MEASURING THE IMPACT OF BIG TECH FIRMS ON THE UK ECONOMY

Methodology paper

A methodology paper for the Department for Digital, Culture, Media and Sport | 08 April 2022

Economic Insight Ltd

Important message to readers

This is a methodology paper that has been prepared by Economic Insight Ltd for our addressee client, the Department for Digital, Culture, Media and Sport. This paper is the product of commissioned research for our addressee client and intended to provide a basis for further discussions and research. The methodology presented should not be considered definitive or exhaustive. Statements made herein do not reflect DCMS policy.

DCMS would like to thank Economic Insight Ltd for all of their work on delivering this methodology paper.

CONTENTS

GLOSSARY

Acronym/word	Definition
ASHE	Annual Survey of Hours and Earnings – annual survey that provides information about the levels, distribution and make-up of earnings and paid hours worked for employees in all industries and occupations
BEIS	Department for Business, Energy & Industrial Strategy
CMA	Competition and Markets Authority
Companies House	Companies House is the United Kingdom's registrar of companies
DCMS	Department for Digital, Culture, Media & Sport
FAME	Database containing information on companies and unincorporated businesses throughout the UK and Ireland
GUO	Global Ultimate Owner
GVA	Gross Value Added – a measure of the value of goods and services produced in an area, industry or sector of an economy. It is calculated as the value of outputs minus the value of intermediate consumption
ICT	Information, communication and technology
IP	Intellectual Property
M&A	Mergers and acquisitions
MFN	Most Favoured Nation clause
ONS	Office for National Statistics
R&D	Research and development
SEC 10-k	Securities and Exchange Commission 10-k, is an annual report required by the US Securities and Exchange Commission, which gives a comprehensive summary of a company's financial performance
SIC	Standard Industrial Classification – a system for classifying industries, enabling comparisons of industries across different datasets
SME	Small and medium-sized enterprises
SOC	Standard Occupational Classification – a coding framework used to classify occupations, enabling comparisons of occupations across different datasets
Statista	Statista is a German company specialising in market and consumer data
ASHE	Annual Survey of Hours and Earnings – annual survey that provides information about the levels, distribution and make-up of earnings and paid hours worked for employees in all industries and occupations

1. Executive summary

This methodology paper sets out a framework for the Department for Digital, Culture, Media and Sport (DCMS) to understand and measure the impact of the world's biggest technology firms (Big Tech) on the UK economy. Whilst the proposed framework aims to allow for a comprehensive and robust assessment of their impacts, there are some practical challenges in implementing it. Some of these challenges could be mitigated if more data, with increased granularity, was available. However, some of these challenges are intrinsic to the characteristics of the firms in question and their services. It is therefore important to be clear regarding the limits of what can be measured – and to what degree of accuracy – in relation to impacts on the UK economy.

1.1 Background to our research

Digital technologies have been transforming much of the economy and have allowed some multinational companies to accrue significant financial, intellectual, and data capital. Reflecting their global reach, ubiquitous presence, and perceived systemic impact, these companies are often referred to as 'Big Tech' firms. Commonly recognised examples include Alphabet (Google), Amazon, Apple, Meta (Facebook) and Microsoft.

The dynamic and globalised nature of the many industries and sectors in which these companies operate necessarily makes such a categorisation imperfect from an analytical perspective. Although they share some characteristics – such as large market capitalisations, significant global user bases, vertical integration or network-effect driven business models – they ultimately engage in a wide range of different activities across their relevant markets and sub-sectors (for example, the services provided by Apple are very different from those provided by Meta). Which companies are regarded as 'Big Tech' may also be context-dependent; and will certainly change as competitors emerge and business models evolve.

This makes any 'collective' or 'uniform' assessment or comparison of their footprints and impact on the UK economy challenging. Whilst there are well-established and best practice analytical frameworks and methods for measuring the specific impacts of companies on the UK economy, to date there is no common agreed approach for applying these in the context of the world's largest tech companies in a comprehensive manner. To address this gap, DCMS has commissioned us (Economic Insight) to develop a measurement framework and methodology to enable the assessment of the main impacts of these firms in a consistent and robust manner. This work also serves to identify the types of data needed and current availability thereof.

1.2 Overview of our approach

This part outlines the methodological approach (economic impact assessment), the considered impact channels and quantification measures selected to assess the impacts of Big Tech firms on the UK economy.

To build our framework, we have used economic principles; undertaken a literature review; and discussed extensively with DCMS officials (including through a workshop). In addition, to highlight some of the key issues relevant to understanding the nature of the qualitative (the 'in principle') impacts relating to structure and competition, we further draw on the expert views of Dr Luke Garrod, an academic competition economist and lecturer at Loughborough University.

1.2.1 What is assessed?

The first step in our methodology is to establish what activities Big Tech firms undertake and how they generate value in the UK economy. This is important because these companies individually undertake multiple activities in the UK - and their products and services further enable many more activities across the UK.

1.2.2 How do we measure the impacts of the Big Tech firms' activities?

We have considered their economic impacts through the lens of an economic impact assessment framework for businesses. This is a widely established approach, used both within Government and in the sector, to determine impact. It is, therefore, in our view, the appropriate overarching lens to apply here. Under an economic impact assessment, a firm's economic contribution is assessed by way of direct, indirect, and induced impacts. The sum of these three impact channels makes up the total of a firm's impact on the UK economy.

The first step in our methodology is to establish what activities Big Tech firms undertake and how they generate value in the UK economy. This is because these companies individually undertake multiple activities in the UK - and their products and services further enable many more activities across the UK.

We have considered their economic impacts through the lens of an economic impact assessment framework for businesses. This is a widely established approach, used both within Government and in the sector, to determine impact. It is, therefore, in our view, the appropriate overarching lens to apply here. Under an economic impact assessment, a firm's economic contribution is assessed by way of direct, indirect, and induced impacts.[1] The sum of these three impact channels makes up the total of a firm's impact on the UK economy.[2]

- **Direct impacts** arise as an immediate impact from a company's activities in the UK. They include the value created by producing the final good or service, and the employment required to do so.
- **Indirect impacts** measure the impacts arising through the supply chain. An increase in demand for a final output will also increase demand for its inputs, and the inputs to those inputs, and so on. When firms conduct business, they must make many direct purchases from suppliers. Thus, these indirect impacts capture the economic activities and employment stimulated along the supply chain by Big Tech firms' procurement of inputs of goods and services from UK suppliers.
- **Induced impacts** measure the increased spend on goods and services in the economy accruing from workers in the direct and indirect industries spending their earnings.

Across the above impact channels, an economic impact framework typically quantifies impacts in terms of three key metrics: employment; GVA (including specifically spend on R&D and IP investment); and tax contributions.

Whilst an economic impact framework should enable the robust measurement of a firm's contribution to the UK economy on aggregate, we are also interested in nature and means of both the redistributive and spillover effects and the market structure and competition effects of these firms - for the purpose of this methodology paper we refer to these as 'wider impacts'. We briefly expand on these below.

- **Redistributive and spillover effects**. In addition to creating a 'total' amount of impact (measured in employment, GVA, or tax receipt) a firm may cause value to be 'redistributed' within the economy

---

1 *We note that there are various alternative ways in which impacts can be captured, for example, through environmental or regulatory impact assessments. Given the main objectives of this study are to understand the impact on the UK economy, our main approach focuses on economic impacts, and we seek to cover all remaining impact channels in the wider effects on the UK economy.*

2 *We note that any estimation of total economic impact will face inherent limitations – such as data availability and reliability. These are discussed throughout this methodology paper.*

(either between different consumer groups; different geographies; and/or across different firms). For example, we can observe instances where the products and services of Big Tech firms have enabled SMEs to reach wider audiences (which may represent a redistributive effect from large companies to SMEs). In addition, some of the impact generated by Big Tech firms may be 'non price' (i.e. it generates benefits or disbenefits that are not reflected in prices paid). These 'spillover' effects include environmental and social impacts.

- **Market structure and competition effects.** Market structure and competition effects are the extent to which the activities of the Big Tech firms affect the nature and intensity of competition in their markets. These effects will, in principle, be captured in the above metrics (employment, GVA and tax receipt), for example, competition and market structure will affect the demand and supply (and therefore prices) of the services provided by Big Tech firms (and their suppliers and so on).[3] Furthermore, services provided by Big Tech firms often have no monetary price to the customer, so there is a challenge of assessing their impact on market structure in non-price markets (using traditional competition assessment tools). Nonetheless, it is important to understand these effects, including the mechanisms[4] by which they occur, in their own right. [5]

In summary, this methodology paper sets out a framework for DCMS to assess Big Tech firms' impact on the UK economy on a forward-looking basis, by providing views on both: what the likely impact channels are; and how to quantify those impacts.

1.3 Methods and measures to assess Big Tech firms' impacts

First, we provide a **framework to identify Big Tech firms' entities and subsidiaries in the UK**. This is important to enable the assessment of the impact on the UK economy. Following that identification process, Table 1 illustrates the key measures and methods to assess Big Tech firms' impacts on the UK economy. This aligns with the framework set out above.

[3] *We note that this applies where Big Tech firms have legal entities established in the UK as well as where they do not. We provide approaches to measure their direct impacts under both circumstances, and therefore the direct impacts of any market structure and competition changes ought to be captured in those metrics.*

[4] *By this, we mean looking at aspects outside of the direct impacts on cost, but more on how competition impacts the market structure and for who.*

[5] *A full competition/market analysis is outside the scope of this methodology paper.*

Table 1: Key measures and methods across impact channels

Impact channel	Key measure/metric	Method to gather metric
Measuring and understanding economic impact of Big Tech firms		
Direct impact Indirect impact Induced impact	GVA Employment R&D	We provide various alternative approaches to gather the measures of relevance, including information from UK and global annual financial accounts, as well as supplementing this with information from the ONS to estimate these impacts.
Additional considerations relevant to policy making		
Redistributive and spillover effects	Metrics will depend on the redistributive/spillover effects identified.	Approaches based on recommendations for additional primary and secondary research.

1.4 Findings and limitations

Overall, we find that the methods set out above can be used in a robust way to measure some of the impacts of Big Tech firms on the UK economy. However, there are some practical challenges in implementing it. Some of these challenges could be mitigated if more data, with increased granularity, was publicly available. But, some are intrinsic to the characteristics of the firms in question and the services they provide.

A key objective of this research is to clearly set out what can be achieved with existing information, as well as to understand what can be achieved with additional research and data. In particular, we find that further work on the following issues would be useful.

- **Stakeholder engagement.** To build on the existing understanding of what activities Big Tech firms undertake in the UK, as well as map out their products and services, and how they affect the economy, we suggest additional engagement with stakeholders and industry experts.
- **Sensitivity analyses.** Annual financial reporting information may not always be sufficiently current or detailed to provide accurate or granular estimates of Big Tech firms' impacts. Notwithstanding this, initial estimates of overarching GVA, employment, and R&D expenditure impacts can be undertaken with the existing information. We recognise that there are practical challenges in undertaking sensitivity analyses - and thus this is an area where further research may be useful.
- **Interlinkages and knock-on effects.** The redistributive and spillover effects rest on identifying the key interlinkages between the different stakeholders affected by Big Tech firms. Therefore, any improvements in developing more accurate logic models will have knock-on effects here. Only once these likely effects are identified can measurement methods be put forward. To improve this, we suggest conducting additional primary and secondary research.

Finally, we note that further research is required to understand the impacts of digital markets. More specifically, the impact online platforms have had on competition in the UK. We acknowledge that DCMS, in support of the upcoming draft digital markets bill, is committed to developing a monitoring and evaluation plan. This work will help to improve the understanding of competition across digital markets as well as the potential impact of introducing the digital markets pro-competition regime.

2. Background and methodology

This chapter provides background and context to our research. It also sets out our research framework, which we apply subsequently throughout the methodology paper.

2.1 Background and context

Currently, DCMS has a high-level view of Big Tech firms' activities and their impact on the UK economy, through data from Companies House and company reports as well as economic impact assessments performed by some of these companies on their own activities. This encompasses: (i) UK headcount; (ii) total revenue and sales reported in the UK; and (iii) some of their R&D investment in the UK. These figures, however, only tell part of the story. As large, multinational companies, the biggest technology businesses can enable knowledge transfers, capital deepening, further employment, and structural changes across sectors and regions. Some firms recognise and openly discuss these effects as they observe them across the UK economy, and over the years, many have published their own impact studies (as detailed in chapter 9). However, these self-assessments often use different methodologies and rely on proprietary data, making their findings difficult to verify, compare or analyse further.

2.2 Our research objectives

Our research objectives are twofold. Specifically, to provide DCMS with a framework to:

(i) understand how Big Tech firms impact the UK economy; and
(ii) measure by how much they impact the UK economy by providing DCMS with the toolkit to undertake a comprehensive assessment of the impacts, by identifying key metrics and data that are publicly available.

2.3 Our research framework

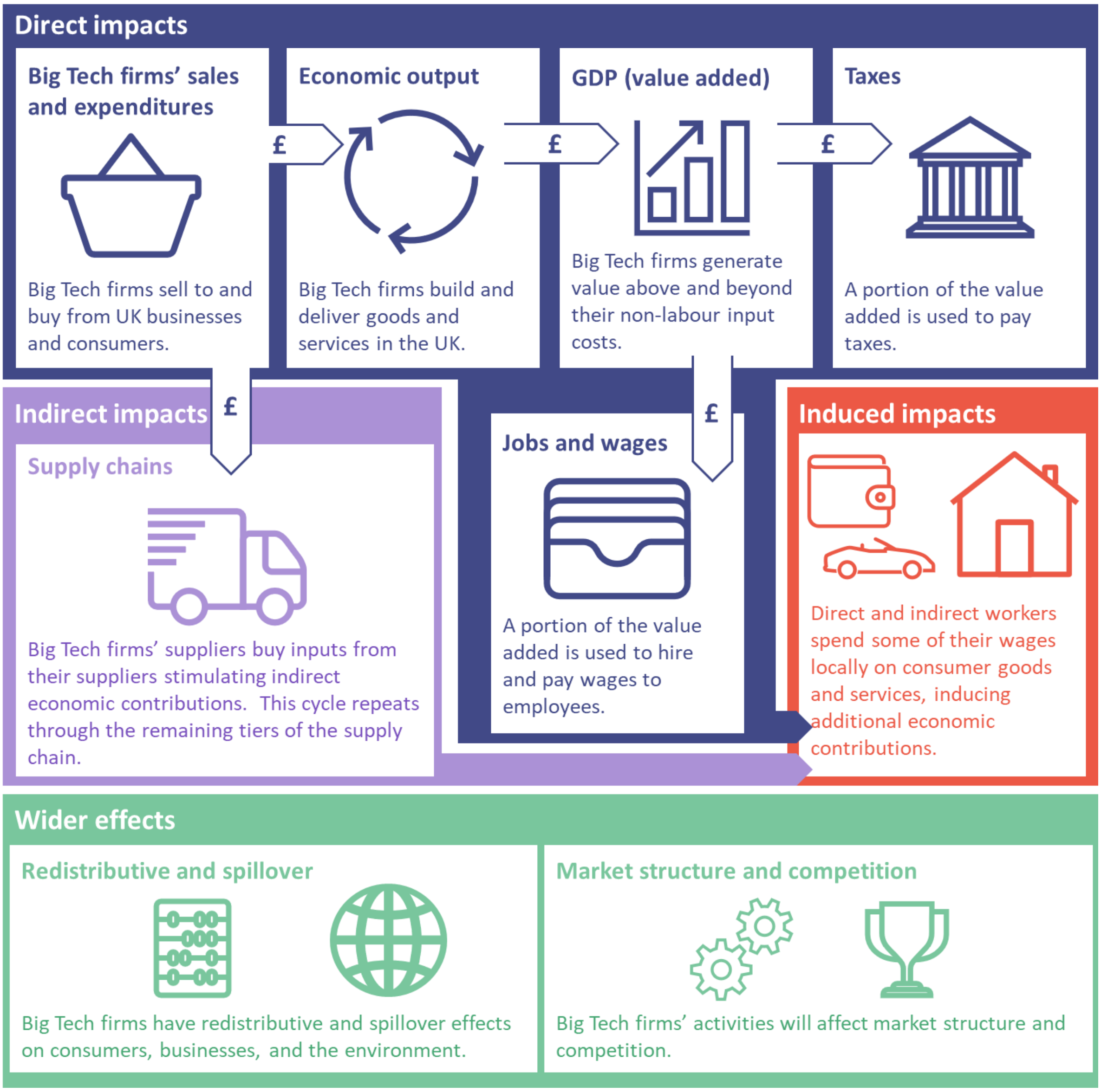
Assessing Big Tech firms' contribution to the UK economy is a complex matter, which requires consideration of different dimensions.

- First, the value added by Big Tech firms takes many forms – economic, social, environmental, structural, and intellectual – some of which is not easily quantifiable or varies over time.
- Second, Big Tech firms add value both to *those who use their products and services directly*, and to *the wider UK population who benefit indirectly from their presence in the UK*.

This framework focuses on commercial or profit-making activities. For example, we do not consider pro-bono work undertaken by Big Tech firms, nor the impact on developing digital skills, which has been particularly valuable in the context of the COVID-19 pandemic and the shift to remote working and learning.

In the next two sections, we provide an overview of the overarching framework we apply to this study, illustrated in Figure 1.

Figure 1: Economic and wider impact framework



Source: Economic Insight.

We will primarily focus on the economic impacts of Big Tech firms on the UK economy – captured by the direct, indirect, and induced impacts set out in Figure 1 above – as well as the wider effects, respectively. We note that as part of the economic (and wider) impact assessment, we explicitly consider R&D investments, IP, and M&As given their importance and impact on business, consumers and the wider economy.[6]

[6] *We note that, in principle, this approach avoids double counting, as all the impact channels are distinct. However, in practice, given the firms under consideration may have complex supply chains, double counting may occur where one subsidiary's outputs are inputs into another company's. Our approach attempts to mitigate for this risk by clearly identifying all the relevant entities, as well as their interlinkages.*

2.3.1 Economic impact assessment

Usually, an **economic impact assessment** measures changes in business revenues and profits, wages, and/or jobs. This widely established approach assesses a firm's economic contribution by way of direct, indirect, and induced impacts. Together, these three impact channels make up the overall economic impact on the UK economy of these firms.

- **Direct impacts** arise as an immediate impact from a company's activities in the UK. They include the value created by producing the final good or service, and the employment required to do so.
- **Indirect impacts** measure the impacts arising through the supply chain. An increase in demand for a final output will also increase demand for its inputs, and the inputs to those inputs, and so on. When firms conduct business, they must make many direct purchases from suppliers. Thus, these indirect impacts capture the economic activities and employment stimulated along the supply chain by Big Tech firms' procurement of inputs of goods and services from UK suppliers.
- **Induced impacts** measure the increased spend on goods and services in the UK economy accruing from workers in the direct and indirect industries spending their earnings. This, therefore, induces additional economic impact.

Usually, these direct, indirect, and induced impacts are measured through: (i) the gross value-added (GVA) [7] contribution to GDP (which captures spend on R&D and IP investment); (ii) employment, measured on a headcount basis; and (iii) tax contributions.

The indirect and induced impacts are often coined multiplier effects, as they increase overall economic impacts compared to the direct impacts alone and capture the knock-on economic impacts on the UK economy.[8]

2.3.1.1 Methods to measure direct, indirect, and induced economic impacts

Economic impact assessments usually employ one of two methods for determining impacts.[9]

- **Input-output models** rely on inter-industry data to determine how effects in one industry will impact other sectors. Additionally, these models also estimate the share of each industry's purchases that are supplied by other firms – and based on this data, multipliers are calculated and used to estimate economic impacts.
- **Economic simulation models** are more complex econometrics and general equilibrium models. They account for everything the input-output model does, as well as forecasting the impacts caused by future economic and demographic changes. Moreover, by applying econometrics and other statistical approaches, they allow for disentangling the relationship between various inputs and outputs.

The most frequently used method to assess the impact of businesses on the UK economy is input-output modelling. For example, six (out of twelve) [10] of the reviewed studies use input-output modelling, and it is generally considered best practice to use this method when determining economic impacts. [11] Other studies used primary research and then extrapolated impacts from there.

---

[7] *Where GVA contribution to GDP is defined as the value of the output produced minus the expenditure on inputs to produce that output. GDP measures the total economic output of the country and equals the sum of GVA plus taxes minus subsidies on production.*

[8] *The most commonly used multiplier is a ratio of the total economic effects in a particular category divided by the direct effects. The multiplier tells you how much the overall economy changes per unit change in the direct effects (e.g., how much the remaining economy changes per change in a pound of output, a pound of personal income, or per job in the direct industries or institutions that we are analysing).*

[9] *'Measuring Economic Impacts of Projects and Programs'. Weisbrod, G., Weisbrod, B.; Economic Development Research Group (April 1997); 'The Green Book: Central Government Guidance on Appraisal and Evaluation'. HM Treasury (2020).*

[10] *We note that the remaining six studies used a variety of approaches, ranging from various primary to secondary research methods. See chapter 10 for more details.*

[11] *See chapter 10 for the literature review.*

2.3.1.2 Measures that show direct, indirect, and induced economic impacts

The following measures are usually considered when assessing economic impacts through the above framework.

- **Revenue** is the broadest measure of economic activity, as it generates the largest numbers and includes the gross level of business revenue, which pays for cost of sales and labour, as well as generating net business profits. However, this measure can be misleading, as a large value is not always consistent with a large economic impact.[12]
- **GVA** or **Gross Value Added** is one way of measuring the contribution (economic output) made to the economy by a producer, industries, regions, etc. This is the quantitative assessment of the value of the goods and services minus the cost of inputs and materials used in the production process. For an individual producer (or firm) one way of measuring GVA is by calculating the income earned by businesses and workers in producing its goods and services.[13] R&D and M&A effects are captured within GVA (over the long-term), as they ultimately affect a firm's profitability (by either increasing their revenues or reducing their costs).
- **R&D expenditure** and wider IP generated is incurred in the process of finding and creating new products or services. What companies define as R&D expenditure can range from staff's salaries (e.g. scientists, software developers, etc.) to acquisitions of IP rights or other companies altogether.[14] It is considered a common operating expense, and, therefore, when looking at a company's operating **profits**, these will be net of the R&D expenditures and therefore will be accounted for in the overall value-added analysis above. For example, see how pre-tax operating profit for Apple Inc. is derived, in Table 2.
- **Total employment** is the most popular measure of economic impact, as it is easier to put into context than large, abstract monetary figures. However, job counts have two limitations:
  - they do not necessarily reflect the quality of employment opportunities; and
  - they cannot easily be compared to the costs of attracting those jobs.[15]
- **Tax** captures all the companies' tax contributions to central and local government. Given the difficulties in estimating this, subsequently, we do not consider it in more detail.

---

[12] *This is because it does not distinguish between a high value-added activity (generating substantial profit and income for the economy) and a low value-added activity (generating little profit and income from the same level of revenue).*

[13] *These effects will be relevant to where the company under study is located, i.e. if we are considering UK legal entities, these will cover the UK GVA impacts, whereas if we are considering the US legal entities, this will likely cover the global GVA impacts.*

[14] *Company accounts may provide more details on what is or is not included in R&D expenditure. For example, Apple Inc.'s 2021 accounts set out that "headcount-related expenses, R&D-related professional services and infrastructure-related costs" are all included.*

[15] *The costs of attracting a job include both the salary package offered (which will in part be determined by the level of skill the job demands), as well as the time and effort from the company's recruitment process itself.*

Table 2: Apple Inc. 2021 (Year End 25th September) income statement excerpt

	2020 ($m)	2021 ($m)
Revenue		
Products	220,747	297,392
Services	53,768	68,425
A. Total revenue	**274,515**	**365,817**
Cost of sales		
Products	151,286	192,266
Services	18,273	20,715
B. Total cost of sales	**169,559**	**212,981**
C. Gross margin (A-B)	**104,956**	**152,836**
Operating expenses		
Research and development	18,752	21,914
Selling, general and administrative	19,916	21,973
D. Total operating expenses	**38,668**	**43,887**
E. Operating income (C-D)	**66,288**	**108,949**

Source: Apple Inc. United States Securities and Exchange Commission.[16]

R&D EXPENDITURE IS DEDUCTED FROM GROSS OPERATING PROFIT (C) TO OBTAIN THE PRE-TAX OPERATING PROFIT (E). THIS IS THE CASE FOR UK ENTITIES, TOO, EVEN WHERE IT MAY NOT BE ITEMISED SPECIFICALLY IN THE ANNUAL REPORTS.

As Table 2 shows, R&D expenditure is deducted from gross operating profit (C) to obtain a pre-tax operating profit (E).[17]

2.3.2 Wider impact assessment

Whilst an economic impact framework should enable the robust measurement of a firm's contribution to the UK economy on aggregate, we are also interested in nature and means of both the redistributive and spillover effects and the market structure and competition effects of these firms - for the purpose of this methodology paper we refer to these as 'wider impacts'. We briefly expand on these wider impacts below.

- **Redistributive and spillover effects** occur when activities of Big Tech firms do not create additional value in and of themselves – but rather, existing (external) value is redistributed or spilled over.
  - **Redistribution** is when value is transferred between different stakeholders *because of* a company's activities. For example, we can observe instances where the products and services of Big Tech firms have enabled SMEs to reach wider audiences (which may represent a redistributive effect from large companies to SMEs).
  - **Spillover effects** are impacts of activities that affect stakeholders not directly undertaking the activity and are not reflected in the price paid by consumers. For example, these are usually

[16] *Available at <https://d18rn0p25nwr6d.cloudfront.net/CIK-0000320193/42ede86f-6518-450f-bc88-60211bf39c6d.pdf>; page 32 [Accessed 28 March 2022].*

[17] *This is the case for UK entities too, even where it may not be itemised specifically in the annual reports.*

environmental or social impacts, and also include knowledge transfers from staff. It should further be noted that taxes or subsidies are one way to address these imbalances between private and social benefits/costs, as they seek to internalise externalities, albeit imperfectly. Therefore, rather than directly measure these effects – which is inherently difficult and uncertain – here we seek to gain a deeper understanding as to how these imbalances are being addressed.

- **Market structure and competition effects.** Put simply, this is the extent to which the activities of the Big Tech firms affect the nature and intensity of competition in their markets. These effects will, in principle, be captured in the above metrics (employment, GVA and tax receipt), for example, competition and market structure will affect the demand and supply (and therefore prices) of the services provided by Big Tech firms (and their suppliers and so on). Nonetheless, it is important to understand these effects, including the mechanisms by which they occur, in their own right.[18]

2.3.2.1 Measuring wider impacts

There is no established single methodology to assess the above wider impacts. Therefore, given these wider impacts can vary greatly by firm, we focus more on understanding what they are, and how they could be conceptualised and measured. Generally, they are measured using any of the following.

- **Qualitative assessments**. For example, to understand the social and environmental impacts of a Big Tech company, a more qualitative assessment of publicly available information may be required. This could take the form of case studies of specific schemes or programmes funded by these firms in the UK. This would be particularly relevant in the absence of substantial supply-chain or environmental data.[19]
- **Primary research**. Input-output models typically assess impacts at the aggregate level. Therefore, to quantify wider impacts, such as redistributive impacts or to quantify benefits to individuals, typically, additional primary research is needed. Some methods include:
  - **Stated preferences**. This is a survey-based method for determining the economic value of products and services, which relies on asking people hypothetical questions. There are different ways in which this valuation can be undertaken, including **contingent valuation**, which is frequently used to determine the economic value of resources and goods not typically traded in economic markets; and **discrete choice experiments**, which elicit preferences and valuations from participants without directly asking them to state their preferred options; etc. Moreover, stated preferences approaches also help to establish whether and to what extent there is redistribution.
  - **Revealed preferences**. This method assumes that consumer preferences can be revealed by their purchasing decisions. Examples include **hedonic pricing**, which refers to the measurement of effects which show up in labour or property markets; **travel cost approaches**, which estimate the economic value of recreational sites by looking at the expenditure on travelling to those sites; and **averting behaviour** approaches, which involve expenditures to avoid unwanted effects (e.g., paying for YouTube Premium to avoid listening to adverts).

[18] *A full competition/market analysis is outside the scope of this methodology paper.*

[19] *We note that in some circumstances, environmental impacts can be quantified using historic data and forecasts from BEIS. See for example: < https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2019 >; and < https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2019 > [Accessed 28 March 2022].*

3. What entities are in scope and what activities do they undertake?

This chapter provides a method to establish what entities and subsidiaries Big Tech firms have in the UK, what activities they undertake here, and what products and services they provide. It uses publicly available data from Companies House.

3.1 Method to establish what UK entities and subsidiaries Big Tech firms have in the UK

3.1.1 Method

To aid the development of this framework, we have looked at a range of companies commonly recognised as Big Tech, all of which have their ultimate parent companies in the United States: Alphabet Inc. (Google); Amazon.com Inc.; Meta Inc. (formerly Facebook); Apple Inc.; and Microsoft Corporation. This group of companies does not represent an exhaustive list or definition of Big Tech firms. The types of companies designated as Big Tech and deemed systemically relevant is likely to evolve over time.

For practical reasons, we will be limiting the approach set out in this paper to US companies that operate globally. The following provides us with a starting point for identifying UK branches or subsidiaries of US-based Big Tech companies, but we note that our method may require revision depending on the scope in which the framework is ultimately applied.

- **Step 1:** Using the US companies' SEC 10-k filings, identify all subsidiaries that have the relevant Big Tech company as their parent.
- **Step 2:** Using the FAME database, identify all companies in the UK that have the relevant Big Tech company as their Global Ultimate Owner (GUO), or any of the subsidiaries identified in step 1 as their GUO.
- **Step 3:** Undertake desk-based research to ensure that all UK entities of the relevant Big Tech firm have been identified.

3.1.2 Limitations

One of the key limitations of this approach is that it does not include UK companies where Big Tech firms have a controlling interest without owning the company outright. Therefore, any impact estimates based on entities identified under this approach would (potentially) be an underestimate of the company's impacts on the UK economy.

However, extending the scope to companies in which Big Tech firms hold a controlling interest would present other challenges, namely with attributing impacts to them, as opposed to the other shareholders in the entity.

We consider that providing an overview of the controlling interests provides further insight into their likely impact, without seeking to quantify or attribute this. This can be done using the following approach:

- **Step 1:** Using the FAME database, identify all companies in the UK that have one of the US companies identified above as their controlling shareholder, or any of the subsidiaries identified above as their controlling shareholder.

- **Step 2:** Undertake desk-based research to understand how this controlling shareholding impacts those companies.

We do not consider that these companies ought to be included in any subsequent analyses, given the considerations set out above.

3.2 Method to establish what activities Big Tech firms undertake in the UK

3.2.1 Method

The following steps will help us understand what activities the companies in scope specifically undertake in the UK.

- **Step 1:** Using the FAME database/Companies House, identify the Standard Industrial Classification (SIC) of the UK entity. This will provide a broad view of the activities that the UK entities of Big Tech firms undertake in the UK.
- **Step 2:** Examine UK entities' annual reports on Companies House and identify the principal activity that Big Tech firms undertake in the UK.
- **Step 3:** Undertake desk-based research to ensure that all activities of the UK entities of Big Tech firms have been identified.

3.2.2 Limitations

SIC codes and companies' reported principal activities may not provide a clear view as to what their activities in the UK are. Moreover, we note that SIC codes were last revised in 2007,[20] and thus may not accurately depict the current sectors in which Big Tech firms operate. However, they provide a common way to categorise companies' activities and compare them across the UK economy more broadly for our subsequent analyses.

One way to address this limitation is to examine alternative industrial classifications of these companies, for example, those provided by commercial data platforms such as Pitchbook or Beauhurst. These offer alternative keywords or buzzwords to structure our data, but since they are unique to those platforms, their practical use may be limited. If applied, they would need to be matched to SIC codes to enable further analyses using other official statistics.

3.3 Method to establish what products and services Big Tech firms provide in the UK

3.3.1 Method

We now turn to identifying the products and services which the companies in scope provide in the UK.

- **Step 1:** Using information from the US and UK annual accounts, identify products and services Big Tech firms provide.
- **Step 2:** Examine whether all products and services are provided in the UK, using desk-based research.

---

[20] *See: <https://www.ons.gov.uk/methodology/classificationsandstandards/ukstandardindustrialclassificationofeconomicactivities/uksic2007> [Accessed 5 April 2022].*

- **Step 3:** Classify them into broader categories, so it becomes easier to compare them across firms and subsidiaries.

3.3.2 Limitations

Since Big Tech firms operate in dynamic markets and are ever evolving, any categorisation of products and services is only ever accurate at any one point in time. Moreover, classifying their products and services in the first place can be relatively complex, given some products and services are bundled together.

Notwithstanding this, it is still an important step to get a good understanding of a firm's potential impact on the UK economy. We note that in practice it will be hard to achieve a complete mapping based solely on desk-based research. Challenges likely to be encountered include establishing what business activities are being undertaken in the UK, as well as what products and services are generating value in the UK. In principle, we can use Companies House to identify key activities of UK entities and subsidiaries. However, attributing these to a specific product or service becomes difficult in practice.

4. What are the direct impacts of Big Tech firms in the UK?

This chapter provides a framework to both understand and measure the direct impacts of Big Tech firms' activities in the UK. For the former, we set out a 'logic model approach' to identify the direct impacts, whereas for the latter we consider three approaches to quantify Big Tech firms' GVA, employment, and R&D investment in the UK. These approaches are based on publicly available financial information, as well as ONS data on employment and R&D expenditure by SIC codes.

4.1 What are Big Tech firms' direct impacts?

The direct economic impacts generated by Big Tech firms refer to the total value of the economic output that results from the economic activities they undertake in the UK.

In order to understand how Big Tech firms generate direct economic value, we first need to identify the activities they undertake, and the products and services that they offer. As noted in chapter 3, identifying what activities are undertaken in the UK, as well as the precise delineation of products and services, can be challenging in practice. For instance, products are often bundled together, or increasingly sold as part of subscription services.

We propose undertaking desk-based research as part of a wider 'logic model approach' to get an overview of their key activities, products and services. That is, we take Big Tech firms' products and services to be an input into various other stakeholder activities and establish where value might be created in the UK economy. For example, to write this methodology paper for DCMS, we are using Microsoft Word. Therefore, Microsoft Word is an input into our activity of 'methodology paper writing', where the immediate output will be a publishable methodology paper. The value of this methodology paper should be accounted for in our direct cost of using Microsoft Word (by way of our company licence or as a proportion of a Microsoft 365 subscription, for instance).

Despite the limitations of this approach, mapping activities, products and services helps us identify redistribution and spillover effects. Even where it does not lead us to a direct measure of impact, it can provide us with a deeper understanding of where value is likely to be generated.

4.1.1 Method to identify Big Tech firms' direct impacts in the UK

Our starting point to identify the direct impacts of Big Tech firms follows a logic model approach, which is illustrated in Table 3. This ensures that both the direct impacts of products and services being developed in the UK are captured, as well as the *wider* impacts of products and services available here (but not necessarily developed in the UK).

To complete this table, we set out the key questions that ought to be answered in each column, as well as likely sources of answers.

- **Step 1**: Identify all the products and services (inputs), which the relevant firm offers in the UK via desk-based research. This requires careful evaluation of evolving business practices, such as bundling of services and products (as described in chapter 3).
- **Step 2:** Identify the stakeholders who use the firm's products and services and the stakeholders who are directly impacted by their developments. Depending on the type of activity, this may require

consideration of individuals and distinctive organisations (e.g. public, private, or third-sector organisations) who feed into, build on, or otherwise engage with platforms (e.g. sellers, advertisers, distributors or aggregators).

- **Step 3:** Identify the activities of the stakeholders which require, or use, the firm's products and services. For this step it may be helpful to undertake desk-based research about the individual products and services to fully understand what they can offer and therefore what stakeholders are using the products and services for. This research could be complemented by inviting stakeholder views, including from the businesses themselves, their customers, or market analysts.
- **Step 4:** Identify the direct outputs which the stakeholders create with the products and services of the relevant firm as the input. For organisations, the output is usually something that can generate income (or create wider value, for example when considering public sector stakeholders), whereas for individual consumers the output can be as straightforward as entertainment or leisure.
- **Step 5:** Identify the mechanism through which value is created for other stakeholders. For (commercial) organisations, the value created is often in the form of revenue from the sale of a product which uses the Big Tech firm's products and services as an input. For individual users, value is manifested through the consumption of the products and services sold by the Big Tech firm directly, as well as those sold by businesses who, in turn, have used the products and services of the Big Tech firm as inputs. Value can also emerge in the form of increased choice, opportunity, utility, access to markets, etc.
- **Step 6:** Identify the commercial model used by the relevant Big Tech firm to monetise their products and services. This step usually requires desk-based research in order to understand the different types of commercial models. As mentioned above at step 3, input from firms themselves, their customers or other stakeholders could be sought to complement this work. The commercial models used can take on various forms, such as subscription models or in-app purchases.

Ultimately, completing these steps for Big Tech firms in scope, as set out in Table 3, will help to identify the areas that generate value – in particular, those that generate direct value for the UK - and how they do so.

Table 3: Logic models for selected products and services of Big Tech firms

Inputs	Outputs			How does this generate value for other stakeholders?	What is the commercial model?
Direct products/services (*What products/services do Big Tech firms create from inputs and activities?*)	Stakeholders (*Who uses Big Tech firms' products/services?*)	Activities (*What do they do with Big Tech firms' products/services?*)	Direct outputs (products/services) (*What do they create with Big Tech firms' products/services as inputs?*)		
Platforms: *e-commerce*	Buyers (individual or business consumers)	Search for products; browse; save to favourite list; read and write reviews; compare prices; buy products	Purchased products; product (and price) comparisons For business consumers: input into further product/service	Buyers benefit from increased choice; ease of shopping; etc.	Margin on purchase price
	Sellers (individual, business sellers, or platform itself)	Sellers list products; pay platform for sponsored adverts/list products more prominently; sell products to consumers New ways to market	Sold products Revenues from sold products	Sellers benefit from increased sales and as a result increased revenue	Margin on selling price and/or listing fee
	Advertisers	Place adverts on website/sponsored content Optimise search words	Ad impressions/ click-throughs Revenues from advertisements	Advertisers benefit from increased sales and more efficient advertising spending, resulting in both increased revenues and reduced costs	Advertisement listing fee and/or price per click/conversion etc.
	Distributors	Distributors ship products from sellers to buyers	Delivered products Revenues from deliveries	Distributors benefit from increased deliveries and therefore increased revenues. The digitisation of the process enables the distributors to be notified immediately when the sale has taken place and this	Margin on selling price and/or listing fee

				leads to more efficient and fast-paced deliveries	
Add additional category of products/services offered by Big Tech firm under consideration, following step 1 set out above	*Complete following step 2 set out above.*	*Complete following step 3 set out above.*	*Complete following step 4 set out above.*	*Complete following step 5 set out above.*	*Complete following step 6 set out above.*

Source: Economic Insight review.

4.1.2 Limitations

As this approach is based on desk-research, it does not fully rely on data or may not provide the complete picture. This means that inferences have to be made as to the relevant stakeholders, their activities and outputs, as well as benefits and commercial models. By using as many external sources as possible, this mapping can be improved, yet some degree of uncertainty will remain. Relatedly, it will not be possible to confirm that all the relevant stakeholders and outputs are included and that the full scale of direct effects is captured. This could be improved upon with extensive stakeholder and market analyst engagement.

4.2 How can Big Tech firms' direct impacts be measured?

As set out in chapter 2, Big Tech firms' direct value creation in the UK will be based on the: **value added** they generate in the UK directly, [21] as well as the **number of staff** they employ in the UK directly, and **taxes** they contribute.

It should be noted that GVA, employment, and tax contributions are three commonly used metrics to quantify the magnitude of economic impacts. Specifically, the following measures capture the direct economic impacts:

- the individual GVA of Big Tech firms, which accounts for its employment costs and investment expenditure;
- the headcount of Big Tech firms in the UK; as well as
- the corporate and income tax of the company and its employees respectively.

The logic model illustrates how the value that is reflected in GVA is generated and the specific commercial models Big Tech firms use to monetise this value.

GVA measures the contribution to the economy of the individual Big Tech firm. It is calculated as the difference between the value of goods and services produced and the cost of inputs (non-labour) that are used up in production. The balance of the output (the products and services offered by the firms) less intermediate consumption (their cost of sales) is the firm's GVA, which is equivalent to the value experienced by the stakeholders.

Big Tech firms' products and services are produced using non-labour inputs (such as raw materials and electricity) and labour inputs. They are then sold to consumers at a price which is equal to the cost of the inputs and the additional value that has been created. Consumers that are willing to pay the price for those products/services derive sufficient value/utility from those products/services, to purchase them. Therefore, the direct economic impact captures the value (utility) that the consumer derives from the consumption or use of the product or service, which is the difference between the output (the product) and the immediate cost of sales.

Below, we provide two approaches to measure Big Tech firms' GVA, R&D expenditure and broader investments, and employment contributions in the UK. The **first approach** uses figures sourced from Big Tech firms' UK entities (as identified in section 3.1); and the **second approach** is based on the firms' global figures. These approaches provide aggregate estimates of the UK impacts (i.e. they provide the impact as the sum of all UK entities and subsidiaries).[22] Further to this aggregate impact, we also provide an overview as to how one might be able to attribute direct impacts to specific activities that Big Tech firms undertake by determining how and where the overall value is being created in the UK. That is, we seek to establish where this value is being generated (i.e. which of the entities and subsidiaries is generating the value). This closely links to the activity mapping set out in chapter 3 and the logic model set out in section 4.1, and ensures there is no double counting of impacts under the first two approaches.

As set out in chapter 2, a firm's R&D expenditure is captured within the operating profit measures. Big Tech firms are known as being some of the world's largest private investors in R&D.[23] These firms may create separate companies with innovation and development as its core objective. If this is the case, the third

---

[21] *The value added they generate is in turn also dependent on the amount of R&D they undertake, and how successful this process is at either improving their own processes (and reducing costs of production), or developing new products/services that drive additional revenues.*

[22] *We note that this approach avoids double counting as the calculated GVA is for the respective entity. Where there are inter-company or subsidiary transactions, these will be considered separately.*

[23] *'The 2021 EU Industrial R&D Investment Scoreboard'. European Commission. (2021); page 36.*

(complimentary) method, which is discussed in section 4.2.3, provides a more detailed measurement of Big Tech firms' investments in R&D.

4.2.1 Approach 1: Measure Big Tech firms' direct impacts based on their UK entities

4.2.1.1 Method

This method captures the direct economic impacts of all activities that occur within the UK and are recorded within Big Tech firms UK entities' financial accounts. Websites such as Companies House and commercial platforms such as FAME provide the financial accounts of all UK entities, as set out in chapter 3.

To identify the appropriate figures for the direct impacts – GVA, employment, and investment contribution – it is important to acknowledge that Big Tech firms are often structured as separate entities. For example, in the UK, Apple has various legal entities – of which Apple Retail Limited and Apple (UK) Limited are but a few. Each legal entity undertakes separate economic activities (or in some cases similar ones). Therefore, when calculating the overall direct impact of a firm, i.e. the total GVA, employment, and investment impact, this will encompass impacts from various activities and various different UK legal entities.

Approach to measure GVA

GVA is an assessment of the value of goods and services produced minus the costs of inputs and materials used in the production process (such as raw materials). It can be estimated at the individual firm level using the following formula, based on publicly available information.

$$GVA = Operating\ profit^{24} + Employee\ costs^{25} + Depreciation^{26} + Amortisation^{27}$$

That is, a firm's operating profit generally provides an indication of the value added of a company to the wider economy. However, operating profit excludes any cost of sales (which likely include employee costs), depreciation, and amortisation expenses, which are added back in to obtain the overall firm GVA. This is because these items stand for additional value created or used by the firm.

Usually, the above information is included in companies' annual financial accounts. However, it is often unclear as to what is included in cost of sales, and therefore, how operating profit is defined. Notwithstanding this, all the key variables above can be sourced for each of their UK legal entities, and an overall GVA measure calculated.

Approach to measure employment

Publicly available information from annual financial accounts allows us to infer overall headcount and other useful information on employment. For example, they provide information on the total spend on: salaries and wages; social security costs; pension costs; and share-based payments. Alongside this information, annual financial accounts usually provide the average number of people employed by the company during the year, occasionally broken down by type of staff (e.g. engineering vs administrative staff).

---

[24] *Operating profit usually considers total income from core business functions for a given period, excluding the deductions of interest and taxes. It is calculated as Operating profit = Gross profit - Operating expenses - Depreciation – Amortisation, where Gross profit = Revenues – Cost of sales.*

[25] *Employee costs includes all of a company's costs in relation to its employees, including wages and salaries and any national insurance contributions etc.*

[26] *Depreciation is the expense related to a fixed asset over its useful life.*

[27] *Amortisation is the practice of spreading an intangible asset's cost over that asset's useful life.*

As above for the GVA calculation, the information on headcount and wages/salaries should be sourced for each legal entity and then aggregated to determine the total impact.[28]

Approach to investment in R&D

GVA captures the returns from investment in R&D. However, it is important to understand how much R&D is being undertaken in the UK, as this can be a driver for many spillover effects. Therefore, here, we set out an approach to estimate Big Tech firms' direct R&D investments in the UK, following a two-step approach.

- **Step 1:** Do UK entities set out R&D investments in annual accounts? If so, use entities' R&D spend.
- **Step 2:** If UK entities do not provide R&D spend, estimate using ONS data, using: R&D spending per SIC code and number of people employed in relevant SIC code.

We set this out in more detail subsequently.

Step 1: Do UK entities set out R&D investments in annual financial accounts?

Often, there is limited information in firms' annual financial accounts in relation to R&D expenditure. However, where this information is available, we should use it at face value.

Step 2: Where UK entities do not set out R&D investments in annual financial accounts, we can provide an initial estimate based on assumptions using information from the ONS

The ONS provides both data on:

- R&D expenditure by SIC code;[29] as well as
- number of people employed by SIC code.[30]

The approach set out above provides us with the number of employees of Big Tech firms, as well as the entity's SIC code. Thus, we can estimate the proportion of people employed in an SIC code that work in a Big Tech firm in the UK, and apply that proportion to the total R&D expenditure of that SIC code, to derive the Big Tech firm's investment in R&D. This is illustrated in the following equation.

$$R\&D\ investment_{Big\ Tech\ firm} = R\&D\ expenditure_{SIC\ code} \times \frac{Employees_{Big\ Tech\ firm}}{Employees_{SIC\ code}}$$

4.2.1.2 Limitations

It is unlikely that granular data from Big Tech firms will be accessible and therefore using this method will rely on publicly available information from the firms' annual financial accounts. The existing data is disclosed at a high level and does not provide insight into the granular breakdown of figures needed to conduct a detailed estimation of firms' GVA, employment and R&D impacts.

Big Tech firms are multinational firms and therefore global by their nature. This creates challenges when measuring the value of their economic activity in the UK, as this is not always reflected in the UK entity's financial accounts (depending on how the firm is structured). Therefore, it is likely that this method of estimation will result in an underestimation of direct impacts. Additionally, there is a lag between the time

---

28 *Using this publicly available information we can also calculate the average wage per employee. This is set out in more detail in chapter 6.*

29 *See: < https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/datasets/ukbusinessenterpriseresearchanddevelopment > [Accessed 21 March 2022].*

30 *See: < https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/industry235digitsicbusinessregisterandemploymentsurveybrestable2 > [Accessed 21 March 2022].*

when the value is generated and when it is reflected in the firm's data. This results in the GVA, employment and R&D figures not being illustrative of the current direct economic effects on the UK economy.

Finally, we note that the method to estimate direct R&D impacts has additional limitations, in that it assumes there is a linear relationship between headcount and R&D investment. This may not always hold, as some firms may have low headcounts, but large R&D spends. Moreover, this method does not account for the nuances based on how companies structure their R&D investment, especially if there are R&D arms outside of the UK. These two issues are further compounded by data availability issues, as set out above. To address these limitations, sensitivity analysis should be undertaken, which some of the subsequent methods set out below address (i.e. estimating the R&D expenditure based on a firm's global R&D expenditure).

4.2.2 Approach 2: Measure Big Tech firms' direct impacts based on their US entities

4.2.2.1 Method

This method uses a top-down approach to estimate the direct economic impacts of Big Tech firms. It starts with the group financials and then estimates the proportions that are attributed to the UK. As this method also relies on publicly available information, similar limitations to those set out previously also apply. The consolidated (group) financial accounts can usually be found on the firms' websites and are mostly available on a quarterly and annual basis.

Approach to measure GVA

The first step is to calculate GVA at the group level. The same formula that was used in section 4.2.1.1 is appropriate to use at the group level.

$$GVA = Operating\ profit + Employee\ costs + Depreciation + Amortisation$$

Once GVA has been calculated at the parent company level, the next step is to calculate what proportion of this GVA is generated from the UK. Where the firm provides a breakdown of its revenues by region, the proportion of the UK to the global revenue ought to be used as a scaling factor applied to the group GVA.

Where such breakdowns are not available from the firm's group financial accounts, we can rely on macro-economic indicators as the scaling factors, such as the GDP ratio. The GDP scaling factor is calculated as the ratio of UK GDP to global GDP.[31] Table 4 shows the scaling factor for the past five years.

Table 4: GDP scaling factor (proportion of global GDP attributed to the UK)

Year	2016	2017	2018	2019	2020
GDP scaling factor	3.5%	3.3%	3.3%	3.2%	3.2%

Source: Economic Insight analysis using data downloaded from Statista.[32]

Depending on the time frame of the analysis, the scaling factor of the relevant year should be used. For example, if we are assessing the impacts of a company in 2020, the 2020 scaling factor (3.2%) should then be

[31] *We note that by using global GDP, Big Tech firms' impacts might be slightly diluted, as they are not always present in every country of the world. For example, many social media platforms, including those owned by Meta are not present in China. See: < https://time.com/6139988/countries-where-twitter-facebook-tiktok-banned/#:~:text=China,the%20Great%20Firewall%20of%20China.> [Accessed 5 April 2022]. However, as the reporting scale for the group financial accounts is usually on a global scale, this is the best approximation currently available. In cases where a firm is not present in a particularly relevant market, those countries' GDP can be subtracted from the global GDP for greater accuracy.*

[32] *See: < https://www.statista.com/statistics/263590/gross-domestic-product-gdp-of-the-united-kingdom/ >; <https://www.statista.com/statistics/268750/global-gross-domestic-product-gdp/ > [Accessed 28 March 2022].*

multiplied by the group level GVA in 2020 to estimate the GVA generated in the UK in that year, as illustrated in the following equation.

$$UK\ GVA\ of\ Big\ Tech\ firm = \frac{UK\ GDP}{Global\ GDP} \times Group\ level\ GVA\ of\ Big\ Tech\ firm$$

An alternative scaling factor can be applied to mitigate the risk that the GVA proportion of Big Tech firms attributed to the US is much larger than its GDP proportion in the world. In most cases, the group level financial accounts disclose the proportion that is generated in the US (which is the location of Big Tech firm parents/group). Thus, we can determine the global GVA excluding the US component. Table 5 illustrates this scaling factor for the past five years.

Table 5: GDP scaling factor (proportion of global (excl. US) GDP attributed to the UK)

Year	2016	2017	2018	2019	2020
GDP scaling factor (excl. US)	4.7%	4.3%	4.4%	4.3%	4.2%

Source: Economic Insight analysis using data downloaded from Statista.[33]

Similarly to above, depending on the analysis time frame, the scaling factor of the relevant year should be used. This is illustrated in the following equation.

$$GVA_{UK\ Big\ Tech\ firm} = \frac{UK\ GDP}{Global\ GDP - US\ GDP} \times (Group\ level\ GVA\ of\ Big\ Tech\ firm - US\ GVA\ of\ Big\ Tech\ firm)$$

Approach to measure employment

As Big Tech firms likely employ people from all around the globe, the following approach might be better suited to understand the proportion of Big Tech employees located in the UK.

- **Step 1:** The UK workforce proportion can be calculated by summing up the number of employees in the UK entities (i.e. following the same method as set out previously in section 4.2.1.1) and then taking the ratio of this number to the group's number of employees. From this we can deduce the significance of UK employees for Big Tech firms.
- **Step 2:** Additionally, we can compare the average wage received by UK employees of Big Tech firms with the average wage earned by all employees hired by the firms.[34] From this, we can assess the value of the average UK employees relative to the average global employee of the firm. This will provide insights into the skillset of the workforce amongst Big Tech firms, where higher-skilled roles typically command higher wages than lower-skilled roles.

[33] *See: above and <https://www.statista.com/statistics/263591/gross-domestic-product-gdp-of-the-united-states/> [Accessed 28 March 2022].*

[34] *We note that ideally, we would consider the median wage. However, given data availability constraints, we can only calculate the average wage. In chapter 6, we provide an alternative approach to infer Big Tech firms' median wages. However, this comes with its own limitations, discussed in more detail there, too.*

Approach to measure investment

Thus, we can calculate the proportion of R&D expenditure that is attributable to the UK by using the employment headcount ratio as a scaling factor. This is illustrated in the following equation.

$$R\&D\ expenditure_{UK\ Big\ Tech\ firm} =$$
$$\frac{Total\ headcount_{UK\ Big\ Tech\ firm}}{Total\ headcount_{\ Big\ Tech\ firm\ group\ level}} \times R\&D\ expenditure_{\ Big\ Tech\ firm\ group\ level}$$

As set out in the limitations of section 4.2.1, using headcount as a scaling factor to infer R&D spend has some challenges. However, it is the most practicable, given the available information.

4.2.2.2 Limitations

Since this method uses the same formulas for calculating the direct impacts as the UK entity method, the same limitations addressed in section 4.2.1.2 also apply here. That is, we are likely to face the same data availability and granularity issues, as well as issues around apportioning R&D investments to specific countries.

Additionally, this method relies on high-level macro-economic scaling factors, such as GDP ratios. This is an oversimplification but is nonetheless a useful starting point for further research to estimate overall impacts on the UK economy.

4.2.3 Attribute direct impacts to specific activities that Big Tech firms undertake

Here we provide a complementary method that seeks to attribute direct impacts to specific activities undertaken by Big Tech firms. Further to providing us with a better understanding as to where value is being generated in the UK, this method may also identify whether there is any double-counting occurring, say where one subsidiary’s income is another one’s expense.

We note that this approach rests on both a comprehensive and complete map of activities and (granular) data. This may pose challenges in implementing this method in practice, as we set out in more detail in section 4.2.3.2.

4.2.3.1 Method

The logic models set out in section 4.1.1 will – ideally – provide a complete ‘map’ of all of Big Tech firms’ activities and the ways in which these generate value. In principle, their GVA contribution ought to encompass all their direct impacts on the UK economy. However, there may be spillover effects that are not directly captured within Big Tech firms’ UK GVA (explored in more detail in chapter 7) and there may be indirect effects captured within these aggregate measures (i.e. where one subsidiary’s output is another’s input, for example IP rights) – as set out in the subsequent chapter.

The two approaches set out above provide an **overall estimate** of Big Tech firms’ direct impact on the UK economy. To understand what elements, or what specific activities of Big Tech firms are generating that value, we explore a more granular approach.

- **Step 1**: The first step in this approach is to complete the logic model to fully capture all the economic activities of the firm which generate value for the UK economy.
- **Step 2:** If detailed data is available from the firm, the next step involves grouping the relevant GVA, employment and R&D investment figures according to the categories set out in the logic model.

- **Step 3:** Big Tech firms are often divided into multiple entities along the lines of similar economic activities. Therefore, we can estimate separate GVA, employment, and R&D expenditure to the UK economy for each of the separate economic activities (and their related products and services).

4.2.3.2 Limitations

Since this method uses the same formulas for calculating the direct impacts as the UK entity method, the same limitations addressed in section 4.2.1.2 also apply to this method. That is, we are likely to face the same data availability and granularity issues. Issues around apportioning R&D expenditure to specific countries or entities should fall away, as this analysis is purely at the entity-level.

However, Big Tech firms are not always structured in a way whereby one entity is responsible for one economic activity relating to one product or service. Matching respective entities to economic activities – and estimating their value – is, therefore, challenging. As set out previously, these practical challenges may require further research. For example, stakeholder engagement could be pursued to gain a deeper understanding on these issues.

Similarly to the limitations addressed in the first method, this method likely underestimates the direct effect on the UK economy due to the revenues of some economic activities being recorded with Big Tech firms' entities elsewhere.

5. What are the indirect impacts of Big Tech firms in the UK?

This chapter provides a framework to identify and understand the indirect impacts of Big Tech firms and their activities in the UK. However, there are various limitations in measuring and assessing these based on the existing publicly available data. Nonetheless, an initial estimate to then build upon with further analysis can still be established.

5.1 What are Big Tech firms' indirect impacts in the UK?

Indirect impacts capture that Big Tech firms spend money with suppliers, who in turn also employ staff, generate GDP, invest in R&D, and pay taxes. Big Tech firms' suppliers in turn use other suppliers, and this cycle repeats through the remaining tiers of the supply chain. Here, we focus on Big Tech firms' supply chain impacts in the UK. That is, we seek to capture only the supply chain spend in the UK, as this is the element that will provide the indirect impacts in the UK (i.e. how much indirect employment and GVA they generate, by using UK suppliers).

As Big Tech firms' supply chains likely span multiple jurisdictions, assessing this from the existing publicly available data is challenging. Specifically, the required information to undertake this analysis would entail both supplier spend by these companies, as well as where those suppliers are located (i.e. whether they are UK-based or international). This information is not disclosed in publicly available financial reports and therefore quantifying this impact will be challenging and assumptions-based.

5.1.1 Method

We provide a similar approach to identifying the indirect impacts as with the direct impacts, set out in chapter 4. That is, detailed logic models should be developed to understand the supply chain. Here, Big Tech firms' products and services will be the outputs, rather than the inputs in the logic model. Below, we set out the key questions and ways to identify the inputs and activities that help generate the Big Tech firms' products and services, and thus, identify the relevant supply chains.

Importantly, we will need to identify what industries are feeding into the Big Tech firms' products and services, as ultimately, we will have to identify the respective multiplier, to apply to the direct effects we have established.

Thus, the steps to identify the indirect impacts are as follows.

- **Step 1**: Complete logic model for inputs into Big Tech firms' products and services.
- **Step 2:** Identify industries from which inputs are sourced.
- **Step 3**: Breakdown the activities carried out within these industries.
- **Step 4:** Identify which of these activities are used for Big Tech firms' products and services and where they occur (i.e. within the UK or internationally)..

In order to understand the relevant inputs and complete the logic model, it will be necessary to begin by setting out the final outputs that Big Tech firms produce, and then breaking down the stages involved in reaching these. A sensible approach to this would be to begin with the final product that the end customer receives, and work backwards. For example, working backwards, an e-commerce platform would involve activities – and thus impact the associated industries – such as:

- delivery services (and logistics);

- packaging;
- warehouse storage and transportation;
- customer support;
- software development and maintenance.

To help identify the elements of the supply chain, there are some online information sources that can be drawn upon. For example, some of the Big Tech firms themselves share information on their supply chain and the stages involved. Amazon's Supply Chain[35] and Microsoft's Responsible Sourcing[36] web pages provide details of their supply chain processes, which can be used to identify the key industries in which the indirect impacts will occur, alongside other sources.

Each aspect would then have inputs derived from other industries to account for, within indirect effects. To understand what these inputs are, it again is appropriate to break down in detail what is required for each activity. For example, software development may involve payment, location, and online security systems.

Table 6: Logic models for selected products and services of Big Tech firms

Inputs for Big Tech firms' outputs (*What resources do Big Tech firms need to create products/services?*)	Activities (*What do Big Tech firms do with these inputs to create products/services?*)	Big Tech firms' outputs Direct products/services (*What products/services do Big Tech firms create from inputs and activities?*)
Payment systems Online security systems Warehouses and stock and delivery logistics Staff Offices/research centres Materials Technology Data (e.g., markets, customers, products, and third-party sellers)	Undertake R&D to optimise platform and supporting systems Develop platform and supporting systems Ensure interoperability with payment systems Ensure safety of information kept on domain Ensure warehouses have sufficient stock Provide customer support …	Platforms: *e-commerce*
Complete for additional products/services	*Complete for additional products/services*	*Add additional category of products/services offered by Big Tech firm under consideration*

Source: Economic Insight review.

5.1.2 Limitations

While this approach uses external sources of information, where possible, it does not fully rely on data or verifiable facts. As such, it is necessary to draw inferences as to what the relevant inputs and industries are. The accuracy of these inferences can be improved by drawing on as wide a range of external sources as possible, but there will likely be some degree of uncertainty. Relatedly, it will not be possible to confirm that all the relevant industries are included and that the full scale of indirect effects is captured.

35 *See: < https://sustainability.aboutamazon.com/people/supply-chain?workerCount=true&engagementProgram=true&productCategory=true > [Accessed 22 March 2022].*

36 *See: < https://www.microsoft.com/en-us/responsible-sourcing/hardware-supply-chain > [Accessed 22 March 2022].*

This approach presents additional limitations in that the likely structures of Big Tech firms will mean that some subsidiaries will provide inputs to other Big Tech firms. That is, they will be part of the supply chain. For example, where the IP for designing and developing a video game lies with a subsidiary, but this is then 'charged back' to the parent company. In practice, the key step to avoid double counting where these vertical relationships occur lies in developing the detailed logic models, and thus identifying where the value is being generated and by whom.

5.2 How can Big Tech firms' indirect impacts be measured?

5.2.1 Method

The logic models developed following the approach set out above, and summarised in Table 6, will provide us with the key suppliers used by Big Tech firms in the UK. Usually, supplier spend data is obtained directly from the companies. Therefore, absent that opportunity, below we provide an approach to infer the likely supplier spend by Big Tech firms in the UK, as well as how to measure it.

- **Step 1:** Identify extent of supplier spend by Big Tech firms from accounts or publicly available information.
- **Step 2:** Identify multipliers for respective industries from which Big Tech firms draw their resources.
- **Step 3:** Multiply Big Tech firms' supplier spend with multiplier, and add this to the direct impacts.

5.2.2 Limitations

By using data from publicly available sources, rather than directly from the companies, there is a possibility that the spend data is not fully representative or up-to-date. In practice, it will be difficult to obtain this detailed information from publicly available sources, and the approach followed will be reliant on assumptions. This weakens the feasibility of estimating Big Tech firms' indirect impacts based solely on publicly available information. However, it provides the framework to identify where they will likely occur, and thus provides at least a qualitative assessment of their likely importance for the UK economy.

Depending on the industries identified as being relevant to indirect impacts in the previous stage, there may be some quite specific associated industries which do not have a multiplier figure. In these cases, one could either use a similar industry for which a multiplier is available, or create a new multiplier which blends the values from several comparable industries.

6. What are the induced impacts of Big Tech firms in the UK?

This chapter provides a framework to identify and understand what the induced impacts of Big Tech firms in the UK are. In summary, these are impacts of increased spending by the employees. To reach a view on the magnitude of these effects, one can assess various different wage differentials, and look at household spending information from the ONS.

6.1 What are Big Tech firms' induced impacts?

Induced impacts measure the increased spend on goods and services in the wider economy accruing from the wages earned by the workers in the direct and indirect industries, thus inducing additional economic impacts.

6.2 How can Big Tech firms' induced impacts be measured?

Below, we set out how to measure Big Tech firms' induced effects in four steps.

- **Step 1:** Establish average UK wages of Big Tech firms.
- **Step 2:** Compare Big Tech firms' average wages to UK average wages.
- **Step 3:** Establish where Big Tech firms' employees are spending their wages.
- **Step 4:** Identify multipliers to apply to direct and indirect effects.
- **Step 5:** Consider additional impacts on skills and by region from employment.

6.2.1 Step 1: Establish average UK wages of Big Tech firms

The scale of induced impacts is dependent on the amount that employees are able to spend – i.e. how much income they earn from Big Tech firms. We calculate data on the wages of Big Tech employees in three steps.

- **A**: Obtain total number of staff of Big Tech firms employed in the UK (where possible by region and occupation) from companies' annual reports.
- **B**: Obtain total staff wages[37] from companies' annual reports.
- **C**: Calculate average wages of Big Tech firms' UK employees by dividing B by A.

To enhance the accuracy of the wage estimates, where possible data should be gathered on a regional basis. This will help to reflect that employees in different regions may earn different wages and as such the consequent induced impacts may therefore vary by region

6.2.1.1 Step 1b: Establish average regional wages of Big Tech firms

To enhance the accuracy of the wage estimates, where possible data should be gathered on a regional basis. This will help to reflect that employees in different regions may earn different wages. The consequent induced impacts may therefore vary by region. The approach to do this involves one further stage in addition to step 1 above.

[37] *We note that total staff/labour costs also include other remuneration, such as National Insurance contributions etc. Usually, annual reports split out staff remuneration by the individual cost lines, separating out wages and salaries. For the remainder of this section, we suggest the use of the more granular wage/salary information to deduce the wage comparisons.*

- **A**: Establish where Big Tech firms are located in the UK using information from companies' annual reports and desk-based research.
- **B**: Undertake step 1, but where for each Big Tech firm the average wage can be interpreted as the regional wage of Big Tech firms in the UK.

6.2.2 Step 2: Compare Big Tech firms' average wages to UK average wages

It is preferable to use the median wage given that mean wages can be skewed by outliers. However, the available information on Big Tech firms' wages typically only allows for the mean, not the median, to be calculated. Our framework would instead estimate the median wage by scaling down the mean wages within the Big Tech companies in scope, based on the proportional differences between the mean and median income within the UK.

To account for this, there are two steps involved in comparing the Big Tech wages to the rest of the UK.

6.2.2.1 Step 2a: Calculate difference between UK median and mean wages

- **A:** Obtain mean and median wage information for the UK digital sector (or the most relevant alternative SIC code which applies to Big Tech companies), where possible by region, from the ONS ASHE data.
- **B:** Calculate the percentage difference between the mean and median wages.

6.2.2.2 Step 2b: Compare the Big Tech firms' wages to UK wages

- **A:** Apply the percentage calculated in step 2a to the average Big Tech wages to estimate the median Big Tech firms' wages.
- **B:** Compare A to the median UK wages (obtained in step 2a) and establish whether Big Tech firm employees have more/less disposable income than the median UK (or regional) employee.

When looking at UK wages, we will improve the accuracy of the averages by breaking down wages by industry and occupation, to provide a more precise point of comparison against Big Tech firms' wages. This can be obtained from the ASHE datasets by taking average (or median) incomes based on different SIC (for industry) or SOC (for occupation) codes. The appropriate SIC groups can be identified from Big Tech firms' Companies House pages, which provide SIC codes for each business. Subject to sufficiently granular information being available, the appropriate SOC codes can be inferred where companies provide a more detailed breakdown of their staff numbers and make-up, often setting out the number of staff in, for example, administrative roles or engineering roles. If the companies' data provides approximate breakdowns of staff by role, then the overall median wage could be calculated as a weighted average which takes account for the different wages between roles.

6.2.3 Step 3: Establish where Big Tech firms' employees are spending their wages

Absent detailed information from the Big Tech firms themselves, we assume that their employees have similar spending habits to the average UK consumer. The following steps demonstrate how this can be inferred from publicly available information.

- **A**: Obtain data from ONS on average UK consumer spending.
- **B**: Assume average wages from Big Tech employees is spent on the same items as that of an average UK consumer.
- **C**: Identify industries most likely to benefit from Big Tech firms' employees spending.

Spending habits vary with factors such as age and gender. Within the household expenditure data provided by the ONS, there are breakdowns of spending based on different groups which can be used here to account for the characteristics of Big Tech firm employees. For example, Workbook 2 of the Family Spending datasets provides expenditure broken down by age and income range.[38] Taking the average wages calculated in step 1 above, it would be possible to work out which income decile the average employee is in and therefore how they spend their wages. Similarly, Workbook 3 of the same dataset breaks down expenditure by region, and split by rural versus urban.[39] Therefore, if the companies provide relevant information on the breakdown of their staff within these groups, then the spending figures calculated in this step could be weighted to account for this. Alternatively, if such information is not available, then it would be possible to apply broad assumptions about the ages and locations of employees.

6.2.4 Step 4: Identify multipliers to apply to direct and indirect effects

To estimate the induced effect of Big Tech firms in the UK, the direct effect will need to be uplifted by a multiplier, which captures the wider impact of this induced effect. The following steps set out how this can be achieved with the available information.

- **A:** Identify relevant sectoral multipliers to apply to Big Tech firms' direct effects to establish induced effects from the ONS Supply and Use tables.[40] These tables provide a 'tab' entitled 'Multipliers'. In that 'tab', the firm's industry should be found, and the respective multiplier identified.
- **B:** Apply the relevant sectoral multipliers to estimate the direct effect from Big Tech firms in the UK.

6.2.5 Step 5: Consider additional impacts on skills and by region from employment

Further to the above effects, there are additional impacts that arise through employment. Firstly, with a wide array of firms being considered as Big Tech, their employee breakdowns must be considered. For some firms the majority of their workforce will be highly skilled, which generally would be associated with higher pay, and therefore further expenditure, which leads to the impacts discussed above. However, there are also firms whose workforce is more mixed, comprising both those who are highly skilled and workers in operational roles, which may be considered low-skilled. With appropriate data this could be distinguished to better understand the multiplier impact. This could be considered through assessing employee data broken down by role which could be provided by a firm or by assessing vacancy data along with data held by platforms such as LinkedIn.

Furthermore, the data could be broken down regionally to assess impacts specific to each region. For example, large warehouses based in a region are likely to result in a sizable number of employees for that region.

6.2.6 Limitations

The main limitations of this approach include that it will be difficult to obtain detailed wage information for Big Tech firms at a regional- and occupational-level. Employee's location can be inferred from where Big Tech firms' offices are. However, this will mostly be assumptions-based and therefore not entirely accurate. In terms of employee's occupations, these can also be inferred where companies provide sufficient details in their annual financial reports, but it may not always be possible to discern this at a detailed level.

Importantly, the publicly available information only allows us to infer average (mean) values, which may provide a distorted view of the labour market, as it does not address high or low outliers, salary-wise. Then,

---

[38] *Available at: <https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/expenditure/datasets/familyspendingworkbook2expenditurebyincome> [Accessed 7 March 2022].*

[39] *Available at: <https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/expenditure/datasets/familyspendingworkbook3expenditurebyregion> [Accessed 7 March 2022].*

[40] *See: < https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/ ukinputoutputanalyticaltablesdetailed> [Accessed 5 April 2022].*

some financial accounts may not provide sufficient detail to discern between the total remuneration package (say including pension contributions) from salary/wage data, which may cloud the analysis.

Finally, when identifying spending habits by different characteristics, similar concerns apply. That is, where the location, occupation or wider characteristics of employees are not known, assumptions will ultimately be required as part of this estimation exercise.

7. What are the redistributive and spillover effects?

This chapter provides some examples of the redistributive and spillover effects of Big Tech firms in the UK. It then provides a framework to identify where redistribution or spillovers are most likely to occur, by examining the 'logic models' developed previously in more depth, as well as considering in principle where these might occur. That is, assessing where value is being transferred from one stakeholder to another, or where external value is being created or extracted. To reach a view on the magnitude of these effects, we propose additional primary research and/or further desk-based research.

7.1 What are Big Tech firms' redistributive and spillover effects?

Redistributive and spillover effects are wider impacts on other economic actors, which may not be captured in the methods set out in the preceding chapters. Below, we set out what these are, in turn, and why Big Tech firms tend to create large redistributive and spillover effects.

Redistributive effects relate to value being transferred between different groups of stakeholders as a result of business activities. Common examples of redistributive effects include the following:

- **Redistribution between businesses of different sizes** occurs where a proportion of sales from large businesses is redistributed to smaller ones, or vice-versa. This can occur due to the ease of access to markets created by e-commerce platforms. This is discussed in the next chapter in more detail.
- **Redistribution between regions in the UK** occurs where some areas may experience shifts in employment opportunities. For example, by creating and investing in research centres in certain areas in the UK, Big Tech firms may redistribute where certain employment opportunities are.

Spillover effects capture the 'non-price' impacts of Big Tech firms (i.e. where generated benefits/costs are not reflected in the prices paid by consumers). Common examples of spillover effects include (but are not limited to) the following:

- **Knowledge transfers** across firms through the movement of staff from Big Tech firms to smaller start-ups, or vice versa. There are prominent examples of former Big Tech employees founding new companies.[41] We note that although knowledge transfer is likely to occur, it can be limited by non-disclosure and non-compete agreements, which are relatively common in the tech sector.[42]
- Big Tech firms have historically been well-placed to engage in **R&D** that requires significant upfront investment, computing power, or access to data, for example, in areas like **AI and machine learning**. They may also contribute to **diffusion and adoption of emerging technologies**. This may open up new markets or business opportunities for other firms and allow them to innovate further.
- Newspapers and other content providers may be negatively impacted by the effects that digital advertising has on their revenues. For example, whilst digital advertising might reduce consumers' search costs, and thus positively impact them, it may also divert other advertising spend that would otherwise be a revenue for newspapers and other content providers to online platforms and other digital players.[43]
- The negative impact on the environment may not be fully factored into the prices of goods and services, which leads to prices being sub-optimally low and resulting in overconsumption. For instance, online

41 For example, see: < https://www.forbes.com/sites/alejandrocremades/2019/04/07/this-ex-googler-built-what-is-now-a-6-billion-business-and-raised-400-million-for-his-next-company/?sh=6d4bf1d63149 > [Accessed 18 March 2022].

42 'An Obsession With Secrets'. The New York Times (July 2021).

43 'Online platforms and digital advertising: Market study final report'. CMA (July 2020).

shopping may be considered to enable excessive consumer behaviour. This may impose negative externalities on their local environment, some of which have not been accounted for by overall taxation and thus require further exploration.

- On the other hand, Big Tech firms have significantly contributed to the 'work from home' model, which benefits the environment through less transport being used and less need for large office blocks and additional utilities.

Big Tech firms' ubiquity means that they are likely to have particularly large redistributive and spillover effects. This is because they are large both in the scale and scope of their activities, as well as benefiting from network effects, which we set out in more detail in the next chapter. As such, their impact will be felt across several different industries, and in a wide range of different ways.

The redistribution and spillover effects can be both positive and negative, as illustrated by the above examples. Therefore, the framework is designed to account for the redistributive and spillover losses, as well as the gains. Importantly, to identify key redistributive and spillover effects, the approach set out in the next section should be followed.

7.2 How can Big Tech firms' redistributive and spillover effects be measured?

Below, we set out how to, in principle, identify and measure Big Tech firms' redistributive and spillover effects in two steps. The approach to measuring redistributive and spillover effects is broadly the same, so we only describe it once here.

7.2.1 Method

Step 1: Use the logic models to identify stakeholders where redistribution/spillovers are most likely to occur.

First, we use the direct impact logic models set out in chapter 4 as the starting point. They can be used to identify the key stakeholders and therefore identify where value is being created/derived (or where the negative impacts occur) – and thus where redistributive and spillover effects are likely to occur.

To illustrate step 1, we use an e-commerce platform as an example (in line with the examples used for our logic models set out in chapters 4 and 5). Table 3 identifies the following key stakeholders for e-commerce platforms: buyers (individuals or organisations); sellers (individuals, organisations, or the platform itself); advertisers; and distributors. Now, to identify areas where redistribution/spillovers occur, we use the following approach.

- We look at the flow of value across the different stakeholders of the logic model. Specifically, we look at how an e-commerce is monetising each individual economic activity from the different stakeholders (and who is paying). For example, sellers (who might be SMEs or large organisations) receive money from buyers. In turn, sellers provide the e-commerce platform with compensation for the listing. Thus, when considering this flow, we can see that there are potentially two areas, where existing value is either being re-distributed; or where external value is being captured/generated:
  - **Redistributive effects from large to SME sellers.** For example, where customers are buying from SMEs instead of large sellers.
  - **Negative environmental spillovers.** Customers may purchase products that eventually harm the natural environment, where this negative effect is not captured in the purchase price (e.g. household products containing microbeads). We note that this spillover impact is not unique to Big Tech firms, but rather that they facilitate it in this instance.

Having identified what the likely redistributive and/or spillover effects are, we then need to do the following.

Step 2: Assess to what degree redistribution/spillover occurs.

Once the areas (and stakeholders) in which redistribution/spillover could occur have been identified, we assess the scale at which these would occur by identifying the best approach to measure them. Depending on what the identified effects are, this can be done through any of the following:

(i) a literature review to gain both, an overview of the scale of the impacts, and collect data points where available;
(ii) primary research to understand the perceived value to stakeholders; and
(iii) using company data to quantify the value – this step may also help to somewhat refine the findings of step 1.

We have identified potential redistribution of sales from large to SME sellers as a potential redistributive effect in our e-commerce platform example above. Conversely, information from the ONS suggests that consumers are more likely to purchase from large sellers than SME ones. For example, in 2019, "*e-commerce sales were dominated by businesses with 1,000 or more employees; their sales of £368.5 billion were more than half the total value of sales by all businesses with 10 or more employees (£668.9 billion)*".[44] Therefore, to be able to determine whether any sales from large sellers are re-distributed, further (primary) research would be required. This is because the available evidence relates only to e-commerce – and thus may exclude some important sales from the analysis – as well as not providing sufficient granularity in terms of whether these sales are redistributions between the sellers, or whether they are simply additional ones.

Table 7 provides an overview of potential metrics to measure some of the redistributive and spillover effects of Big Tech firms mentioned above. This list is only illustrative, as it would have to be undertaken on a company-specific basis.

Table 7: Possible metrics to measure redistributive and spillover effects of Big Tech firms using the above examples

Redistributive/spillover example	Suggested metrics/approach to quantify impacts
Redistribution between SMEs and large retailers	Growth in turnover of SME/large firms using similar platforms as the main sales channel
Redistributive effect of value for different groups of consumers	Monetised consumer surplus estimated through undertaking primary research
Direct environmental consequences not priced in	Metrics from environmental impact assessment of Big Tech firms

Source: Economic Insight.

7.2.2 Limitations

The logic models may not capture all of Big Tech firms' economic activities. Where there are omissions, this may lead to unidentified redistributive or spillover effects.

Moreover, given that these redistributive or spillover effects will vary by Big Tech firm, it is not possible to set out ex ante what relevant metrics should be measured. Rather, we provide a framework to identify sensible metrics on a case-by-case basis. Most likely, to measure these effects, additional primary and/or secondary

---

[44] *See: <https://www.ons.gov.uk/businessindustryandtrade/itandinternetindustry/bulletins/ecommerceandictactivity/2019> [Accessed 9 March 2022].*

research will be necessary. The exact form of this additional research will depend on the likely redistributive or spillover effects identified above.

8. What are the market and competition effects?

Market and competition effects can only be assessed in relation to specific (defined) markets and require detailed analysis and careful consideration. As Big Tech firms provide products and services across a range of (varied) markets, it is not meaningful to analyse competition for Big Tech as a whole. Thus, here we focus on the market and competition effects in the UK relating to online platforms in principle, and subsequently initial views on how one could better understand the mechanisms through which they occur.

8.1 What are Big Tech firms' market and competition effects?

Competition authorities across the world have been looking at the impacts of digital markets, as evidenced by the number of reports on the topic, including the UK's independent Furman Review,[45] the report of the Stigler Committee on Digital Platforms in the US,[46] Australia,[47] Germany,[48] France,[49], and the European Commission[50] to name a few.

Throughout, they identify key characteristics of digital platforms that also apply to some of Big Tech firms' products and services. In particular, they often focus on specific markets, such as online platforms. That is why in this chapter, we cover the key issues relating to **how, in theory, competition can be affected by online platforms.**

The European Commission described online platforms as "*software-based facilities offering multi-sided markets where providers and users of content, goods and services can meet*."[51] This broad definition covers a wide range of platforms that offer a variety of goods and services. Examples include (but are not limited to) communications and social media platforms; operating systems and app stores; audio-visual and music platforms; e-commerce platforms; and search engines. Most Big Tech firms provide at least one (and in some instances more) online platforms. Therefore, by assessing the impacts of online platforms on competition, we cover an important element of Big Tech firms' products and services inventory. Assessing competition effects across all of Big Tech's product and service lines was out of scope for this methodology paper.

The identification of the competition effects is based on insights from Dr Luke Garrod, who is a Senior Lecturer in Economics at Loughborough University and an Associate of Economic Insight.[52] In the next sections, we consider how online platforms can (from an in principle perspective) benefit and hinder competition; followed by a discussion of how the impact of online platforms can depend upon firm size. Finally, we explain why online platforms can become dominant and describe how dynamic competition may lead to positive outcomes. Subsequently, we set out ways in which all of the above effects could be measured.

---

45 *'Unlocking digital competition: Report of the Digital Competition Expert Panel'. (2019).*

46 *'Stigler Committee on Digital Platforms'. (2019).*

47 *'Digital platforms inquiry - final report'. ACCC (June 2019).*

48 *'A new competition framework for the digital economy'. Commission 'Competition Law 4.0' (2019).*

49 *'Competition and e-commerce'. Autorité de la concurrence (May 2020).*

50 *'Competition policy for the digital era'. Jacques Crémer; Yves-Alexandre de Montjoye; and Heike Schweitzer (2019).*

51 *'A Digital Single Market Strategy for Europe – Analysis and Evidence'. European Commission (2015).*

52 *Dr Garrod's research uses advanced theoretical techniques to model the incentives of firms, with the aims of explaining real-world behaviour and improving the effectiveness of competition policy. He has published in leading journals in the field, including the Journal of Industrial Economics and the International Journal of Industrial Organization. Dr Garrod has also worked with the Office of Fair Trading to provide advice to policymakers on market interventions.*

8.1.1 How platforms can benefit competition

Online platforms create large networks of different types of users and act as intermediaries between them. This can lead to efficiencies for the platforms' users and when the platform brings together one side of a market (i.e. potential buyers) with another (i.e. potential sellers), it can facilitate better outcomes for both. In this section, we explain how platforms are able to create these large networks and the benefits of the network for buyers and sellers.[53]

8.1.1.1 Network effects

Online platforms can create large networks to the benefit of their users due to 'network effects'. Network effects arise when there is a greater incentive for people to use a platform as there are more users on that platform. Platforms can create 'direct network effects' and 'indirect network effects'.

- **Direct network effects** arise if users find a platform more appealing when there are more users of the same type.
- **Indirect network effects** arise when users find a platform more appealing when there are more users of a different type.

Different platforms will create different types of network effects. For example, on a social media platform, direct network effects can arise because users may be most interested in connecting to other users; but indirect network effects can also arise because advertisers will want to advertise their goods and services on platforms with many users. Similarly, on an e-commerce platform that brings together potential buyers and sellers, indirect network effects arise because sellers want to sell on a platform that has many potential buyers, and buyers will also want to use a platform on which there are many sellers.

The desire to create a large network can incentivise platforms to only charge fees for their services to one type of user. For instance, it is commonly the case that firms will pay fees to the platform, whereas individuals are able to access a platform's services for zero monetary price. The reason is that by offering the platform's services to individuals for free, it increases their number on the platform; this in turn raises the value of the platform for firms on the other side of the market, as the firms value people's attention and/or data. As a result, firms are willing to pay more to access the platform's services, which enables the platform to extract higher profits than if they charged a monetary price to users on both sides.

8.1.1.2 Benefits to buyers and sellers

Online platforms make it easier for buyers to access information about a wide variety of goods and services. They enable buyers to navigate many potential sellers efficiently, reducing consumer search costs and raising the transparency of markets. This means that consumers are better able to find the goods and services they want and the firms that offer those goods and services at the lowest prices. Competition between sellers will be more intense as sellers strive to be the one that offers consumers the best deal. This will result in better outcomes for consumers, such as lower prices and/or higher quality of goods and services. Such outcomes may not just be restricted to online platforms, because firms selling through other channels would have to remain competitive in comparison to their platform rivals.

Online platforms can benefit sellers by facilitating connections with more potential buyers, so that sellers are able to achieve greater sales. This can often involve expanding sellers' access to other geographic markets. Online platforms can assist sellers to lower their costs and raise their profits, through helping them realise economies of scale and/or making their business processes more efficient. As a result, sellers of niche products may be able to operate as viable businesses when they might not otherwise. Similarly, online

[53] *The benefits of online platforms are explained in depth by Oxera (2021) 'How platforms create value for their users: implications for the Digital Markets Act' A report prepared for the Computer and Communications Industry Association.*

platforms may enable businesses to engage in more targeted advertising and pricing strategies, which will make such strategies more efficient and effective.

Online platforms can also foster trust between potential buyers and sellers to overcome inefficiencies in the market that could arise otherwise. For instance, a market can fail when consumers are not able to assess the quality of products before buying. In extreme cases, this can mean that only low-quality products are sold, because high-quality firms are driven out of the market due to consumers being wary of mistakenly buying low quality at high prices. This market failure is known as the problem of adverse selection, and it can be a particular issue in online markets where consumers are usually unable to assess quality until after buying. However, online platforms can provide a trusted environment that assists sellers to develop and signal a reputation of being a high-quality supplier. The consumer review facilities of online platforms can also help consumers to better assess the quality of the sellers pre-purchase.

8.1.2 How platforms can hinder competition

There are various ways in which online platforms can hinder competition. Governments and regulators across the world are grappling with the challenges associated with competition issues in digital markets. For instance, the UK government will bring forward legislation to implement a new pro-competition regime for digital markets to address competition concerns.[54] Important examples of ways in which online platforms can hinder competition include (i) conduct that excludes rival firms from the market; (ii) restrictions on the prices that can be set by sellers; and (iii) merging with potential competitors. We consider each in turn. While there may be benefits associated with such conduct, our focus in this section is on the potential harmful effects on competition.[55]

8.1.2.1 Potential Exclusionary Conduct

Online platforms can hinder competition by excluding rival firms. In general, this can arise in two settings. The first is in vertically related markets where the platform acts as both an intermediary that brings buyers and sellers together *and* as a seller of its own products on its platform. In such a situation, the platform plays the role of both a player and the referee, and so it may have an incentive to make decisions as a referee that favours its team. The second setting is where the platform sells a portfolio of complementary products, and it links one product with others in a bid to leverage market power from one to another.

Which type of firms are excluded and the underlying reasons for the exclusion will depend upon the specific conduct, and we next consider three different types.

- **Refusal to supply.** The conduct known as 'refusal to supply' can lead to the exclusion of rival platforms in a vertically related market. This occurs when a platform develops an important good or service and chooses to self-supply it exclusively through its online platform. This can lead to the exclusion of rival online platforms when buyers value the important input so much that they use these platforms less. As a result of the reduction in competition between the platforms, sellers may end up paying higher fees to the online platform, which could translate into higher prices for buyers.
- **Self-Preferencing.** 'Self-preferencing' refers to conduct where an online platform provides preferential treatment to its own goods and services over others on the platform. One example of such conduct is when a search engine ranks its related goods and services more prominently within a search list than its rivals' goods and services.[56] This can exclude the suppliers of rival upstream goods and services from the market, as they find it difficult to gain customers through the downstream platform that displays

---

[54] 'Government response to the consultation on a new pro-competition regime for digital markets'. (2022).

[55] For further discussion, see OECD (2020) 'Abuse of dominance in digital markets'.

[56] For example, see the EC's 'Google Shopping' case, available at: https://ec.europa.eu/competition/elojade/isef/case_details.cfm ?proc_code=1_39740 [Accessed 11 March 2022].

their products less prominently. Consequently, buyers can miss out on the best deals and sellers have reduced incentives to develop new goods and services.[57]

- **Tying and Bundling.** Other potential exclusionary conduct includes 'tying' and 'bundling'. Tying is when a firm makes consumers buy one or more 'tied' products when they buy a 'tying' product. This can arise from 'technical tying', where the firm restricts the compatibility of a rival's products, or through 'contractual tying', where the firm requires its customers to buy the tied products with the tying product. Similarly, bundling is when a firm sells its (usually complementary) products together as a package. This can take the form of 'pure bundling', where the firm only sells the products in a bundle without selling the individual components separately, or 'mixed bundling', where the bundle is also sold alongside the individual components, but price of the bundle is less than buying individual components. Both tying and bundling can enable a firm to leverage market power from one product to others, and as a result it can hinder competition by leading to the foreclosure of rival firms from the market.

8.1.2.2 Price Restrictions

Online platforms can also hinder competition by preventing sellers on their platforms from selling at lower prices via other sources, such as sellers' own websites, other platforms, and bricks-and-mortar retailers. These restrictions have become known as "price parity clauses" and are sometimes referred to as Most Favoured Nation (MFN) clauses.

Price parity clauses have the potential to hinder competition by limiting competition between platforms. For instance, without price parity clauses, a smaller or entrant platform could charge sellers a lower fee than a larger incumbent platform to attract sellers to its platform. This could translate into the sellers setting lower prices on the smaller platform, which entices buyers to switch to the platform too. However, when these price clauses are applied, buyers know prices will be the same on both platforms, so there is little incentive for them to switch from the incumbent platform. As a result, a new platform may not enter the market or, if it does, there would be little incentive for the entrant platform to undercut the incumbent's fee for sellers.

8.1.2.3 Killer acquisitions

Online platforms can hinder competition by eliminating a potential competitor from the market. The term 'killer acquisition' has often been used when a large incumbent firm acquires a smaller innovative firm that, at the time, may not be a close competitor to the incumbent. However, absent the merger, the innovative firm could have become larger over time and compete with the incumbent in the future. Consequently, following the merger, the incumbent firm may be able to sustain its market power into the future and consumers may not experience the lower prices, better quality products and/or greater innovation that could have arisen through competition, had the acquisition not happened.

8.1.3 How the impacts of platforms on firms vary by size

Here, we explain that online platforms may have the potential to provide greater benefits for SMEs than for larger firms. However, we also note that online platforms can have greater bargaining power over SMEs and that larger sellers may be able to dampen the competitive effects of the platform.[58]

---

[57] *Additionally, other behaviours may be considered to distort competition in online markets, for example the use of non-public third-party business data, to benefit a platform's rival goods or services. See here: <https://ec.europa.eu/commission/presscorner/detail/en/ip_20_2077> [Accessed 22 March 2022].*

[58] *For a more in-depth discussion see OECD (2021) 'The Digital Transformation of SMEs' OECD Studies on SMEs and Entrepreneurship, OECD Publishing, Paris.*

8.1.3.1 Greater Benefits for SMEs

The benefits of online platforms for sellers are discussed above in section 8.1.1.2. There are three main reasons why such benefits are likely to be greater for SMEs than for larger firms.

- First, in the absence of online platforms, SMEs would be unlikely to have the resources to invest in the costly digital infrastructure they would need to make the most of the opportunities from online markets. However, larger firms would have the resources and they may even still invest in such infrastructure, in addition to using online platforms, to increase the channels through which they sell.
- Second, SMEs are especially likely to benefit from realising economies of scale which has the potential to boost their competitiveness and productivity. In contrast, larger firms are more likely to be less dependent upon the online platforms and can realise economies of scale through their other sales channels, such as offline stores or their own websites.
- Third, online platforms can provide a level playing field for SMEs and larger firms, because SMEs can be presented as equals with their larger rivals on online platforms. Furthermore, smaller firms may also be able to develop a reputation for delivering a high-quality service by, for example, earning positive customer reviews, and this could counter the brand loyalty often associated with larger firms.

As outlined above, there may be advantages for SMEs to engage with online platforms. However, the potential imbalance of power between large online platforms (including larger businesses that use them) and SMEs could mean that SMEs don’t always achieve the same level of benefits described above. The reasons for this are discussed in more detail below.

8.1.3.2 Bargaining Power

Given online platforms can be vital in providing SMEs with access to online markets, one potential downside is that SMEs can be too reliant on a platform. As a result, SMEs may have limited bargaining power in comparison to the platform, and so the platform may be able to impose exploitative terms and conditions in return for access to the platform. This would especially be a concern when there is no alternative platform to switch to or when there are switching costs relating to changing platforms. Such switching costs may involve, for example, a seller not being able to transfer its positive customer reviews to a different platform and so by switching the SME would hinder its ability to signal its quality. Larger firms that sell through multiple channels will be in a stronger bargaining position with an online platform and so may be able to negotiate better terms.

8.1.3.3 Strategies of Larger Firms

Since the benefits of online platforms are likely to favour SMEs, larger firms may have incentives to dampen the competitive effects. For instance, larger firms are likely to be more willing and able to ‘pay for prominence’, whereby their goods and services are promoted or displayed prominently on an online platform in exchange for a fee. This can increase their sales at the expense of less prominent firms, as consumers rarely spend time searching through many webpages. Similarly, larger firms may be better able to employ obfuscation strategies that make comparisons more difficult for buyers. For example, they may offer multiple versions of a similar product on the online platform in an attempt to reduce the prominence of the offers of rival smaller firms that cannot offer as many versions. Finally, larger firms may be more successful at 'bait and switch' strategies, where they offer low priced products on the online platform in order to attract consumers to their own website. Once they have a consumer away from the competitive environment of the online platform, they then try to sell higher quality goods with higher profit margins.

8.1.4 Dominant online platforms and dynamic competition

Dynamic competition is often used to describe a situation where firms have incentives to compete through innovation over time. In this section, we explain why there can often be only one single dominant online platform in the market and describe how dynamic competition can lead to positive outcomes even in a market where a platform is dominant.[59] We end by discussing the conditions under which a dominant online platform is less likely to emerge or persist over time.

8.1.4.1 Winner Takes All

The markets in which online platforms operate can be highly concentrated, with a market being served by a dominant network. This may arise for two reasons.

- First, an innovative platform can be the first to offer the service and it will therefore effectively be the creator of the market.
- Second, the network effects associated with online platforms can create what are known as 'winner-takes-all' markets, where the market tends towards a single dominant network due to the platform benefiting from the virtuous circle of becoming more valuable to users as more users use the platform.

In either case, network effects may also represent a significant barrier to entry, because an entrant platform would have to achieve sufficient scale to be valuable enough to users and thereby become a viable competitor to the incumbent platform.

8.1.4.2 Competition for the market

Although entry in platform markets can be difficult, a successful entrant can be highly rewarded, because network effects provide the potential for it to grow very large, very quickly. Similarly, an incumbent platform's position can also be precarious in the face of a successful entrant due to the vicious circle of becoming less valuable to its users as it becomes smaller. Consequently, while there may be one dominant platform at any point in time, this dominance may be temporary, and the loss of network effects might lead to a rapid collapse. In practice, we note that over the last decade none of the major, incumbent platforms operated by Big Tech firms have been displaced by a new market entrant. Where business models have been disrupted by a smaller challenger, this has generally not led to the displacement of the business itself. In particular, in the context of the online platforms and digital advertising market study, the CMA considers that many established companies and their platforms "*are now protected by such strong and self-reinforcing incumbency advantages that similar innovation by new entrants is much more difficult*." The CMA has also voiced concern that "*existing market dynamics will mean that the next great innovation cannot emerge to revolutionise our lives in the way that Google and Facebook have done in the past*".[60]

Notwithstanding these incumbency advantages, in principle limited competition *within* the market (i.e. the market is served by one dominant platform) does not preclude competition for the market. In online markets, this is often in terms of dynamic competition as platforms look to gain an advantage over their rivals and potential rivals through innovation. For instance, an entrant platform may develop an innovative service that unlocks network effects by convincing enough users to switch from a dominant platform, or adopt it alongside the incumbent service. Similarly, in a bid to keep ahead of the potential competition, dominant incumbent platforms may develop new and innovative features or services for their existing platform businesses.

---

[59] *Evidence of the effects of dynamic competition in online markets is provided by Europe Economics (2017) 'Dynamic Competition in Online Platforms: Evidence from Five Case Study Markets'. A report prepared for the Department for Business, Energy and Industrial Strategy. See also: 'Competition and Innovation in Digital Markets' (2021). A report prepared for the Department for Business, Energy and Industrial Strategy.*

[60] *See: < https://assets.publishing.service.gov.uk/media/5fa557668fa8f5788db46efc/Final_report_Digital_ALT_TEXT.pdf > pages 7-8. [Accessed 28 March 2022].*

However, as mentioned above large online platforms have been able to maintain their dominant positions in the market for a significant period of time.

The extent to which there is competition *for* the market may also depend, to some degree, upon the intensity of competition within the market. If a platform believes that innovation will ensure that it will maintain or achieve a dominant position, then it will be more likely to invest in that innovation to obtain the profits associated with a dominant position. Likewise, a platform will not have an incentive to innovate if the resultant profits are low.

8.1.5 Competition within the market

We end this section by noting that a dominant network is not the only feasible market structure for platform markets. There are three main reasons why two or more rival platforms may co-exist. When one or more of these apply, a winner-takes-all market is less likely to materialise or persist over the long term.

- **Platform differentiation.** Platforms may offer services that are sufficiently different from each other. The greater the differentiation between platforms, the less network effects will matter to consumers when they choose which platform to use. For example, even if most consumers initially used an incumbent platform, some may be willing to switch to a smaller entrant because it offers a service that better satisfies their preferences. This more preferable service may compensate the switchers from benefitting less from network effects.
- **Multi-homing.** 'Multi-homing' is where platform users operate on more than one platform. When there are two platforms and one type of agent (say, buyers) multi-home, then there can be incentives for other users (say, sellers) to 'single-home', where they subscribe to one platform only. The reason is that single-homing sellers will not incur the costs of operating on two platforms and, if most buyers multi-home, they will also still be able to access a large network by operating on only one platform. This can mean that both platforms are able to attract enough single-homing sellers to operate in the market and this, in turn, can ensure buyers have incentives to multi-home.
- **Interoperability.** When two platforms adopt interoperability, then each user on one platform can connect with other users on both platforms. As a result, users do not have to be on the same platform to realise network effects, so two or more platforms can attract enough users to be viable in the market.

Further research is required to understand the impacts of digital markets. More specifically, the impact online platforms have had on competition in the UK. We acknowledge that DCMS, in support of the upcoming draft digital markets bill, is committed to developing a monitoring and evaluation plan. This work will help to improve the understanding of competition across digital markets as well as the potential impact of introducing the digital markets pro-competition regime.

9. Findings and limitations

This chapter sets out a summary of the overarching findings and limitations of the framework. We consider that there are some practical challenges in implementing it which may require further research. However, some of these challenges are intrinsic to the characteristics of Big Tech firms and their products and services. Therefore, we also recognise the limits regarding what can be measured uniformly across these companies, and thus to which degree impacts across the UK can be measured accurately and robustly throughout.

9.1 Findings

Overall, we found that it is possible to develop a robust and consistent approach to identify and measure:

- all the **relevant UK entities and subsidiaries** of Big Tech firms, as well as their **activities** and what **products and services** they offer;[61]
- the **direct impacts** in the UK, by using a logic model approach to identify the routes to impact, followed by an aggregate quantification method, using both UK and US information to estimate the size of the impacts, as well as ONS data;
- the **indirect impacts** in the UK, by using a logic model approach to identify the routes to impact, followed by an aggregate quantification method using both publicly available company information and ONS data; and
- the induced impacts in the UK, which are the additional wage impacts, measured using both publicly available company information and ONS data.

However, we found that there are some practical challenges in implementing these approaches accurately, based solely on desk-based research and publicly available information. In particular, we found challenges in both: identifying the activities undertaken in the UK, as well as the complete set of products and services offered; and measuring the direct, indirect and induced impacts. We set out these issues in more detail subsequently.

Relatedly, we found that it is more challenging to develop a robust and consistent approach to identify and measure the *wider* effects. This is because:

- Both redistributive and spillover effects need to be assessed by reference to the products and services Big Tech firms offer – and how they affect wider stakeholders. As Big Tech firms offer a range of varied (and not always comparable) products and services, formulating an approach that a priori identifies and measures these effects is unachievable. Therefore, we provide some high-level views on the types of effects one might expect to encounter, and how one might identify them in practice (and then subsequently measure them).

Separately, we note that further research is required to understand the impacts of digital markets. More specifically, the impact online platforms have had on competition in the UK. We acknowledge that DCMS, in support of the upcoming draft digital markets bill, is committed to developing a monitoring and evaluation plan. This work will help to improve the understanding of competition across digital markets as well as the potential impact of introducing the digital markets pro-competition regime.

[61] *We note that the way in which Big Tech firms structure themselves – and whether they have any legal entities in the UK – affects the extent to which their overall impacts on the UK economy can be measured accurately subsequently.*

In summary, we find that:

- in principle it ought to be possible to assess Big Tech firms' direct, indirect, and induced impacts consistently – with the right information; and
- identifying a consistent and robust method that identifies and measures Big Tech firms' wider impacts will remain a challenge.

9.2 Limitations

The key overarching limitation to consistently implement all of the approaches above robustly relates to data and information availability issues. We further note the following specific limitations in relation to the different impact channels and approaches set out above.

9.2.1 Identify relevant UK entities and subsidiaries

We faced some challenges when seeking to establish what activities Big Tech firms' UK entities undertake, as well as what products and services they provide, based on desk-based research and publicly available information only. In particular, companies' activities and main SIC codes may not always best reflect the activities that they undertake in the UK.

Therefore, to further improve the overall framework, stakeholder engagement and consulting with industry experts could lead to a stronger identification of key UK activities, products and services.

9.2.2 Direct impacts

The main limitation on the identification of the direct impacts using a logic model approach consists in ensuring all impact channels in the UK are identified, as well as all those affected by them. We consider that doing this solely based on desk-based research is challenging. We note the challenges above in terms of identifying the relevant activities and products and services, which would have a bearing here. For example, if we were to identify and measure all direct impacts of Amazon Web Services (AWS), this could require the identification of hundreds of service lines and use scenarios, which may not be practical or feasible.

Therefore, the framework could be refined by consulting with industry experts and stakeholders on both the activities, and products and services offered by Big Tech firms. Further topics to explore could include how these affect wider stakeholders and the UK economy more broadly.

The main challenges when measuring the direct impacts relate mostly to data availability issues at a sufficiently granular level to allow for the desired analysis. We can calculate indicative estimates based on the available data, however their robustness may be limited and will need refinement. This is why – as part of our framework – we provide two methods to calculate them, which can act as a sensitivity analysis on one another, as well as filling some information gaps. For example, R&D expenditure is sometimes only itemised in the parent company's annual reports.

Therefore, to enable us to undertake a detailed, robust, and accurate estimation of the impacts of Big Tech firms, we would need to obtain detailed information from them directly, such as revenues and headcount by location and product/service, as well as wage information and R&D spend.

Finally, we sought to develop a complementary method to attribute where the value is being generated, based on a combination of matching activities and outcomes from the logic models to UK entities. In principle, it could be that each legal entity is responsible for a product or service line, or an activity. In practice, this is not the case, since one entity may be responsible for a range of products and services, while in other cases multiple entities may be responsible for different steps of the value creation process. Therefore, any matching between products and services and legal entities did not prove useful. Rather, some of the companies' annual reports provide revenues by product or service category, and instead, this could be used as an alternative to estimate what products and services are responsible for contributing most value to the firm (and likely, therefore, the UK economy). Thus, we did not consider that there would be merit in pursuing this approach further. Where the information mentioned above does become available, this approach may also be revisited.

9.2.3 Indirect impacts

The key limitation in relation to identifying and measuring indirect impacts is that it rests on accurate supplier spend and location information from Big Tech firms. This is not publicly available, and therefore, the current method does not provide for an accurate measurement of those impacts. It rests on a detailed 'logic model' approach, which helps to fill some gaps, and, in principle, identify likely sectors that might be impacted by the firms' spend on suppliers. Despite not being able to provide a robust estimate, by developing detailed 'logic models' it does identify potential instances of double-counting, and thus ways of avoiding it. For example, where Big Tech firms use inputs such as IP, these could either be proprietary, or from the parent company. Therefore, identifying who owns them, as well as whether there are any internal value transfers, mitigates this risk.

Finally, as above, to undertake a robust and accurate estimation, detailed information from Big Tech firms themselves would be required, in terms of who their UK suppliers are, where in the UK they are, as well as what products/services they are supplying. Some of this information may be considered commercially sensitive.

9.2.4 Induced impacts

The main limitations in relation to identifying and measuring induced impacts are rooted in data availability issues. That is, we are not able to obtain sufficiently detailed information from Big Tech firms from publicly available sources in relation to their staff payroll, including information on staff location, characteristics, occupation and salary. For example, we can – in most instances – only obtain information at an aggregate level (e.g. staff numbers and wages), and thus only calculate average (mean) values.

To enable a more detailed analysis, individual payroll data would be required, including individual staff's salaries and where they are located to assess the median wages by region, for instance. Similarly, to understand in more depth where Big Tech firms' staff is likely to induce additional impacts, staff surveys on their spending habits could be undertaken.

9.2.5 Redistributive and spillover effects

The identification of redistributive and spillover effects is rooted in the logic models developed for the direct and indirect impacts above. Where these are not complete or accurate, some redistributive or spillover effects may not be identified and, subsequently, quantified. As they are likely to be far-reaching, there is no single methodology to measure them, and this will again, be context specific.

10. Annex

This chapter sets out supporting evidence, to help us reach our views and approaches for the framework. Specifically, it sets out a summary of DCMS's rapid evidence review in relation to this topic; and a summary of additional literature we identified and reviewed.

10.1 DCMS's literature review

DCMS's Big Tech Team shared its rapid evidence review of five studies with us, of which Table 8 overleaf provides the summary results. Three studies had been commissioned by firms themselves (Google, Microsoft, and Amazon), whereas the remaining two were part of broader market investigations (digital markets and online advertising). Overall, we consider there are some useful key findings and methodological approaches.

- The impact studies commissioned (or undertaken) by firms tend to be based on a mixture of company data and primary research. For example, Google's impact assessment in the UK is based on individual and business survey responses, whereas Amazon's impact assessment in the UK appears to be based on company information.
- The broader market investigations provide useful contextual information to place the economic impact assessment in.

Table 8: DCMS's rapid evidence review - summary table

Title	Author	Methodology	Key Findings	Limitations
Google's Impact in the UK 2020[62]	Public First	Building on the precedent of previous Google impact reports, Public First used traditional economic modelling built upon third-party estimates of Google market size in the UK, and returns on investment (ROI) to measure the economic activity driven by Google's core products. They conducted extensive polling of over 5,000 individuals representing every region in the UK. As well as polling 1,000 senior business leaders from small, medium and large businesses, representing a range of different industries. They then linearly regressed the results of their polls to derive a demand curve and used this to calculate total consumer surplus per user. Finally, they scaled this estimate by third party estimates of Internet prevalence and polling information, with differing methods used for the search engine, maps and YouTube.	Google's core search and advertising tools helped support an estimated £55 billion in economic activity in 2020. As well as supporting over 700,000 businesses in the UK in 2020. By helping businesses shift to online sales for the first time during 2020, Google helped support £17 billion in economic activity. That is the equivalent to the GDP supported by a city the size of Bristol.	The use of polling is a limitation as it will be extremely difficult to replicate in this research project. Furthermore, polling has inconsistencies (e.g. consumers over-/under- estimating their use of the product in this case). There are also limitations on Varian's (Google's Chief Economist) assumptions regarding the value of leisure time saved as a result of using their services. Specifically, using Google saves 15 minutes per question, with the average person asking 1 answerable question every 2 days as well as the value of leisure time being assigned a value of mean hourly earnings.

[62] *Public First., 2021. UK – Google Impact Report. [online] Available at: <https://googleimpactreport.publicfirst.co.uk/uk/ > [Accessed 15 October 2021].*

Title	Author	Methodology	Key Findings	Limitations
Social, environmental and economic impact of Microsoft in the UK[63]	Microsoft	Microsoft has performed a materiality audit[64], the resulting plotted graph can be viewed in the linked document in the bibliography. They performed this through a series of targeted stakeholder engagement programmes. They asked their partners, employees, 2,000 consumers, as well as policy makers, NGOs and other industry experts to tell them which issues relating to four key dimensions of impact were of greatest importance to them.	25,000 partners in the UK, between them employing 570,000 people, generating over £38bn in attributable revenue and investing £26bn. More than 200,000 people have been trained in digital skills at the Microsoft Experience Centre since it opened in June 2019.	The materiality audit is based on stakeholder engagement programmes. It would not be possible to replicate this approach for a research project assessing multiple companies due to the sheer size of stakeholders to engage with. Furthermore, the lack of sourcing and/or methodology for key statistics, e.g. attributable revenue, means we cannot assess the robustness of the figures.
Amazon's Economic Impact[65]	Amazon/Keystone	N/A - No methodology has been linked or presented, instead the workings are just reference to Keystone.	Amazon has invested heavily in the UK – more than £23bn since 2010. At the end of 2019, the company employed more than 30,000 people across the country and estimates show that Amazon's investments have created nearly £45bn in value-added GDP since 2010.	The limitation of this study is the lack of methodology. Thus, we cannot assess the robustness of the report or any stated evidence.
Unlocking digital competition - Report of the Digital Competition Expert Panel[66]	Jason Furman (and the Digital Competition Expert Panel)	This report was commissioned to an independent panel of experts, with a designated set of questions and objectives, with key themes such as mergers, competition and ad-funded products and services. They engaged with stakeholders and reviewed literature. Thus, this was primarily a qualitative assessment.	In the last decade, Amazon, Apple, Facebook, Google, and Microsoft combined have made over 400 acquisitions globally. Some of these acquisitions have been exceptionally high value, peaking with Microsoft paying $26.2 billion for LinkedIn.	The limitation of this approach would be the qualitative nature of this methodology would not allow for quantitative evidence and metrics to be assessed in this project. Furthermore, assembling the experts and representative stakeholders to engage with would be an extremely difficult task.

63 *'UK impact - overview Social, environmental and economic impact of Microsoft in the UK'. Microsoft (2021) [Accessed 15 October 2021].*
64 *In this context, a materiality audit is an internal inspection of significant aspects of the company. For Microsoft this ranged from diversity, to environmental impacts to digital skills.*
65 *'Amazon's Economic impact'. Amazon/Keystone (2020) [Accessed 15 October 2021].*
66 *'Unlocking digital competition - Report of the Digital Competition Expert Panel'. Furman, J. (2019) [Accessed 15 October 2021].*

Title	Author	Methodology	Key Findings	Limitations
Online platforms and digital advertising[67]	Competition and Markets Authority	Over the course of the study, the CMA have consulted a large number of parties, and gathered a broad range of qualitative and quantitative evidence. This has involved a high volume of submissions (both qualitative and quantitative evidence) from parties, in response to their statement of scope, their interim report consultation, and their numerous requests for information.	In 2019, Google had more than a 90% share of the £7.3 billion search advertising market in the UK, while Facebook had over 50% of the £5.5 billion display advertising market.	The research factored in a large number of sources and this would be a limitation if we replicated the same approach but for a much broader set of metrics then it wouldn't be efficient.

Source: DCMS Big Tech Team.

[67] *'Online platforms and digital advertising Market study final report'. CMA (2020) [Accessed 15 October 2021].*

10.2 Additional literature review

We reviewed an additional 12 studies that determine the impact of Big Tech companies on various economies, as well as more general impact assessments. When evaluating any impact measures stated in these studies, it should be borne in mind that these tended to be commissioned by Big Tech firms themselves. Notwithstanding this, there are some useful key findings and methodologies to note.

In particular, two approaches to estimate economic impacts were most frequently used, across the 12 studies.

- **Input-output models** were most frequently used to quantify the economic impacts. These models require detailed data to be provided from the individual companies, especially in relation to their employee numbers, location, and wages; as well as their spend on suppliers. Half of the 12 additional studies used this method to estimate direct, indirect, and induced economic impacts in terms of GVA and employment.
- **Primary research**, such as business surveys or interviews with the organisations who use the services, was used to establish the impacts. Specifically, three out of the 12 studies based their economic impact estimates on findings from primary research.

Across the 12 studies, the focus is largely placed on the direct impacts. The main channels through which economic impacts take place are the following.

- **Increased trade**. Companies are able to increase the sales of their goods and services through platform use. The literature illustrates that, as a result of using various platforms, companies are able to increase sales, both globally and locally, as the platforms enable an easier access to new and existing markets.
- **Marketing.** Companies are more frequently relying on search and social media to promote their products and services. Marketing options are available at a much cheaper cost than previously and therefore enable SMEs to engage in marketing activities where they previously would not have had the budget to do so. Marketing has also become more targeted, which has a higher conversion rate and therefore feeds through to increased sales.
- **Productivity.** Through the use of a wide variety of Big Tech firms' products and services companies have significantly improved their productivity, and business operations have become much more efficient.
- **Employment.** Big Tech firms are both employing significant amounts of people as well as being instrumental in the growth of companies which use Big Tech products and services, which then consequently increase their employee numbers. The literature shows that employment is both supported by Big Tech firms, as well as changed because of it. New types of employment models have become commonplace and contract work, with little or no employment benefits, is frequently used by Big Tech companies.

There are also significant indirect effects which have been quantified by literature. The two main examples of these are as follows.

- **Innovation.** Big Tech firms undertake a significant amount of research and development. For example, in 2020, "*three-quarters of the top 10 [R&D investors] are from […] ICT related sectors, which together, invested a total of €114bn (77% of the total investments of the top 10)*".[68]
- **Construction expenditure.** When Big Tech firms build research and data centres (such as Facebook in the EU and AWS in Virginia) or headquarters (such as Google in Dublin and London), the largest indirect effect is shown to be in the construction sector. This is followed by the manufacturing sector and then the wholesale and retail trade industry.

[68] *'The 2021 EU Industrial R&D Investment Scoreboard'. European Commission. (2021); page 36. It should also be noted that Amazon is not included in this scoring method, as it does not provide sufficiently detailed information on its R&D spend.*

Table 9: Additional literature review

Title	Author	Methodology	Key Findings	Limitations
Online platforms: Economic and societal effects[69]	European Parliamentary Research Services	This study uses a literature review to: • offer a definition of digital platforms and to provide a classification of the most salient types of digital platforms ; • investigate how the new models of economy and in particular the platform economy has affected users, businesses, competition, innovation, employment, and the social fabric; • examine the effects of platforms on working conditions and labour market dynamics; and briefly examine the effects on social values, consumer and societal risks, and environmental sustainability; • examine briefly how digital platforms are currently regulated under EU law and to map the main regulatory challenges that their operation (and expansion) is raising in the areas covered by the study; • draft policy options – including a possible EU platform regulation - that could respond to the challenges associated with online platforms' specific effects: competition, innovation, working conditions and labour market dynamics, and briefly also consumer and societal risks and environmental sustainability.	Usage of platforms within Europe: • one million EU businesses were selling goods and services via online platforms and more than 50% of small and medium enterprises selling through online marketplaces sold cross-border; • in 2017 the B2C e-commerce turnover was estimated around €602 billion growing at 14% per annum; • 53% of EU enterprises use social media; 82% SMEs relied on search engines to promote their products and services; and • the use of social media increased for marketing purposes (22% to 45%) and for recruiting employees (9% to 28%) between 2013 and 2019. Measuring the impact of platforms on the economy: • the median Facebook user needed a compensation of around $48 to give it up for a month; • the development of the Android app ecosystem supports €11.7 billion in revenue for European developers and Google Maps is saving Europeans over 1,180 million hours a year; • 72% of the 6,000 businesses surveyed for the study agreed that it is now far easier for global customers or clients to find their business compared to the time before search engines; • in 2018, the total consumer surplus of Google's core products was worth around €420 billion a year (Google Search was estimated to be equivalent to €230 billion; YouTube was estimated to €136 billion and Google Maps €53 billion). Positive effects of platforms on Global Innovation:	The research factored in a large number of sources, including primary research. This is a limitation, given it would be difficult to replicate this approach for a broader set of metrics, as proposed in the framework.

[69] '*Online platforms: Economic and societal effects*'. *European Parliamentary Research Services (March 2021) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations

			• Amazon, Alphabet, Microsoft, and Apple all featured in the top 10 companies for global spending on research in 2018;
			• the total R&D investment of Google, Apple, Alphabet, Facebook, and Microsoft was $71 billion for 2017;
			• Google has consistently spent over 15% of its revenue on R&D since 2016 (the average percentage of R&D spending in the EU is 3.4%.
			
			Platforms stimulate innovation in complementary products and services:
			
			• as of 2018, there were 20 million registered application developers on iOS and collectively they have made about $100 billion in revenues, with the App Store bringing in 500 million visitors per week;
			• in 2020, there were 2.56 million apps on the Google Play store; 1.85 million apps on the Apple App Store; 669,000 apps on the Windows Store; and 489,000 apps on the Amazon Store.
			
			The creation of new types of jobs:
			
			• the new jobs can be sorted into two categories: on-demand work and crowdwork – all of them are organised via digital platforms and all of them focus on short-term work, where:
			  ○ on-demand work requires offline labour involving tasks such as cleaning, ride-sharing, delivering, caring, maintenance, etc. that must be physically carried out in geographically specified locations; and
			  ○ crowdworkers use platforms to find clients who require their services, which are then provided virtually rather than in-person;
			• in the UK, 1.5% of the working-age population performs taxi or delivery platform work at least weekly, and 2.6% perform platform-based household services;
			• crowdworkers are those who use platforms to match with clients who are in need of their services,	

Title	Author	Methodology	Key Findings	Limitations
			which are then provided virtually rather than in person – this includes professionals who use platforms for freelance work and more low-skilled low-wage work such as data entry, image labelling, etc.; • professionalised crowdwork can often provide a sufficient income as well as employment benefits, however this is not the case for the low-wage variant. Employment characteristics: • Platform work typically relies on contracts where workers are not defined as employees but rather self-employed. This enables companies to cut labour costs, for example, companies report savings of 20-30% on costs by relying on this type of employment contract. • Evidence suggests that platform work allows many people who would otherwise struggle to find jobs to find one, and it allows people to be fired without any recourse or explanation. • Most research finds that a majority of platform workers use the work as a supplement to other income, rather than a primary source of income. • Surveys of platform workers have found that many of them (up to 90%) desire more work. • The majority of the work in the gig economy is low waged, with crowdwork typically being paid less than offline work. • Surveys of workers find that the flexibility of the platform work is the central attractive quality.	
The Impact of AWS in the UK in 2020[70]	Public First	This study is based on a nationally representative survey of 2,001 UK businesses.	This study (conservatively) estimates that AWS is generating £8.7 billion in economic value for businesses across the UK, which is equivalent to 0.4% of GDP. It found that AWS is saving businesses money, earning them extra revenue and reducing their carbon emissions.	The main limitation of this study is being based on a business survey. Notwithstanding this, the underlying survey responses and data are provided, and

[70] *'The Impact of AWS in the UK in 2020'. Public Frist (2020) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations
			The study also finds that companies running on the cloud are nearly three times as likely to be growing over 5% a year than those who are not. 85% of AWS-using small businesses say that the use of cloud has made it easier to flex their IT (Information Technology) to meet their business needs, helping save costs. On average, AWS customers receive a return of £2 for every £1 they spend on AWS from higher revenue and reduced costs, with the top 10% of customers reporting a return of £10 or more. Over half of the world's 25 largest software-as-a-service (SaaS) companies use AWS, including Zoom, Slack and Atlassian. 67% of AWS-using businesses say that their business or operating model would not be possible without the cloud. 39 of the UK's 50 fastest-growing tech companies and 16 of the UK's 17 current unicorns, worth over £20 billion in total - including Babylon, Deliveroo, and Monzo - are using AWS. A 'unicorn' is a private company with a valuation of over $1 billion. There are currently around 400 unicorns globally.	thus allow additional analyses by DCMS and/or other entities.
AWS Economic Impact Study: AWS in Virginia[71]	AWS Economic Development	This report provides an overview of AWS investment in Virginia. It includes the construction and operation of the data centre, employment, workforce development, education and community engagement, and renewable energy. Estimates of economic impacts on the economy of Virginia are obtained by combining detailed AWS investment data, the U.S. Bureau of Economic Analysis (BEA) data for Virginia and input-output	From 2011 to 2020, AWS has invested $35 billion in data centres located in Northern Virginia. In 2020, AWS investment in the construction and operation of data centres contributed $1.3 billion in GDP and supported over 13,500 jobs. AWS is among the largest private-sector employers in the state, with over 8,800 full time, well-paying jobs in corporate offices and data centres across Virginia. Among other taxes, AWS paid over $220 million in business personal property taxes in 2020 in connection with its data centres located in Fairfax, Loudoun, and	This research relied upon detailed investment data which was provided by AWS. This is a significant limitation as we would not have access to this same data and therefore cannot replicate the methodology used.

[71] *'AWS Economic Impact Study: AWS in Virginia'. AWS Economic Development (2021) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations
		methodology (IMPLAN economic modelling software).	Prince William counties. This amounted to 20% of personal property tax revenues received by these counties in the 2020 fiscal year. AWS relies on the support of more than 100 Virginia businesses to build and operate its data centres, spending over $1.8 billion on purchasing goods and services from these vendors in 2020. This spending directly supports jobs in these businesses, and employment in associated sectors of the Virginia economy (5,500 FTE jobs in total). Companies in Virginia benefit from the proximity of fibre network, data centres and the pool of tech talent attracted to the area. AWS develops collaborative initiatives between education systems, governments, economic development organisations, and employers to create a variety of pathways to cloud careers in Virginia. This includes primary and secondary school districts, community colleges, and universities across the state that create certificates, two- and four-year degree programmes, or other credentials to help learners build skills aligned with careers in cloud computing. Amazon identifies the following direct, indirect and induced effects when measuring their economic impact in Virginia: • Direct effects – investments in construction and expenditures for operations. 4,100 on-site workers were directly employed. • Indirect effects – inter-industry and supply chain spending. 1,300 jobs were supported within the local supply chain and AWS spent over $1.8 billion on purchasing goods and services in 2020. • Induced effects – household income spending in the local economy. There were 2,600 induced jobs in the broader economy.	

Title	Author	Methodology	Key Findings	Limitations
Empowering the European business ecosystem – An impact study of businesses using Facebook apps and technologies[72]	Copenhagen Economics	This report was commissioned by the Facebook Company (now Meta) and investigates how firms use Facebook apps and technologies to support their businesses and the corresponding macroeconomic effects. Copenhagen Economics conducted a survey focussing on the role of social media (e.g. using Facebook apps and technologies) and its subsequent effects. Representatives from 7,720 businesses in 15 countries across the EU responded. Relying on national account classifications designed to be comparable globally, the survey questionnaire and the economic modelling was structured along 11 industry classifications. Respondents were spread across all industries and all sizes of businesses across the 15 EU countries. They use micro-level survey data of businesses' use of Facebook apps and technologies, as well as how much businesses credit Facebook apps and technologies in their sales, and inferred macro-level estimates based on best available national account data. The quantitative macro estimates measure gross value added (GVA), exports, and jobs created by businesses using Facebook apps and technologies.	The survey results suggest that digital technologies, like Facebook apps and technologies, facilitate business growth, trade and innovation. The key results of the report are as follows. • Digital technology reduces the cost of marketing – a study reported that 69% of SMEs found lower costs of marketing to be the main benefit of using digital tools and social media for business purposes and in 2017, nearly half of all EU enterprises used social media for advertising purposes. • Digital technology helps to target core customers – this increases the return on marketing expenditures (cost per thousand impressions). Some studies show that the cost of marketing through social media is more than 90% lower than traditional television marketing. • Digital technology helps firms gain access to new markets – the survey found that 7 in 10 businesses using Facebook apps are exporting to other countries, compared to 5 in 10 of companies not using Facebook apps. Revenue from international sales also differed for the two groups of companies at 19% versus 14%. Of those surveyed, 6 in 10 businesses using Facebook apps and technologies report them as helpful when entering new markets. • Digital technology enables SMEs to grow – the surveyed SMEs using Facebook apps and technologies report the following: (i) 47% find the apps helpful to start a new business; (ii) 59% report that the apps are important for growing their businesses; (iii) 58% find that apps are helpful in lowering their marketing costs; and (iv) 55% consider them instrumental in entering new geographical markets. • Digital technology gives the customer a voice and adds intelligence to the business innovation process	The limitation of this methodology is that it relies upon survey data which consisted of 7,720 businesses and the data is not publicly available. This methodology is focussed on the businesses using Facebook apps and technologies and the influence these tools have on their ability to generate sales. Therefore, they do not capture the indirect effects through supply chains, nor the induced effects through employee spending. This methodology additionally does not capture any displacement effects that may occur as businesses prefer to adopt new services, new technologies, and new ways of doing business.

72 '*Empowering the European business ecosystem – An impact study of businesses using Facebook apps and technologies*'. *Copenhagen Economics (2020) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations
			– 54% of companies using Facebook apps and technologies use them to communicate with customers, and 63% say Facebook apps and technologies are important in their efforts to improve customer service. 4 in 10 companies state that they use this feedback to improve their product offering, while 3 in 10 companies use it to improve how their business is organised. • Digital technology empowers business and job opportunities – it allows people from diverse social and economic backgrounds to become entrepreneurs and enter a global job market. • Quantifying the economic benefits – surveyed businesses across the 15 EU markets say that using Facebook apps and technologies helped them generate sales corresponding to an estimated €208 billion in economic activity in 2019. This translated into an estimated 3.1 million jobs. Facebook apps and technologies helped businesses generate international sales corresponding to €98 billion in exports in 2019. Of this total, €58 billion was within the EU and €40 billion outside of the EU.	
The economic contribution of Facebook data centres in Denmark, Ireland, and Sweden[73]	IHS Markit	Facebook commissioned IHS Markit to evaluate the economic contribution of Facebook's European data centres on their respective countries from 2011 to 2018. The study focussed on how Facebook stimulated economic contributions to the Danish, Irish and Swedish economies through its capital expenditures, operational expenses, and direct wages. Facebook supplied IHS Markit with detailed direct purchasing data for each of the European data centres for 2011-2018. The dataset included a description of the	**Sweden** Overall, Facebook's three European data centres have directly purchased €1.2 billion worth of goods and services from Swedish suppliers through the company's direct spending on construction, investment, and operational activities from 2011 through 2018. The top three industries that benefited the most from Facebook's data centre were construction, manufacturing and wholesale/retail trade: • During the construction peak of 2012, nearly 16,000 construction jobs per year were supported. The data centre stimulated a total of €431 million of sales activity which contributed €200 million to Swedish GDP. The annual salary for the construction	The limitation of this approach is that we do not have access to the detailed direct purchasing data for Big Tech companies and therefore are not able to replicate this methodology. Additionally, we do not have access to the employment data used for Big Tech companies (wages paid per location).

[73] *'The economic contribution of Facebook data centres in Denmark, Ireland, and Sweden'. IHS Markit (September 2019) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations
		vendor, its origination city, the transaction amount, and details on the types of purchases made. IHS Markit then classified each vendor to an industry based on 2-digit *International Standard Industrial Classification of All Economic Activities.* Facebook's purchasing activity was then aggregated by industry and country and this data was used to generate core inputs for its economic impact models. Facebook also provided data on the number of employees and total wages paid for each data centre location. IHS Markit used an enhanced input-output (I-O) modelling approach to determine Facebook's contributions to the respective economies. They constructed unlinked I-O models using the most recently available I-O data from the World I-O database (WIOD). The standard I-O modelling approach was further enhanced by incorporating the social account matrices for each country from the WIOD database to capture induced (labour income and wage-related) impacts.	jobs averaged €43, 526 which was 1.2 times higher than the national construction industry average for manual workers. • The manufacturing sector benefited due to the increased demand for machinery and equipment. Facebook's spending stimulated 254 jobs annually, with cumulative contributions of €557 million to sales, €198 million to GDP, and €84 million to labour income. • Facebook's spending stimulated €397 million of cumulative sales activity and supported 306 jobs per year in the wholesale and retail trade sector. Construction firms hired by Facebook spent approximately €54 million in the wholesale trade sector in 2011-2018. This means that for every €100 Facebook directly spent on construction, €14 was re-spent by construction firms with Swedish wholesalers. **Ireland** Facebook's direct expenditures stimulated a total of €599 million of Irish GDP and €358 million of labour income from 2015 through 2018. In 2015–2018, Facebook's total spending of €912 million led to an additional €628 million of indirect and induced sales. The total of €1.5 billion indicates a multiplier of 1.7 relative to Facebook's direct spending. Construction and wholesale trade experienced the most economic benefit from Facebook's spending activity in Ireland: • Facebook spending stimulated a total of €721 million sales activity and €188 million of GDP in the construction sector. This supported an annual average of 548 jobs paying an average salary more than double the national average in the construction sector. In 2017, Facebook-related construction activity accounted for 2% of all sales in the Irish construction sector.	

Title	Author	Methodology	Key Findings	Limitations
			• In the wholesale and retail trade sector, Facebook spending drove €210 million of sales activity, €79 million of GDP, and €40 million of labour income. For every €100 Facebook spent in Ireland, approximately €19 of sales activity occurred in the wholesale trade sector. **Denmark** From 2016-2018, Facebook spent €554 million on construction services from Danish businesses. Danish vendors benefitted from a total of €17.3 million in wholesale and equipment sales. An additional €19.6 million in goods and services, such as legal and managerial services, were purchased from Danish vendors for the Facebook campus. Of the total €599 million Facebook directly spent for Danish goods and services, Facebook stimulated €1.2 billion of combined direct, indirect and induced sales activity in Denmark in 2016-2018, a multiplier of about 2.0. In 2016-2018, Facebook stimulated an average of €172 million of GDP per year. At the same time, Facebook drove an annual average of €105 million of labour income and supported more than 1,800 jobs per year. Jobs stimulated by Facebook spending earned wages of €56,923 on average – 2.3 times higher than the 2017 national average.	
Like it or not? The impact of online platforms on the productivity of incumbent service providers[74]	OECD Working Paper	The OECD assess if the development of online platforms affects the productivity of service firms. They build a proxy measure of platform use across four industries (hotels, restaurants, taxis and retail trade) and ten OECD countries using internet search data from Google Trends, which is then linked to firm-level data on productivity in their industries.	The main finding is that platform development supports the productivity of the average incumbent service firm, and also stimulates labour reallocation towards more productive firms in these industries. Over 2011-2017, the estimated multifactor productivity gain for the average service provider in the industries considered was about 2.5% in sample countries with relatively high platform development. However, the effect depends on the platform type. "Aggregator" platforms that connect incumbent service providers to consumers tend to push	The main limitation of this methodology is that the total value of search would not be able to be quantified as there are infinite products/services/businesses one could search that could translate into increased revenue or profit for the searched entity.

[74] *'Like it or not? The impact of online platforms on the productivity of incumbent service providers'. OECD Working Paper (May 2019) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations
		The first step of the methodology was to build a proxy indicator of the development of online platforms across countries, industries, and years, based on data from Google Trends. This indicator was matched (at a very detailed industry level) to firm-level data on the productivity of existing service firms derived from the ORBIS database. This was then used to test, with two different regression models, how platform development affects (i) the productivity of the average incumbent service firm; and (ii) the reallocation of resources towards the most productive of them.	up the productivity of incumbents, while more disruptive platforms that enable new types of providers to compete with them (e.g. ride hailing) have on average no significant effect on it. It is also shown that different platform types have different effects on the profits, mark-ups, employment, and wages of incumbent service firms. The final conclusion is that the productivity gains from platforms are lower when a platform is persistently dominant on its market, suggesting that the contestability of platform markets should be promoted.	
The Economic Impact of Huawei in the UK[75]	Oxford Economics	This report provides an assessment of the economic contribution Huawei makes to the UK. An economic impact assessment is used to estimate the contribution to annual GDP, number of jobs supported, and tax revenues generated. The direct effects were estimated from information provided by Huawei. To estimate the indirect and induced impacts, the report utilised an input-output model of the UK economy, using the latest official UK input-output table published by the ONS. The total value of the procurement from the UK suppliers by Huawei's UK operations and the company's headquarters in China was provided by Huawei. The induced impact was modelled using estimates of employee spending power –	The key findings from the study were as follows: • In February 2018, Huawei made a further five-year commitment to spend another £3 billion with firms based in the UK between 2018 and 2022. • Huawei's GVA contributed to the UK GDP was £1.7 billion in 2018 (£287 million in direct impacts; £806 million in indirect impacts; and £598 million in induced impacts). • Out of the £1.7 billion UK contribution, 24% occurred in the South East of England where Huawei's headquarter is located; 14% occurred in London; and 9% occurred in the East of England. • Huawei supported 26,200 jobs and generated tax receipts of nearly half a billion pounds in 2018. • In 2018, each Huawei employee made an average contribution to the UK's GDP of £183,000, which was 3.5 times more productive than the average for the whole UK economy. Huawei is also boosting the UK's productive potential (catalytic impacts). They invested £112 million in R&D in 2018 and collaborated with 35 universities and research	In this approach the effects are estimated from information provided by Huawei. We do not have access to equivalent information from Big Tech companies and therefore, this approach is not replicable.

75 'The Economic Impact of Huawei in the UK'. Oxford Economics (May 2019) [Accessed 9 February 2022].

Title	Author	Methodology	Key Findings	Limitations
		the sector wage bill net of employees' tax and national insurance – as the starting point. Tax contributions were estimated taking into account sales, value-added and employment by industrial sector, and applying various appropriate tax-to-expenditure and tax-to-income ratios, sourced from HM Revenue and Customs, and other official datasets.	institutes. They invested £1.3 million in training their own staff and sent 50 STEM undergraduates from leading UK universities to China.	
Economic and social impacts of Google Cloud[76]	Deloitte	This study analyses the Economic and social impacts of Google Cloud across 14 different markets. Key findings are based on Deloitte's Public Cloud Business Users Survey, which was conducted with 1,488 IT decision makers using cloud services from any provider. Findings were also based on a further Google Cloud business case studies survey, conducted with 80 IT decision makers among some of the most successful Google Cloud users. Both surveys include IT decision makers from SMEs and large businesses.	The study finds that there is an average net return on investment of up to $2.50 for every $1 invested in cloud services, with even higher returns possible. More than 300,000 businesses in the countries covered in this study could not operate at all without Cloud, including start-ups with new business models enabled by Cloud. On average, 5% of users' revenue is enabled by cloud services. On average, capex is reduced by 19% due to cloud services. Companies reported average time savings of 2 to 3 hours per employee per week. Businesses also use Google Cloud services in ways that have a variety of social impacts, such as helping to improve patient outcomes in healthcare and educational results for students.	The study relies upon data from Deloitte's Public Cloud Business Users Survey, which again is not replicable. The impacts from the use of public cloud services and Google Cloud are estimated relative to a scenario where only on-premises solutions are available. Therefore, this does not measure the impact within a scenario where other providers are present and therefore doesn't reflect the true values of the impacts.
Connecting benefits: How social networking supports Australian small businesses and communities[77]	PwC Australia	This report is prepared by PwC (Australia) to explore the economic and social benefits of using Facebook from the perspective of small and medium sized	The study finds that there are five core reasons SMBs use social networking platforms, namely to: 1) advertise to potential customers; 2) share information on products and events;	The main limitation is that this study only considers the benefits to small businesses.

[76] *'Economic and social impacts of Google Cloud'. Deloitte (September 2018) [Accessed 9 February 2022].*
[77] *'Connecting benefits: How social networking supports Australian small businesses and communities'. PwC Australia (August 2018) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations
		businesses (SMBs) and local communities in Australia. PwC used a framework for assessing these benefits. The analysis was split between commercial and non-commercial use and then, within each of these, the activities were identified and then the outcomes were explored in both qualitative and quantitative terms. The quantitative terms included figures relating the employment, user numbers, donations made via Facebook, and number of people using Facebook safety check in times of need.	3) access new markets (domestically or internationally); 4) drive traffic to their own website; and 5) understand and communicate with their customers. Social networking platforms help to remove barriers to help businesses find relevant consumers (locally and internationally) allowing them to grow organically and employ more people: • 57% of SMBs with a Facebook Page have hired more staff as a result of the growth they have experienced aided by Facebook. • Approximately $16.8 billion in additional economic value (GVA) was generated by these additional employees in 2017. • Australians spent an estimated $2.1 billion in 2017 on purchases from a business of any size after seeing an advert or promotion on Facebook. • 56% of Facebook users in regional Australia have purchased something from another user through Facebook, compared to 43% in metropolitan Australia. • An estimated 8.2 million Australians have purchased from, or visited, an SMB after seeing content relevant to the business on Facebook. • 35% of Australian SMBs exported to foreign markets in 2017, 80% of which had a Facebook Page. Social media helps to connect individuals to build resilient communities: • 83% of Australian Facebook users surveyed are a member of at least one Facebook Group (more in regional areas compared to metropolitan areas). • 55% of Australians who use Facebook Groups have made new friends directly through their use of these groups. • 23% of Australian Facebook users have donated to a cause they care about through a link they saw on	

Title	Author	Methodology	Key Findings	Limitations
			Facebook; this led to approximately $475 million donated by Australians in 2017.	
Fostering Business and Organizational Transformation to Generate Business Value with Amazon Web Services[78]	IDC	IDC interviewed 27 organisations around the world running various enterprise workloads on Amazon Web Services (AWS) to understand the impact of AWS on their information technology (IT) and business operations.	It was revealed that participants in the study are leveraging AWS to lower the cost of providing IT services and it is changing the way they deliver IT services. These organisations are using AWS to help transform business operations to better compete and address market demand. AWS customers are achieving strong value at an average of $20.97 million per year per organisation over five years. The benefits were mainly achieved by: • Creating more cost-effective IT environments by optimising compute, storage, and database costs or moving away from running own IT infrastructures. IDC calculated that surveyed organisations will spend 31% less on AWS fees than running comparable infrastructure. • Shifting IT staff focus to differentiated work and strategic business initiatives, including substantial gains in application developer productivity. It is projected that IT infrastructure teams will be on average 62% more efficient and application developers will be 25% more productive with AWS. • Offering reliable and high-performing applications that lead to operational efficiencies in the form of higher usage productivity and fewer business disruptions. There is, on average, 94% less productive time lost to these outages with AWS. • Instilling IT and business operations with agility required to deliver cost effective IT resources on an on-demand basis to address business opportunities as they arise. The organisations were able to deliver almost three times more new application features due to AWS. This helped them to win more business and increase revenue.	This research is based on 27 interviews with different organisations around the world running various enterprise workloads on AWS. Again, this is not replicable.

[78] *'Fostering Business and Organizational Transformation to Generate Business Value with Amazon Web Services'. IDC (February 2018) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations
Facebook's global economic impact[79]	Deloitte	The purpose of the report is to estimate Facebook's impact on the economy. The study uses economic and econometric modelling to analyse the effects Facebook enables for third party businesses that use the platform. The study analyses Facebook's broad economic impact (value added – that is, the value added by an activity at each stage of production; analogous to GDP contribution) through: • **marketing effects** – the economic impact of Facebook for businesses that use it as a marketing platform to connect with consumers and build brand value; • **platform effects** – the impact on the developer app economy; and • **connectivity effects** – the impact created through the sale of mobile devices and internet connectivity. Economic impact is estimated across four regions: Europe, Middle East and Africa (EMEA); Asia-Pacific (APAC), North America, and Central and South America. Estimates are based on Facebook data for the twelve-month period between 1 October 2013 – 1 October 2014. To assess the economic impact, the analysis: • estimates the third party gross revenue supported by Facebook; and • converts this gross revenue supported into estimates of economic	Facebook connects more than 1.35bn people with their friends and family around the world. This study finds that Facebook enabled $227bn of economic impact and 4.5m jobs globally in 2014. These effects accrue to third parties that operate in Facebook's ecosystem. Facebook's tools allow businesses to reach new and existing customers through pages and advertising. This helps businesses grow their sales, and eventually employ more people. Marketing effects, worth approximately $148 billion, form the largest share of the economic impact facilitated by Facebook through third parties. Facebook developer tools, which power and enhance third party apps, enabled an estimated $29 billion of economic impact. The purchases of mobile devices and connectivity services motivated by Facebook contributed an estimated $50 billion of economic impact. When also considering the broader economic impacts, the effect is much larger. In 2014, Facebook enabled a global economic impact of $227 billion while only having an asset base of $8 billion. Facebook facilitates economic activity as it: • allows new and traditional businesses to reach customers locally, nationally and globally; • reduces barriers to marketing, by helping businesses raise awareness of their brands and find the people most likely to be interested in their products and services; • supports entrepreneurship, by providing a way for businesses to promote their activities; • enables new ecosystems, such as the app economy, that stimulate innovation and generate jobs; and	The estimates are based on Facebook data which is not publicly available. Therefore, this methodology is not replicable.

79 *'Facebook's global economic impact: A report for Facebook'. Deloitte (January 2015) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations
		impact and jobs enabled by applying multipliers to capture the *ripple* effects (and excluding cannibalised activity). The report estimates economic impact and jobs enabled as follows: • it first estimates gross revenue supported by Facebook, using different approaches and metrics across effects; • it then estimates economic impact enabled: - as the sum of direct, indirect and induced effects. The induced effect is estimated by multiplying gross revenue by: (i) an output multiplier to reflect how the initial spending *ripples* through the economy; and (ii) a value added ratio to convert output to economic impact; and - by applying particular adjustments to capture new economic value Facebook enabled (excluding value displaced/cannibalised) • In the last step, jobs are estimated by calculating the number of jobs required to produce the economic impact estimated. This is calculated through metrics of economic impact per employee.	• increases demand for mobile devices and internet services that carry positive spillovers to other parts of the economy. The Facebook enabled economic impacts of marketing effects totalled **$148bn** and were split as follows: • EMEA: $36bn; • APAC: $16bn; • South America: $15bn; and • North America: $81bn. The Facebook enabled economic impacts of platform effects totalled **$29bn** and were split as follows: • EMEA: $13bn; • APAC: $7bn; • South America: $1bn; and • North America: $9bn. The Facebook enabled economic impacts of connectivity effects totalled **$50bn** and were split as follows: • EMEA: $18bn; • APAC: $13bn; • South America: $5bn; and • North America: $14bn.	
Measuring Facebook's economic impact in Europe[80]	Deloitte	The study finds that Facebook creates economic impact – that is, Facebook's total contribution to the economic output	This study estimates Facebook's economic impact across the 27 Member States of the European and Switzerland (EU27*) in 2011.	The estimation of the narrow impacts follows a traditional economic impact assessment

[80] *'Measuring Facebook's economic impact in Europe'. Deloitte (March 2012) [Accessed 9 February 2022].*

Title	Author	Methodology	Key Findings	Limitations
		of Europe measured in terms of GVA and jobs created – through both (i) narrow effects, caused by its day-to-day activities within Europe; and (ii) broad effects, accrued to third parties as a result of the Facebook ecosystem. It defines Facebook's **narrow** economic impacts as the sum of three economic effects: • **direct effect**: spending by Facebook on its employee wages, on paying taxes, and the profit generated from its activities in 2011; • **indirect effect:** value created in associated supply-chain industries resulting from the supply of inputs to Facebook; and • **induced effect**: value created from spending in the overall economy as a result of direct and indirect effects from the generated activity of Facebook and associated industries. Facebook enables **broader** economic activity across a series of economic agents, in particular, it is found to have significant impacts upon: • **business participation**: enabling businesses to raise awareness of their products and therefore generating new sales through Facebook business pages; • **platform effects**: developing a focused specific app community and enabling more frequent and larger social activities among users; and • **technology sales**: boosting the demand for technology through	Their central estimate of gross revenue enabled by the activities of Facebook is €32bn. This translates into an economic impact of €15.3bn and supports 232,000 jobs. Narrow impacts Facebook has economic impact in Europe through its physical presence, its purchases of intermediate inputs from suppliers and induced consumer spending from staff remuneration. This narrow economic impact amounts to €214m and directly supports ca. 3,200 jobs in the EU27*. Broader impacts • **Business participation**: Facebook allows firms to promote their brand, raise awareness and generate new sales through the creation of pages and advertising. This broader impact amounts to €7.3bn and 111,000 jobs across the EU27*. • **Platform impacts**: Facebook provides a platform on which applications can run and facilitates easier socialisation between users. These broader impacts amount to €2.2bn and 32,900 jobs across the EU27*. • **Technology sales**: Facebook creates demand for, and therefore generates value through, the sale of devices and broadband to access its services. This broader economic impact amounts to €5.5bn and supports over 85,300 jobs across the EU27*. UK specific impacts Over three-quarters of the narrow economic contribution of Facebook comes from Ireland, as the company has a significant operations centre located there, with the UK accounting for a further 15% of this impact due to the around 100 employees being located there. Deloitte estimates that the UK accounts for €2.6bn of economic impact, split as: (i) narrow impacts of less than €0.1bn; (ii) business participation impacts of €1.4bn;	framework. Therefore, provided the underlying data is robust and the modelling has been undertaken accurately, these should provide a good indication of the narrow economic impacts. The estimation of the broader impacts – by definition – is more assumptions-based and also uses a mixture of traditional impact assessment methodologies, as well as other estimation techniques. There is a risk of double counting of impacts, in particular the impacts related to technology sales should already be captured in the narrow, induced effects.

Title	Author	Methodology	Key Findings	Limitations
		increased sales of devices and broadband connections. To estimate the narrow effects, Deloitte follows an input-output methodology and uses publicly available data (Eurostat), as well as Facebook's own data. To estimate the broader effects, Deloitte applied various methods. • **Business participation***:* They estimated gross revenue advertisers derive from their Facebook advertising spend and then used input-output modelling to derive the impacts. They estimated the value of raising business awareness by using estimates of the advertising revenue per thousand impressions. • **Platform impacts**: This was an adaptation of the University of Maryland's methodology to quantify the economic impact of Facebook apps in the USA. • **Technology sales**: The total stock of devices to access Facebook was estimated and an assumption on additionality was then applied. A similar method was used for broadband consumption.	(iii)platform effects of €0.6bn; and (iv) technology sales of €0.7bn.	

Source: Economic Insight review.

WE MAKE ECONOMICS RELEVANT

Economic Insight Limited

125 Old Broad Street
London
EC2N 1AR
+44 207 100 3746
www.economic-insight.com