4.8 Measuring cloud computing services

Why are indicators on cloud services needed?

New technologies and business models are fundamentally changing the way in which businesses access and use software and hardware (DeStefano et. al., 2019). Cloud services mark a paradigm shift in ICT provision, allowing businesses and individuals to access on-demand IT services over a network. Data processing and storage takes place in a remote data centres which will typically have a scalable and resilient modular design. These can offer businesses, especially small and medium- sized enterprises, cost- reduction opportunities and increased flexibility.

While there are undoubtedly broader impacts for businesses, such as enabling wider access to the latest technologies by lowering barriers to adoption, the most important, fundamental impact of moving to cloud provision of business ICT is on cash flow. Simply put, firms can now access powerful ICTs on a "pay-as-you-go" basis, avoiding the need to finance large capital expenditures on servers, maintenance and the like. For established businesses, this makes managing their money much easier, and the scalability of cloud services reduces risk exposure. For new firms, this can reduce financing needs and lead to more start-ups securing funding.

As a consequence of this shift, ICTs may become less visible in firms' production costs (as recorded in financial reports), while simultaneously becoming ever more vital to their productive activities. Alongside this, the shift to cloud services is likely to reduce the efficacy of existing policies incentivising purchases of ICT equipment and software. It is therefore vital to measure cloud services, in order to determine their impacts on firm-level performance and aggregate productivity, and to manage associated infrastructural needs (e.g. bandwidth) and other policy implications. The OECD digital supply and use table framework distinguishes a separate product category to capture the amount of cloud services purchased by firms (see page 2.11).

What are the challenges?

The nature of cloud services allows them to be used anywhere with a reliable Internet connection, while the cloud services are "produced" from any combination of data centres located across the globe. Even where a given customer's data is known to be housed in a specific data centre, it is also likely to be duplicated (e.g. backed-up) in one or more other locations, with the network dynamically determining where the data should be accessed and processed. This means that the location where production of cloud services takes place can also vary dynamically. Meanwhile, payments by the end-user for those services may be made to a different economic territory. Challenges arise in measuring, and ensuring the coherence of, transactions between the ultimate owner of the cloud computing infrastructure, the unit where the infrastructure is located, and the end-user. This exacerbates other challenges related to measuring digitally traded services (see page 9.6).

In addition, the capital-substituting nature of cloud services can have material implications for economic statistics, including recorded GDP. Fundamentally, businesses (and others) are continuing to use ICTs in their business processes - for data storage, processing, access, analysis and so on - as they long have. However, the way they access these components is changing considerably – moving away from a local provision model towards local terminals used to access cloud services. In National Accounts terms, this implies a switching from investment in hardware such as servers to increased intermediate consumption expenditure, which reduces value added at the level of the enterprise, other things being equal. It is likely that specific questions on cloud computing services will need to be included in business surveys in order to fully understand the scale of substitution towards the cloud.

In the current Central Product Classification (CPC), category 8315 "Hosting of information technology (IT) infrastructure provisioning service" is likely to capture some cloud-related transactions. However, it may be necessary to incorporate a specific product, or sub-product breakdown, for cloud services to provide a complete view. Furthermore, source data and product categories do not always align well with common definitions of cloud computing (BEA, 2018). This makes it difficult to assess the rate of growth of consumption of cloud services and how it compares to decreases in ICT investment among firms.

This shift also implies a concentration of ICT investment in the balance sheets of a relatively small number of cloud service providers, many of which deliver services, and have data centres, in many countries. In principle, this capital formation will be captured in national statistics under investment categories such as software, buildings, and ICT hardware - whether these are developed on own account or procured from third parties. However, an explicit category for cloud based infrastructure should be considered, along with methods to estimate this investment through aggregating related expenditures by producers of cloud services.

Measures of price change are also important. Existing deflators do not always appear to account for the rapid quality improvements observed in cloud services. By using archived online price lists and press releases from cloud services providers to construct a price index for cloud services, it has been argued that quality-adjusted prices are declining even more rapidly than nominal prices (Coyle and Nguyen, 2018). Nevertheless, there are significant challenges with such an approach, including the wide range of different products offered by each provider, a lack of expenditure weights for these products, and the fact that quality improvements tend to be continuous. A further complicating factor is the proliferation of cloud computing services that are provided to end users free of charge or through a "freemium" model where basic

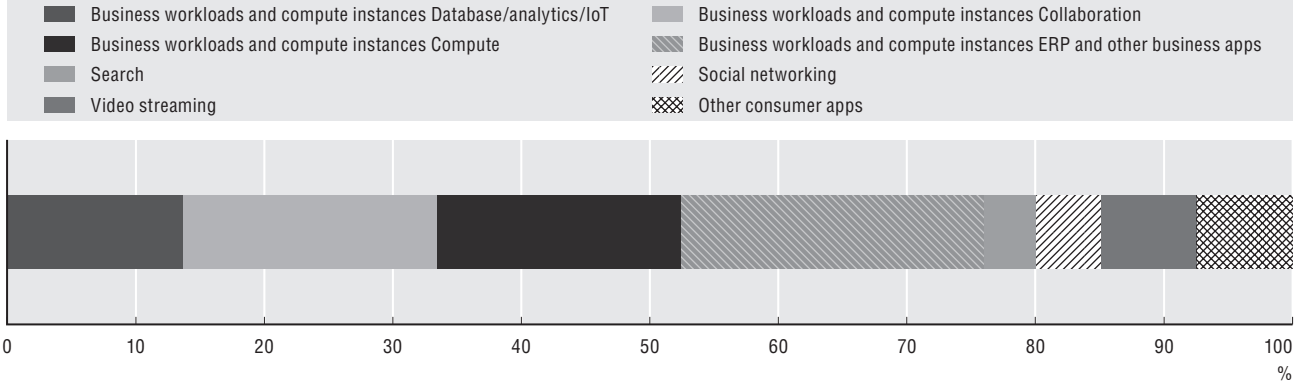
service is free but payment is required for additional features such as extra storage. This is especially common in products targeted at individuals rather than businesses, such as personal email services. Such services are likely uncounted in measures based on transactions and may also act as a substitute for paid software.

Business ICT use surveys give an indication of how many firms use cloud services in each country. Additional detail on services used and the perceived outcomes in terms of production costs, sales and productivity can be collected to provide contextual and policy- relevant information. Nevertheless, the extent and impacts of cloud services can only be understood by finding ways to measure the amounts paid, the volumes of cloud services used and the extent of substitution from ICT investments toward cloud services. The upcoming 2019 Survey of Digital Technology and Internet Use in Canada will attempt to measure the sale of cloud services from an enterprise perspective. Nevertheless, ICT usage surveys may need to be complemented by other means for collecting data (e.g. expenditure on cloud services). A natural fit might be the business expenditure component of structural business statistics. However, without a specific cloud services category in the CPC, such presentations are likely to rely on experimental collection of additional breakdowns.

Much relevant information might be available from cloud services providers themselves, including information on installed capacity, use volumes and the types of applications using cloud services. However, obtaining data from these large multinational companies can be challenging. There is therefore a need to identify viable strategies that minimise the burden on them (e.g. imposed by multiple countries making separate data requests). Another key concern for cloud service providers is the commercial sensitivity of such information.

Global data centre workloads and compute instances, by application, 2016

As a percentage of total data centre workloads and compute instances



Source: OECD, based on Cisco (2018). See chapter notes.

StatLink https://doi.org/10.1787/888933930136

Options for international action

Given the evident role of cloud services as a keystone digital technology, they have been classified separately in digital supply-use tables currently under development by the OECD (see page 2.11). The next step is the collection, by countries, of separate data on cloud services to demonstrate the viability of including a separate category for cloud services in a future revision of the CPC. Alongside this, the OECD and others should build upon previous work to establish internationally agreed definitions and classifications of types of cloud services for statistical purposes, and to operationalise these in business ICT usage surveys in order to gain additional insights into the use of different cloud services.

In addition, it may be possible to reach an agreement with some of the largest cloud services firms to provide standardised data to the OECD under a non-disclosure agreement. The data could then be aggregated to provide an overall view of the cloud services market while mitigating commercial sensitivities. As it is likely that cloud services providers will have some knowledge of where their customers are based (e.g. based on the payment address), this approach might help to shed light on the flows of cloud services being provided into different countries.

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