



CPI EU News Presents:

Highlights from the OECD's November 2020 Roundtable on Competition in Digital Advertising Markets

*By Max Fischer-Zernin¹
(Axinn, Veltrop & Harkrider)*



Copyright ©2021

Competition Policy International, Inc. For more information visit [competitionpolicyinternational.com](https://www.competitionpolicyinternational.com)

January 2021

Over the past decade competition enforcers across the globe have investigated various aspects of “digital” or “online” advertising. The Organization for Economic Co-operation and Development Competition Committee’s (“OECD’s”) “roundtable on competition in digital advertising markets” suggests enforcers’ interest in the digital advertising sector may continue, if not intensify, in the coming years. At the November 30 virtual roundtable, enforcers, academics, and representatives from the business community gathered virtually to exchange learnings from the past few years and set out an agenda for future market studies and legislative changes.

While the roundtable was an off-the-record meeting, the OECD has published OECD-member country submissions (“Notes”), an extensive OECD briefing document (the “Brief”), and remarks to the Committee by Hal Varian, David S. Evans, and Fiona M. Scott Morton.² A notable absence is the lack of a submission from the United States.

In this article I draw out some of the key themes from the roundtable material.

Market Studies, Enforcement Actions, and Regulatory Initiatives

The country submissions offer a helpful retrospective on major market studies and enforcement actions of the past decade. The Australian Note summarizes the Australian Competition and Consumer Commission’s (“ACCC”) recent Digital Platforms Inquiry and the ongoing Digital Advertising Services Inquiry. The French Note summarizes the 2010 and 2018 *Autorité de la Concurrence* inquiries into digital advertising, and a variety of decisions imposing interim measures, fines, and commitments in the search advertising sector. The UK Note discusses the 2020 Final Report from the Competition and Markets Authority’s (“CMA”) online platforms and digital advertising market study. And the Japanese Note raises the JFTC’s 2019 Report regarding trade practices on digital platforms.

Some Notes discuss existing or planned specialized competition “units” to oversee digital advertising and other digital sectors. The Australian Note provides an overview of the ACCC’s newly established digital platforms branch, charged with monitoring competition in digital platform markets and taking competition enforcement action.³ The French Note mentions the new digital economy unit in the *Autorité*, established in early 2020.⁴

The UK Note calls for the creation of a broader “Digital Markets Unit” within the CMA to oversee a new “pro-competitive ex ante regulatory regime” for the digital advertising sector, including an enforceable code of conduct to govern the behavior of platforms with “strategic market status” and a set of “pro-competitive interventions” including data access and interoperability remedies.⁵ The UK submission views the new Unit as a necessary response to perceived gaps in competition law.

The Spanish Note finds that “competition policy offers a flexible framework to adapt to complex industries such as online advertising” but agrees that “perhaps more and better resources are needed (in specialized units) to deal with the complexity of digital markets.”⁶

Other country submissions discuss the need for new enforcement powers. The French Note highlighted the importance of the *Autorité*'s power to issue interim measures (injunctions), and forthcoming legislative enactments that will allow the *Autorité* to "to start proceedings *ex officio* when it deems interim measures to be necessary in a given market, without having to wait for a referral by third parties," as is currently required.⁷

The *Autorité* has also made "proposals for possible adjustments to its means of intervention in order to address the challenges and specificities of the digital economy,"⁸ which call for "implementing a prevention and sanction system specifically for [large digital platform] players."⁹

Like the French Note, the Korean submission previews legislation by which the KFTC "has strengthened investigations and monitoring on infringements by online platform operators, while pushing ahead with institutional improvement including revision of laws and regulations to promote competition and establish order for fair trade in the field."¹⁰

The Spanish Note calls for additional scrutiny of mergers in "data-intensive digital services" to identify harms to competition "even if apparently they are not involving potential competitors."¹¹ The submission concludes that "apart from merger control, antitrust tools can adapt to theories of harm related to potential concerns in online advertising markets,"¹² but leaves the door open for "some type of regulation" around issues like data portability and interoperability, and transparency.¹³

The OECD Brief cautions that the proposed legislative and regulatory responses could have harmful unintended consequences, warning that "it will be important to consider any possible unintended consequences, such as undermining procompetitive digital business models that rely on digital advertising as a main or significant source of revenue."¹⁴

While these Notes do refer to more extensive comments made in market studies and issue papers, they lack an extensive discussion of error costs, administrability, and the risk of chilling procompetitive conduct.¹⁵ An exception is the Note by Spain, which states: "If regulation were to be enacted to overcome some of the challenges raised by digitization and, specifically, by online advertising, it is crucial that it is well-designed in order to avoid unintended effects on competition."¹⁶

The OECD Brief also suggests "[i]t will also be important to ensure that related policy experts, such as from data protection and privacy agencies, and consumer protection agencies, are involved to ensure there are no unintended consequences in these adjacent policy spheres."¹⁷ The call to align competition and data privacy initiatives is echoed by the OECD-member countries.¹⁸

The Structure of the Digital Advertising Sector and Attempts to Define Relevant Markets

Various member countries recognize digital advertising as an innovative sector. Business at OECD¹⁹ finds that "[a] common feature of digital media markets, including online

advertising, is that they bring fast and potentially disruptive innovation, are characterized by an impressive growth rate as well as by the presence of digital platform intermediaries that have a central role. Online advertising is able to compete with traditional advertising because it has generated unprecedented advantages for businesses and end consumer[s] alike.”²⁰

The French Note states that the display advertising sector “is developing within a powerful technological dynamic” and “[m]any intermediation and data processing service providers have entered the market.”²¹ The Spanish Note states “[d]igital advertising has been, in general, a positive disruption, increasing the efficiency of campaigns and bringing new innovations.”²²

These views find support in other expert analyses, such as the 2020 ACCC submission by Daniel S. Bitton and Stephen Lewis, *Clearing Up Misperceptions About Google’s Ad Tech Business*. Bitton & Lewis review industry data and conclude that “the ad tech space displays two key features of a highly competitive space: growing output and declining prices.”²³

Country submissions also suggest a taxonomy for digital advertising inventory (ad slots on different types of websites and apps). The United Kingdom, Australian, Mexican, and French Notes divide advertising into offline and digital,²⁴ and further divide digital advertising into search, display, and classified advertising, suggesting limited substitutability between the three.²⁵ The UK Note, for example, suggests search and display advertising serve different purposes: search advertising is “aimed at driving consumers to take a particular action” while display advertising is intended for “raising brand awareness and shifting brand perceptions.”²⁶

Catherine Tucker, whose work is quoted extensively in the Business at OECD Note, explains the key determinant is neither the type of format nor the objective of an advertisement, but the advertiser’s measured return on ad spend:

“In the past, advertisers believed that in the upper funnel, because they were competing against clutter, they needed to use storytelling and highly visual formats to gain attention. . . . However, this rule has been replaced by measurement, meaning that advertisers can effectively use any format at any place in the funnel and evaluate whether it is effective for that particular target audience. Ultimately, an advertiser is indifferent between whether it is a video ad, or a static text-laden ad that influences a customer to purchase as long as they can measure how effective that format was relative to its price.”²⁷

The ability to “target” advertising and measure its effectiveness is discussed at length in the country submissions.²⁸ But the Notes largely omit arguments about how targeting and measurement can blur the so-called “marketing funnel.” Targeting could be used in display advertising to elicit an action from the user, such as with “remarketing” advertising, or search advertising could be used for brand awareness, especially when a user’s search query does not suggest commercial intent (i.e., the user is not using search to make a purchase). As the UK Note acknowledges, the CMA has seen “some evidence that display advertising, particularly on Facebook, is increasingly being used for targeting in-market conversions.”²⁹

The French Note also acknowledges that while digital advertising’s innovations in targeting and pricing distinguish it from traditional advertising, like television, “this observation could change in the future depending on the development of targeted and programmatic television advertising.”³⁰

To varying degrees UK, Australian, and French Notes use the taxonomy for digital advertising inventory to suggest separate relevant markets for display and search advertising.³¹ With the exception of certain adjudicated enforcement actions, the member countries explain that these statements are not intended to provide binding conclusions about relevant market definitions.³² For example, The UK Note states clearly that the CMA market study “did not seek to undertake a formal market definition exercise.”³³

In his remarks to the roundtable, David S. Evans cautions against drawing binding conclusions about market definition from market studies: “Market definition is very much tied to whatever it is the conduct is that we are trying to analyze Trying to make an overarching determination now as part of a market inquiry sort of approach . . . I’m not sure aside from providing general information that that’s really a great thing to do.”³⁴

Business at OECD encourages competition enforcers “to undertake any analysis of online advertising markets with precision to ensure that conclusions are robust and directed at identifiable competition violations, and that remedies are appropriate to address the competition violation at hand [and] to the extent that regulation (rather than enforcement) is considered on the basis of competition concerns, precision in identifying the underlying competition problems is both a necessary precursor and an essential element of an effective framework.”³⁵

An Overview of the Ad Tech Stack and its Complexities

The UK, Australian, and Mexican submissions and OECD Brief provide an overview of the “ad tech stack,”³⁶ those services that “assist advertisers and publishers in the automatic purchasing and selling of digital display advertising.”³⁷

The Notes highlight the complexity of the ad tech stack, but do not address arguments that the historical origin of each ad tech service or functionality explains how they increased competition and efficiency compared to the then-prevailing status quo. For example, Bitton & Lewis explain that, when viewed “in the context of market developments that took place over this time,” Google’s publisher ad tech product Google Ad Manager “has a track record of enhancing rather than inhibiting competition, and that its evolution reflects Google’s responses to rapid technological and competitive changes, as well as attempts to balance the interests of users, publishers and advertisers.”³⁸

Network Effects and Data in the Digital Advertising Sector

There is widespread agreement among member countries that digital advertising platforms are two-sided platforms that exhibit network effects and use user data as an

input,³⁹ and that these characteristics contribute to market power in the digital advertising sector.

The UK Note states that “network effects” and “unequal access to user data” “entrench” incumbent platforms’ market power.⁴⁰ And the Mexican and Spanish Notes argue that network effects and big data facilitate market concentration.⁴¹

Regarding network effects, country submissions do not discuss the risks of relying on network effects as indications of substantial power or monopoly power. As the American Bar Association Section of Antitrust Law has written, “[w]hen evaluating network effects, it is important to consider, next to switching costs and multi-homing and other factors, the possibility of negative network effects.”⁴²

As Koren Wong-Ervin has explained: “[n]etwork effects can cut both ways, sometimes leading to highly concentrated markets due to positive feedback loops or ‘tipping,’ and other times hastening the decline of a dominant player.”⁴³

In a prior publication, Evans and co-author Richard Schmalensee explained that “[n]etworks can have exponential growth when every additional customer attracts more consumers. . . . the same principle can lead to exponential decline. Each lost customer induces other customers to leave, which induces more to leave.”⁴⁴

Regarding the importance of data, the UK submission describes data as “highly valuable” and an “essential input” for ad targeting and measurement,⁴⁵ two uses of data also highlighted by the Spanish Note.⁴⁶ The Australian Note also characterizes data as a “source of competitive advantage.”⁴⁷

Multiple submissions discuss the allegedly unique characteristics of data. The Mexican, Spanish, and Business at OECD Notes agree data is non-rivalrous.⁴⁸ Business at OECD states data is also non-exclusive,⁴⁹ but the Spanish Note suggests “regulation actually promotes excludability in general.”⁵⁰

Wong-Ervin has explained that, while data is a valuable input, new entrants do not need to replicate incumbents’ data to succeed.⁵¹ Similarly, Darren Tucker and Hill Wellford have argued that “[a]n entrant that needs personal data can collect relevant information from its users once the service is operational. Data collected in this manner is free or nearly so. Entering the market and then collecting and analyzing user data is not a theoretical approach but rather the very model followed by many of the leading online firms when they were startups or virtual unknowns, including Google, Facebook, Yelp, Amazon, eBay, Pinterest, and Twitter.”⁵²

The Mexican Note states that, despite its risks, “the collection of large datasets and analysis of data could lead to benefits for consumers, such as access [...] to better and personalized services.”⁵³ Business at OECD also explains that targeted advertising results in efficiencies as advertisers waste a smaller portion of their budget advertising to an overly broad audience.⁵⁴

Types of Potential Conduct Raising Competition Risks

The OECD Brief provides a summary of the structural issues and conduct that were raised in countries' submissions as potential issues to examine in the digital advertising sector: conflicts of interest in vertically integrated firms, self-preferencing that raises rivals' costs, leveraging market power, opaque data practices, and more general market opacity that gives dominant platforms the ability to create market distortions.⁵⁵

Concluding Thoughts

The OECD's Competition Committee's "roundtable" offers a helpful summary of how key competition enforcers have approached the digital advertising sector. This article highlights some areas of agreement among countries as well as the disagreements and misunderstandings that still remain.

As David S. Evans told the roundtable, showing monopoly power or dominance in a relevant market is a fact-specific inquiry that must be conducted in the context of the merger or conduct at issue. Market studies, white papers, and submissions to the OECD may provide helpful general information but they are not dispositive. In the context of the digital advertising sector it is helpful to consider some of the arguments made by Business at OECD, Wong-Ervin, and Tucker regarding the complexities of network effects and data inputs.

Looking ahead, as certain member countries pursue new legislative initiatives, it will be important that they clearly identify market failures and consumer harms to be remedied, any actual gaps in competition law, and how the new regulation will mitigate error costs, administrability issues, and the risk of chilling procompetitive conduct. Member countries will often find that their existing competition regimes are the more appropriate channel for competition enforcement in the digital advertising sector.

-
- ¹ Max Fischer-Zernin is an associate in the antitrust practice of Axinn, Veltrop & Harkrider LLP. The author thanks Koren Wong-Ervin for her insightful comments, and Parris Greenwood and Stephanie Goebel for their valuable assistance. The views expressed here are the author's alone and do not necessarily represent the views of Axinn or any of its clients. Axinn represents a number of clients, including Google, that have or may have an interest in the subject matter of this article.
- ² *Competition in Digital Advertising Markets*, OECD (Nov. 30, 2020), <https://www.oecd.org/daf/competition/competition-in-digital-advertising-markets.htm>.
- ³ Note by Australia, *Competition in Digital Advertising Markets*, OECD (Nov. 2, 2020), [https://one.oecd.org/document/DAF/COMP/WP2/WD\(2020\)2/en/pdf](https://one.oecd.org/document/DAF/COMP/WP2/WD(2020)2/en/pdf) (hereinafter *Australian Note*).
- ⁴ Note by France, *Competition in Digital Advertising Markets*, OECD (Nov 24, 2020) at 2, [https://one.oecd.org/document/DAF/COMP/WP2/WD\(2020\)3/en/pdf](https://one.oecd.org/document/DAF/COMP/WP2/WD(2020)3/en/pdf) (hereinafter *French Note*).
- ⁵ Note by the United Kingdom, *Competition in Digital Advertising Markets*, OECD (Nov. 23, 2020) ¶¶ 81-5, [https://one.oecd.org/document/DAF/COMP/WP2/WD\(2020\)9/en/pdf](https://one.oecd.org/document/DAF/COMP/WP2/WD(2020)9/en/pdf) (hereinafter *UK Note*).
- ⁶ Note by Spain, *Competition in Digital Advertising Markets*, OECD (Nov 2, 2020) ¶ 49, [https://one.oecd.org/document/DAF/COMP/WP2/WD\(2020\)6/en/pdf](https://one.oecd.org/document/DAF/COMP/WP2/WD(2020)6/en/pdf) (hereinafter *Spanish Note*).
- ⁷ *French Note* at 7.
- ⁸ *French Note* at 2.
- ⁹ *Contribution of the Autorité de la Concurrence to the Debate on Competition Policy and the Challenges Raised by the Digital Economy*, Autorité de la concurrence (Feb. 19, 2020), https://www.autoritedelaconcurrence.fr/sites/default/files/2020-03/2020.03.02_contribution_adlc_enjeux_numeriques_vf_en.pdf.
- ¹⁰ Note by Korea, *Competition in Digital Advertising Markets*, OECD (Nov. 12, 2020) § 2.2, [https://one.oecd.org/document/DAF/COMP/WP2/WD\(2020\)4/en/pdf](https://one.oecd.org/document/DAF/COMP/WP2/WD(2020)4/en/pdf) (hereinafter *Korean Note*). Initiatives include advocating for “a law to enhance transparency and fairness in transactions on online platforms, a revision of the E-Commerce Act “to make online platforms more responsible for protecting consumers,” and “[i]ntroducing the guidelines for competition law enforcement reflecting on the features of the digital economy.” The Korean Note expressed particular concern regarding the collection and use of user data, user data portability and interoperability, and misleading advertising including by social media “influencers.”
- ¹¹ *Spanish Note* ¶ 50.
- ¹² *Spanish Note* ¶ 51.
- ¹³ *Spanish Note* § 5.2.
- ¹⁴ Note by Secretariat, *Competition in Digital Advertising Markets*, OECD (Nov. 30, 2020) at 51, <http://www.oecd.org/daf/competition/competition-in-digital-advertising-markets-2020.pdf> (hereinafter *OECD Brief*).
- ¹⁵ As the ABA explained in its *Comments to European Commission on New Competition Tool* earlier this year: “Existing market imperfections should be compared to market outcomes in the presence of the proposed new tool or regulation (taking into account error costs and administrability), rather than to the theoretical ideal of perfect or perhaps ‘better’ competition.” *Comments to European Commission on New Competition Tool*, A.B.A. (Sept. 8, 2020), https://www.americanbar.org/content/dam/aba/administrative/antitrust_law/antitrust-comments-eu-new-competition-tool.pdf; see also *Comments on European Commission’s Consultation on Proposed Digital Services Act*, A.B.A. (Sept. 8, 2020), https://www.americanbar.org/content/dam/aba/administrative/antitrust_law/antitrust-comments-on-eu-dsa-consultation.pdf (“The basis for economic regulation rests on the need to correct a market failure in a particular industry. Moreover, even if a market failure is identified through careful study, careful attention needs to be given as to whether a proposed regulatory solution sufficiently corrects it and has an overall positive effect as determined by a rigorous economic cost-benefit analysis, including consideration of potential unintended consequences. . . . Any assessment of potential ex-ante regulation must assess the impact on all sides of the relevant platform markets.”).
- ¹⁶ *Spanish Note* ¶ 52.
- ¹⁷ *OECD Brief* at 51.
- ¹⁸ *UK Note* § 4.2; *Australian Note* § 5; *Spanish Note* § 4.
- ¹⁹ Business at OECD is an independent international business association devoted to advising government policy makers at the OECD.
- ²⁰ Note by Business at OECD, *Competition in Digital Advertising Markets*, OECD (Nov. 24, 2020) at 5, [https://one.oecd.org/document/DAF/COMP/WP2/WD\(2020\)8/en/pdf](https://one.oecd.org/document/DAF/COMP/WP2/WD(2020)8/en/pdf) (hereinafter *Business at OECD Note*).

-
- ²¹ *French Note* at 5, discussing *Opinion 18-A-03 of 6 March 2018 on data processing in the online advertising sector*.
- ²² *Spanish Note* ¶ 60.
- ²³ Daniel S. Bitton & Stephen Lewis, *Clearing Up Misperceptions About Google’s Ad Tech Business*, ACCC (May 5, 2020) at 36, <https://www.accc.gov.au/system/files/Google%20-%20Report%20from%20Daniel%20Bitton%20and%20Stephen%20Lewis%20%285%20May%202020%29.pdf>.
- ²⁴ *French Note* at 3; but see *Business at OECD Note* at 5 (“Online advertising generally serves the same goals as offline advertising: namely, to educate, influence, and drive consumers through the delivery of information.”) (citing James D. Ratliff & Daniel L. Rubinfeld, *Online Advertising: Defining Relevant Markets* (2011) at 12, <https://www.law.berkeley.edu/files/Online-Advertising2011.pdf>).
- ²⁵ See *UK Note* § 1.2; *Australian Note* ¶ 19, citing *DPI Final Report*, ACCC (26 July 2019) at 89 ; *Note by Mexico, Competition in Digital Advertising Markets*, OECD (Nov. 2, 2020) ¶¶ 13-4, [https://one.oecd.org/document/DAF/COMP/WP2/WD\(2020\)5/en/pdf](https://one.oecd.org/document/DAF/COMP/WP2/WD(2020)5/en/pdf) (hereinafter *Mexican Note*); *French Note* at 3.
- ²⁶ *UK Note* § 1.2; see also *Mexican Note* ¶ 14 (Search, display, and classified advertising “might have limited substitution with each other, because they serve different purposes depending of [sic] the objectives of the advertiser’s campaign. For example, display advertising is suitable for raising brand awareness and reaching new audiences that might not yet have shown interest in the product, whereas search advertising is suitable for consumers that have shown interest and has immediate impact in sells [sic].”).
- ²⁷ Catherine Tucker, *Competition in the Digital Advertising Market*, Section II, Report on the Digital Economy, Global Antitrust Institute (2020), <https://gaidigitalreport.com/2020/08/25/competition-in-the-digital-advertising-market/>.
- ²⁸ *UK Note* §§ 1.4, 5.2; *Australian Note* §3.4; *Mexican Note* ¶¶ 18, 26; *Spanish Note* ¶¶ 7, 11;
- ²⁹ *UK Note* ¶ 10.
- ³⁰ *French Note* at 6, discussing *Opinion 18-A-03 of 6 March 2018 on data processing in the online advertising sector*.
- ³¹ *UK Note* ¶ 33; *Australian Note* ¶¶ 21-27, 40-42; *French Note* at 3.
- ³² For discussion of enforcement actions see *French Note* at 8-9, 14, discussing market definition in enforcement actions against Google.
- ³³ *UK Note* ¶ 10.
- ³⁴ OECD Competition Division, *David Evans Describes the Economics of Attention Markets and Implications for Competition*, YouTube (Dec. 2, 2020), <https://www.youtube.com/watch?v=Ae46wwFWbCY&feature=youtu.be>.
- ³⁵ *Business at OECD Note* at 1-2. *Business at OECD* explains in its submission: “Business at OECD recognizes that there are numerous investigations and proposals related to online advertising and takes no position with respect to those initiatives. Our membership consists of companies that both support and oppose these initiatives. We believe that it is important, however, that any action considered or undertaken be based on sound competition principles, rigorous economic analysis and thoughtful remedies that address the specific competition problems identified.” *Business at OECD Note* at 9.
- ³⁶ *UK Note* § 1.3; *Australian Note* § 2.3; *Spanish Note* § 1; *OECD Brief* § 3.
- ³⁷ *Australian Note* ¶ 29.
- ³⁸ Bitton & Lewis, *supra* note 23, at 3.
- ³⁹ *French Note* at 14; *Mexican Note* ¶ 10; *Australian Note* ¶ 44; *Spanish Note* ¶ 13; *Japanese Note* ¶ 4.
- ⁴⁰ *UK Note* ¶ 38; see also *French Note* at 6.
- ⁴¹ *Mexican Note* ¶ 16; *Spanish Note* ¶ 19.
- ⁴² *Comments to European Commission on New Competition Tool*, A.B.A. (Sept. 8, 2020), https://www.americanbar.org/content/dam/aba/administrative/antitrust_law/antitrust-comments-eu-new-competition-tool.pdf.
- ⁴³ Koren W. Wong-Ervin, *Assessing Monopoly Power or Dominance in Platform Markets* (Jan. 26, 2020) at 6, <https://ssrn.com/abstract=3525727>.
- ⁴⁴ David S. Evans & Richard Schmalensee, *Debunking the Network Effects Bogeyman*, Regulation, Vol. 40, No. 4, Winter 2017-2018, at 36, <https://ssrn.com/abstract=3148121>.
- ⁴⁵ *UK Note* ¶¶ 49, 60.
- ⁴⁶ *Spanish Note* ¶ 11.
- ⁴⁷ *Australian Note* § 3.4.
- ⁴⁸ *Mexican Note* ¶ 23; *Spanish Note* ¶ 23; *Business at OECD Note* at 8.

⁴⁹ *Business at OECD Note* at 8.

⁵⁰ *Spanish Note* ¶ 23.

⁵¹ Koren W. Wong-Ervin, *Assessing Monopoly Power or Dominance in Platform Markets* (Jan. 26, 2020) at 8-9, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3525727.

⁵² Darren S. Tucker & Hill B. Wellford, *Big Mistakes Regarding Big Data*, *Antitrust Source*, Vol. 14, No. 2, A.B.A. (Dec. 2014)

at 7, https://www.americanbar.org/content/dam/aba/publishing/antitrust_source/dec14_full_source.pdf.

⁵³ *Mexican Note* ¶ 28.

⁵⁴ *Business at OECD Note* at 8.

⁵⁵ *OECD Brief* at 51. See *Australian Note* ¶¶ 35-8; *French Note* at 6; *Spanish Note* §§ 3.3-4.