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# The presence and issues of altmetrics and citation data from Crossref for working papers with different identifiers from Econstor and RePEc in the discipline of Economic and Business Studies

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## Abstract

For the past years, preprints started to be very common in Economics and Business Studies and economic researchers simply referred to them as working papers (Cruz & Krichel, 2000). Since a previous study of Nuredini & Peters (2016) confirms a relatively good coverage of journal articles for Economic and Business Studies literature in Altmetric.com, this study explores the altmetric representations for working papers in these fields. We present altmetric information from Altmetric.com for working papers from Econstor. Considering that working papers in Economics and Business Studies from Econstor often have handles for their identification, our study explored handles and confirmed a lower coverage in Altmetric.com (0.2%). Therefore we investigated altmetric information for two other working papers identifiers: DOIs, and URLs. Better coverage is identified for working papers with DOIs (7%). Econstor URLs are less found in Altmetric.com with coverage of 0.04%. The topmost used altmetric source for working papers in Economic and Business Studies is Twitter for handles and DOIs and for URLs is Policy Posts. Mendeley counts are well present for working papers with DOIs but not for handles. A negative correlation ( $r = -0.0157$ ) is identified between citation counts from Crossref and Altmetric Scores. Additionally, we noticed several issues that are happening while sharing Econstor working papers on social media that prevent from collecting altmetric information. Thus, we suggest an alternative way to share these papers on social media to prevent losing altmetric information.

## Introduction

Nowadays, with the use of digitization of the archives, there is an immense rise in disseminating research online (Speidel & Spitzer, 2018). Especially this rise effects open access repositories (e.g., arXiv<sup>1</sup>, bioRxiv<sup>2</sup>, OSF preprints<sup>3</sup>, etc.) that host documents prior to formal publication or so-called preprints (Speidel & Spitzer, 2018). According to Tomaiuolo & Packer (2000) preprints can be of different types: 1) papers that are not yet submitted to any journal, 2) papers that are under a peer-review process and waiting for publication decision and 3) papers that are electronically available that might fall in the category 1) and 2) or that can be used to assemble online feedback before submitting to a journal. Publishing a preprint provides various benefits to authors and readers such as 1) the research findings are published quickly and indexed in different services such as Google Scholar and Altmetric.com while traditional papers that are under review take longer (months or years) to be published and indexed; 2) Authors can collect feedback and further revisions about their research prior to a formal submission; and 3) papers that have a preprint gain more visibility and are 30% more cited than papers without a preprint (Speidel & Spitzel, 2018; Ozler, 2011; Krugman, 2013). Preprints are very common in different fields of study i.e., physics (Delfanti, 2016) and life sciences (Serghiou, et al., 2018) as well as in Economics (Cruz & Krichel, 2000; Ozler, 2011). Preprints in Economics and Business Studies are simply referred to as working papers

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<sup>1</sup> <https://arxiv.org/>

<sup>2</sup> <https://www.biorxiv.org/>

<sup>3</sup> <https://osf.io/preprints/>

(Frandsen, 2009; Ozler, 2011). Working papers are often issued from authors that are part of departments and research organizations rather than from individual authors (MacKie-Mason & Lougee, 2008). Working papers are published in informal series such as NBER<sup>4</sup>, BREAD<sup>5</sup>, World Bank Policy Research Working Paper Series<sup>6</sup> (Ozler, 2011) and as well as in repositories Econstor<sup>7</sup>, SSRN<sup>8</sup>, AgEcon Search<sup>9</sup>, etc. One of the reasons that economists might have turned to working papers is because the journal review process for economic papers takes about two years followed by an extensive revision (Ellison, 2002). Publishing in economic journals seems to be the most time-consuming tasks for economic researchers (Moffitt, 2011). So, according to Ellison (2002), working papers are used as means for disseminating information and journals are used to receive an approval of the quality of the paper.

Preprint repositories allow papers to be available online and that provides the opportunity to connect them with the audience through social media platforms (Shuai, Pepe & Bollen, 2012). All social media platform activities such as for example, tweets, shares on Facebook, mentions in blog posts, readership counts on Mendeley as well as mainstream media, downloads, and policy posts are so-called alternative metrics or altmetrics. Altmetrics may measure the societal impact of different research outputs (Wilsdon et al., 2015). Furthermore, altmetrics are known as a complementary measure to traditional indicators (e.g., citations) for assessing impact (Costas et al., 2015). Similarly, as for other disciplines citations, seem to play an important role in economics as well, for reflecting the quality of the scholarly work of researchers and its achievements (Hammermesh, 2018).

Numerous studies showed that altmetric information significantly correlates with citations (Costas et al., 2015; Nuredini & Peters, 2016) suggesting that altmetrics may be related to scholarly activities anyway (Wilsdon et al., 2015). For example, a study found a significant correlation of social media mentions (i.e., tweets), downloads and citation counts for preprints in arXiv.org. The authors suggest that early tweets of preprints published in arXiv can lead later to higher download counts and more citation counts in arXiv (Shuai, Pepe & Bollen; 2012). A recent study of Bornmann & Haunschild (2018) explored altmetrics for papers in F1000Prime to determine whether altmetrics correlate with the scientific quality of papers. The authors found out that citations and readership counts from Mendeley are more related to quality as the tweets from Twitter. Another study of Nuredini & Peters (2016) found relatively good coverage of journal articles for Economic and Business Studies literature in Altmetric.com. Serghiou et al., (2018) explored preprints in biological sciences for how they are used online via altmetric information and cited via the community. According to their results, they concluded that publications that had preprints have received more citations and altmetric scores as those publications without preprints.

Within this research, we will perform a study that looks at altmetric information and citation counts for working papers in Economic and Business Studies literature to investigate their visibility and impact within the online environment. According to Frandsen (2009), working papers seem not to be well-cited especially in the field of economics and that the citation rate of working papers is similar to citation rates of low impact journals. This might happen because economic researchers are encouraged to wait for journal articles to read and cite rather than use working papers. Since working papers can be changed over time and can lead to different available versions (Ozler, 2011). Therefore, we would like to explore to what

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<sup>4</sup> <https://www.nber.org/papers/>

<sup>5</sup> <http://ibread.org/bread/papers>

<sup>6</sup> <http://www.worldbank.org/en/research/brief/policy-research-working-papers>

<sup>7</sup> <https://www.econstor.eu/about>

<sup>8</sup> <https://www.ssrn.com/en/>

<sup>9</sup> <https://ageconsearch.umn.edu/?ln=en>

extent working papers are shared within social media platforms. Specifically, the main objective of this study is to identify the coverage of altmetric information for three different identifiers for working papers from Econstor and RePEc. Secondly, we will present their main issues with altmetric data and thirdly we will check whether working papers are preferably cited.

Accordingly, with this research study we would like to answer the following research questions:

1. What is the coverage of working papers of Economic and Business Studies literature for different identifiers from Econstor in Altmetric.com?
2. In which altmetric sources are working papers from Economic and Business Studies most often mentioned?
3. How is the citation rate from Crossref for working papers in Economic and Business Studies?

### **Methodology and data**

This study selects working papers (with three different identifiers i.e., handles, DOIs, and URLs) for Economic and Business Studies from the Econstor repository and additionally considers handles and URLs from RePEc.

Econstor is a non-commercial and one of the largest repositories for scholarly economic literature. It includes different types of documents, such as working papers as well as journal articles and conference proceedings summing up to a total 165,000 resources that are freely accessible (Weiland, 2011). Around 100,000 documents in Econstor are working papers. Econstor as a disciplinary repository uses DSpace to assign identifiers respectively handles to working papers that officially started in 2009 (Borst & Weiland, 2009; Weiland, 2011). The handle<sup>10</sup> is a persistent identifier assigned to digital objects and other internet resources managed by the Handle System (Sun, Lannom & Boesch, 2003). Handle's first implementation system was developed in 1994 at CNRI<sup>11</sup>. Econstor is one of the main contributors to RePEc and one-third of Econstor publications are also available in RePEc especially the content that comes from German institutions since Econstor is known as a "national input service" for RePEc (Weiland, 2011). RePEc is a decentralized database with over 2,000 archives from 99 countries that holds working papers and other research manuscripts in the discipline of Economics and Business Studies.

Altmetric.com<sup>12</sup> is queried for altmetric data and Crossref<sup>13</sup> for citations. Altmetric.com collects social media information for research products found online from specified sources such as social media platforms, traditional media, and online reference managers (Costas et al., 2015). It tracks eleven<sup>14</sup> different research identifiers such as DOIs, handles, RePEc IDs, URLs, ISBNs, SSRN IDs, PubMed IDs, arXiv, ADS IDs, URNs, and ClinicalTrials.gov. Crossref<sup>15</sup> is a registration agency for scholarly communication; it provides metadata for DOIs and since 2017 offers free scholarly citation data for their own DOIs.

To perform our study for exploring altmetric information from Altmetric.com we selected Econstor working papers with three different identifiers: handles, DOIs, and URLs. Econstor

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<sup>10</sup> <http://www.handle.net>

<sup>11</sup> <https://www.cnri.reston.va.us/>

<sup>12</sup> <https://www.altmetric.com/>

<sup>13</sup> <https://www.crossref.org/>

<sup>14</sup> <https://help.altmetric.com/support/solutions/articles/6000134562-what-scholarly-identifiers-are-supported-by-altmetric->

<sup>15</sup> <https://support.crossref.org/hc/en-us/articles/215787303-Crossref-Data-Software-Citation-Deposit-Guide-for-Publishers>

also supports URNs<sup>16</sup> but we excluded them from this study since in Altmetric.com we couldn't find any records for URNs with altmetric information. Each entry in Econstor can have at least one of the identifiers listed above.

URLs in Econstor are represented in two different ways: a) *landing page* that present the page of metadata of a specified working paper and b) *pdf full text* that redirects to the .pdf of the document. Since our study focuses on working papers only, in Econstor 100,000 working paper are found for URLs with landing page and 100,000 URLs for pdf full text. Landing pages links start with a prefix (<https://www.econstor.eu/handle/10419/>) which is followed by an Econstor-local ID as the suffix. Pdf full-text links start with the prefix <http://www.econstor.eu/bitstream/10419> and the Econstor ID follows as a suffix. Additionally, to Econstor URLs, we use also RePEc URLs (33,735) only for working papers that are listed in Econstor. RePEc URLs start with a prefix from the IDEAS website <https://ideas.repec.org/p/zbw/> where "p" denotes the working paper and this URL is followed by the RePEc ID. The RePEc ID came un-encoded for example, one of the RePEc IDs is: RePEc:zbw:agawps:01 and to attach this ID at the URL we needed to encode into a URL form such as: zbw/agawps/01 and add .html at the end of the URL (<https://ideas.repec.org/p/zbw/agawps/01.html>).

## Results

### *1: Coverage of working papers in Econstor and Altmetric.com*

In Table 1 we present the coverage of working papers in Econstor, Altmetric.com, and Crossref additionally also working papers that are listed in Econstor and are available in RePEc. Dataset I contains working papers found in Econstor with handles - that sums up a total of 99,985 handles. We only selected the working papers with handles that have publication dates attached at them since we wanted to see the handle coverage of working papers in Econstor through the years. Dataset II has working papers with handles from Econstor that possess DOIs (4,605) and is a subset of Dataset I. Crossref is used only for Dataset II because Crossref API can be queried only by a DOI. Dataset III includes Econstor URLs of the working papers. Dataset IV includes all RePEc handles for working papers found in Econstor and Dataset V includes the RePEc URLs for working papers listed in Econstor.

**Table 1: Datasets for working papers in Economic and Business Studies and their coverage in Econstor/RePEc, Altmetric.com and Crossref**

	<i>Dataset I Handles only</i>		<i>Dataset II Handles and DOIs</i>		<i>Dataset III URLs</i>		<i>Dataset IV Handles RePEc</i>		<i>Dataset V URLs RePEc</i>
Found in Econstor	99,985		4,605		100,000		50,008		33,735
Found in Altmetric.com	246	0.25%	320	7%	37	0.04%	589	1.2%	0
Found in Crossref			1,613	35%					

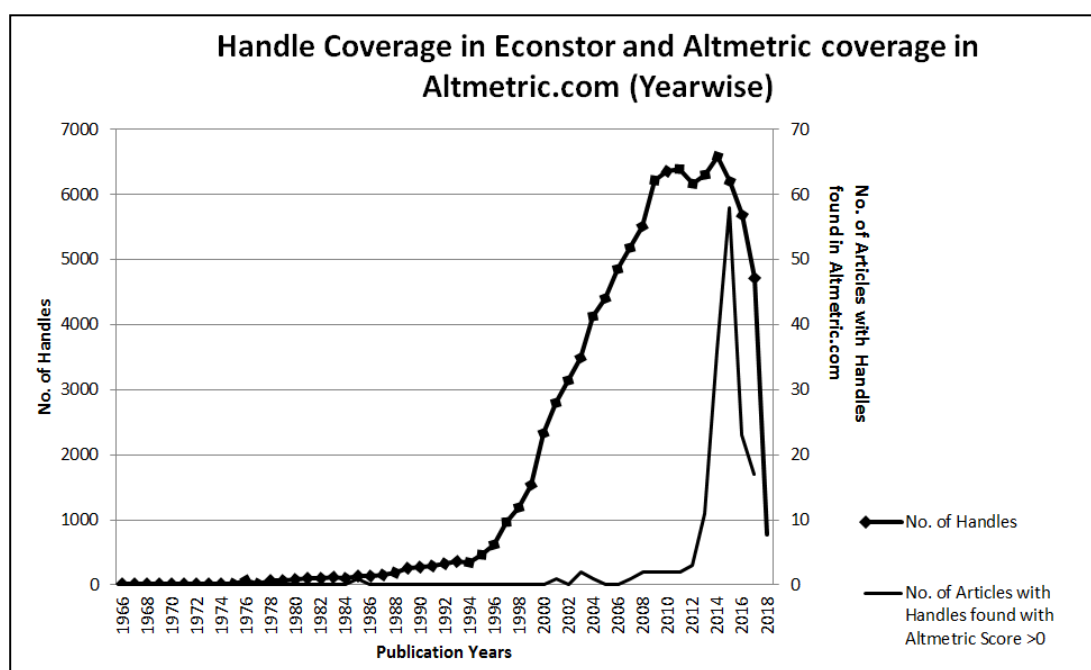
<sup>16</sup> <https://tools.ietf.org/html/rfc8458#page-13>

### *Dataset I: Economic Working Papers with Handles Only*

In Econstor, 100,000 handles that identify working papers for Economic and Business Studies are found (download date: 25.05.2018). Few papers do not have publication dates attached at them therefore, only 99,985 handles are retrieved with publication dates and upon them Dataset I is generated. Econstor records papers in two ways: 1) via internal full-service for paper series, journals or conferences, where the Econstor team organizes the full-text upload and metadata recording with no charge and 2) via self-archiving where single authors are able to self-archive their papers (i.e., pre/post publications, reports or thesis; Weiland, 2011).

According to Figure 1, adding handles for working papers started to increase from 1998. Based on the publication year 2009 until 2016 we found roughly 50,000 handles assigned to working papers and that represents the half of coverage of the Dataset I.

On June 08<sup>th</sup>, 2018 the Altmeter Explorer<sup>17</sup> is used for downloading altmetric information and a MySQL database for holding and querying the dataset. The dataset I result in 661 handles found in Altmeter.com but only 246 handles have altmetric information with an altmetric score greater than 0<sup>18</sup>. The Altmeter attention score is a full number that indicates the attention the research output has received online. The score is calculated based on an algorithm provided from Altmeter.com that uses the weighted counts of each source used for (i.e., Twitter, news, blogs, etc.) tracking research outputs<sup>19</sup>.



**Figure 1: The coverage of Handles in Econstor and Altmeter.com**

The other rest of 415 handles have an altmetric score of 0 which means they are not tracked for any attention by Altmeter.com even though those handles are found in Altmeter.com. It is worth mentioning that Mendeley counts are not calculated in the altmetric score so there

<sup>17</sup> <https://www.altmetric.com/explorer/outputs>

<sup>18</sup> <https://help.altmetric.com/support/solutions/articles/6000060970-putting-the-altmetric-attention-score-in-context>

<sup>19</sup> <https://help.altmetric.com/support/solutions/articles/6000060969-how-is-the-altmetric-attention-score-calculated->

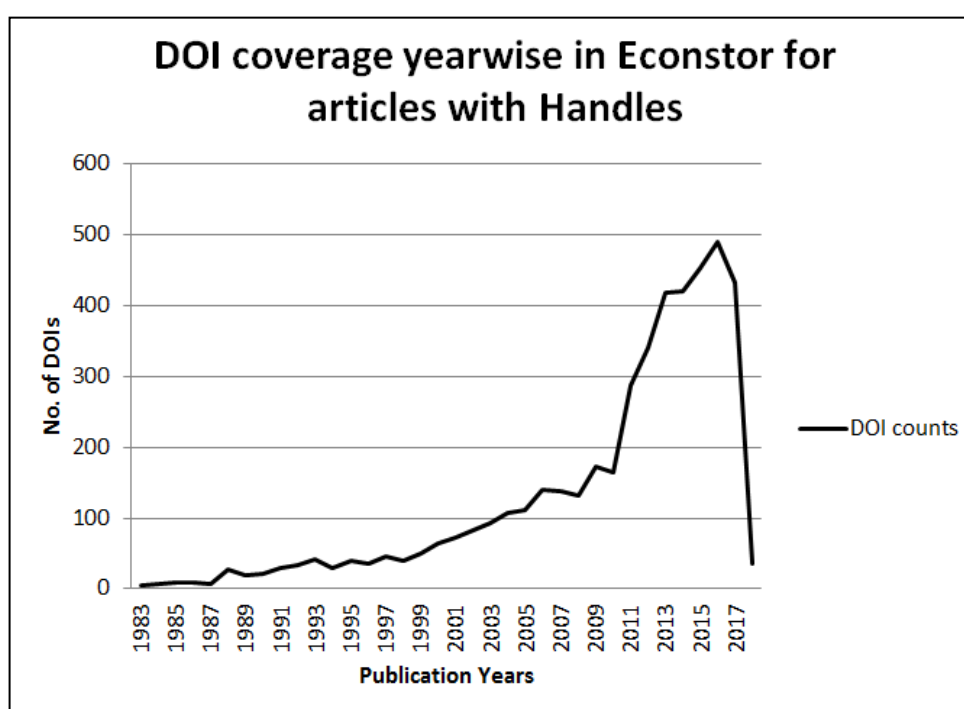


might be working papers that have gained Mendeley attention but are not considered in the selection. Therefore from our Dataset I we found out only one handle that has Altmetric Score=0 but Mendeley count higher than 0 and we added this handle to our Dataset I.

The coverage of handles in Econstor and Altmetric.com is shown in Figure 1 where it only presents those articles that have Altmetric Score > 0 or Mendeley counts > 0 and had a publication date listed from Altmetric.com. Another limitation here appears because eighty-three articles out of 246 had no publication date from Altmetric.com and therefore they are not presented in Figure 1. Altmetric data for working papers are better present from the publication year 2011 and onwards since Altmetric.com started tracking attention in 2011. This leads to a bias of altmetric information that also has been mentioned in other studies exploring other research products such as journal articles (e.g., Costas et al., 2015; Nuredini & Peters, 2016).

#### *Dataset II: Economic Working Papers with Handles and DOIs*

Given that the analysis of Dataset I with handles has a low coverage in Altmetric.com a second Dataset II was explored. For Dataset II we used DOI as an alternative persistent identifier for working papers in Economic and Business Studies. Thus, according to Dataset I we selected all the handles that have been assigned a DOI. We found a subset of Dataset I with 4,605 working papers with DOIs presenting Dataset II. From Figure 2 below, we can clearly see that DOIs are found mostly for handles that are published from 2009 until 2016. We assume that since 2009, DOIs appears to be more common in the economic community for working papers and not only to journal articles.



**Figure 2: DOI coverage in Econstor for working papers with Handles**

Dataset II is found in Altmetric.com with 756 DOIs of which 244 DOIs have an Altmetric Score > 0 and 76 DOIs with an Altmetric Score = 0 but Mendeley counts > 0. This means that the total number of DOIs found with altmetric information is 320 and covers 7% of Dataset II.

### *Dataset III: Economic Working Papers with URLs*

For dataset III Econstor URLs for identifying working papers in Economic and Business Studies are used. Econstor provides two types of links: *front-door* and *direct document links*. Both link types are searched in Altmetric.com for altmetric information. In Econstor 100,000 URLs are found for front-door links and 100,000 for direct document links.

- a) *Landing page* links in Altmetric.com (date of study: 25.06.2018) are found only for 37 research outputs with altmetric information.
- b) *Pdf full-text* links have no altmetric information in Altmetric.com (date of study: 25.06.2018).

According to a) the coverage of URLs is pretty low when it comes at sharing Econstor links especially via Twitter. For example, giving the Twitter news feed from NEP-DEV<sup>20</sup> they share almost every day at least one Econstor working paper link. NEP-DEV<sup>21</sup> is a twitter page tweeting the latest working papers from RePEc. Since Econstor is the main contributor to RePEc and one-third of the content that is published in Econstor is also available in RePEc (Weiland, 2011) the coverage of URLs should have been higher in Altmetric.com. One reason that this low coverage of URLs appears in Altmetric.com is that NEP-DEV tweets short links which we assume that this feature makes it difficult from Altmetric.com to track the original links (i.e., landing page and pdf full-text links). The second reason might be that since Econstor contributes to RePEc there are cases (according to the tweet feeds) were for the Econstor working paper a RePEc front-door link is tweeted instead of an Econstor link. Therefore we created two new Datasets IV and V that looks up altmetric information for RePEc handles and URLs listed in Econstor.

### *Dataset IV and V: Economic Working Papers with Handles and URLs from RePEc listed in Econstor*

Dataset IV includes RePEc handles (50,008) for working papers listed in Econstor. The handles are searched in Altmetric Explorer (date of study: 29.06.2018) and 589 are found, of which 583 have an altmetric score > 0. Thus, the coverage of RePEc handles is higher than Econstor handles in Altmetric.com.

Dataset V is composed of RePEc URLs and none of the URLs is found in Altmetric.com with altmetric information.

After exploring all the URLs in Altmetric.com from Dataset III and V we can conclude that short URLs make it difficult for Altmetric.com to track pdf full-text links shared in altmetric sources especially on Twitter. Specifically, Altmetric.com will not pick up a URL when it is shared for example on Twitter, but rather the directed page of that URL and then looks up for a handle, DOI or URL on that page. Moreover, the study of Zahedi & Costas (2018) that explores data collection from five (i.e., Altmetric.com, Mendeley, Crossref Event Data, Lagotto, Plum Analytics) altmetric aggregators claims that unfortunately there is no direct way to explore how altmetric aggregators query and collect altmetric information from third party APIs.

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<sup>20</sup> <https://twitter.com/search?f=tweets&q=econstor.eu%2Fbitstream%2F10419&src=typd>

<sup>21</sup> [https://twitter.com/RePEc\\_NEP\\_DEV](https://twitter.com/RePEc_NEP_DEV)



## 2: Best providers of altmetric sources

### Dataset I

Table 2 below displays the top 6 altmetric sources for which altmetric information for the handles of Dataset I have been found. The calculation of total counts is done by selecting only articles that have altmetric score  $> 0$  and summing up the usage numbers for every social media source tracked by Altmetric.com. Twitter is the source providing most altmetric counts for Economic and Business Studies working papers. Mendeley is not included in the Altmetric Score of Altmetric.com<sup>22</sup>, therefore, our selection criteria with an altmetric score  $> 0$  excludes articles that only have gained Mendeley attention. News and Blogs have the same number of counts and because of that, we show 6 altmetric sources in Table 2. The total count of altmetric sources is 2,121 which is the total of each sum of the altmetric source received from all handles found in the dataset. The sum of the altmetric score for all handles found is 1,892. The difference between the sum of total counts from altmetric sources with the altmetric score is that the altmetric score<sup>23</sup> is calculated based on the weighted values each source has in Altmetric.com. And the sum of total counts from altmetric sources is provided by simple counts that these sources have received.

**Table 2. Sum of Counts of Altmetric Sources for Handles in Altmetric.com**

Altmetric Source	Total Count of Altmetric Sources	Coverage of handles in %
Twitter	1,925	76%
Facebook	72	18%
Policy posts	50	15%
Google Plus	34	12
Blogs	20	6%
News	20	4%
<b>Total</b>	<b>2,121</b>	

### Dataset II

Dataset II is the subset of Dataset I which includes only those records from Dataset I that have DOIs (4,605). Twitter is the most used altmetric source for working papers in Economics and Business Studies with DOIs. Mendeley, in this case, is the second source after Twitter even though for Dataset I the coverage of Mendeley was quite low. We assume that Mendeley users do not save working papers with handles but rather working paper with DOIs in their system.

The sum of the altmetric scores received for all papers searched in Altmetric.com via DOI is 1,946 which is lower than the sum of altmetric scores found via handles (2,121).

<sup>22</sup>

<https://help.altmetric.com/support/solutions/articles/6000060969-how-is-the-altmetric-attention-score-calculated->

<sup>23</sup> How altmetric score is calculated: <https://help.altmetric.com/support/solutions/articles/6000060969-how-is-the-altmetric-attention-score-calculated->

**Table 3. Sum of Counts of Altmetric Sources for Handles with DOIs in Altmetric.com**

<b>Altmetric Source</b>	<b>Total Count of Altmetric Sources</b>	<b>Coverage of DOIs in %</b>
Twitter	1,136	58%
Mendeley	545	42%
Policy posts	170	27%
News	40	6%
Facebook	33	7%
Blogs	22	4%
<b>Total</b>	<b>1,946</b>	

*Dataset III*

The altmetric sources for URLs have a very low number of counts. Table 4 represents the top 3 altmetric sources for working papers with Econstor landing page URLs. Most of the working papers are mentioned in policy documents, news, and Wikipedia. Twitter, in this case, is not covered even though there is a high number of URLs shown. Policy documents in Altmetric.com are defined as reports, white papers or documents that provide policy and guidance from government or non-government organizations<sup>24</sup>. Thus, policy posts include references to working papers in policy documents. Altmetric.com searches for mentions in policy documents based on links, identifiers, and text mining<sup>25</sup>. Text mining works by using a scraper that can match the mention in the policy document with an appropriate research output based on the author names, journal-title and time frame. This step is needed when in the policy documents neither URL nor DOI is found. According to our results, we confirm that in the policy documents, working papers are mostly referenced by the URL. The same procedure is used in the News. Altmetric.com tracks around 2,900 news outlets via link recognition and news tracker mechanisms to pick up the mentions<sup>26</sup>. The news tracker mechanism is based on the search of the text of that news based on the author name and journals.

**Table 4. Sum of Counts of Altmetric Sources for landing page URLs found in Altmetric.com**

<b>Altmetric Source</b>	<b>Total Count of Altmetric Sources</b>
Policy posts	22
News	9
Wikipedia	4

*Dataset IV*

The altmetric sources for RePEc handles found in Econstor are explored. Table 5 presents the top 3 altmetric sources of which Twitter has the highest altmetric score and Mendeley=0.

<sup>24</sup> <https://help.altmetric.com/support/solutions/articles/6000060968-what-outputs-and-sources-does-altmetric-track->

<sup>25</sup> <https://help.altmetric.com/support/solutions/articles/6000129069-how-does-altmetric-track-policy-documents->

<sup>26</sup> <https://www.altmetric.com/about-our-data/our-sources/news/>

**Table 5. Sum of Counts of Altmetric Sources for RePEc handles listed in Econstor**

Altmetric Source	Total Count of Altmetric Sources
Twitter	1,140
Facebook	91
Blogs	49

### *3: Working Paper citations from Crossref (Dataset II)*

Dataset II with DOIs is used to query Crossref for citation data. 35% of DOIs are found in Crossref of which 231 DOIs (14%) have citation counts greater than 0 and 8% citation counts of 1. Citations from Crossref are based on the “is-referenced-by-count” parameter. According to our results, working papers with DOIs have relatively low citation counts. However, it is important to mention that Crossref has data limitations and can result in missing citations data.

Crossref calculates the citation counts upon the publishers that deposit reference lists. It is worth mentioning according to Crossref, that not all publishers deposit references lists and that not all references use DOIs. Therefore, there are limitations regarding the accumulation of Crossref citations that can result in low citation counts. Regardless of limitations in the citation data, we calculated the Spearman rank correlation between altmetric score and citation counts for working papers that have DOIs. The Spearman rank correlation is calculated with

$r = -0.0157$  and  $p = 0.6746$ ; According to the results, there is no significant correlation between altmetric score and citation counts for working papers in Economics and Business Studies. This suggests that working papers that have high citation counts do not have high altmetric score and vice versa.

## **Discussions**

With this study, we found out that altmetric information for working papers is differently presented for different identifiers. Altmetric information is better to present for working papers with DOIs (7%) rather than with handles or URLs. URLs either have relatively low coverage in Altmetric.com or no altmetric information at all. URLs are mostly presented to policy documents. We assume that the low coverage of URLs in Altmetric.com might fall in two categories: 1) might be a technical issue that is present when collecting altmetric information from different identifiers. Zahedi & Costas (2018) for example, mentioned that we should be aware of technical issues that appear while tracking different identifiers (shortened URLs, URLs, DOIs, PubMed, etc.) since they can influence the rate of altmetric information. For instance, URLs are often shared on Twitter according to the NEP-DEV Twitter stream. But most of URLs have no altmetric information. This might happen because Altmetric.com may not count URLs mentioned in a Twitter post but rather it checks for the URLs that might appear on the directed content page of the mentioned URL in Twitter. 2) Might be that working papers are not shared in social media because economists think that working papers are problematic to be shared. Ozler (2011) claimed that working papers in Economics can be changed - even significantly meaning that the findings can be improved or changed over time before the original premise. Therefore he suggests that readers of working papers should be informed for every updated version of the working paper that might exist to avoid missing the new changes. However, he points out that since people are busy and they

might not have the time to read every possible version of the working paper they are interested in, more attractive for them to read are journal articles that contain the ultimate results.

Within this paper, we also presented the technical issues that got in our way while accumulating altmetric information for economic working papers with different identifiers. To prevent technical issues mentioned above and to enable papers to gain more online attention via social media platforms (i.e., Twitter) we suggest to economists or other counterparts to tweet the handle or DOI of that particular paper additionally to the shortened link. With this approach, Altmetric.com can be able to record the altmetric information for shared working papers on Twitter without losing information.

## **Conclusions**

This study explored to what extent Economic and Business Studies working papers are shared within social media platforms as well as showed the technical issues that were present during the process of data collection. Generally, for all working papers identifiers we selected, altmetric information is low. We assume that economic researchers do not often share working papers on their online social media platforms since working papers are often changing which leads to different working paper versions.

With this study, we presented altmetric information for working papers in Economic and Business Studies from Econstor (additionally RePEc data listed in Econstor) using social media metrics from Altmetric.com. Our results are based on three different working paper identifies and confirm different coverage of altmetric information. Our study confirms that working papers in Econstor are increasing especially recently. In Altmetric.com we found a better coverage of DOIs (7%) rather than for handles (0.2 %) and URLs from Econstor (0.04%).

The topmost used altmetric sources are Twitter for working papers from Econstor for both identifiers handles and DOIs. For Mendeley, we found a lower coverage for working papers with handles, which means that not many researchers save handles in Mendeley but rather DOIs. RePEc handles, on the other hand, have a higher coverage with 1.2% as in comparison with Econstor handles.

According to the citation rate of working papers gathered from Crossref, we found out that working papers in Economics and Business Studies from Econstor are not well cited which confirms the study of Frandsen (2009). We indicate that working papers in Economic and Business Studies are not well shared online as well which confirms the study of (Ozler, 2011). We also show that Altmetric Scores and citation counts for working papers are not significantly correlated. Since citations received from Crossref are represented for a smaller number of articles and with low citation rates it is worth mentioning that the citation dataset in this study has limitations. Therefore in order to validate the results more research is needed. Moreover, a complete citation database should be used to confirm the results of this study. Another limitation of this study is the coverage of working papers. The working papers investigated here are only based on Econstor titles and their identification numbers but do not include working papers published in other databases or series.

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