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# Open Access and Open Science: Some Implications for the Agricultural Economics Profession

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## Abstract

In this paper, we introduce a special issue of Q Open on open access and open science that presents papers from a session at the 2023 European Association of Agricultural Economists Congress. We briefly discuss some of the emerging issues confronting applied economists regarding open access and open science. We also consider how the growth in open access is changing the publication landscape, as well as ongoing efforts to promote open science. As the papers published in the special issue show, there remain unresolved questions regarding the costs and benefits associated with implementing open access and open science.

Key Words: Open Access; Open Science; Transformative Agreements

JEL: Q1; A10; I28

## 1. Introduction

The call for open access (OA) publishing can be traced back to at least 2002, with the Budapest Open Access Initiative, the ECHO Charter, the Bethesda Statement on Open Access Publishing and the Berlin Declaration leading the United Nations Educational, Scientific and Cultural Organization (UNESCO) to define OA as:

*"By 'open access' to the literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself." (https://www.unesco.org/en/open-access)*

Subsequently, the academic community has started to address the growing requirement to embrace OA publishing as part of the wider open science (OS) research agenda. OA is only one facet of the OS agenda although its influence on how OS is practiced is complex. Indeed, at the outset it should be understood that it is not always the case that OS and OA are complementary. OS is a wide-ranging set of practices including OA all of which can have conflicting objectives in terms of transparency, participation, and fairness. The importance of OS has also been recognised by UNESCO who coordinated the production of an internationally agreed definition via its Recommendation on Open Science which was adopted by 193 countries in November 2021.<sup>2</sup> OS is defined by UNESCO as:

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<sup>2</sup> <https://unesdoc.unesco.org/ark:/48223/pf0000380399.page=39>

*“Open science is a set of principles and practices that aim to make scientific research from all fields accessible to everyone for the benefits of scientists and society as a whole. Open science is about making sure not only that scientific knowledge is accessible but also that the production of that knowledge itself is inclusive, equitable and sustainable”* (<https://www.unesco.org/en/open-science/>)

The benefits of OA and OS are frequently articulated by a wide array of bodies, institutions and organisation.<sup>3</sup> In particular, there have been many calls for publicly funded research output to be “free” and OA. In many cases it has become an essential requirement that a grant holder must (i.e. it is mandatory) ensure that all outputs are OA. Examples of funders insisting on this requirement include the US National Institute of Health; the European Commission: the US National Science Foundation; and the Wellcome Trust. In the US from 2025 there will be OA requirements following announcements from the US White House Office of Science and Technology Policy. Funders in the US such as the Open Research Funders Group and universities (Higher Education Leadership Initiative for Open Scholarship) are also pushing for greater access to research software as part of this agenda and are actively contributing to various OS initiatives.<sup>4</sup> There is also significant emphasis being placed on data sharing to enable OS by many governments including: Colombia, France, Ireland, and Spain.

A particularly important driver of OA has been Plan S, which came into being in 2018 following the launch of cOAlition S, a group of nation researcher funders, supported by the European Commission (EC) and the European Research Council (ERC) with the objective of ensuring that scientific research be published as OA from 2021.<sup>5</sup> In its most recent annual review (Plan S, 2024) cOAlition S reports continued support for

*“open, non-profit, equitable and fit-for-purpose scholarly publishing from high-level political bodies, as reflected in the EU Council Conclusions of May 2023<sup>6</sup> and the G7 declaration by ministers of science and technology.”<sup>7</sup>*

The impact of this agenda continues to be far reaching, and it is still evolving. For example, Horizon Europe will only fund publication fees in full OA outlets (i.e., Gold and Diamond), and it will not fund publication of research in hybrid journals (e.g., journals with a paywall and OA options). The European Commission launched its own OA platform called Open Research Europe in 2021.<sup>8</sup>

The rapidly changing academic publishing environment raises questions about the impact of OA and OS. It also presents challenges for how best academic societies that publish academic journals should respond, as the hybrid model has become an increasingly prevalent OA publishing approach (Schmal, 2024). It remains unclear if traditional society journals will satisfy OA requirements of key funders in the future especially if hybrid journals are no longer considered appropriate outlets. This raises the prospect of academic societies and their publication outlets needing to reposition themselves and how they are financially operated. It also raises questions around how quickly a hybrid journal could become OA or a new OA journal can establish the “necessary” reputation to be attractive. Finally, the extent to which OA and OS is considered important by the academic community remains unclear, especially with respect to unfunded research which is not uncommon in economics.

The set of papers in this special issue of Q Open originate from an organised session at the 2023 Congress of the European Association of Agricultural Economics (EAAE) in Rennes. The session

<sup>3</sup> See, for example, the Australian Academy of Sciences: <https://www.science.org.au/curious/policy-features/open-science-and-scientific-excellence>

<sup>4</sup> <https://www.orfg.org/> and <https://www.heliosopen.org/>

<sup>5</sup> <https://www.coalition-s.org/about/>

<sup>6</sup> <https://data.consilium.europa.eu/doc/document/ST-9616-2023-INIT/en/pdf>

<sup>7</sup> <https://www.ouvrirescience.fr/g7-science-and-technology-ministers-commit-to-open-science/>

<sup>8</sup> <https://open-research-europe.ec.europa.eu/>

was entitled: *Q Open: Open Science and Implications for the Agricultural Economics Profession*. The session aimed to capture key issues and topics that set Q Open apart from existing journals in applied economics. We wanted to engage the profession in topics such as replications, null-result research registered experimental research and OS in general. The final set of papers cover a diverse set of issues that emerge from the OA and OS agendas. In this paper, we place the contributions in context by means of textboxes.

The paper proceeds, as follows. In Section 2, we briefly review the economics of OA and OS. We also examine how agricultural economics journals have responded to OA. In Section 3, we consider several issues that are emerging in relation to OA and OS.

## 2. Economics, OA and OS

### 2.1. Economic Analysis of OA

There is relatively little economic analysis of OA given the importance of the topic as an economic issue. Analysis of OA typically takes the typology of publishing options offered by publishers as a starting point. This is summarised by the Open Economics Guide<sup>9</sup> and repro-

Gold Open Access	First publication in Open Access. Costs born by Article Processing Charge (APC).
Green Open Access	Secondary publication from access-restricted journals or books on repositories or archives.
Hybrid Open Access	Authors “buy out” articles from access-restricted journals with an APC. Thus, institutions are often charged twice if no framework agreement as DEAL applies.
Bronze Open Access	Freely accessible journal articles on publishers’ servers without clear details on reuse.
Diamond Open Access	Publication free of charge both for readers and for authors
Black Open Access	Illegal Open Access via services such as SciHub

duced as Table 1.

**Table 1: Open Access: Meaning of the Types of Colours**

Source: <https://openeconomics.zbw.eu/en/knowledgebase/the-meaning-of-the-different-types-and-colours-of-open-access/>

As Table 1 neatly summarises, the business models that publishers employ ranges from traditional subscriptions that bundle journals from a specific publisher through to fully OA that may or may not employ an article processing charge (APC). In between we have transformative agreements (TAs)/hybrid agreements that describes “Publish and Read” deals. TAs were initially intended to enable the transition to full OA, but progress has been slow with no clarity regarding when full OA will be achieved (Bakker et al., 2024). These agreements have given rise to what is referred to as the “hybrid” OA model which allows the author of an article to buy OA (via some sort of institutional deal) while restricting access to articles for those who do not have subscriptions, either individually or via their institutional affiliations. The importance of hybrid journals can be understood by the dramatic increase in TAs. For example, Schmal (2024) reports that the number of TAs enabling OA

<sup>9</sup> <https://openeconomics.zbw.eu/en/knowledgebase/the-meaning-of-the-different-types-and-colours-of-open-access/>

is growing rapidly with some 100,000 articles published with a TA in 2020 and almost 900,000 by 2023.<sup>10</sup>

In terms of economic literature examining OA, Bobtcheff et al. (2023) provide a review with a specific focus on the theory of two-sided markets and certification. Both issues are considered in detail by Armstrong (2015, 2021) to explain the academic publishing market. In these papers, Armstrong explains that the purpose of an academic journal is to i) disseminate research; and ii) provide certification (i.e., signalling). The characterisation of the situation as a two-sided market arises because publishers gain value from both readers and authors. Journals do incur costs to publish which need to be covered, which they do so by imposing fees on both sides of the market when employing the hybrid business model. The conclusion drawn is that the hybrid model amounts to a form of “double dipping” as publishers charge twice: once for an OA article and again for the journal subscription.

Unsurprisingly, the hybrid journal business model has been the subject of criticism. For example, Schmal (2024) uses a theoretical model to examine publish and read type TAs. Model results suggest that TAs may in fact provide unintended negative outcomes by increasing barriers to entry in publishing. This is essentially a crowding out argument, with hybrid publishing ensuring a continued flow of payments to the main academic publishers. Therefore, TAs may be inhibiting new credible entrants coming into the publishing market to disrupt the current situation. This can occur because TAs require buyers (i.e., universities, research organisations, etc) to use their limited funds which means they have less to spend on alternative providers. Butler et al. (2023) examines this issue by estimating the growth in APCs that the “big five” publishers (Elsevier, Sage, Springer Nature, Taylor and Francis, and Wiley) charge. They report that revenue growth has been significant, which follows from the way OA has become tied to the payment of APCs and reinforces existing aspects of the market structure in academic publishing. It is also the case that TAs obfuscate the transparency of costs associated with academic publishing. This is all somewhat ironic given that Borrego (2023) notes:

*“The notion was that APCs would bring about a more competitive, transparent market than subscriptions.” (p. 372).*

The costs associated with OA are also not limited to those incurred in paying for OA. Frank et al. (2023) examines the costs and unintended consequences of the OA agenda and find that it has introduced hurdles to publication for junior staff and researchers from resource-poor environments. Even though many journals offer support for publishing such as fee waivers, according to Frank et al. (2023) there is growing evidence indicating discrimination because of APCs. Borrego (2023) reviews the literature on APCs and notes that waivers have been shown not to improve access for poorly funded researchers. These issues are common across all areas including medicine as detailed by Nabyonga-Orem et al. (2020).

A related issue identified by Frank et al. (2023) is that some high impact journals have not embraced OA. This occurs almost certainly because the hybrid financial model remains viable, and publication reputation trumps other requirements placed on academics. And even if OA is embraced and a hybrid journal business model is employed some journals can and do charge very high APCs. Puehringer et al. (2021) note that it has been argued by some that high APCs for OA journals are a function of quality and the need to maintain standards, but there appears to be weak or no correlation between journal quality and APCs. In fact, Puehringer et al. (2021) note the cost is related to who publishes a journal and the subject area. Butler et al. (2023) estimated that more than \$1 billion was paid in OA APCs between 2015 to 2018 to the five largest commercial publishers (Elsevier, Sage, Springer Nature, Taylor and Francis, and Wiley). Most recently, Haustein et al. (2024) present estimates of global APCs for OA paid to six leading publishers (i.e., Elsevier, Frontiers, MDPI, PLOS, Springer Nature, and Wiley) between 2019 and 2023. They report that \$8.968 billion US dollars was spent in this period and that expenditure increased by

<sup>10</sup> See <https://esac-initiative.org/about/transformative-agreements/>

three times. Also, as noted elsewhere, hybrid fees typically exceed gold OA. These estimates represent a huge transfer of funding from research organisations to publishers.

Finally, another consequence of the rapid growth in OA journals has been the emergence of so called “predatory journals”. This is a controversial topic that has attracted much attention. Hanson et al. (2024) provide an insightful assessment of how the emergence of predatory journals has impacted academic publishing. In particular, the proliferation of certain types of OA journals and some of the associated practices (e.g., rapid growth in special issues) has meant a rapid growth in the number of papers being published, with serious questions being raised around academic quality and the rigour of peer review. The scale of this issue is highlighted by Mora and Pilia (2025), who observe that we are seeing a rapidly growing number of researchers with

*“...implausibly high-publication and new coauthor rates, with many producing tens to hundreds of papers per year, and gaining hundreds to thousands of new coauthors annually.” (p.1).*

The reason that these practices have emerged is in response to the use of metrics such as impact factors to quantitatively evaluate research and researchers. Thus, predatory journals have benefited from the desire and need of academics to publish research in OA outlets as well as to attain high citations, but the value associated with many of these publications and associated citations is now being openly questioned by many academics, universities and funders. For example, in 2024 Finland’s Publication Forum<sup>11</sup> which is a rating and classification system, downgraded 271 journals published by Frontiers and MDPI such that papers published in these journals are now treated as if they have not been peer reviewed. However, a group of academics have subsequently questioned this decision in relation to Frontiers which highlights the complexity of classifying journals in terms of academic merit.

In summary, the hoped-for benefits of TAs supporting the move to full OA has not occurred. From an economics perspective the strategy employed by publishers (and implicitly some academic societies) has been to side-step the need to embrace full OA. The dominance of hybrid journals has meant that full OA journals (Gold or Diamond) have struggled to gain a real foothold in the marketplace. At the same time, many of the large publishers have introduced a small number of OA journals that have at times struggled to gain traction. This strategy can be understood as a form of insurance if funders move against the hybrid model. The announcement by the Bill and Melinda Gates Foundation that from 2025 it will not fund APCs that will likely diminish the attractiveness of hybrid journals. Also, the lack of change in behaviour on the part of publishers has led cOAlition S to no longer financially support TAs. The criticisms cited by cOAlition S include the absence of and obvious transition to OA, researchers paying twice for journal services and the fact that hybrid journals are more expensive than fully OA journals. Whether or not these changes will alter the publishing habits of researchers remains to be seen.

## **2.2. OS and Economics**

The emergence of the OS within academic circles is not a new phenomenon. David (1998) provides a fascinating explanation of the historical emergence of OS: how the “*fusion of experimentalism and Renaissance mathematics*” (p. 16) in the 16<sup>th</sup> and 17<sup>th</sup> centuries signalled a change in how the knowledge of science was pursued during the scientific revolution. In related research Lerner and Tirole (2005) examine the topic of open-source production in academic research. In their analysis they identify two important differences between economics and other academic disciplines in terms of open-source production. First, open-source production places much emphasis on the degree of dissemination. Lerner and Tirole (2005) observe that economics paid little attention to this, especially with respect to the availability of data sets. Second, they refer to OA and raise the following question:

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<sup>11</sup> <https://julkaisufoorumi.fi/en>

*"It is an interesting question as to whether open access will have the same appeal for the economics community."* (p. 118).

Interestingly, this discussion of OA is more general than the current fixation on access to published research. It is also the case that, given the preceding discussion, OA and OS are now issues that clearly concern economists both as an academic question but also practically.

**Box 1: Finger et al. (2025): Open Science in Agricultural Economics, in Q Open Special Issue: Open Science and Implications for the Agricultural Economics Profession**

Finger et al. (2025) examine benefits, costs and challenges resulting from OS for the agricultural economics profession. They explain that OS is composed of various strands including access to research, the transparency of research, how data and software underpinning research is made available and the implications for teaching and education. The associated costs and benefits of the OS agenda are then examined as well as ongoing issues around adoption of OS practices. Finger et al. (2025) report that the identified benefits of OS are frequently not being realised and, in an effort, to improve adoption they provide several best practice examples. An important step in ensuring that OS practices become common place is by the development of OS communities such as the Open Science Community Wageningen. They also examine a set of agricultural economics journals and assess the state of OS practices. Their findings provide interesting insights into the extent to which OS practices are being supported by the profession and the gaps that need addressing. How the journals can improve this situation is discussed along with a broader set of recommendations

### 2.2.1. The Scope of OS in Economics

Within economics the growing demand for the profession to embrace OS can in large part be traced to issues around research practices and robustness of reported research. For example, Askarov et al. (2023) present results from a meta study of economic research, examining its statistical power and – insofar as power is lacking – excess statistical significance. The results they report are striking in that they conclude that serious questions can be raised about the overall credibility of economic research. It is findings such as this that drive the call for the widespread adoption of OS practices in economics such data availability, access to code and the need for replication. These findings are consistent with those reported by Christensen and Miguel (2018) about ongoing issues around publication bias, inherent difficulties in replicating results and selective reporting of empirical results (i.e. specification searching).

Many of the same issues have been identified in agricultural economics by Ferraro and Shukla (2023), who argue that there is a credibility crisis within the profession, as they found previously for environmental and resource economics (Ferraro and Shukla, 2020). Similarly, Heckelevi et al. (2023) identify issues around p-hacking and poor practice in statistical application in agricultural and food research. These findings are even more worrying given that many of the leading journals in these areas will have manuscript rejection rates of at least 75%. Many manuscripts are desk rejected for econometric deficiencies (i.e., insufficient data sizes and unaddressed endogeneity) and if journal editors are already filtering out those manuscripts that contain the worst failings it suggests that the problem is even worse than revealed by assessments of published peer review research.

In response to these issues, agricultural economics and economics in general has started to adopt OS practices. Certain aspects of the OS agenda are being more regularly implemented by the economics profession. For example, the OS agenda has led to calls to make sure that software used in the production of research is both open and available. There are growing requirements for software/scripts/codes to be made available for sharing by depositing in open repositories such as GitHub (McKiernan et al., 2023). There are also increasing requirements around data sharing prior to accept of research for publication in many journals. Askarov et al. (2023b) report findings showing

that mandating data-sharing has reduced claimed statistical significance of results and excess statistical significance. However, Brodeur et al. (2024a) report that this change in practice does not necessarily result in a reduction in “p-hacking”.

**Box 2: Huettel and Hess (2025): Lessons from the p-value debate and replication crisis for “open Q science” - the editor’s perspective, in Q Open Special Issue: Open Science and Implications for the Agricultural Economics Profession**

In this paper Huettel and Hess (2025) examine the scientific production system and consider how various challenges (e.g., the replication crisis; p-value debate; publication bias) that have arisen and gained traction because of the OS agenda have been dealt with by the agricultural economics profession. Huettel and Hess (2025) observe that there is a piecemeal approach to addressing many OS issues and no overarching agenda within the profession to deal with them. The need for a collective response to these challenges has been exacerbated by the rapid emergence of artificial intelligence (AI) and its complicated impact. They note that AI could amplify the issues identified with the scientific production system. Also, they caution against what they refer to as “naïve openness” and a call for whole systems reform. This in large part requires that incentives with the production system reflect both costs and benefits.

In related research Brodeur et al. (2024b) also examine if pre-registration contributes positively to the research credibility agenda in economics. To do this they examine test statistics from all randomized controlled trials (RCT) published in leading economics journals. The study reveals that many studies do not provide what is called a pre-analysis plan. This plan is put in place to avoid arbitrary choices being made after data is collected. If a pre-analysis plan is not implemented, the authors find that implementation of OS practices does not result in a statistically significant reduction in p-hacking and publication bias. In contrast when a pre-analysis plan is employed evidence of p-hacking and publication bias is significantly reduced. This type of research demonstrates that implementing the OS agenda correctly is not by itself sufficient and any claim that such practices are producing the desired behaviours needs to be treated with caution.

**Box 3: Arpinon and Lefebvre (2025): Registered Reports: How to Prepare a Registered Report and Associated Benefits, in Q Open Special Issue: Open Science and Implications for the Agricultural Economics Profession**

Arpinon and Lefebvre (2025) discuss at length the potential benefits of registered reports to deal with many current practices around undertaking and publishing research. They provide the reader with an excellent introduction to registered reports and at the same time they demonstrate and discuss the benefits of this approach compared to pre-registration of research. They also present a useful benchmark of registered reports within the economics profession and discuss how agricultural economics as a profession can more widely adopt the practices that registered reports bring.

Another feature of the OS agenda that has grown in importance in economics and agricultural economics is replication (e.g. Finger et al., 2023, 2024). In a study examining replications and the associated benefits, Ankel-Peters et al. (2023) note that within the economics literature there appears to be little in the way of self-correction. They come to this conclusion as they find little evidence that replications receive any attention in the literature. This in turn leads them to argue that robustness of results and replicability are difficult to define in a meaningful way in economics (i.e., falsifiability of a hypothesis).

*“The absence of a clear-cut definition of robustness and replicability raises questions about the extent to which empirical economics can live up to the Popperian definition of “science.”*



**Box 4: Rose et al. (2025): Long-term Effects of the Targeting the Ultra-Poor Program – A Reproducibility and Replicability assessment of Banerjee et al. (2021), in Q Open Special Issue: Open Science and Implications for the Agricultural Economics Profession**

Rose et al. (2025) provide an example of how to produce and replicate published research so that the robustness of results can be assessed. They show how original research should be presented both in terms of the published work but also the accompanying data, code and methods of implementation. Rose et al. (2025) also considers wider issues around OS including pre-specification diligence and external and construct validity. For example, Rose et al. (2025) note that reference is made to pre-registration, but they could not locate a pre-analysis plan.

**Box 5: Ankel-Peters et al. (2025): A Protocol for Structured Robustness Reproductions and Replicability Assessments, in Q Open Special Issue: Open Science and Implications for the Agricultural Economics Profession**

In this paper, Ankel-Peters et al. (2025) propose a protocol for how to practically implement reproducibility and replicability assessments, with a focus on robustness. The protocol calls for researchers who undertake replications to prespecify their robustness tests. The protocol also provides several reporting tools that to help research. In addition, the protocol enables an examination of *“adherence to the pre-analysis plans in the replicated papers as well as external and construct validity.”* The overarching purpose of the protocol is to advance how replicators and the original study authors interact constructively.

Finally, the discussion regarding OS and credibility clearly has far greater resonance in relation to econometrics, and particularly the application of experimental economics (e.g. RCTs). It is also worth noting that for non-experimental studies there is a clear trade-off in how inference is conducted (if employing Classical methods). If you raise the significance level of a hypothesis test (i.e., lower the chance of a Type 1 error), you only get a positive finding if you get a big effect, which leads to the claim that coefficients are biased upwards. However, at the same time this lowers power, (i.e., an increased chance of making a Type 2 error) for example, because of a small but real effect. Within economics, there is a tendency to be more concerned with false positives than say medical researchers who will be more preoccupied with false negatives. This partly explains the pervasiveness of low power identified by Askarov et al. (2023a).

### **2.2.2. OS and Ongoing Challenges**

Inevitably there remain many challenges facing the adoption of OS practices. First, it is the case that academics do not always tell the truth about the research they are conducting and reporting. Drupp et al. (2024) note that there is evidence of unethically conducted research such as fabrication of results and modification of data and/or results. To substantiate this, they report results of an experiment assessing the degree to which a large sample of scientists truthfully reveal the outcome of two lab type experiments (i.e., a coin-tossing task). Findings indicate that there is some degree of dishonesty. The OS agenda, however well intentioned, is not guaranteed to necessarily improve academic conduct.

Second, Carayannis et al. (2024) examine how OS provides societal benefits in relation to fusion energy research when all intellectual property generated is shared openly. But, in this specific case, when the private sector entered the “market”, which often occurs when additional funding is required for research, we observe the emergence of proprietary technology. In this case OS is no longer practiced as the private sector wishes to earn a return on its investment. Carayannis et al. (2024) argue that this has a negative impact on future research advances as the positive network externalities no longer occur. In this case, even though OS is generating positive network externalities it cannot make up for funding shortfalls.

Third, Zhang and Ma (2023) examine how OS and the enforcement of data sharing affects citations. They report that data sharing does increase the speed at which an article is cited but that those papers are subsequently cited less frequently, indicating that the longevity of the research is reduced. This may not be an issue of economic significance, but it does indicate the changes in practice can bring about unintended consequences.

Fourth, the OS agenda is also drawing attention to how evidence produced by research is being employed in policy. Shukla et al. (2023) report results from a call for papers on applying behavioral science-based tools for policy in agriculture and related fields. They observe that many of the papers submitted have significant limitations in terms of experimental design and scope. These results led Shukla et al. (2023) to conclude that applied researchers need to implement better research designs and practices if credibility of research findings is to be achieved. El Benni et al. (2023) argue for the need for research credibility in the generation of scientific evidence for policy making.

**Box 6: by Krasovskaia and Just (2025): Food, nutrition, and related policy issues: Evidence-based policy and the credibility crisis, in Q Open Special Issue: Open Science and Implications for the Agricultural Economics Profession**

The paper by Krasovskaia and Just (2025) examines the issue of evidence-based policy and the demand for this approach within the food and nutrition context. The links to OA and especially OS are obvious. Krasovskaia and Just (2025) consider this to be a high priority area for aligning policy with robust scientific evidence. The paper considers in detail the credibility crisis drawing attention to issues around the misuse of scientific findings, scope of evidence employed and the temporal mismatch between policy need (short term) and evidence generation (medium to long term). To highlight these issues, they draw attention to some of the perverse incentives within the research ecosystem and how this can give rise to bias.

Finally, although we have noted that the adoption of OS practices faces challenges there are positive signs that the culture is changing. Ferguson et al. (2023) presents results of a survey examining OS practices in top social science departments in the US. They find that OS practices, especially code and data sharing are widely supported and practiced. Of maybe more importance is the large increase in OS activity between 2010 and 2020 (49% to 87%).

### 2.3. OA and Agricultural Economics Journals

The OA and OS agenda have given rise to some important changes within the publishing world of agricultural economics. A selection of agricultural economics journals is listed in Table 2 with several key OA features shown.

**Table 2: Agricultural Economics Journals and Open Access in 2023<sup>12</sup>**

Journal*	Society	IF**	Issues^ OA%	OA Price	OA Revenue <sup>r</sup>	OA Type***
Agribusiness <sup>1</sup>	No	2.1	1: 3/12; 2: 5/13; 3: 8/14; 4: 10/19; 5: 2/14 <sup>#</sup> OA% = 28/72 = 39%	\$3620 £2,552 €3,080	\$101,360	Green
Agricultural Economics <sup>4</sup>	Yes	4.5	1: 4/8; 2: 5/10; 3: 2/6; 4: 4/8; 5: 4/9; 6: 6/10 OA% = 25/51 = 50%	\$3,840 £2,590 €3,190	\$96,000	Green
American Journal of Agricultural Economics <sup>1</sup>	Yes	4.2	1: 8/15; 2: 6/14; 3: 7/12; 4: 6/11; 5: 6/10 OA% = 33/62 = 53%	\$3,570 £2,380 €2,970	\$117,810	Green

<sup>12</sup> The fees being charged are subject to increase. For example, the Journal of Agricultural Economics has seen an increase in fees to \$4,250, €3,470 and £2,720.

Applied Economics Perspectives and Policy <sup>1</sup>	Yes	3.3	1: 12/30; 2: 16/30; 3: 19/25; 4: 13/24 OA% = 60/109 = 55%	\$3,570 £2,380 €2,970	\$214,200	Green
Australian Journal of Agricultural and Resource Economics <sup>1</sup>	Yes	2.6	1: 4/8; 2: 3/8; 3: 4/8; 4: 6/9 OA% = 17/33 = 52%	\$2,710 £1,810 €2,260	\$46,070	Green
Canadian Journal of Agricultural Economics <sup>1</sup>	Yes	2.5	1: 2/6; 2: 3/5; 3/4: 6/6 OA% = 11/17 = 65%	\$2,760 £1,840 €2,330	\$30,360	Green
European Review of Agricultural Economics <sup>2</sup>	Yes	3.3	1: 2/8; 2: 6/22; 3: 4/11; 4: 3/13; 5: 3/7 OA% = 18/61 = 30%	\$4,665 £3,717 €4,487	€80,766 (\$97,000)	Green
Food Policy <sup>3</sup>	No	6.8	1: 4/10; 2: 2/10; 3: 8/14; 4: 11/18; 5: 7/15; 6: 10/17; 7: 6/12; 8: 10/21 OA% = 58/117 = 50%	\$4,090 £3,257 €3,933	\$237,220	Green
Journal of Agricultural Economics <sup>1</sup>	Yes	3.4	1: 11/16; 2: 11/14; 3: 11/15 OA% = 33/45 = 73%	\$3,950 £2,590 €3,300	\$130,350	Green
Journal of the Agricultural and Applied Economics Association <sup>1</sup>	Yes	N/A	1: 10; 2: 12; 3: 14; 4: 14 Total = 50	\$2,000 <sup>M</sup> £1,560 €1,800 \$2,500 <sup>N</sup> £1,950 €2,250	\$100,000	Gold
Q Open <sup>2</sup>	Yes	N/A	1: 19; 2: 10; 3: 8 Total = 37	\$1,791 £1,427 €1,722	£52,799 (\$79,998)	Gold

Notes: \* = Publisher: 1 = Wiley; 2 = OUP; 3 = Elsevier; \*\* = Impact Factor (2023); ^ = Issue number & ratio OA published papers divided by total number of papers; r = Revenue calculated as number OA papers times OA fee (ignoring waivers etc); \*\*\* = Definitions of OA type (<https://openeconomics.zbw.eu/en/about-the-open-economics-guide/>); # = Special Issue; M = Member OA fee; N = Non-member OA fee.

We have not listed the JARE (Society journal of Western Ag Econ Association) IF = 1.192, Open Access and uses page charges \$89 (non- member) and \$79 (member). Some of the journals indicate (more or less clearly) that there are OA fee waivers of either 100% or 50%.

An examination of these journals reveals that the majority are society journals, and most are hybrid typically employing some form of TA such that they are Green OA. Currently, there are two Gold OA journals (Journal of the Agricultural and Applied Economics Association and Q Open). We can see that there is some variation regarding the percentage of papers that are published OA as well as the OA fees charged. Table 2 also provides an upper bound estimate from OA fees (excluding papers published with a fee waiver) being generated by each journal. In terms of the variation in OA APCs these are not that large when compared to some of the leading journals in other fields such as general interest science and various branches of medical research. Interestingly, as noted by several authors including Borrego (2023), in Table 2 we see that hybrid journals (Green OA) are charging higher APCs than the Gold OA journals.

A simple way we can place the estimates in Table 2 in context is to compare them with the costs of publication. Grossmann and Brembs (2021) have estimated that the cost of publishing an article ranges from \$200 up to \$1000 for journals that are prestigious and have very high rejection rates. If we assume that the average in agricultural economics is \$400 per article and we assume 50 articles are published per annum this yields an estimate of \$30,000. Although only an estimate of the costs the difference with OA revenues is still significant and this is before journal subscription fees are included.

We can also consider the magnitude of the opportunity cost associated with the peer review process. LeBlanc et al. (2023) estimates that the global cost was \$6 billion in 2020. The costs being imposed on the “producers” of academic research is significant and significantly under-priced. Given these results LeBlanc et al. (2023) argue for the payment of reviewers by journals. Although there is no data to hand, we can guesstimate the opportunity costs associated with peer review for agricultural economics journals. Very crudely, assume that, for illustrative purposes, journal X sends out on average 100 articles for review per year, and peer review will be based on at least two evaluations that take on average one day to complete, and that the cost is \$300 per day. This yields an annual hidden cost to the profession, for journal X of \$60,000 which is indirectly being borne by universities, research institutions as well as individual researchers. With more and more university and research organisations struggling to remain financially viable it becomes a questionable point if “free” peer review will continue to be supported especially if academic time must be accounted for explicitly.

At the same time within economics the review process has become ever more demanding and drawn out. There are many reasons given for this practice and to refocus efforts Berk et al. (2017) proposed how the refereeing process could be improved. For example, they recommended keeping reviews short, numbering the points being raised and making a clear recommendation to the editor. However, even if reviewers improve how they undertake the review process there are issues that have emerged with the growth in the supply of submissions, reflecting the globalisation of research, as well as the number of OA journals

One possible solution that has been considered is the use of artificial intelligence (AI) to support the peer review process. Checco et al. (2021) examined the potential for AI to complement the review process and to potentially reduce the burden on reviewers. However, as they note there could be unintended consequences. In fact, with the growing use of open reviews it has been reported by Piniewski et al. (2024) that we are seeing a growth in peer review plagiarism.

### 3. The Evolving Landscape of OS and OA

The evolving landscape OS and OA and the related agendas have far reaching consequences for the agricultural economics profession. However, how this evolution occurs can only be understood with an appreciation of the incentive structures of the main protagonists: Publishers; Research Funders; Universities and other Research Institutions; Academic Societies; and Researchers.

As already discussed, publishers have in general a clear profit motive that will guide how they attempt to shape as well as respond to changes in academic publishing.

Funders do not wish to see excessive rents appropriated by the publishers. Indeed, some of the initial efforts by funders to support OA and OS, have been used by publishers to extract economic rents. As a result, various funders are changing how they will support research and what is expected of researchers. For example, the ERC although initially very enthusiastic about Plan S in 2018 had by 2020 withdrawn its support. The main reason given by the ERC was that Plan S, as implemented, could severely hamper the careers of young academics by limiting publication options. However, the ERC remains an advocate for OS and provides extensive guidance on the use of online repositories. More recently, The Bill and Melinda Gates Foundation have announced significant changes to how they will support OA and OS in 2025. Following an extensive review of OA, they will implement in 2025 a new OA policy<sup>13</sup> called “Funded Manuscript”. All funded research outputs will need to be made OA as soon as possible via a preprint server recognized by The Bill and Melinda Gates Foundation and all data will need to be made available immediately. And the most striking change is that there will be no support for the payments of APCs. Like the European Commission, The Bill and Melinda Gates Foundation has put in place its own publishing platform (Gates Open Research), which is free. As they note it will provide,

<sup>13</sup> <https://openaccess.gatesfoundation.org/open-access-policy/2025-open-access-policy/>

*“editorial, production and administrative support to authors throughout the publication and post-publication peer review process.”*

Given these changes it is likely that more funders will follow a similar strategy and no longer support payment of APCs, requiring publication in a recognised OA form.

When it comes to universities and research institutions in many cases, they appear to be all too often passive bystanders. For example, in the UK, for research to be included in the 2029 Research Evaluation Framework it must be published in in OA journals and outlets (both hybrid and Diamond OA journals). The UK Research Evaluation Framework requirements have been the subject of some debate in the UK with some universities providing enhanced OA/OS platforms and support whilst other have argued that the need for OA across all academic disciplines including the humanities will be costly.<sup>14</sup> Examples of OA/OS platforms include: i) the Open Library of Humanities<sup>15</sup> at Birkbeck, University of London, that provides diamond OA; ii) University College London (UCL) Press<sup>16</sup> launched in 2015 with UCL strongly committed to OS; and iii) the Diamond Open Access Journals platform at the University of Cambridge launched in 2024 which is a year-long trial.<sup>17</sup> In terms of the cost of OA several UK universities (e.g., Sheffield, Surrey and York) have recently declined to continue with the government arranged OA deal with Elsevier. Given the significant financial pressures being felt within UK universities this may become challenge to the price charged by publishers for read and publish OA deals.

In addition, a growing number of universities have joined the International Network of Open Science and Scholarship Communities. This network brings together what are referred to as Open Science and Open Scholarship communities that are hubs that enable peer to peer learning. This type of movement is considered as essential if OS is to become the status quo. Wageningen University and Research is member of International Network of Open Science and Scholarship Communities with a vibrant OS community. It provides an OS model that academics at other institutions can embrace.<sup>18</sup>

Turning to academic societies, many operate a not-for-profit business model which means that they cannot in many cases stop rents being extracted by publishers given that they have insufficient resources or incentive to challenge the status quo. Borchardt et al. (2024) identified cost as a major reason for why journals do not transition to Diamond OA. However, if an academic society does want to publish its members research OA then this can be done. With reduction in the costs associated with journal management and publishing falling academic societies could go it alone. Katz et al (2019) present a financial model for running an online journal explaining the costs of running the Journal of Open Source Software.<sup>19</sup> They report that the cost of publishing each paper is less than \$100. However, on the journal website it is stated that the costs of publishing to be as little as \$4.75 per paper. There are also open-source publishing software platforms such as Open Journal Systems (OJS) that is provided by the Public Knowledge Project that support low-cost journal implementation.<sup>20</sup> The OJS is currently used by the International Journal on Food Dynamics<sup>21</sup> and the Spanish Journal of Agricultural Research<sup>22</sup> both of which are Diamond OA. All of this means, that the barriers that are perceived to exist for societies to move away from relying on publishing houses are being removed. Indeed, within the agricultural economics profession there already exists evidence of this change. For example, the German Journal of Agricultural

<sup>14</sup> See <https://www.hepi.ac.uk/2024/06/11/open-excess-remove-open-access-burden-from-ref/>

<sup>15</sup> <https://www.openlibhums.org/site/who-we-are/>

<sup>16</sup> <https://uclpress.co.uk/books/>

<sup>17</sup> <https://diamond-oa.lib.cam.ac.uk/home>

<sup>18</sup> <https://openscience-wageningen.com/>

<sup>19</sup> <https://joss.theoj.org/>

<sup>20</sup> The Public Knowledge Project is an *“Our open source publishing platforms for scholarly journals, monographs, and preprints are a leading force in the global embrace of open access to research for the benefit of all.”*

<https://pkp.sfu.ca/>

<sup>21</sup> <http://131.220.45.179/ojs/index.php/fsd/index>

<sup>22</sup> <https://sjar.revistas.csic.es/index.php/sjar>

Economics is now Diamond OA.<sup>23</sup> The change occurred when the ownership of the German Journal of Agricultural Economics moved from Deutscher Fachverlag GmbH to become the official journal of the Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e.V. There is also the journal Bio-based and Applied Economics, the Agricultural Economics (Czech journal)<sup>24</sup>, and Studies in Agricultural Economics<sup>25</sup> that are OA. The Bio-based and Applied Economics journal is promoted by the Italian Association of Agricultural and Applied Economics and published by Firenze University Press that was established in 2003. The Firenze University Press webpages state:

*"The fundamental principle in FUP is that ideas, discoveries and research outcomes must be freely accessible to the general public. Our mission, as a leading Open Access publisher, is to publish the latest, high quality research from all over the world, and disseminate it as rapidly and as broadly as possible."* <https://www.fupress.com/>

Finally, we have the academics and scholars who are in general supplicants within the publishing world. Of course, as we have already noted, there are growing bottom-up efforts enabling not only OA but more importantly the adoption of OS practices. Whether these efforts will yield a rapid adoption of OS remains unclear especially as the path of least resistance offered by TAs remains so dominant.

#### 4. Final Observations

Given this brief introduction to OA and OS as it affects agricultural, environmental and resource economists, we have two closing observations.

First, in general there are benefits from OS and OA, both in terms of the rigour of research and its reach and influence. However, the profession remains some way away from realising those benefits in full. To enable the change in academic practice to occur there is a role that academic societies can and should play.

Second, a shift towards OA (and OS) implies a major change in working practices. At present there is a lack of momentum behind effecting such a change. The hybrid publishing model suits for profits publishers (who can double dip). It also represents the path of least resistance for (non-profit) academic societies, who rely on royalties to support their activities. However, there is some evidence that leading research funders are trying to change the status quo as are some universities who support OA publishing ventures. But, in general there is little evidence that any participant in the academic publishing ecosystem is prepared to underwrite the full costs of publishing and maintenance of OS/OA infrastructure. The anticipated benefits of OA/OS are a global public good, but the policy approach to ensuring that there is an effective supply has so far been piecemeal. In the meantime, many researchers and reviewers continue to bear an unequal proportion of the costs of academic publishing.

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#### Competing interests

All authors declare that they have no competing interests.

#### Data

The data underlying this article are all in the public domain

<sup>23</sup> <https://www.gjae-online.de/>

<sup>24</sup> <https://agricecon.agriculturejournals.cz/>

<sup>25</sup> <https://studies.hu/>

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