IHS TECHNOLOGY

Paving the way: how online advertising enables the digital economy of the future

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Executive Summary

Online advertising is a key driver of the European digital economy that promotes business and economic growth and paves the way for broader digital sector innovation. This report illustrates this integral contribution of online advertising. Highlights are:

- €46 billion were invested in online advertising in Europe in 2014. Out of this sum, publishers active Europe generated revenues €30.7 billion from online advertising, or 30.4% of all advertising revenue.
- In terms of gross value added (GVA), a standard measure of the contribution to the overall economy similar to GDP, €22 billion are directly attributable to online advertising in the EU-28. Advertising includes a multiplier effect throughout the economy as Euros flow through supply chains (indirect effects) and as companies and their supplies hire and pay employees (induced effects). Considering these effects, the contribution of online advertising increases up to €113 billion.
- Yet approaches which locate economic value only within the immediate value chain are underestimating the much broader economic contribution of advertising. Firms advertise because doing so leads to increased sales. These sales lead to economic activities outside of the advertising value chain. Incorporating these ripple effects increases the value of online advertising to 473 billion, or 5% of the overall economy (expressed in GVA) in the EU-28.
- 0.9 million European jobs (or 0.4% of the EU-28 total) are directly supported by online advertising; this increases to 1.4m jobs if indirect and induced effects are considered, and to 5.4 million, or 2.5% of the EU-28 workforce, if broader ripple effects are taken into account.
- Online advertising is an integral funding model for high-growth digital sectors in Europe. In 2014, 54% of all online video revenues in the EU-28 were generated by advertising. For the publishing industry, advertising is by far the most important source for funding journalistic content with 75% of all their online revenues coming from advertising. Similarly, the buoyant mobile content market depends on advertising. In 2015, paid-for app revenues have been replaced by advertising as the top revenue source.
- Online advertising is an incubator for digital skills that rejuvenate a plethora of different industries. As advertising becomes increasingly data-driven and technology-centric, the sector is at the forefront of nurturing and hiring talent that possesses the skills to transform and future-proof other industries.

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1. Introduction

Over the last ten years, online advertising in Europe has transformed from a nascent industry with a marginal share of the advertising market (1999: 0.5%) to the second largest advertising medium in Europe attracting 30.4% of all advertising revenue in 2014. With publisher revenues at €30.7bn in 2014, it is larger than all types of advertising except TV, which it is expected to surpass by the end of 2015.

Figure 1: Online advertising revenue evolution over time, 2006-2015. [Source: IAB Europe, IHS Technology]

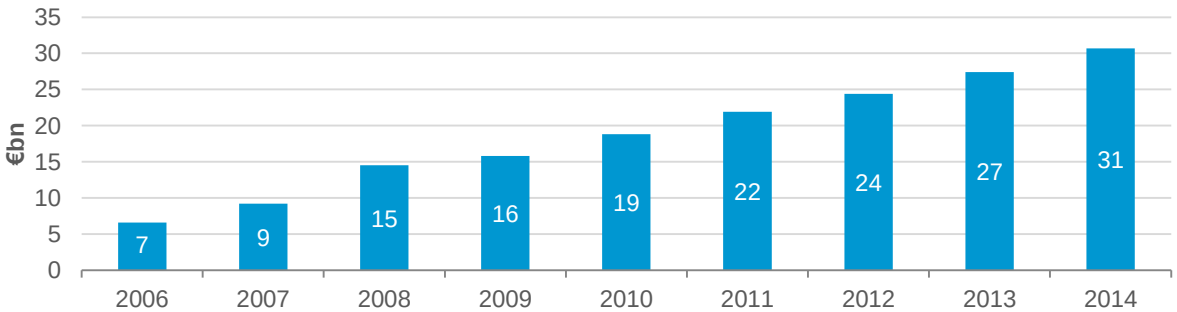
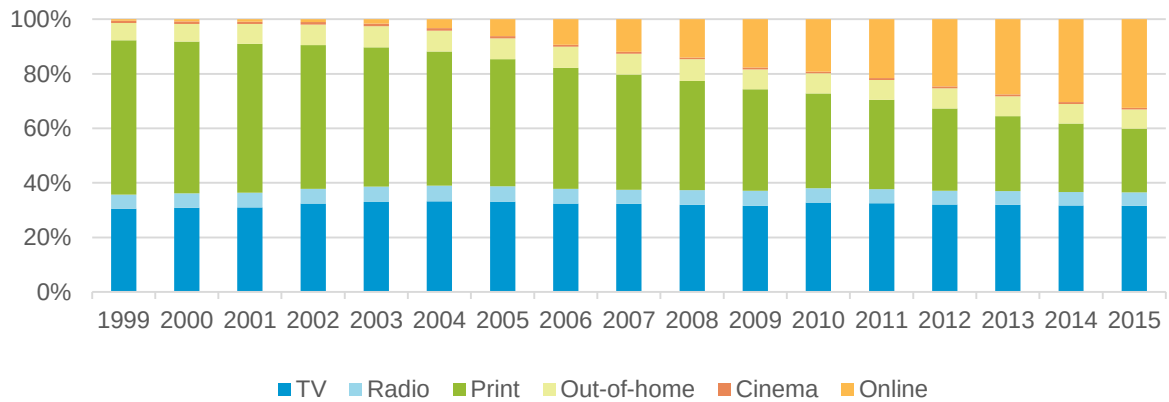


Figure 2: European advertising revenue share by medium [Source: IHS Technology]



Advertising, no matter whether online or in traditional media channels, contributes to the economy in a variety of ways. These include the contribution to employment and to economic output, but also other, less direct impacts, such as supporting the development of the wider media, content, and online industries.

The European Commission has embarked recently on a number of initiatives aimed at deepening the development of a Digital Single Market (DSM), one of the top 10 overall priorities for the Juncker Commission. While this covers a wide range of issues and industries – from audiovisual services to e-commerce and online platforms – a key ambition throughout is to create the conditions necessary for the development of European global leaders in the digital economy.

Advertising has a key role to play in making this ambition a reality, as the technologies and skills being developed there can also drive value in a wide variety of industries. Importantly, Europe has already shown that it can produce world-leading talent in this space. The challenge for policymakers thus is to create the conditions for this success to become widespread, and then for the gains to spread across the economy.

Over the next few pages, this paper sets out these arguments in more detail. We start by examining advertising's role in the economy, first in a broader sense (section 2) and then for the specific case of online advertising (section 3). In section 4 we narrow our view further, looking at some indirect but strategically critical ways in which online advertising can help develop the wider European digital economy. Section 7 summarises our key arguments.

2. Advertising and the economy

2.1 How advertising creates value

The ways in which advertising impacts on the economy fall into three groups:

- **advertising-related activities** – that is, through the jobs and income produced by the advertising and publishing industries and their suppliers;
- **audience-related effects** – that is, by stimulating demand for advertisers' products; and
- **spill-over effects** – other, less tangible mechanisms that can lead to other sectors of the economy innovating or becoming more productive.

We discuss these types of effects separately below.

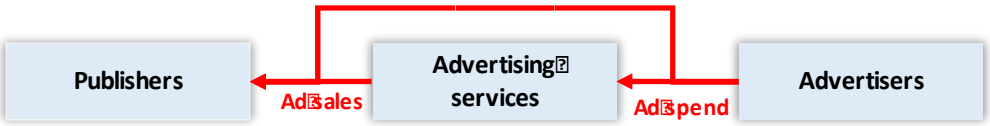
Advertising-related activities

At a direct level, advertising involves activities by three types of firms:

- **Advertisers**, who have demand for audiences to communicate a marketing message with the purpose of generating awareness and/or sales for their products.
- **Publishers**, or media outlets, who serve audiences by providing them with content, and serve advertisers by supplying them with audiences. In this report, 'publisher' includes any type of company where audience attention and content meet.
- **Advertising services** providers, which connect advertiser demand with publishers' audience supply. These are firms that create, buy, sell, plan, and manage advertising content and delivery. Intermediaries can work on behalf of advertisers (the demand side), publishers (the supply side), or both. Intermediaries include advertising creative agencies, planning and buying agencies and technology and data vendors.

The money spent by advertisers to promote their products is commonly referred to as "**ad spend**", and what publishers receive (whether via intermediaries or directly from advertisers) is commonly called "**ad sales**" or "**ad revenue**". The situation is as depicted in Figure 3:

Figure 3: Types of agents and money flows in directly involved in the immediate advertising value chain



The economic impact of advertising is not limited to firms in the immediate advertising value chain above (or what economists call "**direct effects**"), as they also involve these firms' suppliers, their suppliers' suppliers, and so on ("**indirect effects**"). For example, an advertising agency might hire a production company to shoot a TV commercial, and the production company might in turn hire filming equipment from a specialist supplier. Moreover, all of these activities support the jobs of employees throughout this extended advertising ecosystem, who in turn spend money as consumers - thereby triggering further economic activity ("**induced effects**"). All of this activity can be said to be supported by advertising and as such can be seen as part of its contribution to the economy.[i]

The economic activity associated to any of these players can be measured in terms of turnover, jobs, profits, or other metrics. Because money is used and reused across the supply chain as firms rely on each other for part of their activities, it is generally not meaningful to add up the turnover of different firms across the supply chain as doing so would involve over-counting.[ii] Instead, economists usually employ **gross value added** (GVA). This metric denotes a firm's turnover minus what it pays its suppliers, which *can* be added up and whose total sum across the economy is roughly equivalent to the economy's gross domestic product or GDP (GDP is equivalent to the sum of all industries' GVA plus taxes minus subsidies).

Audience-related effects

The effects discussed until now are simply the consequences of an industry serving its customers and dealing with its suppliers; similar observations would apply to any industry. As such, they are essentially unrelated to the nature of advertising, its effects on its audiences, and any value that this effect might create for advertisers.

But firms (e.g. a cosmetics brand) advertise because doing so leads to increased sales – either directly or indirectly through building positive sentiment and share of voice around its products. These sales lead to economic activities (e.g. the production and distribution of cosmetics, which involves a complex supply chain involving jobs, value added, etc.) which are unrelated to the advertising-related activities described above. This suggests that approaches which locate economic value only within the immediate value chain are underestimating the broader economic contribution of advertising.

However, evidence and interpretation of these wider audience-related effects is not straightforward. Even if we accept that advertising creates value for the firms that advertise by stimulating demand for their products, it does not simply follow that advertising contributes to overall economic growth. An observed correlation between advertising expenditure and GDP is not by itself evidence of cause and effect (as it could simply mean

that when the economy grows firms advertise more); and if advertising only resulted in demand for advertisers' brands increasing at the expense of others' (i.e. a shift in market shares), then its contribution to the economy might be limited to the 'advertising-related activities' discussed above.

But if advertising does lead to increased sales overall, or to increased innovation or productivity stemming from intensified competition, then this could mean a significant impact on GDP. And, if we consider that (for reasons analogous to those given above for the case of advertising-related activities) this would benefit not just those firms that advertise but also their suppliers (e.g. chemical manufacturers), their suppliers and their employees, we can expect this effect to be substantial.

Whether advertising leads to economic growth through its effect on audiences is a matter of debate[iii]; this has led some studies on the impact of advertising to only consider advertising-related economic activities of the type we discussed earlier.[iv] While we acknowledge this, we note that several studies have found evidence in support of the view that advertising leads to economic growth far in excess of what might be attributed to what we have called advertising-related activities. We list some of these in Box 1 in section 2.2.

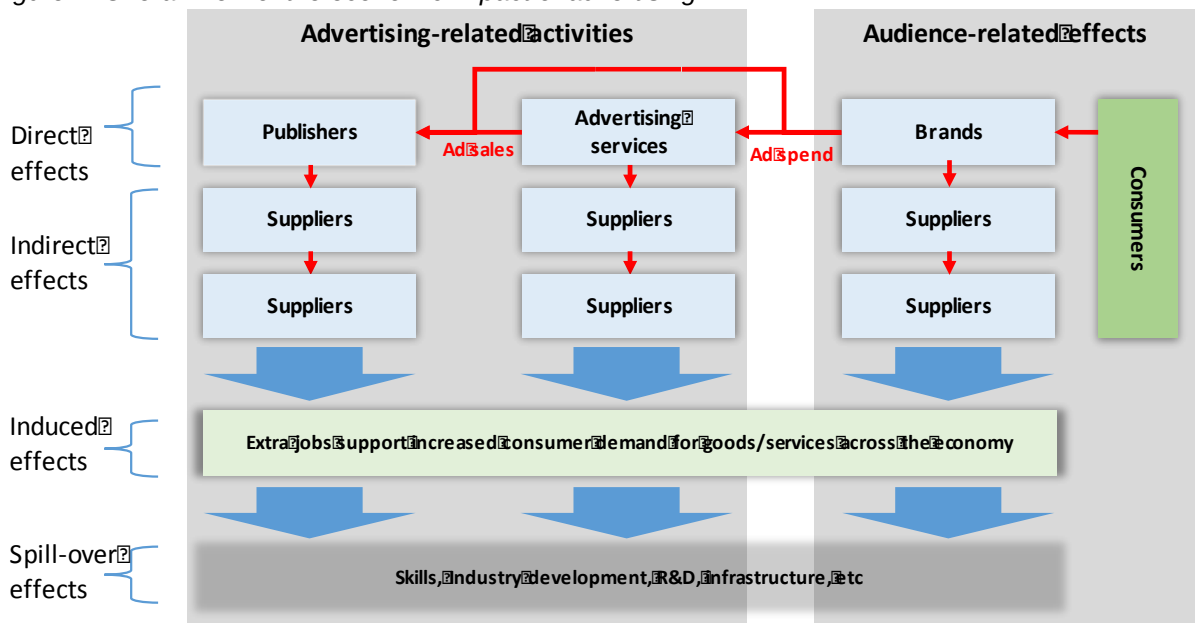
Spill-over effects

Advertising also has other less directly measurable, but nonetheless highly significant, impacts on the economy. By serving as a key source of funds for both the media and digital sectors, advertising underpins the development of industries that are economically important in their own right, and which, particularly in the case of the digital economy, in turn play a strong role in driving value creation across the economy. Moreover, the skills developed within the advertising industry are highly relevant elsewhere in the economy. We return to these considerations for the case of the digital economy in section 4.

Mapping the advertising sector

We have described the role played by advertising in the economy, distinguishing between advertising-related activities and audience-related effects, as well as between direct and other effects. For future reference our discussion is summarised in Figure 4 below:

Figure 4: Overall view of the economic impact of advertising



2.2 How big is it? The size of advertising in Europe

In this section we provide estimates of the size of advertising in Europe. At the simplest level, we can consider some of the key available measures of economic activity. Official European statistics include an industry category (labelled 'advertising') that broadly corresponds to our concept of the 'advertising services' as used in Figure 4 above (specifically, it refers to advertising agencies and sales houses[v]).Under this definition, according to Eurostat data in 2013 the European advertising services industry accounted for around 0.9m jobs (or around 0.4% all EU employment). In terms of economic value, according to Eurostat by 2012 the industry accounted for around €43 billion in GVA (or around 0.4% of of EU GVA).

However, as we saw earlier, advertising services account for only a part of the impact that advertising has on the economy. Although we are not aware of existing EU-level estimates of these effects, relevant studies have been published for other markets (notably the UK and the USA), from which we can make indicative extrapolations for the EU case. These studies and their key points are summarized in Box 1 below:

Box 1: Selected literature on impacts of advertising

The following studies consider advertising-related activities:

- A 2011 study by the Work Foundation[vi] set out to estimate the economic impact of advertising in in the UK economy. As part of this, it used a multiplier of 2.0 for the link between (marginal) GVA in the advertising industry[vii] and net GVA contribution to the economy.
- A 2012 study by Deloitte[viii] set out to assess the impact of advertising in the UK in terms of a number of metrics. As part of this, and drawing on previously published government studies, Deloitte estimated the number of jobs involved in advertising across brands, the ad industry and publishers. It also considered the jobs involved through direct, indirect and induced effects, for which it calculated multipliers (of the order of around 1.6) linking direct and overall jobs effects.
- A 2005 study by Cambridge Economics[ix] estimated the economic impact of the 'Screen Industries' in the UK. As part of this, the authors produced estimates for the 'multipliers' linking an increase in ad sales and the resulting GVA impact across direct, indirect and induced effects. For ad spend incurred in London, it found that this multiplier was 2.1 (for other UK regions it was slightly smaller).

Additionally, the following studies consider advertising's overall impact on the economy, including (explicitly or implicitly) audience-related effects:

- A 2013 report by IHS Global Insight set out to assess the economic impact of advertising expenditures in the United States.[x] As part of this, IHS estimated the impact of ad spend on job creation linked to increased consumer demand for products, considering both direct effects (i.e. jobs at brands) as well as indirect effects (jobs at brands' suppliers) and induced effects (linked to these jobs in turn increasing demand across the economy). IHS estimated that the overall effect combining all these effects (as well as advertising-related activities) of an additional US$ 1m ad spend is 81 jobs, the vast majority of which are linked to audience-side effects (for example, in terms of turnover, IHS estimate that the impact on advertisers is 8.8 times larger than the combined impact on ad agencies and publishers).
- The 2012 Deloitte study mentioned above involved an econometric regression of GDP and advertising expenditure in seventeen countries over a fourteen-year period, using statistical techniques intended to isolate the causal effects of advertising on GDP. It concluded that a sustained 1% increase in advertising spend leads to an increase in GDP of 0.07% within one year and 0.6% within ten years.
- A 2010 study by McKinsey[xi] used econometric analysis to investigate the link between advertising expenditure and GDP in G-20 countries. It concluded that over 2002-2017 advertising supported on average 15.7% of GDP *growth* in these countries.

Our EU-wide estimates in Figure 5 below rely on the figures quoted above.

We have extrapolated the findings in these studies to produce indicative estimates of advertising's economic footprint in terms value added and jobs using four different, increasingly broad definitions of scope:

(a) **Direct footprint of advertising services**: GVA and jobs data as reported by Eurostat for the 'advertising' industry in official statistics (corresponding to advertising services in our definition)

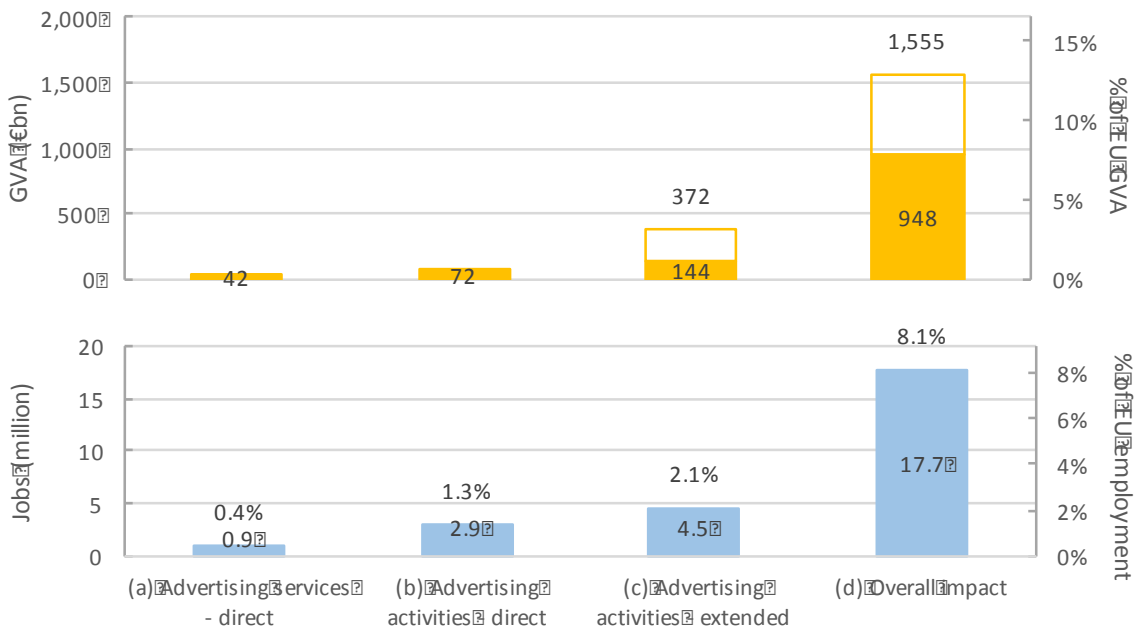
(b) **Direct footprint of advertising related activities**: as above, plus jobs and value added for advertising-funded publishers (for advertisers that are only partly ad-funded, only a corresponding proportion of jobs and value added is taken), and advertising-related staff within advertisers (e.g. within marketing departments)

(c) **Extended footprint of advertising-related activities**: as per (b) above, but also considering the corresponding indirect and induced effects, in the sense discussed in section 2.1

(d) **Overall economic impact**: including all of the above as well as audience-related effects.

The results are shown in Figure 5, where it should be stressed that our estimations are subject not only to any potential weaknesses in the studies listed above (in particular, the existence of audience-related effects is not uncontested in the literature) but also to multiple assumptions involved in our extrapolation process (whose details are discussed in section 7. Accordingly, the figures shown here are intended as only indicative, with emphasis on relative sizes and orders of magnitude rather than exact numbers.

Figure 5: Estimated 2013 Contribution of advertising to EU employment and GVA advertising through direct, indirect, induced and audience-related effects. GVA data for 2013 has been estimated based on available 2013 data. 'Empty boxes' denote high and low estimates depending on the sources and methodologies used. [Source: IHS Technology estimates based on data and estimates from IHS Global Insight, IHS Technology, Eurostat, Deloitte, Cambridge Economics and Work Foundation]



It should be noted from these figures that the audience-related effects are several times larger than those attributable only to industry effects (in both cases, around twenty times larger than the direct, narrow effects). Intuitively, this means that when considering the

impact of advertising on the economy, by far the largest impact is related to the effects that advertising has on audiences (and the effects that in turn this has on brands and their suppliers), so that all the jobs and profits created within the advertising and publishing industries (and their suppliers) pales in comparison. However, we stress that the existence and magnitude of audience-related effects are less firmly established than the effects linked to advertising activities, and therefore the corresponding effects should be taken with a degree of conditionality (accordingly, the third and fourth bars in the GVA figures above are shown in a different pattern).

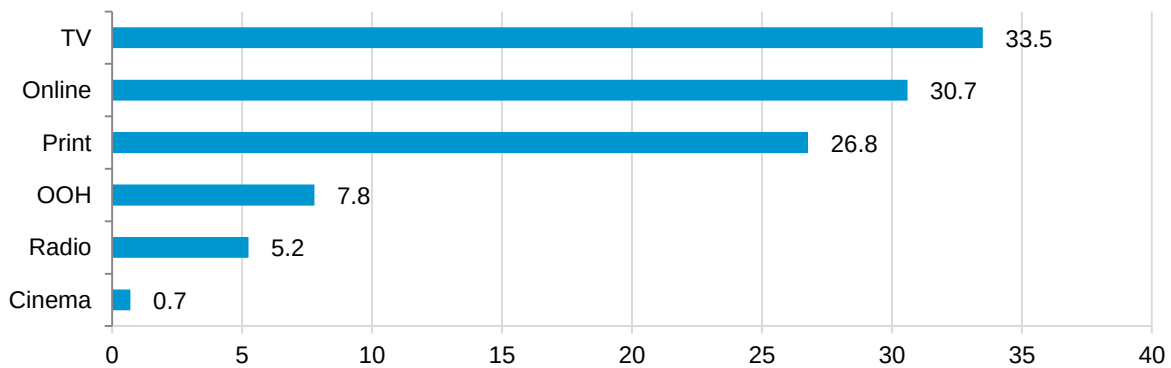
Finally, we note that of the four columns in in Figure 5, column (a) is relatively less meaningful in the context of the economic footprint of advertising, as it restricts our view to advertising services (i.e. intermediaries) rather than considering all persons working in advertising. Because of this, when in the next section we turn to online advertising, we will only consider measures of impact analogous to columns (b)-(d) above.

3. Online advertising

3.1 Introducing online advertising

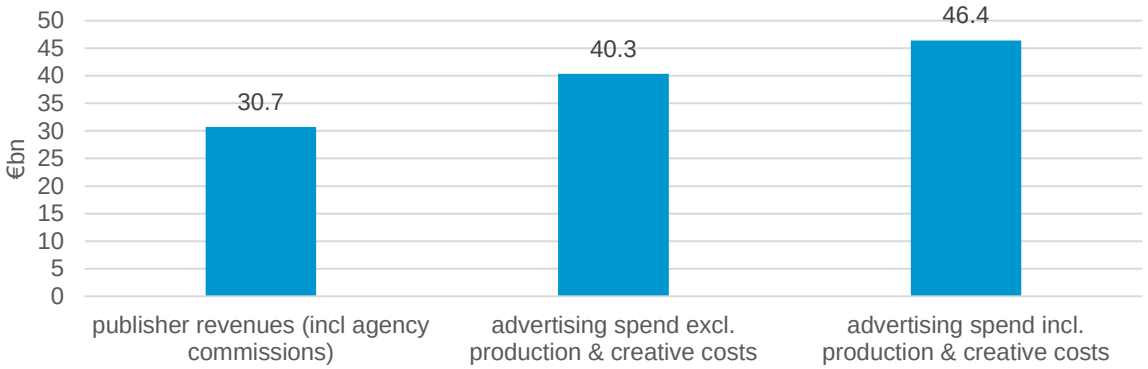
By online advertising we mean advertising on the internet across all formats (display incl. video, paid-for-search, classifieds & directories), devices (e.g. mobile & desktop) and transaction mechanisms (programmatic and non-programmatic). As stated in section 1, online advertising has been growing at a roughly constant linear, double-digit rate for the past decade; it evolved from a marginal trend to €30.7bn in 2014, and establishing itself as the second largest media category behind TV - which we forecast will be overtaken by the end of 2015.

Figure 6: European advertising revenue by format, €billion, 2014 [Source: IHS]



Yet the perspective of publisher revenues only presents a partial picture of the size of online advertising. If we consider the actual spend on online advertising from the advertiser perspective, including money flowing to advertising technology providers, agencies and other intermediaries, production costs, data and analytics services, online advertising was worth €46.4bn in 2014.

Figure 7: European online advertising between advertiser spend and publisher revenue, 2014 [Source: IHS]



3.2 Job-creation and the wider economy: how online advertising contributes

Indicative estimates

In Europe, data on the economic impact of online advertising is scarce, even compared to the limited availability of data on overall advertising. However, the figures above, combined with our estimates for advertising in general in section 2.2, allow us to provide some provisional estimates. Indeed, as we saw in section 1, in 2014 online advertising accounted for 30.4% of overall EU advertising revenues. If as a first approximation we assume that this factor (30.4%) applies not only to ad revenues but also to jobs and value added across advertisers, service providers[xii] and publishers, this would suggest that:

- In term of jobs, 0.9m European jobs (or 0.4% of the EU total) are directly supported by online advertising; this increases to 1.4m jobs if indirect and induced effects are considered, and to 5.4m if posited audience-related effects are considered.
- In terms of gross value added (GVA), €22bn are linkable to online advertising activities (including publishing); this increases to €44bn – €113bn if indirect and induced effects are considered, and to €288bn – €473bn if posited audience-related effects are considered (note that direct GVA is lower than ad spend; see our definitions on section 2.1[xiii])

These estimates are shown in Figure 8 and Figure 9:

Figure 8: Indicative estimates of jobs supported by online advertising in EU-28 countries in 2013 [Source: IHS Technology based on third party estimates listed in Box 1]

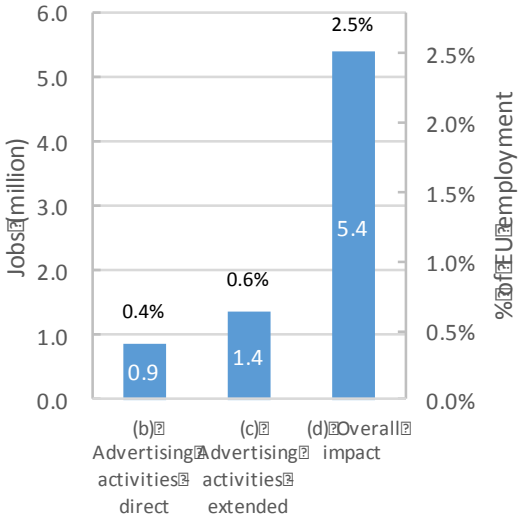
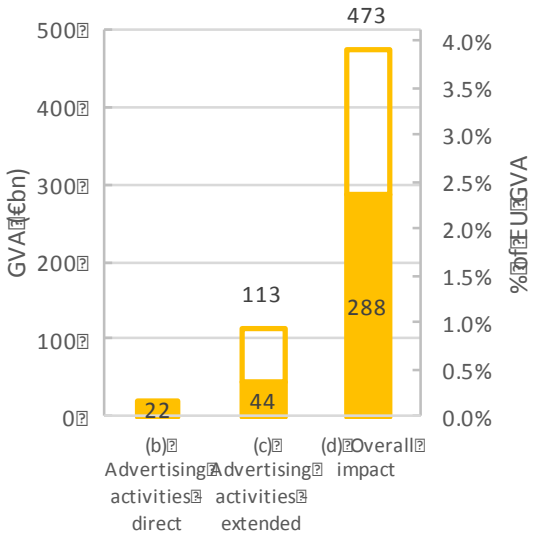


Figure 9: Indicative estimates of GVA supported by online advertising in EU-28 countries in 2013 [Source: IHS Technology based on third party estimates listed in Box 1]



We stress the highly indicative nature of these figures, as they are based on a simple transposition of the estimates in Figure 5. Nonetheless, we note that in our estimate of 1.4m jobs is in the same order of magnitude as a recent estimate by ZAW, the German advertising trade association, of 348,000 digital jobs in advertising in Germany in 2014, using a definition broadly corresponding to our column (b).[xiv] This amounts to 34.5% of our estimate of all EU online advertising jobs. According to the Eurostat data we referenced earlier, in 2013 Germany accounted for 24% of all EU persons directly employed in advertising services overall – both traditional and online The discrepancy between these two percentages is attributable partly to the approximate nature of our approach as well as to definitional differences.

Impact of online advertising's specific characteristics

Our figures above do not take into account any potential implications of prior research that suggests that online advertising is more effective than traditional advertising, and that online advertising provides significant benefits to consumers (see Box 2). If online advertising is indeed more effective than traditional advertising, then the corresponding audience-related effects (and the resulting GVA contribution) may be larger than shown above; indeed, McKinsey's findings suggest that the above estimates may significantly understate the true impact of online advertising.[xv] However, it could also be that increased efficiency leads to fewer jobs than is the case for traditional advertising. Either of these effects might result in online advertising's jobs-to-value ratio (i.e. labour productivity) being different to that applying to advertising in general.

Seeking to investigate this point further, we conducted a benchmark of company reports and tax filings from 22 listed and private companies operating in Europe, from global platforms to local players, from publishers to media agencies. Exact figures are difficult to come by, as

non-listed companies often only express employee numbers as a range, and internationally operating companies tend to not split staff by geography, requiring secondary estimates. Yet our analysis shows the following:

- On the one hand, online advertising is a scale business which has enabled few companies with a high market share to generate higher revenues per employee than in traditional advertising.
- One the other hand, the complex and fragmented value chain of online advertising means that more companies are involved per transaction than in traditional advertising, skewing the revenue to job ratio in favour of jobs again. The specialised nature of online advertising into sub-sectors of expertise from social media over SEO to programmatic advertising also means that it supports a greater diversity of job types which do not compete with each other for rationalisation, limiting a potentially detrimental effect of scale efficiencies on employment.

While available data is not robust enough to claim that these effects cancel each other out, they suggest that any assumption that the relationship between jobs and revenue is significantly different from the industry as a whole may not be warranted.

Box 2: Selected literature on impacts of online advertising

Relevant literature on the economic impact of online advertising includes the following:

(a) A 2010 study by McKinsey[xvi] concluded that one euro spent on online advertising was three times more effective in generating GDP growth than one spent on traditional advertising.

(b) A second 2010 study by McKinsey,[xvii] prepared for the IAB, studied the consumer surplus associated to ad-funded digital services in France, Germany, the UK, Spain, Russia, and Italy. It concluded that surplus for 2010 was around €100bn, or over three times digital ad revenue. This refers to the value that consumers attribute to their use of online services, minus any subscription or any other payments made by them. However, although economically important (corresponding, in size, to (or around 0.7% of EU GDP) this type of value is not included in measures of GDP in national accounts.

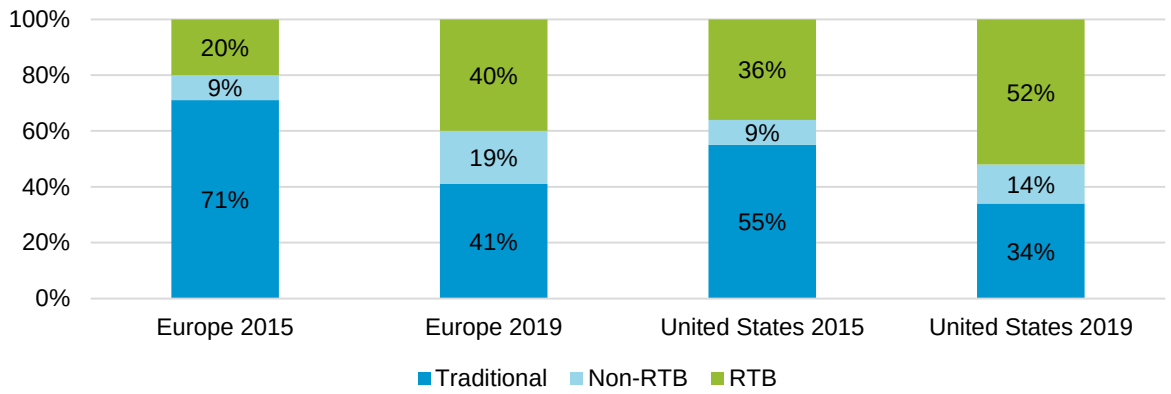
Other studies have been conducted assessing the size of the 'digital economy', understood as variants of either the internet information and communication technologies (ICTs); we discuss these separately in section 4 below.

Even if these figures are accepted at a high level, however, in our view this would miss the most significant long-term impact that online advertising can have in the economy. This requires us to go beyond the quantifiable measures we have discussed so far (direct, indirect, induced and audience-related effects) and to consider *spill-over* effects in the sense we discussed earlier. Specifically, we suggest that attention should focus on the role that online advertising is playing, and can play, in the development of the wider *digital economy*, which centres on the industry's capacity to develop the data-driven skills and technologies that are increasingly needed throughout the economy. We discuss online advertising in the context of the digital economy in section 4, but first we need to discuss some key emerging aspects of online advertising.

3.3 Structural changes in online advertising

Online advertising is being re-architected through new transactional mechanisms involving data and technology. Until recently, display advertising space (or impressions) was bought and sold manually, involving a salesperson at a publisher (or its delegated sales house) agreeing on a price with an advertiser or an agency. However, in recent years a new way of buying and selling advertising - '**programmatic**' - an umbrella term for automated transactional mechanisms using data and software has emerged as a key growth area. This concept covers a wide category of mechanisms and partnership configurations across the value chain, but the general pattern is that advertising impressions are bought and sold by computers. These can be auction-based (RTB), or fixed-price models (non-RTB). Although advertising is not a commodity like stocks, the underlying principles, technologies and skillsets resemble trading on financial markets. Programmatic mechanisms are set to generate 29% of display ad revenues in Europe by end of 2015. This includes all devices from desktop to mobile and both banner and video ad formats. IHS forecasts that by 2019, the majority of all advertising revenue in Europe (59%) will be generated using programmatic mechanisms. The US is leading this transformation of advertising due to the structure of the advertising market, technological expertise and talent. Yet we expect Europe to close its innovation gap with the US, expressed as the percentage point difference in programmatic adoption. This innovation gap stood at 16% in 2015 and will shrink to 7% by 2019, driven by publisher and advertiser adoption of programmatic principles, the acquisition of technology players by European media groups and the proliferation of local technology skillsets and jobs that are able to establish and grow the programmatic ecosystem.

Figure 10 Online advertising revenue by transaction type, 2015 vs 2019 [Source: IHS Technology]



The rise of programmatic advertising has altered the advertising value chain, diversified the types of intermediaries and changed skills needed to operate in this space. Today, the placement of an advertisement can involve not just a publisher, an advertiser and one or two intermediaries, but a complex landscape involving media agencies, independent trading desks, data platforms, verification services, retargeting services, demand side platforms and ad exchanges – among others.

All of this is driven by analytics, algorithms and large-scale data sets – defining factors of what analysts have called the "big data" revolution,[xviii] in which digital the advertising industry

plays a central role. Accordingly, advertisers, publishers and agencies increasingly need staff with the right skills to deal with this ecosystem. But, although adopting programmatic models is seen as a top priority by a majority of publishers and media agencies, the main perceived obstacle to this is the difficulty of hiring and training people with the right skill set (IAB Europe, 2015). This challenge is common across industries going through the big data revolution. Advertising is one of the first industries which is transformed by these forces and has nurtured the relevant skills and practices needed to succeed in this new paradigm.

4. Online advertising in the wider digital economy

4.1 Introducing the digital economy

Online advertising is part of a far larger set of economic activities that are normally referred to as the *digital economy*. Broadly speaking, this refers to the wide variety of businesses that rely on the Internet and related technologies in important ways; it includes internet start-ups, large online players, and an increasingly large proportion of firms in more traditional industries (e.g. banking) that have shifted more and more of their activities online. Indeed, the contours of the digital economy are constantly expanding.

As with advertising, the impact of the digital economy extends far beyond its own boundaries. Products and services provided by digital economy firms – from GPS tracking systems to e-commerce platforms – have played transformative roles across the economy, in industries ranging from transportation to manufacturing. Thus, as with advertising, when considering the impact of the digital economy we can distinguish between direct effects (e.g. jobs and value added by member firms of the digital economy), indirect and induced effects (by the digital economy's suppliers and its employees), and the effects linked to the *usage* of digital economy services. This last effect is analogous to our concept of 'audience-related effects' for the case of advertising, and like it its impact is likely to be far larger than the direct, indirect and induced effects combined.[xix] For example, a recent study in Japan predicted that, by 2020, firms representing only a subset of the digital economy would create value through established industries equivalent to 6.5% of the country's GVA.[xx]

Although the notion of 'digital economy' escapes straightforward definition and quantification, at a high level the available literature leads us to expect that, in a broad sense, its size is roughly similar to that of advertising as a whole. This is discussed in more detail in Box 3 below.

Box 3: Defining and quantifying the digital economy

Defining the digital economy in precise terms is not straightforward. The literature contains a wide variety of definitions which in broad terms fall into two groups:

- Definitions centred around the **Internet,** which vary from including all online service providers, to also encompassing network operators and equipment manufacturers
- Definitions centred around **Information and Communication Technologies (ICTs)**, which generally encompass (among other things) all providers of computer hardware and software, all telecommunications services, and all associated professional services.[xxi]

To gain a sense of the digital economy's size, we have reviewed a number of existing studies, in each case identifying the type of definition used (in the sense above, i.e. internet- or ICT-based), the estimated measures (GDP contribution or jobs), and also whether or not these include the digital economy's benefits on non-digital economy firms ('extended' vs 'restricted'). This is summarised in Figure 11:

Figure 11 Definitions and estimates of the digital economy in the literature

		GDP contribution		Jobs (% of employment)	
Study	**Type of definition**	**Restricted**	**Extended**	**Restricted**	**Extended**
(Boston Consulting Group, 2012)	Internet	5.30%			
(Deighton, 2012)	Internet	2.0% (average of high & low estimates)		1.4%(direct) 3.6% (incl. indirect & induced)	
(McKinsey, 2011)	Internet		3.4%		
(OECD, 2014)	ICT	6%		4%	
(Tech City UK, 2015)	ICT			4.7%	

Comparing Figure 11 with the corresponding figures for (overall) advertising in Figure 5 suggests that the digital economy, even if restricted to its smaller, Internet-based definition, is likely to be larger than advertising as a whole: the 'restricted' effects for advertising (columns c in Figure 5) amount to around 1% - 1.5% GVA, whereas the corresponding figure is more than twice as large for the digital economy.

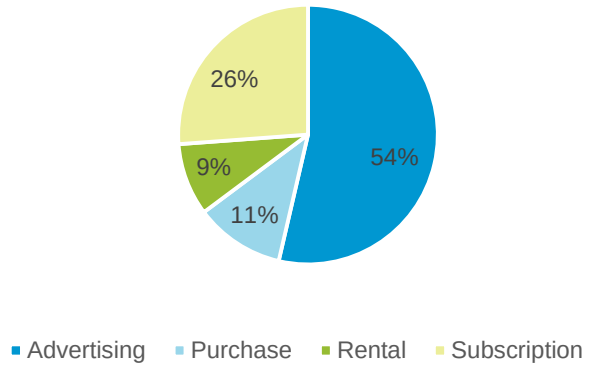
4.2 The role of online advertising in the digital economy

Online advertising is not just any part of the digital economy, but an integral pillar for the creation and development of a wide variety of online business models. We illustrate this below in three examples drawn from the IHS Technology media sector database.

Online video is a rapid growth sector for the digital economy, underpinned by changing media consumption habits and low barriers for entry in audiovisual production. More than half (54%) of the online video sector in Europe is funded by advertising. While paid-for

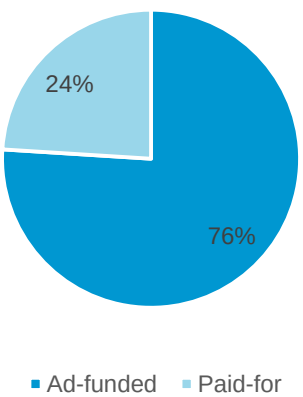
revenues are concentrated on large players, advertising funds audiovisual content from broadcasters, news publishers, digital-first players, general-interest as well as niche players.

Figure 12 European online video revenues by business mode in 2014l [Source: IHS Technology]



The online revenues from news and magazine publishers in Europe are primarily generated by advertising. As print circulation in aggregate is facing a downward trend, generating a sustainable business model on the internet is of existential importance for publishers. While single publications have succeeded with paid-for models, advertising remains the best choice for the majority of publishers, including new and smaller publications. European journalism depends on a vibrant online advertising sector.

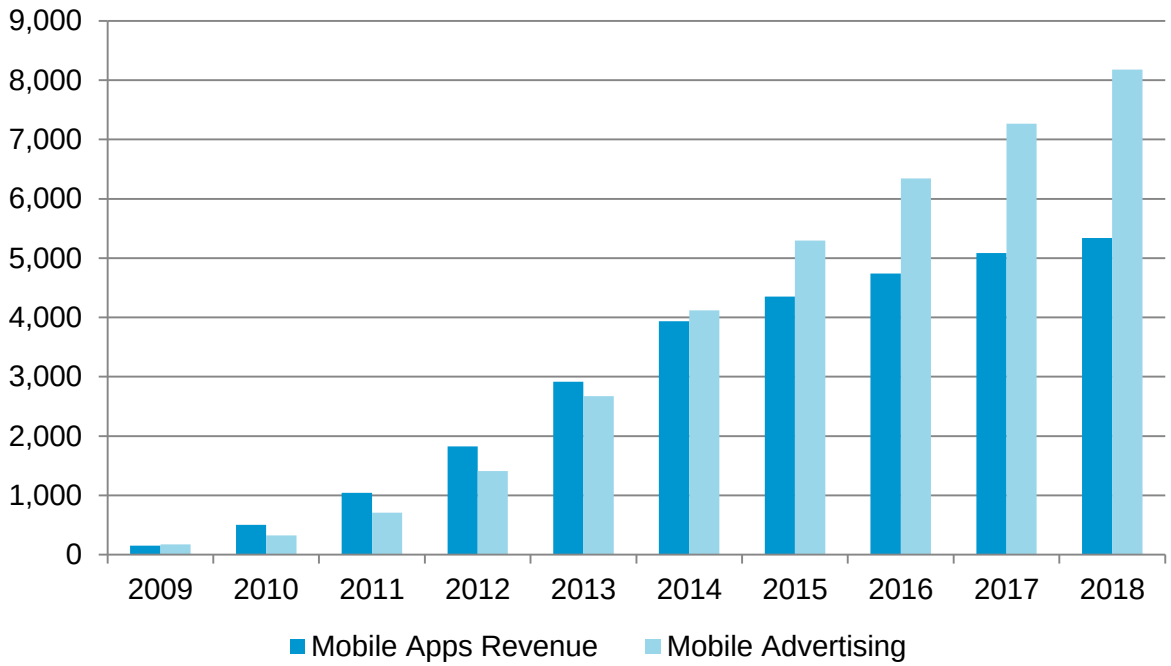
Figure 13 European online news & magazine revenues by business model in 2014 [Source: IHS Technology]



The importance of advertising is also reflected in the mobile sector. Until the end of 2014, paid-for apps were the primary funding mechanism for mobile content, from news over games to utility apps. Yet as paid-for app revenue slows and the mobile advertising matures in terms of scale, technology and standards, as of 2015, advertising emerges as the primary

funding source. IHS expects mobile advertising to outgrow app revenue and to exceed it by €2.8 billion by 2018.

Figure 14 European mobile revenues by business model [Source: IHS Technology]



Importantly, there is no strict distinction between advertising and paid-for business models. Advertising has also served as a key stepping stone towards the development of business models that are *not* reliant on advertising – such as, for example services such as Netflix, which built on consumer habits developed using free ad-supported streaming services such as YouTube. Similarly, 'freemium' propositions such as Hulu in online video, Spotify in online music, and Twitch in online gaming rely on free, ad-funded services to introduce their service to a large number of users, some of whom then upgrade to ad-free, paid versions of the services.

Finally, as one of the earliest, most dynamic and most advanced parts of the digital economy, advertising is a creative lab where the skills and techniques that will drive the wider digital economy are delivered. In what follows we delve deeper on this point.

4.3 Online advertising and skills needed in the economy of the future

As the digital economy progressively touches more and more sectors of the economy, businesses in all industries change in identifiable ways; they become more *data driven*, often involving advanced analytics, real-time online transactions and extensive interconnections with other businesses. Cases include, for example, real-time supply chain management relying on RFID chips and GPS data; supermarket stock planning based on in-store customer behaviour patterns; and health applications that track patients' conditions in real time remotely. Both the development and the use of these innovations involve certain key

skills that are becoming critical in the new economy. At the technical cutting edge these include variants of 'data science', statistics and IT, but as new tools simplifying the use of data become more widespread, a good grasp of analytics techniques and concepts is also becoming important for non-technical workers.

However, as several recent studies have highlighted, staff with these skills are hard to come by. For example, a 2013 survey of European managers found that 62% believe there is a shortage of data-related skills (Teradata, 2013), and McKinsey (McKinsey, 2011a) predicts that by 2018 the US will have a shortfall of data experts of around 180,000.[xxii] These are precisely the skills that are key in online advertising.

Online advertising has been a key breeding ground for not only the skills but also the technologies and techniques that are expected to transform the overall economy. For example, the R&D efforts of firms active in advertising technology have played a key role in exploring practical applications of concepts such as 'bandit' algorithms, which have a wealth of applications from medicine to finance.[xxiii]

There are already encouraging signs that such cross-fertilisation is taking place in Europe, with innovative start-up in many areas leveraging approaches, skills and talent from online advertising and adjacent digital industries. For example, Kloeckner-I in Germany is focussed on "digitalization for the steel industry" and building a transactional and product inventory platform, inspired by digital transformation induced by businesses like YouTube, Facebook, or Amazon. In the 1950s and 1960s, the high tech defence industry that clustered around Silicon Valley gave rise to the semiconductor and software industries, which then became major sources of economic growth in their own right, independently of defence. Online advertising has the potential to play a similarly key role in developing the digital economy. And importantly, Europe already has the talent and infrastructure needed. It is key, however, that the right conditions be in place.

5. Conclusions

In this paper we have reviewed the role played by advertising in the European economy. We started by considering advertising in general, whose contribution is not limited to those persons who work in the advertising industry itself, but also includes activities by media publishers and advertisers, and the suppliers to all of these. All in all, we estimate that by 2013 this accounted for roughly 4.5m jobs across the EU and between €144bn and €372bn in contribution to the EU economy per year. These numbers increase substantially (by factors ranging between 4 and 11 if we also take account of the effects that advertising has on its audiences – although such figures are more subject to debate. Finally, we noted that advertising has other important positive effects, not all of which may be readily quantifiable – for example, by helping fund newspapers' journalism and broadcasters' investment in European audiovisual production.

For the specific case of online advertising, data is much more scarce, but the available evidence suggests that in quantitative terms around a third of the impacts above can be attributed to advertising – specifically, around 1.4m jobs and €44bn - €113bn per annum in

gross value added by 2013, under a broad conception encompassing the advertising services industries, the activities of digital publishers and the suppliers to all these. These numbers are set to grow in line with online's share of all advertising. In a less readily quantifiable way, online advertising has been instrumental to the growth of the internet and the wider digital economy.

The link between online advertising and the wider digital economy is particularly relevant in the context of the strategy for the EU's Digital Single Market. As digital technology comes to play an ever more central role across the economy, some of the skills, techniques and business models being developed for advertising technology become increasingly relevant for other activities – from analytics to real-time marketplaces. Advertising could thus act as a catalyst helping develop Europe's wider digital economy.

We note finally that there is a clear need for further research on this area. Available data is limited not only in regards to online advertising; more generally, a more systematic understanding is required on how specific new technologies are contributing value in different industries (this includes technologies and concepts also used in online advertising, such as predictive analytics). Such evidence would be highly relevant to future policymaking in connection to the EU's Digital Single Market.

6. Policy recommendations

Comments from Townsend Feehan, CEO IAB Europe[xxiv]:

"Digital advertising is the object of significant regulatory scrutiny at the moment at EU level. New data protection rules are being negotiated that seem to work at cross purposes to the European Commission's much-vaunted "Digital Single Market" strategy, and a public consultation on online platforms with a vaguely-defined scope may have negative fallout. The data protection text currently on the table would essentially impose a one-size-fits-all framework to an almost infinitely broad range of data that may be considered "personal", without adequately matching regulatory scrutiny and the onerousness of the obligations on data controllers, to the real risks arising for consumers from a particular act of processing. This may limit digital advertising's ability to continue to deliver a wide range of online content to users at little or no cost at the point of consumption.

To ensure a better-adapted legal framework and a brighter future for the European digital economy, EU policy-makers could usefully focus on the recommendations below.

1. Establishing a **harmonised regulatory environment** to avoid market fragmentation and safeguard innovation as a key driver for economic growth.
2. Preserving legislative frameworks that have achieved their objectives in order to avoid legal uncertainty through repeated regulatory changes. The EU consumer "acquis" and the EU framework for audiovisual media services currently allow for a strong level of protection that ensures consumer trust in the digital single market.
3. Leaving adequate space for inclusive **co-regulation and self-regulation** to ensure durable achievement of policy objectives in an environment of rapid technological and business model evolution.

4. Updating **data protection rules** to focus regulatory scrutiny on processing that entails meaningful risks for consumers and supports an ambitious Big Data agenda for Europe, enabling the emergence of a Single European Data Market to allow the Union to compete effectively in a data-driven global economy.
5. Making sure that freedom of contract is safeguarded to allow fast-paced digital innovation
6. Ensuring that **VAT rules** do not create barriers to online cross-border sales by remedying the problems raised by the country of destination principle.
7. Creating the right incentives for companies to innovate by increasing the availability of **public and private funding for digital start-ups**.
8. Embracing a culture of disruption and entrepreneurship in Europe, teaching the value of experiment and innovation, as well as tolerance of and the value of learning from failures through the establishment of modern and efficient **insolvency rules**.
9. Increasing investments in the teaching of computer science, analytical and e-skills in primary, secondary, tertiary and continuing **education**.
10. Encouraging the emergence of a **European innovation culture** by better informing the start-up community of existing EU initiatives, building bridges between businesses and universities and creating a European Innovation Platform.
11. Investing in ICT and Internet **infrastructure**, including broadband and the Single Telecom Market.
12. Encouraging national and local governments to **"think digital first"**, using e-procurement and e-services to drive uptake and implementing Open Data policies."

Notes

[i] This does not imply that in a world without advertising these employees would be unemployed or that no other economic activities would not make a similar economic contribution. Such a counterfactual analysis is outside the scope of this paper, and in any

case is of limited practical relevance in a world in which advertising exists and has a large footprint across the economy – as we argue.

[ii] For example, if firm A spends 90% of its revenue buying supplies from firm B, then total revenues would be 1.9 times A's revenues – but this does not by itself imply that any more jobs or economic value has been created than if firm A were acting alone.

[iii] For an initial overview, see (Waterson & Luik, 1996); for a view in favour of advertising's impact see e.g. (Nayaradou, 2006); for a critical assessment, see (Broadbent, 2008).

[iv] For example, (Work Foundation, 2011)

[v] Section 73.1 in the NACE Rev. 2 industry classification. This includes two sub-categories: "media representation" (i.e. media sales by non-publishers) and "advertising agencies" (a broad category covering the "creation and realisation of advertising campaigns" and "conducting marketing campaigns and other advertising services aimed at attracting and retaining customers"). See and Appendix A.

[vi] See (Work Foundation, 2011)

[vii] Defined as section M73.1 in the classification used in the UK national accounts, spanning ad agencies and media representation. See (Office of National Statistics, 2015)

[viii] See (Deloitte, 2012)

[ix] See (Cambridge Economics, 2005)

[x] See (IHS Global Insight, 2013)

[xi] See (McKinsey, 2010a)

[xii] A recent report discussed in (Johnson, 2015) noted that in 2014, 40% of US ad agency revenue was due to online advertising.

[xiii] Direct GVA can be expected to be lower than expenditure since much of this spend is used to pay suppliers. Once indirect and induced effects are considered GVA impact is larger; in principle this may be larger than expenditure.

[xiv] See http://zaw.de/zaw/branchendaten/arbeitsmarkt-werbewirtschaft/

[xv] See (McKinsey, 2010a). Moreover, in addition to the caveats given earlier for advertising in general, the figures here assume that digital and traditional advertising have similar degrees of effectiveness and that their value chains are similarly labour-intensive – both of which assumptions may fail to hold.

[xvi] See (McKinsey, 2010a)

[xvii] See (McKinsey, 2010b)

[xviii] See e.g. (Mayer-Schönberger & Cukier, 2013)

[xix] Indeed, McKinsey estimates that 78% of the Internet's impact arises from traditional industries. See (McKinsey, 2011b).

[xx] See (Analysys Mason, 2014)

[xxi] We note that the second type of definition may be said to encompass the first, and therefore can be expected to lead to higher estimates of measures such as jobs.

[xxii] See also (European Digital Forum, 2015) and (Nesta, 2015)

[xxiii] For a discussion of medical applications, see (Littman, 2015)

[xxiv] The comments on policy do not reflect the position of IHS Inc. and are the sole views of IAB Europe.

7. Methodology for selected figures in this paper

This Appendix describes the methodology behind the estimates presented in Figure 5 of this report. We discuss, in order, the four columns in the Figure:

(a) Direct footprint of advertising services

Reported figures are taken from Eurostat for GVA and jobs under the "advertising" category (number 73.1) in the NACE Rev. 2 industry classification; see (Eurostat, 2008). This category, which in this report we identify with or concept of the advertising service providers includes two sub-categories:

- "media representation": media sales by non-publishers and
- "advertising agencies": a broad category covering the "creation and realisation of advertising campaigns" and "conducting marketing campaigns and other advertising services aimed at attracting and retaining customers".

Figure 5 presents aggregated numbers combining these two categories.

(b) Direct footprint of advertising *related* activities

The metrics reported under (a) exclude the advertising-related activities of publishers and advertisers, which involve further value added and jobs. Our "broad" estimates attempt to address this. This is done as follows:

- **Jobs:** For jobs, in addition to the value reported by Eurostat for the ad industry itself (agencies and sale houses), we have added estimates of advertising-related jobs in publishers and brands. To do this,
    - We relied on an analysis contained in Appendix B of (Deloitte, 2012), which estimated the number of advertising-funded jobs in these industries in the UK for 2011, obtaining an overall factor of 3.1.
    - As a check, we considered Table 8 in (Work Foundation, 2011), which yields a corresponding factor of 2.6; this slightly lower number is unsurprising, given that for publishers (Work Foundation, 2011) only considers jobs *related* to advertising whereas (Deloitte, 2012) considers all jobs *funded* by advertising. Further analysis reveals that the two factors can be reconciled if we assume that only 1/3 of publishers' advertising-funded jobs are actually advertising-related (e.g. ad sales, as distinct from e.g. copywriting, reporting, etc.)
    - Finally, we applied this ratio (3.1) to the EU-level number of advertising services jobs as reported by Eurostat (as reported in point (a) above).
- **Value added:** For GVA, we assumed that the value-added-per-worker for the ad-related part of the publishing industry would be the same as for the advertising industry itself; we then took this ratio (which for advertising services is straightforwardly obtained from Eurostat data) and applied multiplied it to the number of relevant jobs in publishing, whose estimation we described above. Given conceptual difficulties, for the sake of conservativeness we did not consider the value-added related to advertising-related functions within advertisers.

(c) Extended footprint of advertising-related activities (direct + indirect + induced effects)

Looking beyond the jobs and value added 'directly' contributed by the advertising industry, publishers and advertisers, it is worthwhile also considering the impact on these industries' suppliers, their suppliers, and so on, both in terms of jobs and value added; all of this is commonly referred to as "indirect effects". Furthermore, the employees of all the involved firms contribute to the economy's aggregate demand as consumers, which in turn supports other jobs and value added; this is called "induced effects".

It is common practice in impact studies to use estimates of "multipliers" linking direct, indirect and induced effects so that, for example, given a change in the "direct" GVA contributed by an industry, the corresponding impact in the economy's overall GVA (combining direct, indirect and induced effects) can be obtained. For Figure 5 we have relied on multipliers of this type used in previous published reports; specifically:

- **Jobs:** For the total impact on jobs, we again relied on (Deloitte, 2012), where the direct, indirect and induced jobs were estimated for UK advertising agencies and brands. We applied the multipliers implied by Deloitte's work (1.55 – 1.66) to the estimates produced earlier (see section 7(b)), to estimate the combined direct, indirect and induced job effects of the advertising-related activities of agencies, brands and publishers.
- **Value added:** For the total GVA effect due to the advertising services, we have provided two estimates:
    - For our lower estimate, we have multiplied advertising services' direct GVA contribution by a factor of 2.0, following (Work Foundation, 2011). We then also applied the same multiplier to the GVA of the advertising-related part of the publishing industry (whose 'direct' component in turn we estimated as described in section 7 (c) above). Since (as noted above) we did not estimate the direct GVA contribution for publishers' advertising-related functions, nor did we estimate corresponding indirect and induced counterparts of this.
    - For our higher estimate, we have used the multiplier value of 2.1 arrived at in (Cambridge Economics, 2005), which links final output from the advertising industry[1] to total GVA impact (combining direct, indirect and induced effects) due to the industry. We have estimated final output as the difference between ad expenditure (itself taken from internal IHS Technology estimates) and publishers' ad revenue. As to the total GVA impact of the advertising-funded parts of the publishing industry, we have assumed that the same multiplier can be applied to publishers' advertising revenue.[2]

It should be noted that multipliers like those we have used are intended to estimate the impact on indirect and induced employment (or value creation) of a potential marginal

[1] Cambridge Economics' study assumes an increase in demand linked to exports. We assume that this refers only to 'final' demand in the sense that it avoids double-counting due to different firms in the advertising industry acting as suppliers to each other.

[2] We note that the definition of advertising industry used in (Cambridge Economics, 2005) does not coincide with that used elsewhere by us (which follows Eurostat classifications) but have nonetheless assumed that this does not invalidate our use of Cambridge Economics' multiplier.

change in direct employment or value creation. Their interpretation in terms of overall impact of an advertising industry thus involves an assumption of linearity.

It should also be noted that the use of these multipliers does not imply that the relevant indirect and induced jobs would disappear if advertising did not exist, or that economic activity or output would diminish overall (that would depend on details of counterfactual scenarios); the claim made is only that this economic activity is currently linkable in indirect ways to advertising.

(d) Overall economic impact (including audience-related effects)

In order to assess economy-wide effects we proceed as in section 7(c), that is, by relying on multipliers arrived at in other studies.

- **Jobs:** for jobs, we rely on (IHS Global Insight, 2013), which concluded that in the US each US$1 million of advertising expenditure is linked to 81 jobs. We assumed that the same would hold in Europe; using the average EUR/USD exchange rate for 2013, this would mean that each €1 million of advertising expenditure can be linked to 102.5 jobs. We used IHS Technology estimates of EU advertising expenditure inclusive of production costs.
- **Value added:** for value added, again we provide two estimates:
    - For our lower estimate, we rely on findings in (Deloitte, 2012), which draw on an econometric regression of GDP and advertising expenditure in seventeen countries over a fourteen-year period, using statistical techniques intended to isolate the causal effects of advertising on GDP. Deloitte's findings imply that an ad spend increase of €1 leads to an overall increase in GDP of around €6. We have assumed that this applies at EU level, and have neglected the distinction between GVA and GDP, given that the numbers we provide are meant as indicative estimates only, and the difference between GVA and GDP is relatively small. As above, for ad spend we have used IHS Technology estimates of EU advertising expenditure inclusive of production costs.
    - For our higher estimate, we rely on estimates presented in (IHS Global Insight, 2013) for the relationship between advertising expenditure and turnover (or sales) across the economy. The IHS Global Insight study separates this impact into direct, indirect and induced effects, with US$1 in ad spend generating US$22 in sales across the economy, of which US$8.8 corresponds to sales by advertisers. We have taken only this last number (8.8), which as a first approximation we assume can be identified with consumption.[3]

All of our figures are subject not only to any potential limitations in the third-party estimates we have used, but also to the multiple assumptions we have made in applying these to an EU context. As can be seen, these considerations are particularly relevant to our economy-wide figures, which are meant only to illustrate rough orders of magnitude rather than actual estimates.

[3] Note that doing so ignores imports (which would lead to a lower GDP figure) and induced effects (which would lead to a higher GDP figure).

8. Bibliography

Analysys Mason. (2014). *Data-driven innovation in Japan: supporting economic transformation.* Retrieved from http://www.analysysmason.com/Research/Content/Reports/Data-driven-innovation-in-Japan/EnglishDownload/

Australian Bureau of Statistics. (2015). *Discussion Paper: Consultation on topics emerging from submissions to the Information and Communication Technology Statistics Review.* Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/mf/8179.0.55.002

Boston Consulting Group. (2012). *The Internet economy in the G-20: the $4.3 trillion opportunity.* Retrieved from https://www.bcg.com/documents/file100409.pdf

Broadbent, T. (2008). Does advertising grow markets? More evidence from the United Kingdom. *International Journal of Advertising , 27* (5), 745-770.

Cambridge Economics. (2005). *Economic Impact of the UK Screen Industries: a report submitted to the UK Film Council and the National and Regional Screen Development Agencies.* Retrieved from http://www.bfi.org.uk/sites/bfi.org.uk/files/downloads/economic-impact-of-the-uk-screen-industries-2005-05-13.pdf

Deighton, J. (2012). *Economic valua of the advertising-funded internet ecosystem.* Retrieved from http://www.iab.net/media/file/iab_Report_September-24-2012_4clr_v1.pdf

Deloitte. (2012). *Advertising pays: how advertising fuels the UK economy.* Retrieved from http://www.adassoc.org.uk/wp-content/uploads/2014/09/Advertising_Pays_Report.pdf

European Commission. (2015). *A Digital Single Market Strategy for Europe - Analysis and Evidence. SWD(2015) 100 final.* Retrieved from http://ec.europa.eu/priorities/digital-single-market/docs/dsm-swd_en.pdf

European Commission. (2013). *Expert group on taxation of the digital economy: general issues working paper. Digit/002/2013.* Retrieved from http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/good_governance_matters/digital/general_issues.pdf

European Digital Forum. (2015). *Data-driven digital business models: powering startups in the digital age.* Retrieved from http://www.lisboncouncil.net//index.php?option=com_downloads&id=1076

Eurostat. (2008). *NACE Rev. 2 Statistical classification of economic activites in the European Community.* Retrieved from http://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF

IAB Europe and IHS Technology. (2015). *Adex Benchmark 2014: Online Advertising Expenditure.* Retrieved from http://www.iabeurope.eu/research-and-papers/european-online-advertising-spend-iab-europe-adex-nonmember1

IAB Europe. (2015). *Attitudes towards Programmatic Advertising.* Retrieved from http://www.iabeurope.eu/research-and-papers/iab-europe-attitudes-towards-programmatic-advertising-report

IAB Europe. (2015). *The Road to Programmatic White Paper.* Retrieved from http://www.iabeurope.eu/research-and-papers/iab-europe-road-programmatic-white-paper

IHS Global Insight. (2013). *The economic impact of advertising expenditure in the United States 2012-17.* Retrieved from https://www.ana.net/getfile/20391

Johnson, B. (2015, April 26). *State of the Agency Market: What You Need to Know.* Retrieved from http://adage.com/article/digital/datacenter-agency-report-2015-charts/298214/

Littman, M. D. (2015). Reinforcement learning improves behaviour from evaluative feedback. *Nature* (521), 445–451.

Mayer-Schönberger, V., & Cukier, K. (2013). *Big Data: A Revolution that Will Transform how We Live, Work, and Think.* Boston: Houghton Mifflin Harcourt.

McKinsey. (2010a). *Advertising as an economic growth engine: the new power of media in the digital age.* Retrieved from http://www.iab-austria.at/wp-content/uploads/2013/03/2012_McKinsey_advertising-role-in-growth.pdf

McKinsey. (2011a). *Big data: the next frontier for innovation, competition and productivity.* Retrieved from http://www.mckinsey.com/~/media/McKinsey/dotcom/Insights%20and%20pubs/MGI/Research/Technology%20and%20Innovation/Big%20Data/MGI_big_data_full_report.ashx

McKinsey. (2010b). *Consumers driving the digital uptake: the economic value of advertising based services for consumers.* Retrieved from http://www.iab.net/media/file/White-Paper-Consumers-driving-the-digital-uptake_FINAL.PDF

McKinsey. (2011b). *Internet matters: The Net's sweeping impact on growth, jobs and prosperity.* Retrieved from http://www.mckinsey.com/~/media/mckinsey/dotcom/homepage/2011%20june%20internet%20economy/mgi_internet_matters_full_report.ashx

Nayaradou, M. (2006). . World Federation of Advertisers.

Nesta. (2015). *Model workers: how leading companies are recruiting and managing their data talent.* Retrieved from http://www.nesta.org.uk/sites/default/files/model_workers_web_2.pdf

OECD. (2014). *Measuring the Digital Economy: A New Perspective.* Paris: OECD Publishing.

OECD. (2015). *OECD Digital Economy Outlook 2015.* Paris: OECD Publishing.

Office of National Statistics. (2015). *Annual Business Survey*. Retrieved from http://www.ons.gov.uk/ons/rel/abs/annual-business-survey/index.html

Tech City UK. (2015). *Tech Nation: Powering the Digital Economy.* Retrieved from http://www.techcityuk.com/wp-content/uploads/2015/02/Tech%20Nation%202015.pdf

Teradata. (2013). *Data science in Europe: skills gap or emerging talent?* Retrieved from http://www.teradata.com/Teradata-Survey-Summary-Report/

Waterson, M., & Luik, J. C. (1996). *Advertising and Markets: A Collection of Seminal Papers.* NTC Publications.

Work Foundation. (2011). *The Contribution of Advertising to the UK Economy: A Creative Industries report.* Retrieved from http://www.theworkfoundation.com/downloadpublication/report/295_the%20contribution%20of%20advertising%20to%20the%20uk%20economy%20311011.pdf