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## Do Firms Publish? A Cross-Sectoral Analysis of Corporate Publishing<sup>1</sup>

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### Introduction

The phenomenon of corporate publishing, i.e. a firm's involvement in publication activities, has received considerable attention from scholars in economics, management, science policy and innovations studies, and scientometrics/bibliometrics. Although publishing may limit firms' ability to appropriate the value of their R&D efforts through other intellectual property protection mechanisms (e.g. patents, secrecy), research has provided evidence that firms tend to publish a significant amount of their R&D (e.g. Arora et al., 2017; Godin, 1996; Hicks, 1995).

This paper aims to increase our understanding of the phenomenon of corporate publishing. To do so, we first systematically review extant literature to identify which incentives lead firms to contribute to publications. We then examine the publication activity of 2,500 firms (and of about 570,000 subsidiaries of these firms) across 20 sectors for the 2011-2015 period. The analysis focuses on characterising firms' publications activity in terms of proportion of publishing firms by sector; collaboration (co-authorship) with academic institutions; and impact (citations).

### Literature review

In order to identify systematically studies on corporate publishing, we first searched for *ad hoc* keywords (e.g. corporate publishing, publishing firms, firm publications) in publications' titles, abstracts, and keywords. We identified an initial sample of 843 articles and reviews in Web of Science (WoS). Within this sample, 64 studies were considered relevant since they (i) discussed firms' incentive to publish; (ii) examined the publication activity of firms or industrial sectors; or (iii) relied on publication data to operationalize and characterize various dimensions of a firm's R&D activity. The list of references of these studies was then examined to snowball 70 additional studies on the topic. As a result, our review builds on a total sample of 134 publications.

The content analysis of these studies enabled us to identify five categories of incentives for firms to publish: (i) accessing external knowledge and resources; (ii) attracting, recruiting, and

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retaining researchers; (iii) signalling and reputation building; (iv) supporting IP strategies; and (v) supporting commercialization strategies. Each incentive is discussed below.

First, firms' involvement in publication activity enables firms to access complementary and possibly geographically dispersed knowledge and resources (e.g. Hicks, 1995; Tijssen, 2009). Publishing, and therefore sharing and disclosing information and knowledge, can be conceived as the 'ticket of admission' firms must purchase to enter the academic network (Rosenberg, 1990). Publishing also enables firm researchers to establish their technical reputation (e.g. Hicks, 1995), which, in turn, places them in better positions to access and build on upstream scientific knowledge (e.g. Hess and Rothaermel, 2011).

Second, publishing can foster a firm's ability to attract and retain researchers (e.g. Liu and Stuart, 2014). Researchers' human capital represents a critical asset for the firm to perform R&D and to improve its R&D capabilities (e.g. Darby et al., 1999). Researchers bring knowledge and capabilities that fuel the firm's R&D process, but also provide access to social and professional networks (e.g. Murray, 2004).

Third, publishing enables a firm to build up its reputation and credibility, thus improving the firm's image. Publications can function as signals for the existence of scientific and technological competences and capabilities, quality of products, scientific findings, or tacit knowledge/unpublished resources within the firm (e.g. Godin, 1996; Hicks, 1995; Tijssen, 2009).

Fourth, publishing is a key component of a firm's strategy to manage and protect its IP portfolio. A firm can strategically disclose pre-patenting information in publications to limit or stop rivals from patenting the disclosed invention. When a firm discloses information about an invention, the firm is *de facto* altering the state of prior art. This, in turn, can make rivals' inventions no longer novel and nonobvious and therefore more difficult to patent or even un-patentable. Such a strategy has been examined by economists and legal scholars in terms of pre-emptive publication, defensive disclosure, or defensive publishing (e.g. Baker and Mezzetti, 2005; Barrett, 2002).

Finally, publications can give publicity to and generate interest about a firm's products or technologies that is sufficient to accelerate the commercialization of or even to open new markets for these products or technologies (e.g. Bergenholtz, 2014). This is especially true in the case of 'sophisticated' or 'professional' customers that could monitor scientific journals to find suitable and specialized products (e.g. Arora et al., 2017).

Table 2: Empirical studies at the level of the firm.

	Country		All studies
	Single	Multi	
Sector	Single	31	40
	Multi	14	21
All studies		45	61

Source: Authors' elaboration.

Of the 134 studies we reviewed, 61 studies were empirical studies that examined corporate publishing at the level of the firm. We distinguished these studies in terms of number of sectors and countries examined. As depicted in Table 2, this analysis provides evidence that a very limited number of studies examined corporate publishing relying on firm samples covering multiple sectors and countries. The empirical analyses we present in the next section builds and expand on these studies.

### Data and methodology

We examine the publication activity of a large multi-country, multi-sector sample of firms composed of the 2,500 companies that were most active in terms of R&D investment in 2013 (see Table 3). These firms contributed to about 90% of global private R&D in the same period.<sup>2</sup> We developed an *ad hoc* methodology to retrieve publication data of these firms and of their 570,000 subsidiaries from WoS. To do so, we first harmonized and cleaned firm and subsidiary names and identified acronyms and variations of parent firm names. We then matched firm names with organization names reported in affiliation addresses (“AD” field in WoS). We focussed firms’ publication activity from 2011 to 2015. More details on the methodology are available elsewhere, see Rotolo and Camerani (2017).

Table 3: Number of firms and subsidiaries by sector.

Sector	Firms	Subsidiaries
Aerospace & Defence	51	11,699
Automobiles & Parts	148	37,384
Basic Resources	65	15,983
Chemicals	139	30,130
Construction & Materials	72	43,911
Consumer Services	64	39,375
Electronic & Electrical Equipment	242	33,663
Financials	56	48,911
Food & Beverage	69	20,631
Health Care Equipment & Services	97	15,407
Industrial Engineering	212	38,939
Oil & Gas, Alternative Energy	51	31,806
Other Industrials	106	46,295
Personal & Household Goods	129	26,384
Pharmaceuticals & Biotechnology	294	17,691
Software & Computer Services	268	19,197
Support Services	32	55,49
Technology Hardware & Equipment	334	23,553
Telecommunications	29	23,592
Utilities	42	39,819
Total	2,500	569,919

Source: Authors’ elaboration.

Our queries identified an initial sample of 1,273,481 publication-firm observations. However, this sample included a considerable number of *false positive* records. We removed *false positives* with regular expressions and with the support of research assistants. This led to a final sample of 342,152 publication-firm observations or 314,411 distinct publications from 2011 to 2015.

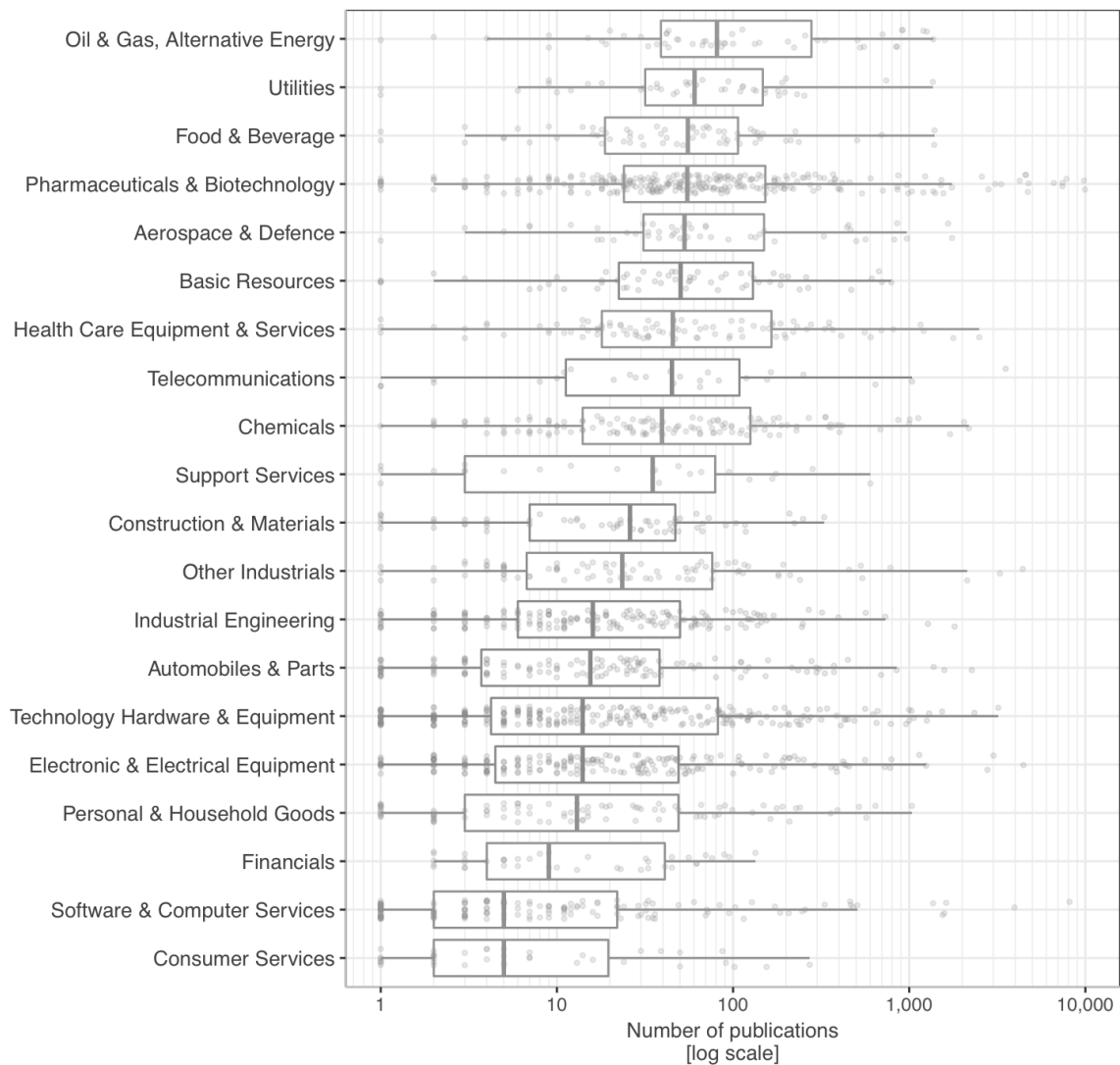
<sup>2</sup> See page 17 of the 2014 Scoreboard – <http://iri.jrc.ec.europa.eu/scoreboard14.html>

**Preliminary results**

*Do firms publish?*

The number of publications to which our firms contributed from 2011 to 2015 (i.e. 314,411 publications) is comparable with the total publication output of French academic institutions (about 357,000 publications) in the same observation period. About 84% of the firms in the sample contributed to at least one publication during the observation period. The sector with lowest proportion of publishing firms is Software & Computer Services, where 58.6% of firms contributed to at least one publication. This proportion is above 90% for seven sectors: Oil & Gas, Alternative Energy (100%), Utilities (100%), Pharmaceuticals & Biotechnology (about 99%), Health Care Equipment & Services (about 97%), Chemicals (about 96%), Aerospace & Defence (about 96%), and Food & Beverage (about 93%).

Figure 1: Box-plot of the number of publications per firm (2011-2015). Firms that contributed to at least one publication are considered. Vertical lines inside the boxes represent median values, boxes the interquartile range (IQR), and horizontal whiskers extend  $\pm 1.5$  IQR outside the box. Circles represent 2,088 publishing firms. Source: Authors' elaboration.



Publishing firms contributed, on average, to 164 publications – when non-publishing firms are also considered, the average reduces to 137 publications. The distribution is, however, highly skewed. About 7% of the publishing firms in the sample contributed to just one publication, while the top-1% publishing firms contributed to 107,713 publications (about 34%). The box-plot chart in Figure 1 depicts the distribution publishing firm-number of publications by sectors. The sector with the highest median value is Oil & Gas, Alternative, Energy (82), followed by Utilities (62), Basic Resources (54), Food & Beverage (53), Aerospace & Defence (52), and Pharmaceuticals & Biotechnology (50).

*Do firms contribute to highly cited publications?*

We analysed firms' publications on the basis of two citation-based indicators. These were calculated considering research articles only – of the 314,411 distinct publication records to which firms in our sample contributed, about 62% (i.e. 194,677 records) are articles. First, we calculated the proportion of firms' articles that are within the top 10% cited articles in the corresponding research area (WoS Categories) and year of publication. Second, we identified the proportion of firms' articles that were published in top tier journals. We defined a journal to be top-tier in a given year if this was among the top 5% journals by Impact Factor of at least one WoS Category.

Table 4: Citation impact of firms' publications by sector.

Sector	Publications	Citation impact		
		Articles	Top-10% Cited (&)	In top-tier (5%) Journals (%)
Aerospace & Defence	10,525	6,295	7.3	13.6
Automobiles & Parts	12,196	8,529	9.7	18.5
Basic Resources	6,759	5,695	6.3	11.6
Chemicals	19,230	14,614	9.4	18.0
Construction & Materials	2,702	1,999	5.8	10.7
Consumer Services	1,020	635	8.3	12.1
Electronic & Electrical Equipment	24,322	16,015	8.8	13.5
Financials	1,046	873	5.2	6.7
Food & Beverage	7,629	5,803	10.3	16.1
Health Care Equipment & Services	16,065	10,020	13.9	17.5
Industrial Engineering	10,767	6,990	7.6	13.5
Oil & Gas, Alternative Energy	12,275	9,932	7.3	10.6
Other Industrials	15,296	9,887	9.5	14.2
Personal & Household Goods	6,317	4,523	6.7	10.8
Pharmaceuticals & Biotechnology	114,792	62,234	17.5	22.6
Software & Computer Services	22,979	13,860	11.7	18.2
Support Services	1,785	1,200	7.7	9.0
Technology Hardware & Equipment	29,829	16,891	9.0	10.3
Telecommunications	6,429	3,725	8.3	10.2
Utilities	5,295	3,987	7.0	12.5
<b>Total</b>	<b>314,411</b>	<b>194,677</b>	<b>11.7</b>	<b>16.9</b>

*Source: Authors' elaboration.*

These indicators provide evidence that firms contribute to a considerable number of publications that are highly cited or included in journals with high Impact Factor values. More precisely, about 12% of the articles published by the firms in our sample are within the top 10%

cited articles in the corresponding research areas and year of publication. The proportion of articles in top-tier journals is instead close to 17%.

Table 4 depicts the number of articles in the sample and both indicators by sector. The sectors with the highest proportion of highly cited articles are: Pharmaceuticals & biotechnology (about 18%), Health Care Equipment & Services (about 14%), Software & Computer Services (about 12%), and Food and Beverage (about 10%). The industrial sectors with the highest proportions of articles published in top tier journals are: Pharmaceuticals & Biotechnology (about 23%), Automobiles & parts (about 19%), Software & Computer Services (about 18%), Chemicals (about 18%), and Health Care Equipment & Services (about 18%).

#### *Do firms collaborate with other organizations?*

As argued in the in the previous sections, a key incentive for firms to be involved in publication is accessing external knowledge and resources. It is not therefore surprising that about 58% of firms' publications are co-authored with at least one academic institution. However, considerable differences exist across sectors (see Table 5). The proportion of firms' publications involving academic institutions ranges from about 41% in the case of "Support Services", to 70% in the case of "Food & Beverage".

Table 5: Collaboration with academic institutions and other firms by sector.

Sector	Publications	Publications with academia (%)	Firm-firm publication (%)
Aerospace & Defence	10,525	53.3	14.1
Automobiles & Parts	12,196	62.2	15.8
Basic Resources	6,759	63.9	9.8
Chemicals	19,230	60.2	13.0
Construction & Materials	2,702	60.4	9.3
Consumer Services	1,020	55.4	13.6
Electronic & Electrical Equipment	24,322	55.5	14.2
Financials	1,046	64.6	15.0
Food & Beverage	7,629	69.9	9.2
Health Care Equipment & Services	16,065	65.1	7.9
Industrial Engineering	10,767	51.8	26.8
Oil & Gas, Alternative Energy	12,275	66.0	8.3
Other Industrials	15,296	55.4	13.7
Personal & Household Goods	6,317	58.5	9.7
Pharmaceuticals & Biotechnology	114,792	59.1	7.2
Software & Computer Services	22,979	52.0	8.2
Support Services	1,785	40.4	16.8
Technology Hardware & Equipment	29,829	51.0	11.9
Telecommunications	6,429	44.3	9.8
Utilities	5,295	54.4	19.9
Total	314,411	57.7	7.0

*Source: Authors' elaboration.*

We also observed collaboration activity among firms in our sample: about 7% of the publications in our sample involved two or more firms. Considerable variations across sectors exists also in this case (see Table 5). The sectors with the highest percentage of publications

co-authored with other firms in the sample are Industrial Engineering (about 27%), Utilities (about 20%), and Support Services (17%).

### **Discussion and conclusion**

The contribution of our paper to extant literature is twofold. First, on the basis of a systematic review of the literature, we have increased our understanding of the incentives that may lead firms to contribute to publications. We have organised incentives to publish into five categories: (i) accessing external knowledge and resources; (ii) attracting, recruiting, and retaining researchers; (iii) signalling and reputation building; (iv) supporting IP strategies; and (v) supporting commercialization strategies. Future research could build on this framework to examine the extent to which the strength of the different types of incentives to publish may vary across sectors as well as by firm type and size.

Second, our empirical analysis showed that publication data (and the relative abundance of bibliometric information embedded in these data) can provide additional perspectives and intelligence on firms' R&D efforts, and on the strategic role that corporate publishing could play in firm's innovation activities. In particular, our analysis has provided evidence that publishing is quite widespread among the firms in our sample. We also showed that firms' publications are cited more than expected and that they are often the results of different forms of collaboration (co-authorship).

In conclusion, our review has provided evidence that extant research has paid considerable attention to industrial sectors where scientific knowledge is a critical input for the R&D process (e.g. pharmaceuticals, biotechnology, chemicals) and has mostly focused on firm samples limited to one or few countries. In line with few recent studies on corporate publishing, we have examined the phenomenon of corporate publishing across industrial sectors and considering a worldwide sample of firms. This analysis has provided evidence that publishing is not limited to few "usual suspect" sectors, but it is a feature of most sectors we considered.

### **References**

- Arora, A., Belenzon, S., and Sheer, L. (2017). Back to Basics: Why do Firms Invest in Research? Technical report.
- Baker, S. and Mezzetti, C. (2005). Disclosure as a strategy in the patent race. *The Journal of Law and Economics*, 48(1):173–194.
- Barrett, B. (2002). Defensive use of publications in an intellectual property strategy. *Nature biotechnology*, 20(2):191–193.
- Bergenholtz, C. (2014). Second-hand signals: How and why firms are being referenced in scientific publications. *European Management Review*, 11(2):159–171.
- Darby, M. R., Liu, Q., and Zucker, L. G. (1999). Stakes and stars: The effect of intellectual human capital on the level and variability of high-tech firms' market values. *National Bureau of Economic Research Working Paper Series*, No. 7201.
- Godin, B. (1996). Research and the practice of publication in industries. *Research Policy*, 25(4):587–606.

- Hess, A. M. and Rothaermel, F. T. (2011). When are assets complementary? Star scientists, strategic alliances, and innovation in the pharmaceutical industry. *Strategic Management Journal*, 32(8):895–909.
- Hicks, D. (1995). Published papers, tacit competencies and corporate management of the public/private character of knowledge. *Industrial and Corporate Change*, 4(2):401–424.
- Liu, C. C. and Stuart, T. (2014). Positions and rewards: The allocation of resources within a science-based entrepreneurial firm. *Research Policy*, 43(7):1134–1143.
- Murray, F. (2004). The role of academic inventors in entrepreneurial firms: sharing the laboratory life. *Research Policy*, 33(4):643–659.
- Rosenberg, N. (1990). Why do firms do basic research (with their own money)? *Research Policy*, 19(2):165–174.
- Rotolo, D. and Camerani, R. (2017). Scientific publication activity of 2014 Scoreboard Companies. Technical report, SPRU-University of Sussex (Brighton, UK) for IPTS, JRC, European Commission.
- Tijssen, R. J. W. (2004). Is the commercialisation of scientific research affecting the production of public knowledge? Global trends in the output of corporate research articles. *Research Policy*, 33(5):709–733.
- Tijssen, R. J. (2009). Internationalisation of pharmaceutical R&D: How globalised are Europe's largest multinational companies? *Technology Analysis & Strategic Management*, 21(7):859–879.