU averages are unweighted averages of the countries with available data. See Figure 7 below for information on the detailed coverage.
Source: OECD STAN database, OECD calculations

2.1. The weak productivity of services partly reflects intrinsic characteristics

6. Services are very diverse but their fundamental difference with goods is that goods are tangible while services are intangible. As a result, services tend to be less standardised than goods and can involve more face-to-face interactions in their delivery. These characteristics may undermine services productivity in various ways (Figure 4).

Figure 4. Certain characteristics of services hamper their productivity



Source: OECD

7. First, service transactions tend to be associated with additional transaction costs compared to selling goods. Services are more prone to information asymmetries between supplier and consumer than goods as their quality can be more difficult to assess before purchase due to their less standardised nature (e.g. a legal or consultancy service). Services can also involve more switching costs than goods purchase, often resulting in consumers engaging in long-term relationships with certain service providers (e.g. banks, telecom companies). Finally, certain services (but not all of them) can involve spatial transaction costs because they have to be delivered in person (e.g. a haircut), in which case they are sold in local markets with typically relatively few players. All these transaction costs imply that competitive pressures and efficient reallocation mechanisms tend to be weaker in services than in manufacturing, reducing incentives to improve productivity and allowing less productive firms to survive.

8. Second, services have overall benefitted less than manufacturing from economies of scale and gains from automation. Indeed, technology has so far been better at replacing the manual routine tasks involved in the production of standardised goods than the more cognitive tasks involved in the production of many services. In addition, the fact that certain services have to be delivered in person implies that firms cannot fully reap the potential benefits from economies of scale. Smaller production units can hinder capital deepening, knowledge spillovers and specialisation of employees. Even in relatively large services firms that utilise brands and franchising to leverage some types of economies of scale (marketing, management, supply chain organisation, innovation), an important part of the core activity has to remain decentralised (e.g. retail or restaurant chains). Finally, informality tends to be more prevalent in certain services industries than in manufacturing, which can also hamper firm growth.

9. Third, these characteristics of services also reduce their tradability within countries and across borders. This is detrimental to productivity to the extent that trade generally enhances productivity through knowledge spillovers, better specialisation and increased

competitive pressures. The tradability of services is also reduced by cross-country differences in regulations, and sometimes even by within-country differences when services are regulated at the subnational level (e.g. different occupational licensing requirements across regions).

10. A number of industry and firm-level studies corroborate this general picture. Average mark-ups tend to be higher in services than in manufacturing (Christopoulou and Vermeulen, 2012[2]; Andrews, Gal and Witheridge, 2018[3]), which may reflect weaker competitive pressures. The relationship between firm size and productivity is weaker in services than in manufacturing (Andrews and Cingano, 2014[4]; Berlingieri, Calligaris and Criscuolo, 2018[5]), suggesting that services benefit less from economies of scale than manufacturing activities. Consistent with this, service firms are on average three times smaller than manufacturing firms (5 against 16 employees)[3] and the difference is roughly the same for plant/establishment (rather than firm) size (Bento and Restuccia, 2018[6]). Finally, cross-border trade in services, although increasing, remains much weaker than in manufactured goods, although services are increasingly important as an input to traded goods (Miroudot and Cadestin, 2017[7]; OECD, 2017[8]).

11. Measuring productivity in services is more challenging than in manufacturing, mainly because volume and price changes are more difficult to disentangle and the quality of output more difficult to observe. While this is an important issue that deserves further attention, it does not appear to call into question the fact that services have on average relatively lower productivity levels and growth rates than manufacturing (Box 1).

[3] This is based on OECD calculations based on the Structural and Demographic Business Statistics (SDBS) database. Alternative calculations based on the Orbis database give very similar numbers.

Box 1. The challenges of measuring productivity in services

Productivity measurement is more challenging in services than in other sectors, reflecting the intangible nature of service output, which often involves human interactions between provider and consumer. This implies that transactions can be heterogeneous and their exact nature ambiguous, creating difficulties to disentangle quality from quantity and to effectively price units of service output (Griliches, 1992[9]; Triplett and Bosworth, 2003[10]; Wölfl, 2005[11]; Grassano and Savona, 2014[12]). Various pricing methods of market services (direct use of prices of repeated services, unit value method, component pricing method, percentage fees, model pricing, pricing based on working time) are used by statistical agencies depending on the type of service considered, as detailed in OECD (2005[13]). Measurement is even more challenging for services where there is no market price, as discussed in Box 3.

Measurement issues in the digital economy have received a lot of attention recently as rapid technological change has given rise to new products and rapid quality improvements (both in manufacturing and services), potentially resulting in overestimated inflation and underestimated real output (Feldstein, 2017[14]; Aghion et al., 2017[15]). Tax planning behaviour involving the cross-border shifting of intangible assets may also affect productivity measures (Guvenen et al., 2018[16]). Still, most researchers assess that the mismeasurement of aggregate productivity related to the digital economy remains relatively limited so far and has not significantly increased compared to the previous decade (Byrne, Fernald and Reinsdorf, 2016[17]; Syverson, 2017[18]; IMF, 2018[19]; Moulton, 2018[20]; Ahmad, Ribarski and Reinsdorf, 2017[21]). For example, Byrne et al. (2016[17]) estimate that adjusting price indices for a number of ICT products and making additional adjustments for underestimated intangible investments would increase measured annual US labour productivity growth by about 0.2 pp over 2004-14 and by about 0.5 pp over 1995-2004. Ahmad et al. (2017[21]) assess that an upper bound of the effect of mismeasurement of price indices on GDP growth rates is 0.2 pp per annum in most economies.

A separate issue is posed by free digital services (e.g. search engines, social networking), which contribute to consumer surplus but fall outside the scope of production accounts and therefore productivity measurement (Brynjolfsson and Oh, 2012[22]; Brynjolfsson, Eggers and Gannamaneni, 2018[23]). The issue of free services is not new (e.g. free radio and television), but it may have increased with the rapid development of digital services (Hatzius et al., 2016[24]). The only way free digital services appear in national accounts is through the revenues from digital advertising that may support their producers, but these revenues generally represent a small fraction of estimated consumer surplus from these services. Nakamura et al. (2017[25]) assess that adding to GDP the consumer surplus from free digital content would add about 0.1 pp. to US GDP growth over 1995-2015. However, rather than GDP, the relevant benchmark for this consumer surplus may rather be overall consumer surplus (including from non-free services), which although not measured is thought to be considerably greater than GDP (Nordhaus, 2005[26]). Interestingly, certain approaches to measure consumer surplus from free digital services, such as online choice experiments

(Brynjolfsson, Eggers and Gannamaneni, 2018[23]), could be used to measure consumer surplus in other areas. Such an extension would contribute to measuring well-being, along with other approaches such as the OECD Better Life Initiative.

Statistical agencies have made a lot of progress to reflect quality improvements in goods and services with an increasing use of "hedonic" price adjustments following the recommendations of the Boskin Commission in the United States (Boskin et al., 1996[27]; Moulton, 2018[20]). However, the resource-intensity of these methods limits their scope of application (Bean, 2016[28]). In addition, the rapid appearance of new products and the growing importance of cross-border trade in digital services pose increasing measurement challenges. Statistical agencies are experimenting with new alternative methods to collect prices at a high frequency, for example using web-scrapping techniques, making it easier to identify price and quality changes. Collecting more data from digital platforms for statistical purposes could help further addressing measurement challenges, as would more cooperation and sharing of best practices between statistical agencies. Efforts on this front are being advanced through the OECD Advisory Group on Measuring GDP in a Digitalised Economy, and through the development of a handbook on Measuring Digital Trade, led by the OECD-WTO Task Force on International Trade Statistics.

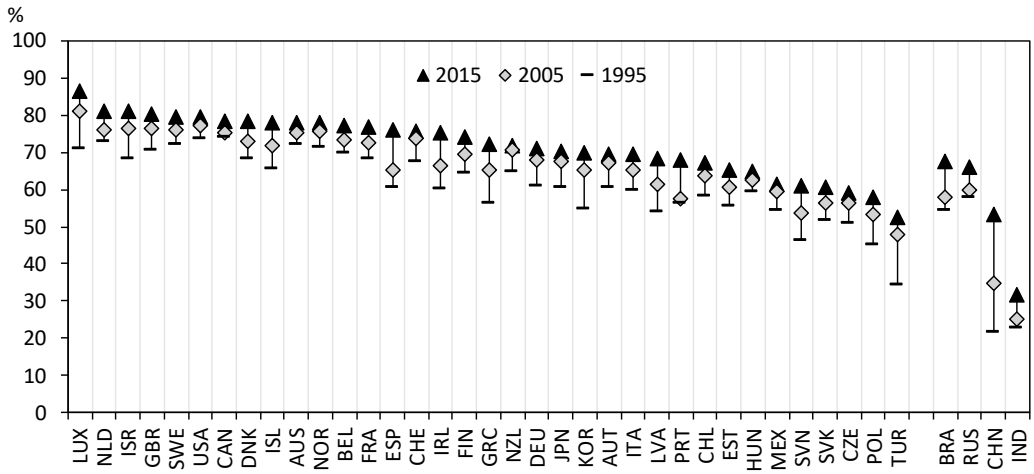
2.2. The share of services is set to increase further

12. The share of services in total employment has strongly increased over the past decades in all OECD economies (Figure 5, panel A). Due to fast productivity gains in manufacturing, the share of services in real output has increased less than its share in employment. As these productivity gains have reduced the relative price of manufacturing goods, the share of services in nominal output has increased more than in real output (Panel B). The share of services is subject to measurement uncertainties since many firms perform both manufacturing and service activities (Crozet and Milet, 2017[29]).[4] Most of these firms are classified as manufacturing firms based on their primary activity (Figure 6, Panel A), suggesting that if anything the share of service activities in the economy may be underestimated.

[4] More broadly, the distinction between goods and services, although generally intuitive, can be difficult. For example, a take-away coffee can be seen either as a good (the coffee itself) or a service (the act of delivering it) (New Zealand Productivity Commission, 2014[144]).

Figure 5. The share of services is rising in all OECD countries

Panel A: Share of services in employment



Panel B: Share of services in employment and output (unweighted OECD average)

Note: The share of services in real output is based on value added in constant 2010 USD. OECD average based on 35 countries for employment and 32 countries (not exactly identical) for real and nominal output. Services correspond to categories G-U of the ISIC 4 classification.
Source: World Bank, World Development Indicators, based on International Labour Organization, ILOSTAT database; World Bank national accounts data; OECD National Accounts data files; OECD calculations

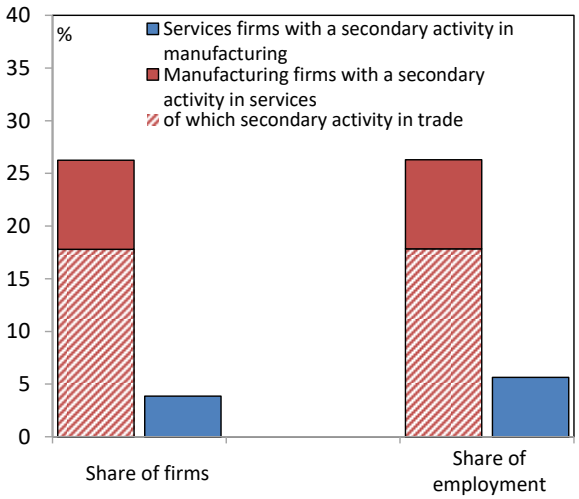
13. The main explanation for the long-term trend increase in the employment share of services is Baumol's cost-disease theory. It relates to services' relatively weak productivity growth and the fact that demand for services tends to increase with income (Box 2). Other contributing factors include (i) the increasing intangibility of investment, (ii) the increasing reliance on outsourcing (i.e. consumption of intermediate service inputs) in manufacturing production, (iii) the increasing substitution of home (non-market) production by market services, and (iv) population ageing. Globalisation, and especially trade with emerging economies, has contributed to a decline in the share of manufacturing employment in a number of OECD countries over the past decades, but overall it appears to have played a smaller role than the combination of other factors listed above (Box 2).[5]

[5] Interestingly, the share of services also increased in large emerging economies over that period (Figure 5).

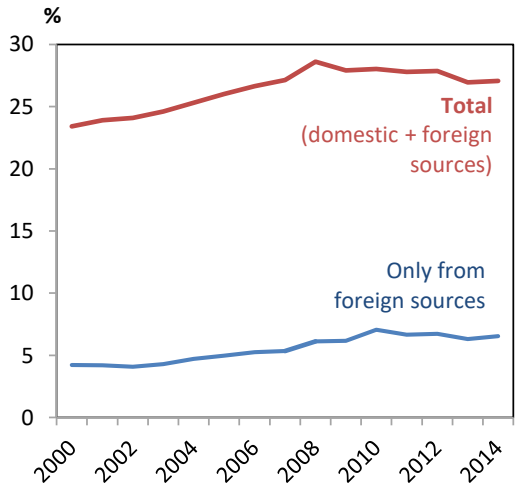
14. Looking ahead, the employment share of services seems set to rise further as many of these underlying drivers, which are largely beyond the reach of economic policies, will likely continue to prevail over the foreseeable future. Still, a few of these drivers may weaken. For example, the outsourcing of service activities shows signs of a slowdown after increasing steadily over the past decades (Figure 6, Panel B) and the effect of trade may also weaken as global value chain (GVC) fragmentation has seemingly reached a plateau (Haugh et al., 2016[30]). However, this is unlikely to stop the overall trend towards services as other underlying forces (propensity to spend additional income on services, rise in intangible investment, substitution of home production, population ageing) will still be at play.

Figure 6. Manufacturing firms both produce and outsource services

Panel A: Share of manufacturing (resp. service) firms with a secondary activity in services (resp. manuf.)



Panel B: Outsourcing of selected services by manufacturing firms



Note: Unweighted average across 23 OECD countries, in 2013. The activity in the horizontal axis corresponds to the core activity of the firm (Panel A). Unweighted average across 31 OECD countries of professional, administrative, transport and logistics services purchased by manufacturing as a share of total value added in manufacturing (Panel B).
Source: OECD calculations based on ORBIS database (Panel A), OECD calculations based on the World Input-Output Database by (Timmer et al., 2015[31]) (Panel B).

Box 2. Why is the share of services increasing?

The main explanation for the rising share of services over the long term is Baumol's "cost-disease" theory (Baumol, 1967[32]; Baumol, 1985[33]). In its most simple form, it postulates that certain activities (e.g. manufacturing) enjoy positive productivity growth, while others do not (e.g. certain services). Productivity gains in manufacturing tend to reduce the share of manufacturing employment as fewer workers are needed to produce the same goods. At the same time, demand for services increases as productivity gains in manufacturing generate higher incomes and households' propensity to consume most services increases with income. This is only partly offset by the diminishing relative price of manufacturing goods, which tends to increase demand for them compared to services but only slightly as goods and services are weakly substitutable.[6] Overall, the prediction from Baumol's theory is that an ever larger share of employment would flow to services (or at least to the sector with weaker productivity growth) leading to continuously slowing aggregate productivity growth.

An abundant empirical literature has documented and refined Baumol's theory and shown its enduring validity over a long time horizon. Boppart (2014[34]), using micro-level US consumption data for 1986-2011, provides evidence for the two theoretical premises of the theory, i.e. that relative demand for services increases with income and that goods and services are only partially substitutable. A number of industry-level analyses in OECD countries show that industries with weak productivity growth (most of which in the services sector) have generally experienced rising relative prices and employment over the past decades (Maroto and Rubalcaba, 2008[35]; Nordhaus, 2008[36]; Jorgenson and Timmer, 2011[37]; Imbs, 2016[38]; OECD, 2018[39]).[7]

Several other factors (some of which are also related to increasing incomes) contribute to the rising demand for services. Intangible investment, which is rich in services (e.g. R&D and ICT services), represents an increasing share of total investment (Haskel and Westlake, 2018[40]). As a result, the share of service value-added in investment is rising and now exceeds 50% in the United States (Herrendorf, Rogerson and Valentinyi, 2018[41]). In addition, services have been increasingly used as intermediate inputs in manufacturing production, either as new inputs or as substitutes for inputs previously produced in-house by manufacturing firms (e.g. cleaning, security). Despite this increase in outsourcing, an increasing share of manufacturing workers engage in service tasks, suggesting that the overall service content of goods production has increased (Pilat and Wölfl, 2005[42]; Fort, Pierce and Schott, 2018[43]). Population ageing also contributes to a rising demand for services as an ageing population tends to consume less goods and more financial and personal services (Siliverstovs, Kholodilin and Thiessen, 2011[44]). Another contributor is the increasing replacement of home production of certain services (e.g. child and elderly care, gardening, cleaning, etc.) by market services, which may reflect the growing opportunity cost of home production for increasingly productive high-skilled workers (Buera and Kaboski, 2012[45]).

For a given global demand for goods and services, the localisation of their production across countries depends on the comparative advantages of the different economies and their trade openness. Globalisation and increasing trade with emerging economies (which have developed comparative advantages in manufacturing) has contributed to a decline in manufacturing employment in certain OECD countries over the past decades (Boulhol and Fontagné, 2006[46]), the flipside of which is an increase in the employment

share of services. More specifically, intensifying trade with China has contributed to significant manufacturing job losses at the local level in the United States (Autor, Dorn and Hanson, 2013[47]) and in other countries – see e.g. Malgouyres (2016[48]). However, the aggregate effect of trade on the share of manufacturing employment is less clear as trade also creates manufacturing jobs in exporting industries (Feenstra and Sasahara, 2017[49]).

A number of recent studies assess the relative contribution of these different causes of the rising employment share of services, or the declining share of manufacturing. They concur to attribute a prominent role to Baumol's theory, i.e. the effect of productivity gains in manufacturing and increasing demand for services as incomes rise (Demmou, 2010[50]; Uy, Yi and Zhang, 2013[51]; Święcki, 2017[52]; Kehoe, Ruhl and Steinberg, 2018[53]). Demmou et al. (2018[54]) also emphasize the key contribution of rising consumption of services as intermediates. These studies suggest that trade has played a secondary role in the overall shift from manufacturing to services in OECD countries over the past decades, although its contribution has been important in some individual countries.

2.3. In service-based economies, overall productivity growth depends on the performance of the service sector

15. A basic shift share analysis suggests that the shift to services has reduced annual productivity growth in the average OECD country by about 0.3 percentage point per year over 1995-2015 (Figure 7). This estimate is consistent with Duernecker et al. (2017[55]), who assess that sectoral shifts have reduced US productivity growth by 0.3 percent per year over 1947-2007. It should be considered as a rough order of magnitude as (i) it can depend on the period considered;[8] (ii) it does not take into account heterogeneities within the service sector (services with different productivity levels may not all grow in the same proportion) or skills considerations (e.g. the skills of a manufacturing worker may be poorly suited to a service job, which may compound the productivity impact of the shift to

[6] Certain services that are relatively substitutable may disappear when the relative price of their production goes up. Also, the relative price of delivering public services (especially labour intensive ones) tends to increase, which is another prominent insight of Baumol's theory. These two facts result from the underlying assumption that wages do not diverge too strongly across sectors.

[7] A number of papers develop models building on assumptions based on Baumol's theory, test them (generally successfully) against the data and/or discuss the compatibility between Baumol's theory and a balanced long-term growth in the sense of Kaldor (Ngai and Pissarides, 2007[141]; Acemoglu and Guerrieri, 2008[146]; Foellmi and Zweimüller, 2008[140]; Herrendorf, Rogerson and Valentinyi, 2013[142]). Buera and Kaboski (2009[148]) acknowledge that complements to Baumol's theory are needed to fully explain observed trends.

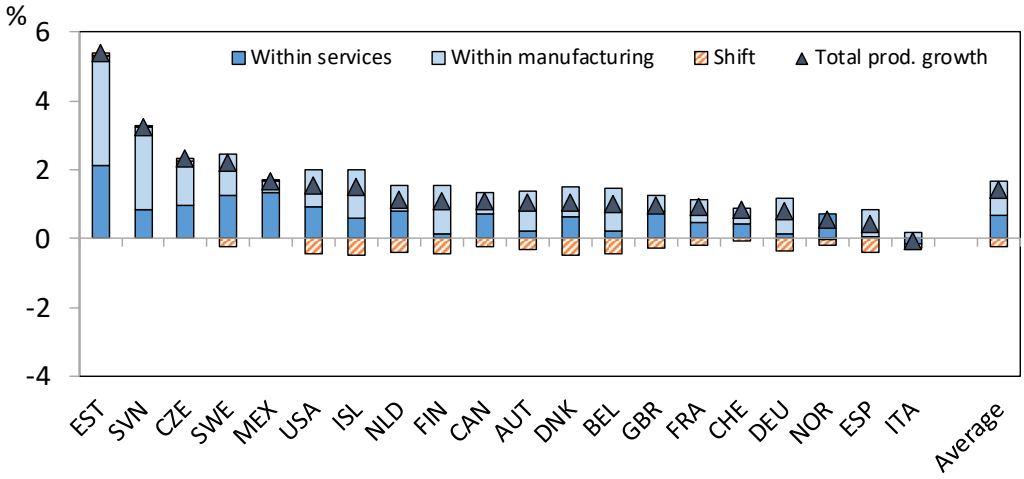
[8] For example, an earlier starting date (not feasible for the selected sample of OECD countries due to data limitations) might have led to a larger shift component to the extent that the initial share of manufacturing would have been higher. However, shift share analyses may become less relevant over long time periods as changes in industry composition become very large.

services), and (iii) it is also subject to broader measurement uncertainties about market and non-market service productivity.[9]

16. Notwithstanding these uncertainties, these estimates suggest that the shift to services has been a moderate but persistent drag on productivity over the past decades, with varying intensity across countries. As the shift to services is a secular trend, this drag predates the global productivity slowdown. For example, the shift component was approximately the same over 1995-2005 and 2005-2015 for the average OECD country (Figure 3). Still, the productivity slowdown makes this drag more important in relative terms, as it represents a larger share of average annual productivity growth than in the past.

Figure 7. The shift to services is a visible drag on productivity growth in some countries

Contributions to annual labour productivity growth, 1995-2015



Note: Decomposition following OECD (2018[39]): $\frac{Y_T}{L_T} - \frac{Y_0}{L_0} = \sum_{j=1}^{J} \theta_{j0} \left(\frac{Y_{jT}}{L_{jT}} - \frac{Y_{j0}}{L_{j0}}\right) + \sum_{j=1}^{J} (\theta_{jT} - \theta_{j0}) \frac{Y_{j0}}{L_{j0}} + \sum_{j=1}^{J} (\theta_{jT} - \theta_{j0}) \left(\frac{Y_{jT}}{L_{jT}} - \frac{Y_{j0}}{L_{j0}}\right)$ where $\frac{Y_T}{L_T} - \frac{Y_0}{L_0}$ is the labour productivity growth between years 0 and T, j is the industry and θ_{jT} is the share of workers in industry j in year T. The first component corresponds to the within-industry productivity growth effect, the second component corresponds to the static component of the structural change effect (static shift effect), and the third component is the dynamic component of structural change (dynamic shift effect). Only the sum of the two shift effects is presented on the figure. Services include both market and non-market services, i.e. sectors 45 to 99 of the NACE Rev. 2 classification, excluding real estate. Manufacturing also includes other sectors, such as utilities and construction (sectors 01 to 43 of the Nace Rev.2 classification). Data start in 1998 for USA and 1997 for CHE, and stop in 2014 for FRA and CHE.
Source: OECD STAN database, OECD calculations.

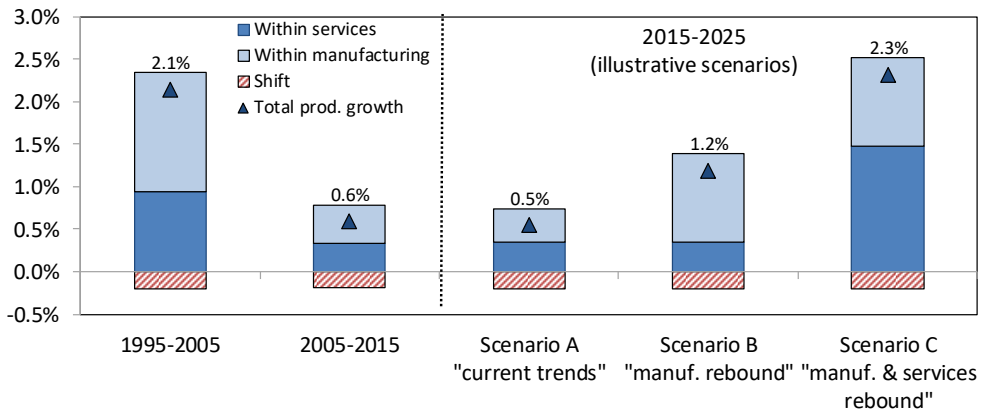
17. The share of services is set to increase further, suggesting that this drag will persist. More importantly, the high and rising share of services implies that future overall productivity performance of OECD economies will largely depend on the productivity performance of their service sectors. This is illustrated by the stylised scenarios presented on Figure 8. If the average productivity growth observed in 2005-2015 continues over the coming decade, both in manufacturing and services, overall productivity growth of the average OECD country will remain weak and even slightly diminish due to the higher share

[9] For example, Bárány and Siegel (2018[145]) assess that about one third of the estimated productivity growth differential between manufacturing and services reflects skill-composition effects (i.e. the shift of lower-skilled workers from manufacturing to services).

of services (scenario A, "current trends"). If the manufacturing productivity growth rebounds to 4% per year (slightly above its 1995-2005 average), overall productivity growth will remain sluggish, as the share of manufacturing is too low to allow manufacturing alone to drive productivity (scenario B, "manufacturing rebound"). Only a pick-up in service productivity can enable robust overall productivity growth (scenario C, "manufacturing and services rebound"). This may still understate the importance of the service sector, which beyond its direct contribution to aggregate productivity growth can also contribute indirectly by providing higher-quality inputs and innovation to other sectors.

Figure 8. Illustrative scenarios for future productivity growth

Contributions to annual labour productivity growth, average OECD country



Note: Illustrative calculations for an average OECD country. Scenario A assumes that labour productivity in manufacturing and services grows at the same pace over 2015-2025 as in 2005-2015. Scenario B includes a rebound in manufacturing productivity growth to 4% per year (slightly above its 1995-2005 average of 3.9%) and scenario C also assumes a rebound in service productivity growth to 2% per year (above its 1995-2005 OECD average of 1.6%, but below the average for the United States over that period, which was 2.2%). For simplicity, the shift component is assumed to be equal to the average of 1995-2005 and 2005-2015 in all scenarios.
Source: OECD STAN database, OECD calculations.

3. There is potential for a pick-up in service productivity

18. Service productivity has been overall sluggish over the past decades in OECD economies. Nevertheless, there are reasons to believe that a productivity pick-up is possible, especially if the right policies are put in place. As discussed below, these reasons include the growing importance of high-productivity knowledge intensive services, the potential of new technologies to boost service productivity growth, including in less knowledge intensive services, and the cross-country discrepancies in productivity that may reflect room to improve policies.

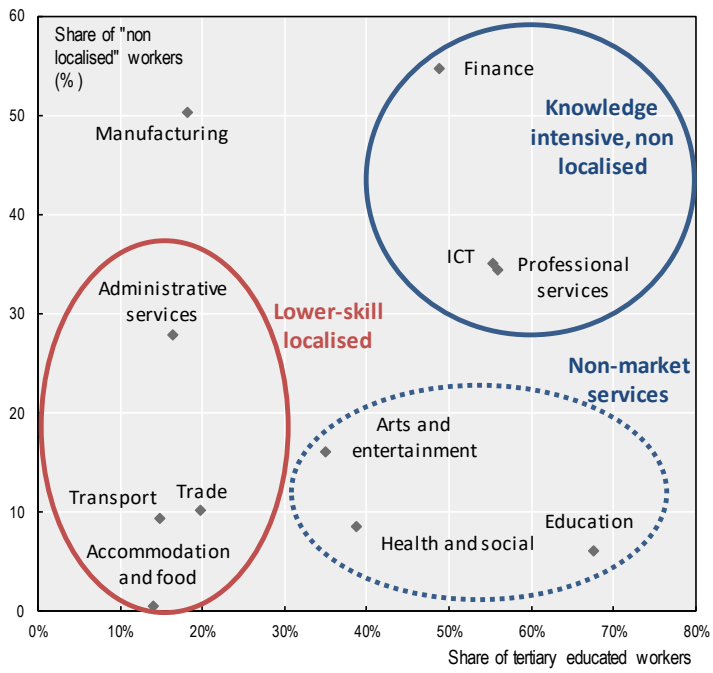
3.1. Services have diverse characteristics and productivity performances

19. Services are a very heterogeneous category and certain services (e.g. ICT) enjoy high productivity levels and growth rates. This heterogeneity reflects the fact that different types of service activities do not face the impediments to productivity presented in section 2 with the same intensity. In this respect, a key parameter that differentiates services is the intensity of face-to-face physical interactions that they require. The services that involve a

lot of these interactions are more affected by spatial transaction costs and therefore suffer more from lack of scale and lack of capital deepening. As a result, they tend to involve a higher share of routine tasks, which have not been automated and are generally performed by low- or middle-skilled workers. Hence, they tend to employ more of these workers. At the other end of the spectrum, more knowledge intensive services can generally take better advantage of economies of scale, capital deepening, knowledge spillovers resulting from agglomeration effects, cross-border trade and specialisation of workers, and tend to employ more high-skilled workers.

20. Using a measure of task offshorability (i.e. whether tasks can be performed from another country) built by Blinder and Krueger (2013[56]) as a proxy for the intensity of face-to-face interactions in different industries, and the share of tertiary educated workers as a proxy for knowledge intensity (in line with Eurostat's definition of knowledge intensive activities), one can distinguish two broad groups of market services (Figure 9): weakly localised knowledge intensive services (ICT, finance, professional services) and strongly localised less knowledge intensive services (e.g. hotels, restaurants, retail trade). This categorisation, summarised in Table 1, will be used throughout the paper. Non-market services (e.g. education, healthcare) are in a category of their own, as they tend to be relatively localised but have a relatively high share of high-skilled workers. Measuring and improving productivity of these services poses specific challenges that are discussed in Box 3.

Figure 9. Localisation and skills define two broad categories of market services



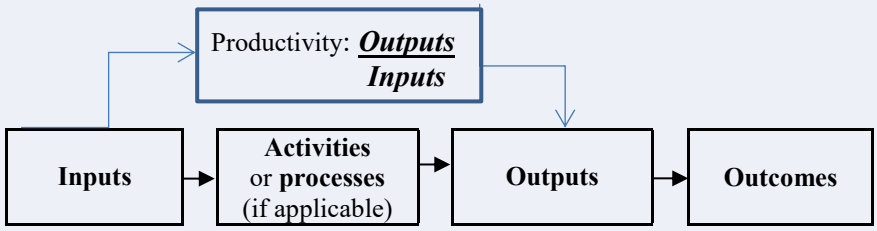
Note: The share of "non localised" workers is based on a measure of offshorability from Blinder and Krueger (2013[56]). The authors build three measures of offshorability (defined as the ability to perform the work duties from abroad with little or no loss of output quality) and the one used in this figure is the so-called "externally coded", which they assess as providing "the most accurate assessment". The share of tertiary education workers is the EU average in 2010.
Source: OECD calculations based on Blinder and Krueger (2013[56]) and Eurostat data

Box 3. Productivity in non-market services: a growing need for better measurement

Most segments of the public sector have broad ultimate goals or outcomes, such as improving health, education or delivering general public services (e.g. defence, justice, environmental protection). However, these outcomes are not under the direct control of the public service provider, hence they do not provide an ideal benchmark to measure the performance of a specific public service provision (Schreyer, 2010[57]). For instance, the health status of the population is affected by many more factors than only the health care system (lifestyle choices, environmental quality, etc.). Moreover, one can think of several relevant outcome measures for the same public service (life expectancy, healthy life expectancy, etc.). These are typically hard to combine or aggregate into to a single composite index, given that their relative importance can be a matter of personal preference.

For these reasons, the statistical measurement systems prefer a concept of output that is under more direct control of the public service provider (Lau, Lonti and Schultz, 2017[58]; Eurostat, 2016[59]), as presented in Figure 10. Prior to the introduction of the 2008 System of National Accounts (SNA), volume estimates for non-market services were based on the sum of deflated input costs, including depreciation (Lehtoranta and Niemi, 1997[60]; Sutherland et al., 2007[61]) reflecting the fact that very few countries were able to produce robust measures of quantities, adjusted for quality. This, of course, unrealistically implied nearly zero productivity growth in these services (Boyle, 2006[62]). To address this shortcoming, the UK "Atkinson review", a reference point in this area (Atkinson, 2005[63]), looked at avenues to develop direct measures of output (see examples in Figure 10), along with adjustments for quality changes. This provided momentum for the 2008 SNA recommendations on using direct output measures. In a few countries, this practice had been already in place for some segments of services since the mid-1980's (Ministry of Finance of Sweden, 1997[64]).

Figure 10. Productivity measurement in non-market services focuses on outputs rather than outcomes



Examples:

Health care	Number of doctors	Number of operations or examinations	Amount of care received by the patients	Health quality or life expectancy
Education	Number of teachers	N/A	Number of pupil-hours or students	Skill level of students
Judicial system	Number of judges	Number of hearings	Number of closed court cases	Efficiency of the legal system

Source: OECD, based on Atkinson (2005[63]) and Lee (2008[65])

Nevertheless, the European System of Accounts (ESA) 2010, a legal instrument used by EU countries which builds on the international SNA 2008, has recommended that quality adjustments are not made, for now, to avoid introducing incomparability across national estimates of non-market services (Office for National Statistics, 2006[66]). At the same time, individual countries continue to experiment with more sophisticated measurement, depending on the needs and available resources (Bean, 2016[28]; Bojke et al., 2013[67]). Moreover, the consumption of public services does not always happen individually, as in health and education, but collectively, as in defence or safety. This further complicates finding adequate measures for output, hence input based methods are still the dominant practice for these collective public services (Eurostat, 2016[59]; Lau, Lonti and Schultz, 2017[58]).

Beyond national accounts, a number of studies use outcome metrics to assess the performance of public service delivery in a broader sense. For instance, Sutherland et al. (2007[61]), Dutu and Sicari (2016[68]) and Canton et al. (2018[69]) measure public spending efficiency by using intermediate outcomes (e.g. PISA scores for education and life expectancy for health) and statistical techniques (e.g. data envelopment analysis) to measure the distance from the most efficient practice. The indicators in the OECD's "Health at a Glance", "Education at a Glance" and "Government at a Glance" publications provide good examples of the richness of the relevant input and output or outcome measures. Given that most governments are organised into various subnational levels, it is also important to collect performance measures and to provide the right incentives at the relevant territorial, regional level (Phillips, 2018[70]; OECD, 2019[71]) At the national level, recent examples of detailed analyses of a broad range of public services can be found in Australian Productivity Commission (2018[72]) and New Zealand Productivity Commission (2018[73]).

Further improving the measurement of public sector performance requires ensuring that statistical agencies have enough resources to develop and maintain adequate methodologies, in particular to take into account quality improvements (e.g. recovery times after operations; skills of pupils). It also requires international cooperation to share best practices and preserve international comparability.

Table 1. Broad categorisation of services

Share of employment in the average OECD country (2015)

Knowledge intensive (11.4%)	Less knowledge intensive (35.1%)	Non-market (24.3%)
Professional services (5.8%)	Retail and wholesale trade (14.7%)	Health (10.2%)
Information and communication (3.0%)	Administrative services (5.6%)	Education (7.5%)
Finance (2.7%)	Transport (5.3%)	Other public services (6.6%)
	Accommodation and food (5.1%)	
	Personal and other services (4.3%)	

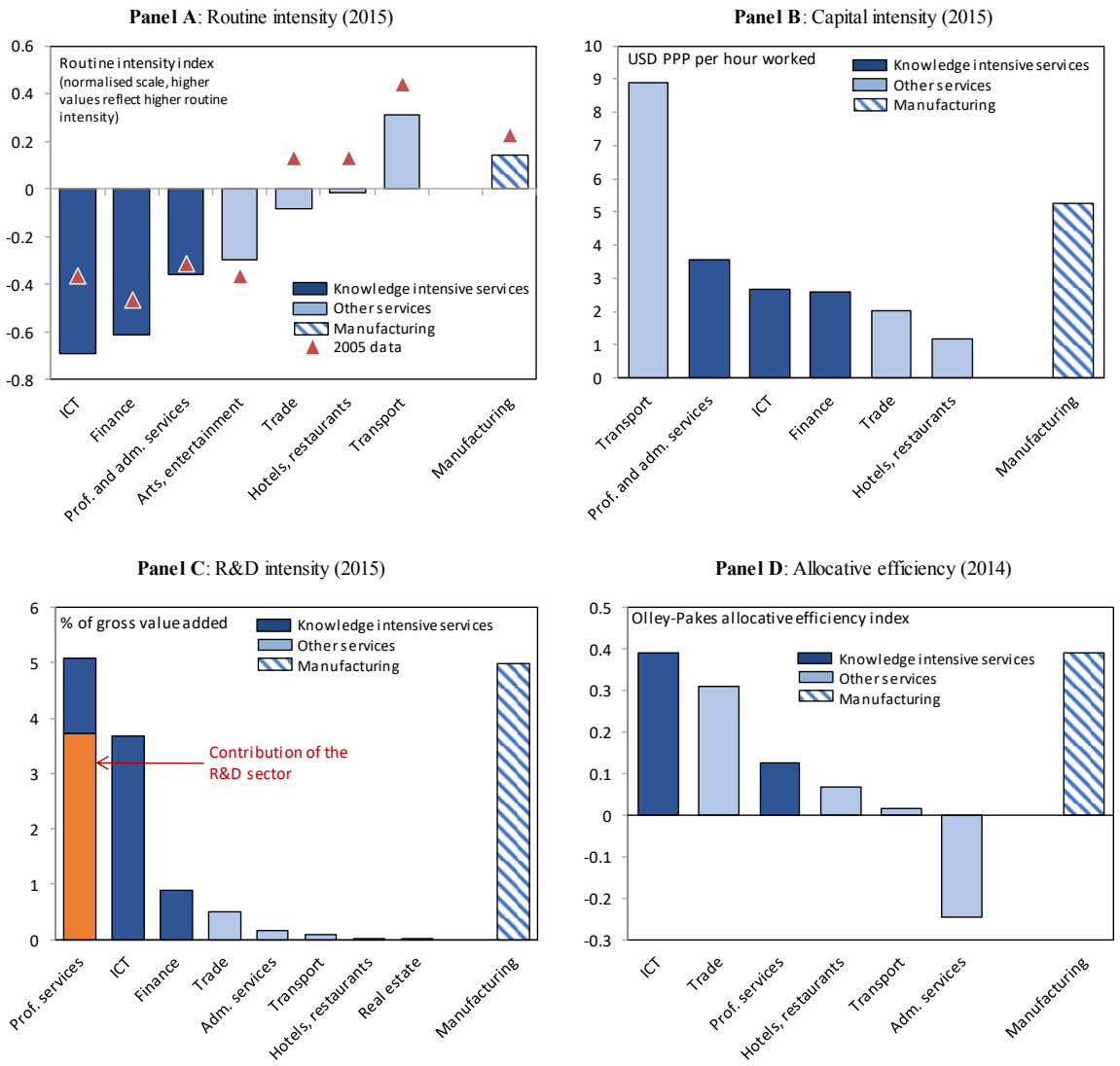
Note: Categories are based on the ISIC4 classification at the one-digit level. The shares are obtained by taking an unweighted average across 30 OECD countries. For comparison, the share of manufacturing is 13.5%. Groups have been classified based on their main characteristics (see Figure 9) but can be heterogeneous. For example, certain health and education activities are market services, while certain personal services are non-market. Utilities are not included as they typically share characteristics with all three categories (mix of knowledge intensive and less knowledge intensive activities and of private and public ownership) and as their share of employment is relatively small (1.2%).
Source: OECD calculations based on OECD STAN database

21. Knowledge intensive services differ from other services in a number of other ways. They tend to exhibit relatively lower routine content, higher capital intensity, higher R&D intensity and higher allocative efficiency.[10] This confirms that they have generally had more possibilities to scale-up and automate routine tasks. As a result, knowledge intensive services have on average higher productivity levels and past growth rates than less knowledge intensive ones (Figure 12).

22. Over the past two decades, two exceptions stand out. The trade sector has experienced relatively high productivity growth despite being strongly localised and generally less knowledge intensive. This relates to the use of technology to transform supply chains and improve managerial and operational processes, and more recently and to a lesser extent to the rise of e-commerce (McKinsey Global Institute, 2018[74]). In contrast, productivity has been stagnant or even declining in professional services, despite the sector being more knowledge intensive and therefore presumably having stronger productivity growth potential. This weak productivity performance may reflect, among other factors, the effect of regulatory frictions (e.g. barriers to entry that inhibit competition, discrepancies in regulatory regimes that reduce tradability). Finally, the strong productivity performance of finance over the period should be interpreted with some caution. It probably reflects genuine productivity improvements, for example related to a reduction of branch numbers and the adoption of digital technologies, but may also be influenced by measurement uncertainties as value added is more difficult to measure in finance than in other industries.

[10] Allocative efficiency is the propensity of more productive firms to be larger than less productive ones. It is measured by the covariance between size and productivity (Olley and Pakes, 1996[76]) following the methodology described in Andrews and Cingano (2014[4]) and using a more recent update of the Orbis database.

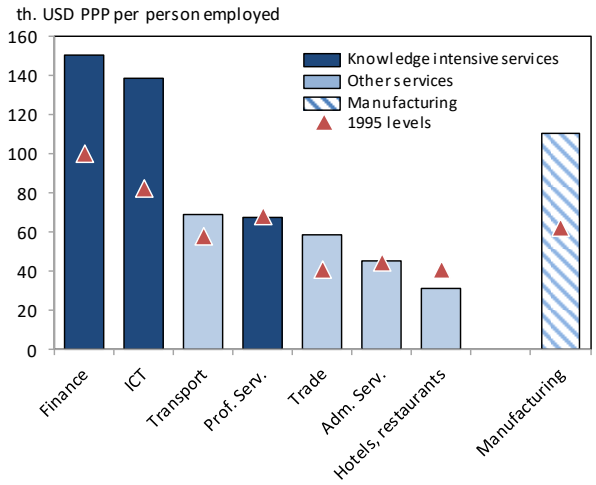
Figure 11. Knowledge intensity is an important characteristic that differentiates services



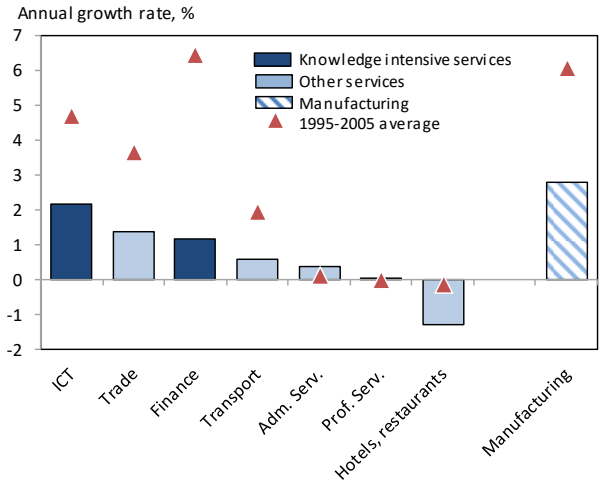
Notes: Sectors correspond to the one-letter NACE codes (G to N). Sectors are not exactly identical across panels the underlying datasets have different gaps and aggregation rules. Panel A: The routine intensity index measures the degree of independence and freedom in planning and organising the tasks to be performed on the job (high independence corresponding to low routine intensity). Unweighted average across 22 OECD countries. Panel B: Investment in Machinery and Equipment divided by total hours worked. Unweighted average across 15 OECD countries (2014 data for SWE and ITA). Panel C: Business R&D expenditure as a percentage of gross value added. Unweighted average across 17 OECD countries. See Galindo-Rueda and Verger (2016[75]) for more details on the methodology. Panel D: Allocative efficiency measures the propensity of more productive firms to be larger than less productive ones. A value of 0 corresponds to a situation where productivity and size are uncorrelated. Methodology based on Andrews and Cingano (2014[4]) who build on Olley and Pakes (1996[76]). Average of 11 OECD countries with superior coverage in the Orbis database. "Employment activities" (temporary work agencies, etc.) sector excluded.
Sources: Panel A: Marcolin, Miroudot and Squicciarini (2016[77]), Panel B: EU KLEMS database, OECD PPPs and exchange rates dataset, Panel C: OECD ANBERD and STAN databases, Panel D: OECD calculations based on Orbis database.

Figure 12. Knowledge intensive services tend to have a relatively good productivity performance

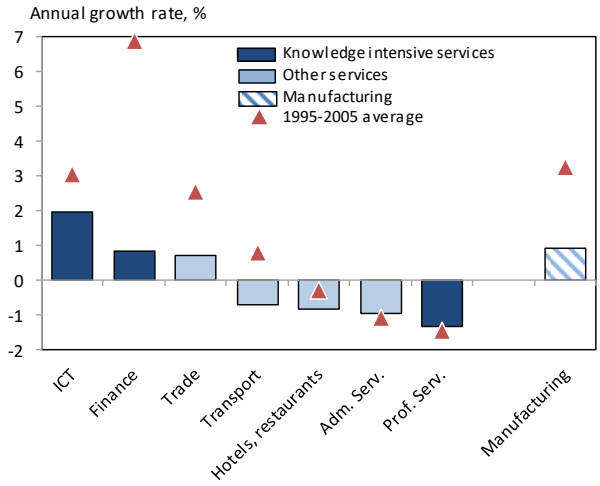
Panel A: Labour productivity levels (2015)



Panel B: Labour productivity growth rates (2005-2015)



Panel C: Multifactor productivity growth rates (2005-2015)



Note: Categories correspond to the one-letter NACE codes (G to N). Labour productivity defined as value added per person employed, in thousands of US $ 2005 PPP. Unweighted averages across 18 OECD countries, except for "Professional scientific and technical activities" in 1995, which relies on 17 countries (USA not included due to data unavailability). Multifactor productivity is the average across 11 OECD countries with the same limitation for the United States.
Source: OECD calculations based on OECD STAN database.

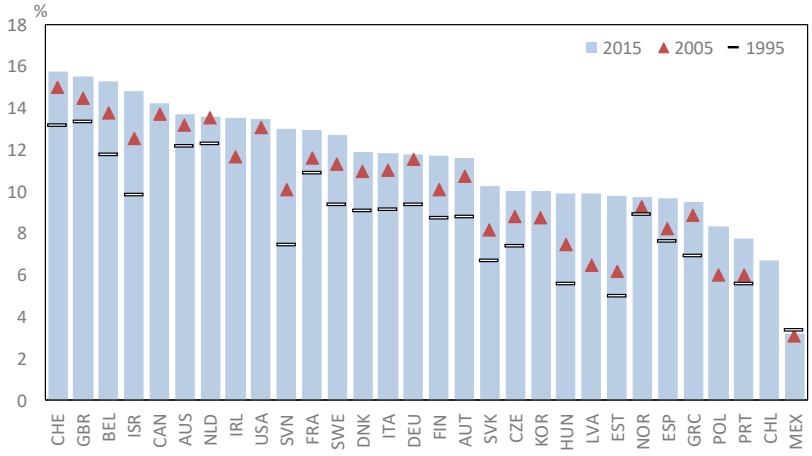
23. As the share of manufacturing declines, a key question is whether services can take over its role as the main engine of productivity growth, and which services offer most potential to do so.[11] Knowledge intensive services are obvious candidates as their intrinsic characteristics (e.g. high R&D and capital intensity, potential for tradability) may generally be more conducive to productivity growth (see Figure 9 and Figure 11). The productivity

[11] This question seems even more pressing for certain emerging and developing economies, which may run out of industrialisation opportunities sooner and at much lower levels of income compared to the experience of early industrialisers (Rodrik, 2016[149]).

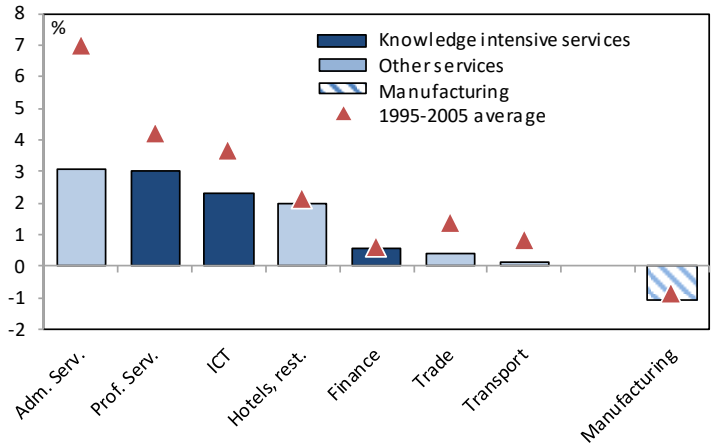
performance of some of them has indeed been as good as that of manufacturing over the past two decades (Figure 12). As discussed below, technological advances and policy improvements (e.g. to increase their tradability) could further enhance their productivity in the future. Encouragingly, the share of knowledge intensive services in employment has increased in almost all OECD countries over the past two decades – it is now close to the share of manufacturing in the typical OECD country – reflecting employment growth in ICT and professional services (Figure 13).[12] Importantly, technologies also offer potential to increase productivity in less knowledge intensive services, which represent a much larger share of employment and hence also an important potential for aggregate productivity (see section 3.2).

Figure 13. Employment in knowledge intensive services is growing across the OECD

Panel A: Employment in knowledge intensive services (% of total employment)



Panel B: Employment growth rate, average per year over 2005-15



Note: In Panel A, knowledge intensive services consist of professional services, ICT and finance. Panel B presents unweighted averages across 20 OECD countries. Data for the United States start in 1998. Data for France stop in 2014. Dark bars correspond to knowledge intensive services.
Source: OECD calculations using the OECD STAN database.

[12] Still, there are signs at the micro-level that workers displaced by automation tend to move predominantly to lower-skill service activities (Autor and Dorn, 2013[147]), highlighting the importance of skills (both initial skills and reskilling) to make the best of structural changes.

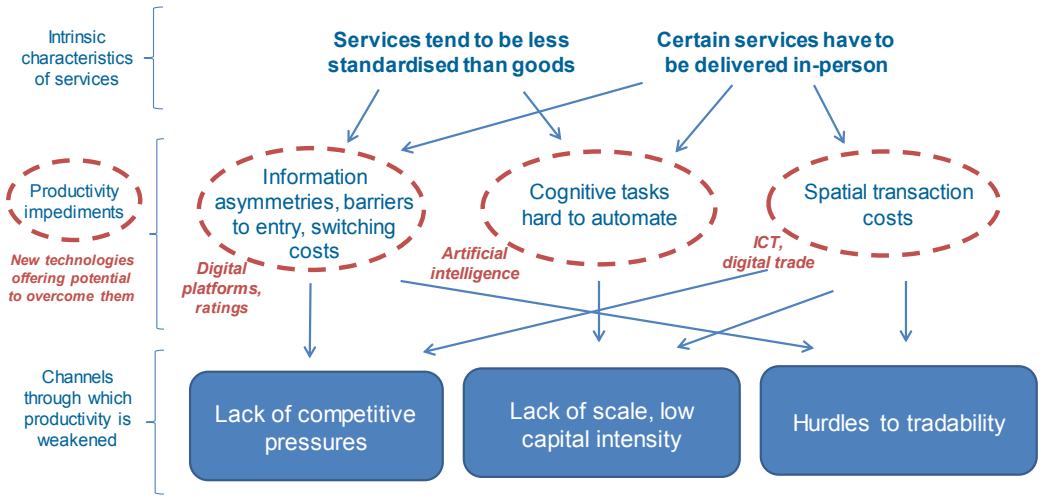
24. In the longer run, knowledge intensive services may be subject to a Baumol effect, similar to manufacturing (see Box 2), in the sense that their share of employment may tend to decline as their relative productivity increases. However, this will depend on demand patterns – relative demand for goods tends to decrease with income, but demand for knowledge intensive services may not necessarily do so, especially if new services continue to emerge at a rapid pace. The development of knowledge intensive services will also depend crucially on the supply of skills, an area where education and lifelong learning policies have a key role to play (OECD, 2016[78]). As technology could make these services increasingly tradable across countries, as discussed below, they are likely to grow primarily in the countries with comparative advantages in terms of skills supply, making upskilling particularly important.

25. Beyond their direct contribution to productivity growth, knowledge intensive services matter greatly because of their indirect effect on the productivity of other sectors. For example, ICT services can enhance the productivity of other industries, including other traditionally low-productivity services, as discussed below. The development of financial services has also been shown to support overall economic growth up to a certain level, but past OECD work has also shown that too large a financial sector could sometimes be detrimental to growth (Cournède, Denk and Hoeller, 2015[79]). Finally, the availability and quality of professional services matters for the productivity of firms in the industries using them as inputs (Bourlès et al., 2013[80]).

3.2. New technologies offer potential to support productivity in a wide range of services if combined with the right policies

26. The adoption of digital technologies remains uneven across countries and industries, and recent OECD research has shown that firms' capabilities and incentives had a complementary role to play in this area (Andrews, Nicoletti and Timiliotis, 2018[81]) and that further adoption of existing technology had potential to boost productivity (Gal et al., 2019[82]; Sorbe et al., 2019[83]). Looking ahead, ongoing technological advances offer vast potential to address the inherent weaknesses of services that hinder their productivity (Figure 14). These new technologies originate mostly in knowledge intensive services (especially the ICT sector), but they will likely have wide-ranging implications in all segments of the economy, including less knowledge intensive industries. In fact, certain technologies may even transform some of these industries so radically that they could become predominantly knowledge intensive (e.g. autonomous vehicles for the transport industry).

Figure 14. New technologies offer potential to overcome impediments to service productivity



Source: OECD

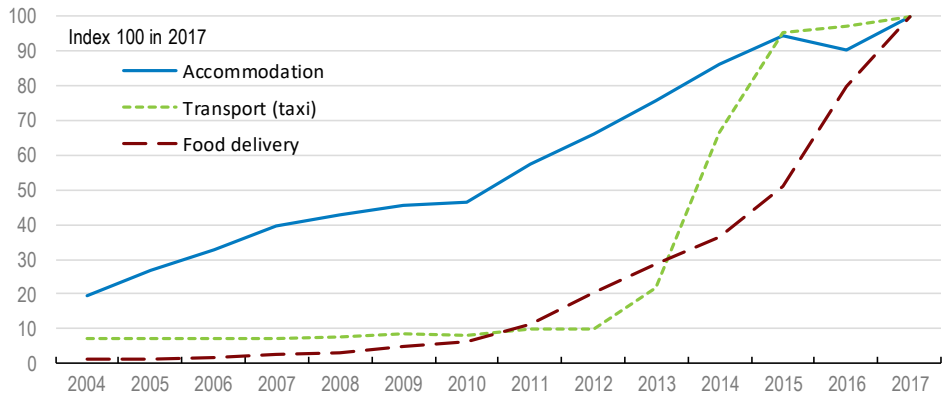
3.2.1. Digital platforms can reduce information asymmetries and barriers to entry

27. Platforms connecting service providers with customers have been developing rapidly over the past decade in a number of industries (e.g. accommodation, transport, food delivery; see Figure 15). There are many models of online/digital platforms (Ker and Zwijnenberg, 2018[84]),[13] but in very broad terms they can be categorised into two main types in terms of their economic effects on service markets. Certain platforms (henceforth called "type 1") specialise in rating and reviewing existing service providers, providing valuable information (and sometimes pre-purchasing or reservation facilities) to potential consumers trying to select a service provider (e.g. Booking.com, TripAdvisor). Other platforms ("type 2") also use rating and review systems, but their main contribution is to enable service provision by new players, increasing service supply overall (e.g. Airbnb, Uber).

[13] An online platform can be defined as a digital service that facilitates interactions between two or more distinct but interdependent sets of users (whether firms or individuals) who interact through the service via the Internet (OECD, 2018[88]). The focus of the present paper is essentially on online/digital platforms connecting (under a range of possible modalities) service providers and consumers through a framework that typically involves ratings and/or review systems.

Figure 15. The use of digital platforms is increasing rapidly

Popularity of digital platforms based on the number of Google searches



Note: Popularity of the largest relevant platforms in each industry, based on the proportion of Google searches for each platform in all Google searches. Unweighted average of results in 12 OECD countries.
Source: OECD calculations based on Google Trends

28. Both types of platforms have the potential to enhance competition among service providers, but they do so in different ways. By reducing information asymmetries between consumers and service providers, type 1 platforms increase incentives to deliver high-quality services and also tend to reorient demand towards better rated (and presumably more productive) service providers, allowing them to grow relative to other providers (Anderson and Magruder, 2012[85]). In contrast, type 2 platforms increase competitive pressures since the new services they propose can to some extent act as substitutes to existing ones (e.g. Uber for taxis, Airbnb for hotels). In this way, these platforms reduce or circumvent entry barriers (including regulatory ones) to certain industries.[14]

29. These differences have implications for policies. Type 1 platforms can act as substitutes to certain regulations or standards meant to reduce information asymmetries between consumers and service providers (e.g. quality standards such as hotel "stars", or occupational licensing requirements). The development of these platforms therefore offers an opportunity to reassess sectoral regulations and potentially lighten certain rules that generate administrative costs and may be used by incumbents to protect themselves from the entry of new competitors. Type 2 platforms pose bigger challenges for policymakers as the new services they enable typically face much lighter regulation (at least initially) than the traditional services they compete with. In this area, policymakers should keep a sufficiently light regulatory framework to enable innovation and entry in the short term (e.g. through "sandbox" regulation), but also ensure a level playing field between competing service providers in the longer run.

30. The regulation of platforms themselves also poses a number of challenges and their recent emergence and rapidly evolving nature imply that many questions are still open. As platforms define how service providers compete with each other (e.g. on pricing rules,

[14] Another potential benefit of both platforms types is that by better matching supply and demand they can enhance within-firm productivity by improving resource utilisation, for example by reducing the idle waiting time of a driver between two rides, or the share of empty rooms in hotels.

product visibility, quality standards, review/rating rules), an important policy objective is that they deliver "fair" and unbiased competition between service providers. This may not always be the case, for example because of fake reviews or ratings,[15] algorithmic collusion (OECD, 2017[86]), or in cases where the platform also operates as a service provider (in which case it may give a preferential treatment to its products). While certain issues may be addressed with current competition law and others may require specific regulation, it would generally help if the incentives of the platforms are aligned with those of the customers, implying for example that platforms have incentives to ensure reliable quality ratings. This would more likely be the case if there is sufficient competition at the level of platforms themselves, i.e. if a platform can be displaced by a competitor delivering more accurate ratings. Competition between platforms also matters more generally to avoid that platforms take advantage of a dominant position vis-à-vis service providers or consumers to extract undue rents (Schwellnus et al., 2018[87]).

31. Ensuring competition between platforms is a challenge because of the winner-takes-all nature of most platform activities, which results from strong network effects on both the provider and the consumer side, as well as from the intensive use of data as an input to improve the quality of platform service. As a consequence, certain markets may not easily lend themselves to the coexistence of a sufficient number of competing platforms. In this case, it can nevertheless make a big difference that the market remains contestable by potential entrants, which requires minimising switching costs between platforms for consumers and service providers. This is closely related to data portability considerations (e.g. the ability for an Uber driver to carry its rating to another platform would reduce switching costs).

32. More broadly, platforms also pose challenges in terms of data privacy, taxation, job quality and labour relations (OECD, 2018[88]; Schwellnus et al., 2018[87]). Overlooking these challenges may hamper the uptake of platform services by consumers, and prevent their full benefits to be reaped in terms of consumer surplus and productivity gains.

3.2.2. Artificial intelligence can support automation of routine service tasks

33. Artificial intelligence and advanced robotics are increasingly good at automating the cognitive tasks that are typical of service activities (Table 2) such as speech or image recognition (including that of human faces), where the best algorithms are already close to or surpass the performance of humans (Figure 16). This is an important change as in the past technology focused primarily on automating manual routine tasks that are mainly present in manufacturing (Cortes, Jaimovich and Siu, 2017[89]). Such automation has huge potential for service productivity and may transform certain localised lower-skilled industries into non-localised higher-skilled ones. For example, the potential development of driverless vehicles could imply vast productivity gains in the transport sector (which has the highest share of routine tasks, see Figure 11) and the replacement of (localised) truck, bus and taxi drivers by (non-localised) developers and programmers, with obvious challenges in terms of skill supply and mismatches (Amaral et al., 2018[90]). Artificial intelligence may also push the boundary of what is considered routine, as certain tasks that were considered non-routine may also be automated (e.g. radiography analysis).

[15] Ratings may be biased because of fake positive or negative reviews, but also more broadly because of biases in rating behaviours (e.g. propensity to rate only very satisfying or unsatisfying experiences, fear of retaliation); they may also not be fully relevant because of differences in consumer preferences (Mayzlin, Dover and Chevalier, 2014[143]).

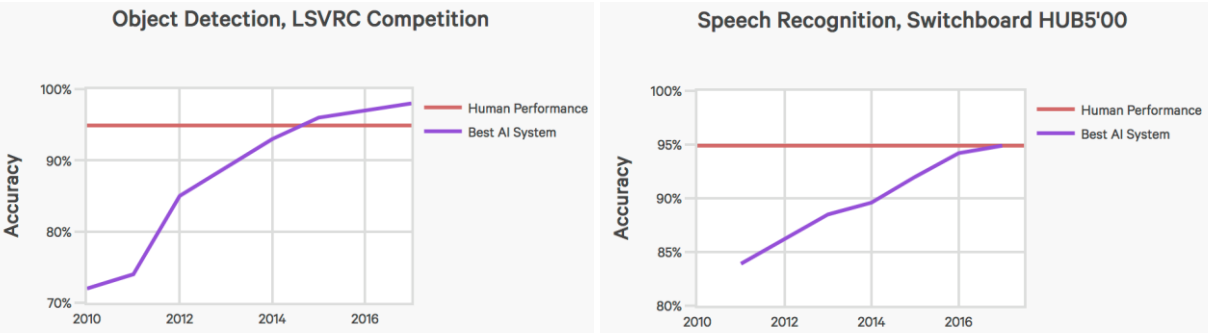
34. The adoption of artificial intelligence remains low and concentrated in the high tech sector, but investment in related research is increasing fast (about 20-30 USD billion in 2016) and anecdotal evidence suggests a clear potential for productivity improvements (Bughin et al., 2017[91]; Brynjolfsson, Rock and Syverson, 2017[92]).

Table 2. Classification of tasks

Type of task	Manual	Cognitive
Routine	production and operative occupations	clerical, administrative and sales occupations
Non routine	personal service occupations	managerial, professional, and technical occupations

Note: See also OECD (2017[93]) for more detailed analysis of skill needs.
Source: Acemoglu and Autor (2011[94])

Figure 16. The performance of artificial intelligence is improving fast



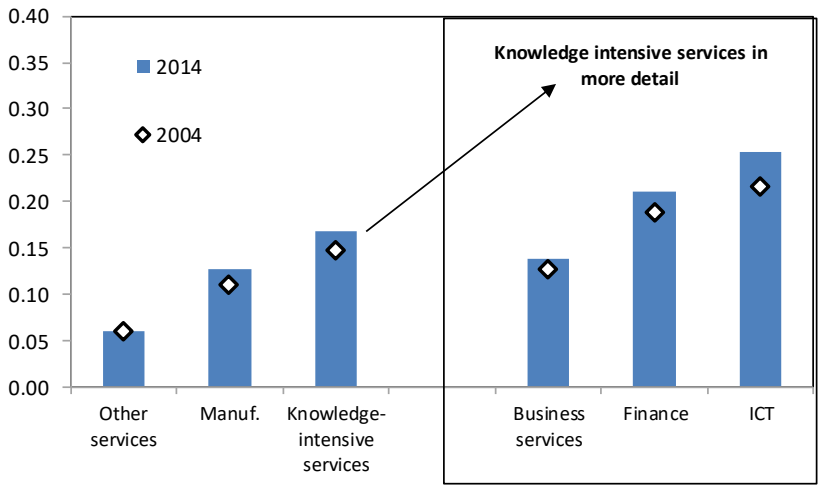
Source: Artificial Intelligence Index, 2017 Annual Report

35. The new technologies that enable automation of service tasks come with a number of challenges. First, automation can lead to large shifts in the demand for skills, likely towards those needed to deal with machines (e.g. programming) or that are complementary to machines (e.g. "soft" interpersonal skills) (OECD, 2016[95]; Grundke et al., 2018[96]). In the case of manufacturing, automation, combined with globalisation, has led to localised job losses that have had a depressing effect at the local level (OECD, 2017[97]; OECD, 2018[98]). Regarding services, the more routine non-knowledge intensive tasks likely to be automated in the future are mainly performed by lower-skilled workers, highlighting the importance of increasing their (currently low) participation in re-training and up-skilling programmes (Nedelkoska and Quintini, 2018[99]).

36. These more automatable service activities tend to be spread relatively evenly across territories due to their localised nature (Figure 17), which suggests that job losses may be more spread geographically than in the case of manufacturing. In contrast, the jobs likely to be created may be very concentrated geographically, since the knowledge intensive service activities – and especially ICT services – tend to be even more concentrated than manufacturing. This may compound regional divergence forces, an area where recent OECD work proposes a range of policies that have a role to play (OECD, 2018[100]).

Figure 17. Knowledge intensive services are geographically concentrated

Index of geographic concentration of economic activities



Note: Averages across 28 OECD countries. Other services comprise so-called non-knowledge intensive services, i.e. trade, transport and storage and hotels and restaurants. Regional concentration is measured using the same methodology as in OECD (2017[97]). Concentration is computed at the TL2 regional level. Results at TL3 level are similar.
Source: OECD Regional Database

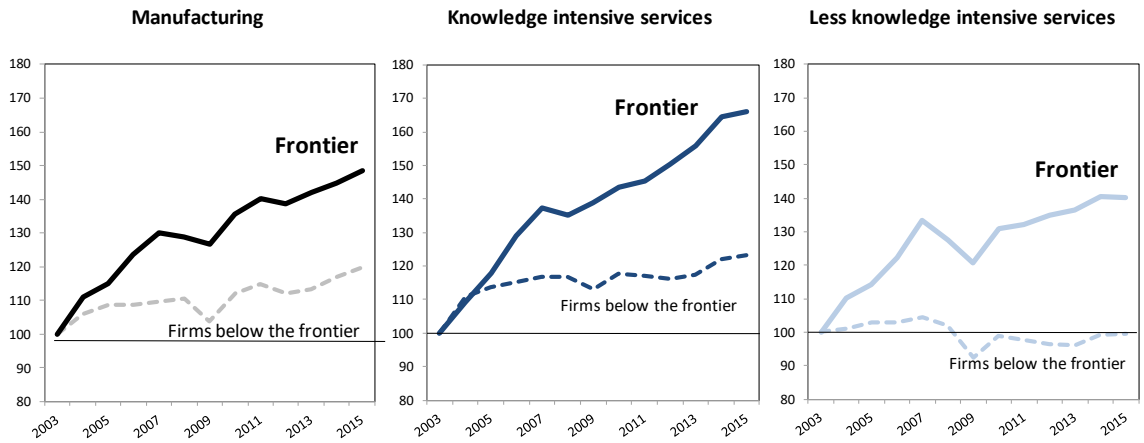
37. The second challenge is that there may be hurdles to the adoption of new technologies in areas where humans traditionally play a central role. For example, uncertainties about responsibilities in case of an accident may slow the deployment of driverless vehicles. Also, solutions have to be found to mitigate the risks of cybersecurity breaches (e.g. hacks) as the potential negative impacts can be more widespread (e.g. hijacking driverless cars).

38. Third, there are mounting concerns about the increasing market power of firms and its potential effect on innovation. There are signs of increasing market concentration and mark-ups, both from firm and macro-level analyses (Autor et al., 2017[101]; Bessen, 2017[102]; Calligaris, Criscuolo and Marcolin, 2018[103]; Schreyer and Zinni, 2018[104]; Bajgar et al., 2018[105]; Andrews, Gal and Witheridge, 2018[3]), as well as an increasing productivity gap between leading and lagging firms (Andrews, Criscuolo and Gal, 2016[106]), especially in services (Figure 18). These trends tend to be more pronounced in digitally-intensive sectors. This may result from certain innovations becoming increasingly firm-specific, primarily in intangibles (software, data use, organisational capital), but even in hardware as firm-specific (as opposed to general purpose) computer chips are emerging (Bessen, 2017[102]; Thompson and Spanuth, 2018[107]). It may also relate to increasing complementarities between skills and new technologies, and also strong network effects in certain activities, especially where data is an important input to production.

39. While the strong market power of certain firms may reflect rewards for past innovation, and as such may be a sign of healthy competition (OECD, 2018[108]), it may ultimately – if it becomes too entrenched – hinder technology diffusion and possibly innovation itself. This is because a strong market position can reduce incentives to innovate to overcome neck-to-neck competitors, discourage certain competitors from innovating as they are too far behind the frontier, or allow dominant firms to use strategic patenting or buy smaller innovative firms to stifle innovation by competitors (Aghion et al., 2005[109];

Díez, Leigh and Tambunlertchai, 2018[110]; OECD, 2018[111]). Ultimately, a lack of innovation and diffusion of technologies would hamper the automation of routine service tasks.

Figure 18. The productivity divergence between frontier firms and laggards is wider in services



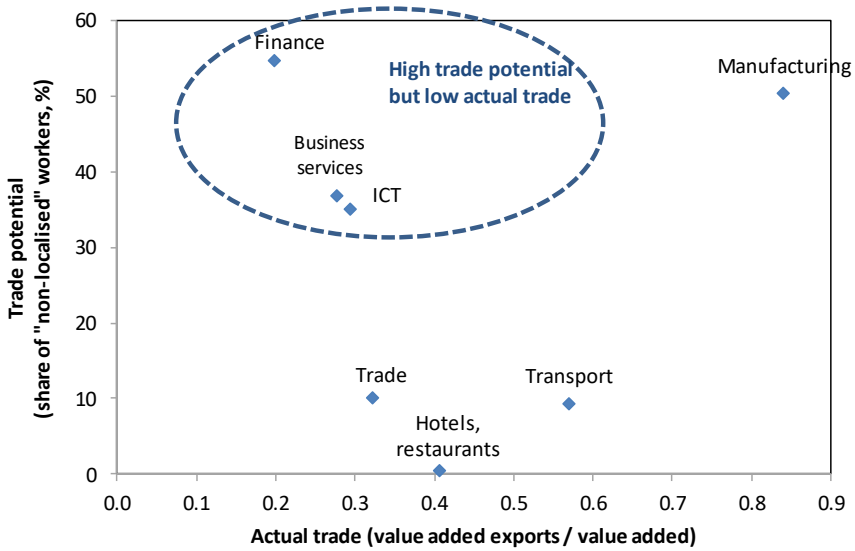
Note: The "frontier" is measured by the average of log labour productivity for the top 5% of companies with the highest productivity levels globally across 24 countries, separately within each 2-digit industry and year. "Firms below the frontier" capture the log productivity for all other firms, constructed in a similar way. The series are normalised to 100 in the starting year (2003=100) and the time variation is approximated by changes in the log measures x 100. Knowledge intensive and less knowledge intensive services definitions follow the classification used elsewhere in the text, with the exception of leaving out the financial sector from knowledge intensive services due to the lack of available firm-level data. See more details about the methodology in Andrews, Criscuolo and Gal (2016[106]).
Source: OECD calculations based on ORBIS data

3.2.3. Communication technologies facilitate service trade

40. Information and communication technologies (ICT) can reduce spatial transaction costs and therefore increase the tradability of services, both within countries and across borders. For example, the increasing availability and convenience of audio and video conference possibilities makes it possible to perform an increasing number of tasks at a distance.[16] Ongoing and future technological advances may further facilitate remote communication, which if combined with appropriate policies could help fulfil the large underexploited potential for trade in knowledge intensive services (Figure 19) and reap the associated productivity gains as trade tends to be productivity-enhancing. For example, speech recognition combined with instantaneous translation has the potential to enable communication between partners that do not speak the same language, in effect reducing greatly language barriers that can be a significant hurdle for trade in services (Nordås and Rouzet, 2017[112]; Brynjolfsson, Hui and Liu, 2018[113]).

[16] Interestingly, these greater communication possibilities have not reduced the geographic concentration of knowledge-intensive services, which as shown in Figure 17 has tended to increase over the past decade. This may be because personal face-to-face interactions are still better than interactions at a distance in terms of ease of informal contact, trust-building and sharing tacit knowledge that is difficult to codify.

Figure 19. Knowledge intensive services have a large underexploited trade potential



Note: The share of "non-localised" workers is based on the measure of offshorability from Blinder and Krueger (2013[56]) also used in Figure 9. It is a proxy for trade potential to the extent that an industry with few localised workers could in theory (and in the absence of policy frictions) locate an important share of its production in a different country from where consumers are located. It is also interesting to note that certain industries (e.g. hotel, restaurants) have a low share of non-localised workers but still generate exports through tourism (where consumers rather than workers are mobile internationally). Actual trade defined is the ratio of value added in exports to value added, averaged across 35 OECD countries for each sector.
Source: OECD TiVA database (data for 2015)

41. In addition to supporting the remote delivery of "traditional" services, digital technologies have led to the emergence of fully digital services, which potentially involve no direct human interaction and are intrinsically almost insensitive to distance. Other new technologies such as blockchain open new possibilities in a number of areas, including financial services. All these technologies create new challenges for policies, especially regarding trade, where most negotiated international agreements pre-date their emergence (López González and Jouanjean, 2017[114]). Policies relative to digital trade differ across countries. Small, open and service oriented economies are generally more open to digital trade, but overall barriers to digital trade have increased over recent years (OECD, 2016[115]; Ferracane, Lee-Makiyama and van der Marel, 2018[116]). Digital trade also poses measurement issues and efforts to develop unified statistical frameworks to address them are under way (OECD, 2017[117]).

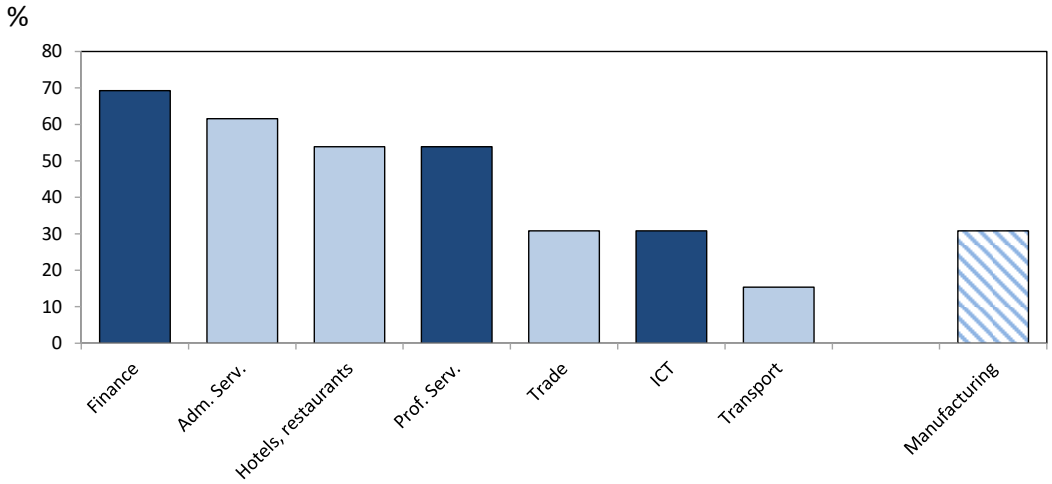
3.3. Large cross-country productivity gaps suggest room for policy improvement

42. There is wide dispersion in the productivity performance of service sectors across OECD countries. More specifically, the share of countries that are well below the productivity frontier tends to be higher in services (both knowledge intensive and others) than in manufacturing (Figure 20). These cross-country differences are likely to reflect many factors, some of which are related to policies, such as differences in skills, digital adoption rates or in the mix of specific activities within each industry. They are also likely to be influenced by a range of regulatory policies in a broad sense, such as product and labour market regulations, occupational licensing, land-use and housing regulations,

insolvency regimes, etc. These policies tend to feature important cross-country differences and shifting them in the direction of international best practices offers an important potential to boost productivity in services in many countries.

Figure 20. More countries are far below best-performing countries in services than in manufacturing

Share of OECD countries where average multi-factor productivity (MFP) is inferior to the best performing countries by more than 30%



Note: Dark bars correspond to knowledge intensive services. In each industry, the productivity of best performing countries is defined as the 90th percentile of the productivity distribution of 13 OECD countries. In contrast to Figure 18, which focuses on productivity dispersion at the level of firms, this figure focuses on the dispersion of aggregate productivity across countries, in each industry.
Source: OECD calculations based on STAN database and using sector-level PPP adjustments by Inklaar and Timmer (2014[118]).

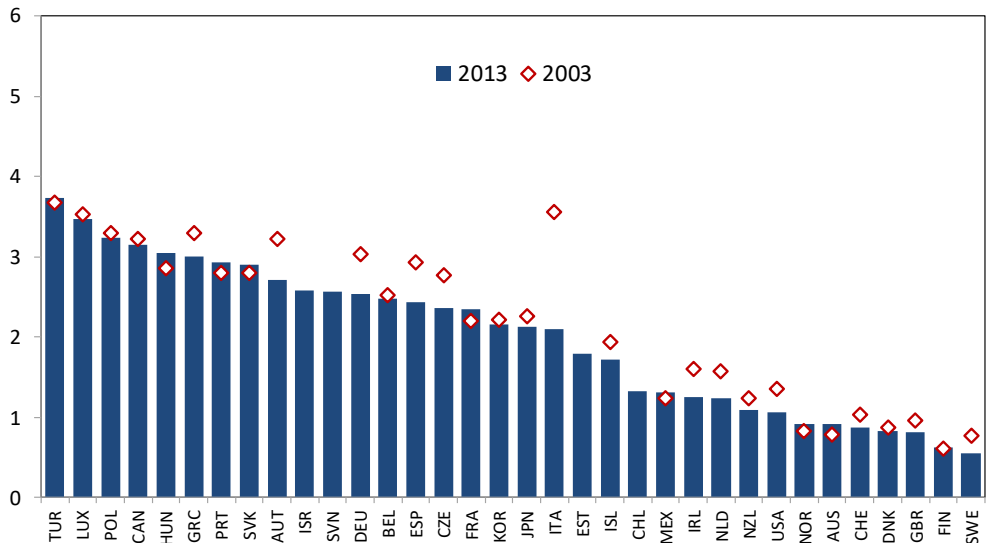
43. For example, there are important differences across countries in the regulation of professional services, and overall relatively little reform over the decade to 2013 (Figure 21) or more recently (OECD, 2018[119]). In this area, cross-country data on regulation is currently available only for the four professions (accounting, legal, architect and engineering) represented in the OECD's product market regulation (PMR) indicators (Koske et al., 2015[120]) – the 2018 PMR update also includes notaries and real estate agents (Vitale, 2018[121]). While there is little evidence on the direct effect of these regulations on professional service productivity, it has been shown that these regulations, jointly with other regulations for example in retail and network industries, have a negative effect on productivity in downstream industries (Barone and Cingano, 2011[122]; Bourlès et al., 2013[80]; Égert and Wanner, 2016[123]; Cette, Lopez and Mairesse, 2017[124]) and increase the productivity gap between leading and lagging firms (Andrews, Criscuolo and Gal, 2016[106]). They have also been shown to increase mark-ups, confirming that they can hamper competition (Thum-Thysen and Canton, 2015[125]; Thum-Thysen and Canton, 2017[126]).

44. More broadly, occupational licensing requirements may create barriers to entry and mobility at the national and subnational level and hinder productivity. In the United States, Kleiner (2015[127]) assesses that 29% of workers required a licence to work in 2008, up from 5% in the 1950s. The implied entry barriers can be important as Kleiner and Vorotnikov (2017[128]) estimate that occupational licensing generates an average wage

premium of about 11% after controlling for other drivers of wages. Different licensing rules across US states have been shown to hinder the geographic mobility of workers (Johnson and Kleiner, 2017[129]). In Europe, Koumenta and Pagliero (2017[130]) assess that occupational regulation affects about 22% of workers and gives a 4% wage premium on average. According to their estimations, making these regulations less stringent could allow employment in these professions to rise by 3-9%. There are differences across EU countries in the prevalence of licensing requirements, but in contrast with the United States no clear rising trend (Koumenta et al., 2014[131]), which may reflect past EU initiatives to facilitate the free movement of professionals.

Figure 21. Professional service regulation strictness varies across countries

Strictness of regulations in professional services (2013)



Note: Higher values indicate a more restrictive stance of regulation. The values presented are simple averages of the four occupations represented in PMR (accounting, legal, architect and engineering).
Source: OECD calculations based on OECD PMR data

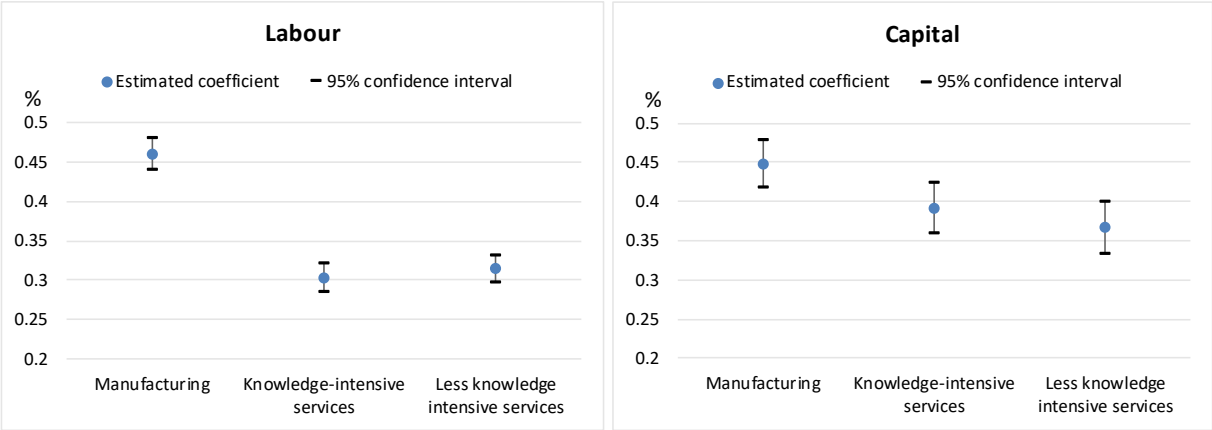
45. A potential symptom of these barriers to entry and mobility is that the efficiency of resource reallocation – i.e. the ability of the economy to enable more productive firms to grow faster than less productive ones – tends to be lower in services than in manufacturing. This is the result of preliminary estimations relying on Orbis data and using the methodology of Foster et al. (2016[132]), presented in Figure 22 and consistent with static allocative efficiency estimates presented in Figure 11, panel D.[17] The low efficiency of reallocation in services may reflect that geographic constraints (the need to be close to consumers) prevent the growth of the most productive service firms. However, the efficiency of reallocation in knowledge intensive services, which as shown in Figure 9 tend to be intrinsically less subject to these constraints, is also weaker than in manufacturing and not statistically different from that of other services. While this requires further

[17] As highlighted in Figure 11, the allocative efficiency is heterogeneous across service subsectors, with professional services having relatively low efficiency compared to ICT, and trade relatively high efficiency compared to other less knowledge intensive services. The relative size of these subsectors affects the overall pattern in Figure 22.

analysis, it may reflect that regulatory frictions (e.g. occupational licensing) hinder the efficient movement of labour and capital in those services. Interestingly, the difference with manufacturing is larger for labour than capital reallocation, suggesting that there may be more regulatory hurdles to the movement of labour than to capital reallocation.[18]

Figure 22. Employment reallocation in knowledge intensive services is relatively weak

Estimated efficiency of the reallocation of labour and capital to the most productive firms



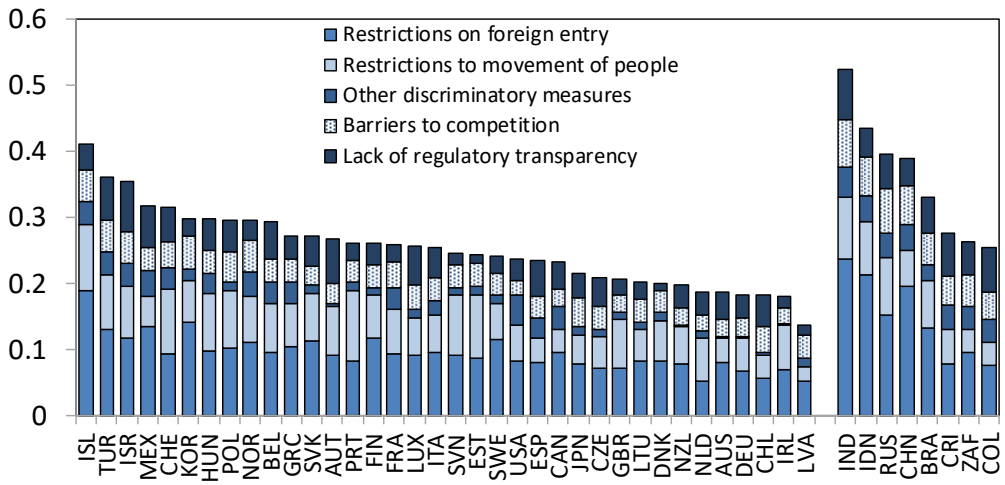
Note: The chart presents the sensitivity of firm employment (resp. real capital stock) growth to the lagged level of multifactor productivity (MFP), based on a firm-level regression following the methodology of Foster et al. (2016[132]). This coefficient can be interpreted as a measure of the efficiency of resource reallocation, i.e. the ability of economies to enable faster growth of the most productive firms, either in terms of employment growth or growth in their capital stock. The coefficient presented is the impact of a 10% difference in MFP on employment (resp. capital stock) growth in the following year. The regression also controls for firm age, firm size classes, and country, industry and year fixed effects. Capital includes both tangible and intangible assets, but may exclude certain intangibles that are not necessarily reported in balance sheets (e.g. internally developed data and software).
Source: OECD calculations based on the Orbis database

46. There are also large cross-country and cross-sector differences in the regulatory barriers to trade and foreign investment in services (Figure 23). Such barriers have been shown to reduce service trade flows (Nordås and Rouzet, 2017[112]) and to enable service firms to charge higher mark-ups (Rouzet and Spinelli, 2016[133]). As a result, they are likely to hinder service productivity, although the magnitude of this effect has not been assessed yet on a cross-border basis. Another open question is the effect of within-country barriers to service trade, for example in federal countries where regulations may differ across states. The development of ICT, which technically facilitates service trade, makes these questions more pressing (US Treasury, CEA and Department of Labor, 2015[134]).

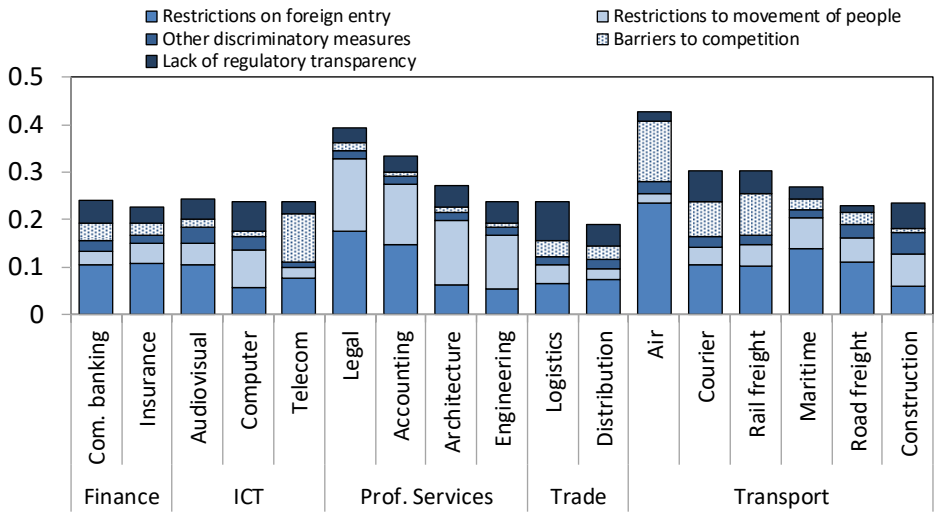
[18] Another potential explanation is that in a digitalised economy with low marginal costs, high-productivity service firms tend to grow more through capital accumulation (especially of intangible assets) than through employment growth.

Figure 23. Barriers to trade in services (STRI index)

Panel A: Unweighted average across available sectors



Panel B: Unweighted average across countries



Note: Panel A is an unweighted average across the 17 sectors presented in Panel B; logistics and audio-visual sectors are computed as simple averages of the 4 logistic sectors and 3 audio-visual sectors in STRI. Data on rail freight transport do not cover ISL, Data on maritime transport do not cover AUT, CHE, CZE, HUN, LUX, SVK. Panel B is an unweighted average across 44 countries.
Source: OECD STRI database, OECD calculations

4. Key policy issues

47. Harnessing the potential for a service productivity pick-up will require identifying and implementing good policies in a range of areas. These include both well-travelled policy areas where there is ample room to move in the direction of international best practices, and pioneering areas related to new technologies (e.g. digital platforms) where best practices still have to be established. As knowledge intensive services and relevant technologies increasingly have a global scale, international policy coordination will be ever more important.

48. Summing up, one can distinguish three main areas for policy action to support productivity in services:

- **Enhancing competitive forces by reducing entry barriers, switching costs and information asymmetries** to enable the emergence and growth of more productive service providers. Competition is relevant both at the local level for localised services and at the national/global level for knowledge intensive ones.

  The rise of ratings and review systems on digital platforms offers an interesting opportunity to enhance competition between service providers, but further research is needed to identify the right policies to ensure that platforms' interests are aligned with those of the customers and address potential competition challenges at the level of platforms themselves. The rise of platforms may also offer room to reassess and potentially lighten other regulations without jeopardising consumer protection and the quality of service. Indeed, some regulations (e.g. certain occupational licensing requirements or quality standards) that were meant to address information asymmetries might not be justified anymore and they can also create barriers to entry and to geographic mobility. In some industries, new players enabled by platforms (e.g. Uber) are competing with traditional service providers (e.g. taxis) and the policy response should encompass both areas and balance the benefits of supporting innovation and entry (e.g. through "sandbox" regulation) and the need for a level playing field in the long run.

- **Favour the emergence and diffusion of new digital technologies** by fostering innovation and encouraging adoption. This would allow the automation of routine tasks in services sectors. Recent OECD research has identified a range of policies to support the adoption of digital technologies by enhancing firms' capabilities and incentives (Andrews, Nicoletti and Timiliotis, 2018[81]). While the intensity of research and innovation in digital technologies has been strong over the past decades, policymakers should be attentive to the potential negative effect of increasing market power of certain firms on the diffusion of innovation and possibly innovation itself. This relates to a broad range of policies, including on the assessment of mergers and acquisitions, intellectual property protection and even labour market provisions as the increasing use of non-compete clauses in labour contracts may be detrimental to the diffusion of innovation (US Treasury, 2016[135]).

- **Enhancing tradability of services within countries and across borders**, to enable better specialisation, knowledge spillovers and stronger competition. This involves both reducing internal and cross-country barriers to the trade of "traditional" services and developing policies regarding digital trade, so as to make the best out of its vast economic potential.

49. These policies should go hand-in-hand with policies to enable an efficient reallocation of labour and capital in economies, including in terms of skills, to enhance their positive effect and minimise the potential adverse consequences of ongoing economic and technological trends. Indeed, as shown by the example of manufacturing, automation and trade have a strong potential to boost productivity but can also lead to large disruptions. This is especially the case at the local level when activities are geographically concentrated and labour mobility is weak. Consequently, policies should focus on ensuring adequate skills and tackling skill mismatches, which requires improving initial education, lifelong learning and active labour market policies (OECD, 2016[95]; Andrews and Saia, 2017[136]; Adalet McGowan and Andrews, 2017[137]; Nedelkoska and Quintini, 2018[99]). Exit policies

(e.g. the design of insolvency regimes) are also important to enable an efficient reallocation of resources (Andrews, Adalet McGowan and Millot, 2017[138]). To the extent that such structural changes may increase inequalities, further inclusiveness policies would also have a role to play (OECD, 2018[139]; OECD, 2018[100]).

50. Further analysis is needed to better understand the drivers of productivity in services and identify more specific policy recommendations. Promising avenues for future work could include the following areas: (i) How does the development of digital platforms affect the productivity of service providers in the industries where they operate (e.g. hotels, taxis)? (ii) How do barriers to entry, labour mobility and trade (including occupational licensing requirements) affect productivity in services? (iii) What are the risks posed by increasing market power of certain firms for future innovation and productivity?

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