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Advancing the evaluation of graduate education: towards a multidimensional model in Brazil

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Citation

Brasil Varandas Pinto, A. L. (2023, October 24). *Advancing the evaluation of graduate education: towards a multidimensional model in Brazil*. Retrieved from <https://hdl.handle.net/1887/3645840>

Version: Publisher's Version

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Note: To cite this publication please use the final published version (if applicable).

The unseen costs of article processing charges

” *As long as scholars rely on journal impact measures in order to boost their career perspectives, OA publishers can benefit from higher APCs by improving the standing of the journals they run.*

— Sergio Copiello

Some 25 years after the start of the open science movement, a strong development in the transition towards opening practises can be seen in parts of academia, ranging from scholarly publishing access to the first steps taken towards open governance. While many in the science system applaud the movement, it is necessary to follow such developments critically, making sure the intended goals are reached. One of such initial goals of the Open Science (OS) effort was to improve accessibility of publicly funded research to everyone in the science system, creating a global level playing field. Thus, Open Access became one of the most recognisable aspects of OS (Fecher and Friesike, 2014).

This study investigates particular dimensions of Open Access publishing, especially those connected to the payment of Article Processing Charges (APCs) and the less visible consequences of such practises. Research was carried out at the country level, with a special focus on Brazil and the Netherlands, as both played a pioneering role in the development of OS in their own contexts. Brazil clearly was a forerunner in adopting Open Science, as can be seen by the 1998

This chapter has been published as: Brasil, A., Van Leeuwen, T. (2022). The unseen costs of article processing charges: The different realities of Brazil and the Netherlands. In *Proceedings of the 26th International Conference on Science, Technology and Innovation Indicators (STI 2022)*. Granada, Spain. <https://doi.org/10.5281/zenodo.6966707>

launch of the SciELO database – introducing a cooperative publishing model for OA journals (Packer, 2010) – or by the country’s approach to make closed publications democratically accessible with a nationally maintained Portal of Journals (de Almeida et al., 2010). From the Netherlands side, the country already implemented a national Gold Open Access mandate in 2014, followed by national transformative agreements with large publishing houses.

The country selection for this study was also motivated, as will become clear in discussing the results, because Brazil and the Netherlands are in opposite extremes of a spectrum when APC payments and resulting publication impact are taken into consideration. From the initial focus on these two cases, a scenario representative of the Global South and North will become evident, as will the complexity of Open Access practises leading not only to blessings, but also to unintended effects that may force countries to adapt in creative ways.

9.1 Methods and data

This study has been conducted primarily through the analysis of data originating from the Web of Science core collection, considering the in-house version available at the Centre for Science and Technology Studies (Clarivate Analytics, 2022). Data were used to identify journals and articles considering affiliations to assign publications by country. The Digital Object Identifier (DOI) of the publications was used to collect OA information from Unpaywall (Else, 2018). The Directory of Open Access Journals (DOAJ) also provided data on APC. The financial data and the corresponding exchange rates were obtained from the Organisation for Economic Co-operation and Development (OECD), including the Purchasing Power Parity (PPP) (OECD, 2022). For the analyses, only articles published between 2015 and 2018 were considered, allowing the calculation of the Mean Normalised Citation Score (MNCS) based on a four-year window.

For a detailed perspective on Brazil, microdata of the scientific output of the country was collected from the Brazilian Agency for Support and Evaluation of Graduate Education (CAPES, 2021a). The agency’s information system offers details on published articles that allow data to be matched with WoS, using a procedure described in a previous study (Brasil, 2021b). The data set was also enriched with information from Latindex, RedALyC, SciELO, and DOAJ.

9.2 Analysing impact and APCs

In the debate around the different types of Open Access, the cost of APCs usually plays a central role (Bosman et al., 2021; Raju et al., 2020; Siriwardhana, 2015). Most scholars recognise that the prices practised by many publishers are not reasonable, and the potential of such practises to increase asymmetry in the science system is often considered a consequence (Siler et al., 2018). Despite that, the movement toward opening science is stronger every day, and those who can afford publishing in high-impact journals, despite costs, often pursue that path to make their findings available to everyone (Jubb et al., 2017). The reality of different countries varies, as do the available resources for publication and the consequential choice of journals (Copiello, 2020). Evidently, this may also cause problems with the impact of research by these countries, and Figure 9.1 shows a known relation between APC costs and impact, in this case represented by the Mean Normalised Citation Score (Waltman, 2016).

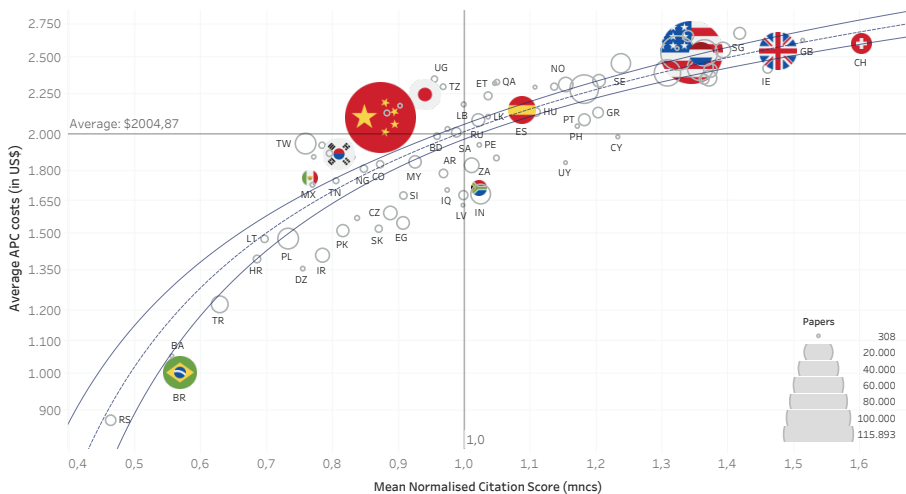


Figure 9.1.: MNCS of OA papers indexed by Web of Science, by country, in relation to average APC costs (2015 – 2018). All figures shown in this chapter are available in interactive format at <https://tabsoft.co/3F2mc5y>

Figure 9.1 displays countries according to the average APC costs paid for OA publications and the related mean normalised citation score (mnsc). The size of each marker represents the number of Gold OA papers found in WoS, with

corresponding matches in Unpaywall, as connected by the digital object identifier (DOI). The visualisation suggests that the more a country pays for its open publications, the higher the impact measured by mncs. For instance, it is possible to see a high concentration of countries paying around average value APCs with an impact close to the mncs database average. Some countries take the lead with higher average APC costs and mncs, and there are a few countries with low APCs expenditures and low observed impact.

One could argue that the seeming correlation between impact and high APCs may be a result of the supply-demand mechanism, as high-impact journals would receive many submissions of high-quality papers, being able to raise their charges without reducing demand to a quality-threatening level. However, this study is interested in investigating another economic dimension related to APC costs for countries in distinct social-economic realities. In this sense, [Figure 9.1](#) shows the Netherlands among the leading countries both in average investment and resulting impact, with an mncs 36% above the average of the database for its 12,5 thousand papers. At the other extreme, towards the tail of the logarithmic trend line, Brazil is seen with more than 25 thousand articles that match the adopted criteria, but with an mncs 43% under the reference and an APC value of US\$ 1004, half of the average measured for all countries.

If the theory of Purchasing Power Parity (PPP) is considered, one cannot convert currency values to understand how much an APC would cost for any given country. It is necessary to equalise currencies by considering costs of predetermined baskets of products and services in those countries and currencies. This process reveals the US\$ 1004 average APC cost for Brazilian OA papers would be equivalent to US\$ 2139 in the United States of America. Therefore, [Figure 9.2](#) replaces the average APC of the previous scatterplot with the exchange rate corrected according to the Purchasing Power Parity index available from the Organisation for Economic Co-operation and Development ([OECD, 2022](#)).

Although the PPP-corrected expense of APCs for Brazilian publications more than doubles the nominal investment, the situation is quite different for most countries with high mncs averages. For example, the Netherlands spends an average of US\$ 2527 on APCs, and the corrected value is only slightly higher, at US\$ 2818. [Figure 9.2](#) also shows that most countries with higher impact measures spend proportionally less on APCs, while several countries with around average mncs spend much more if power purchasing parity is considered.

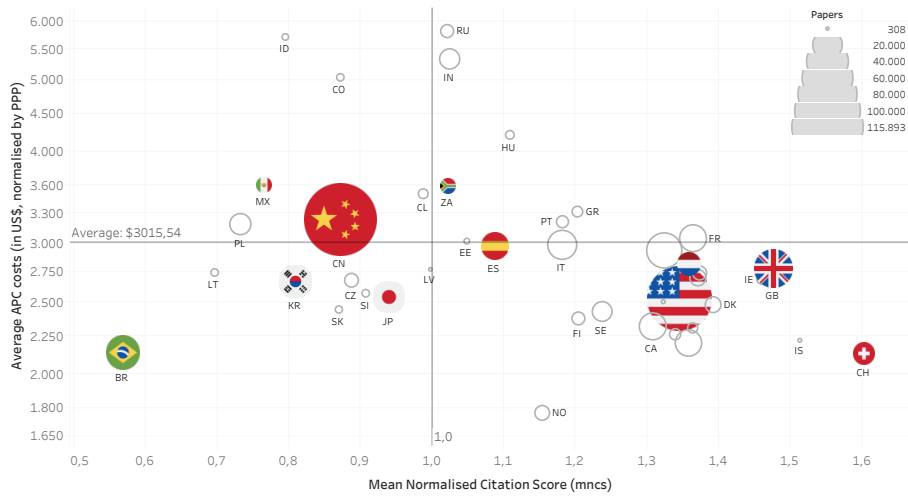


Figure 9.2.: MNCS of OA papers indexed by Web of Science, by country, in relation to average APC costs adjusted by Purchase Power Parity (2015 – 2018).

Although Brazil’s investment in golden open-access publishing is small compared to the Netherlands, the reality is that the costs are relatively high if the social-economic situation of the country is considered. This perspective suggests much injustice behind some scholarly communication practises, which intensifies the Matthew effect in science. While everyone is expected to pay exorbitant prices for high-impact publishing, the investment is significantly more expensive for numerous countries, especially those in the Global South. However, this study found a second layer of complexity with respect to publishing practises beyond the cost of APCs and what they represent for different countries.

9.3 The Brazilian practises of OA publishing

A previous study has shown that the Web of Science indexes only around 50% of all Brazilian papers, and most of the country’s scientific output finds space in databases such as SciELO, Latindex, and RedALyC (Brasil, 2021b). Conducting a similar analysis of OA publishing in Brazil, we see even more extreme results, since 6429 of the 8010 journals in this category are not indexed by WoS. Most of those are Diamond OA, with no APCs charged for publication (6226 journals,

representing 77,7% of the total). Of the 1581 WoS-indexed journals, only 668 are APC-free, representing 8,3% of the total. The distribution of OA journals by indexation in WoS and the price range of APCs can be seen in Figure 9.3.

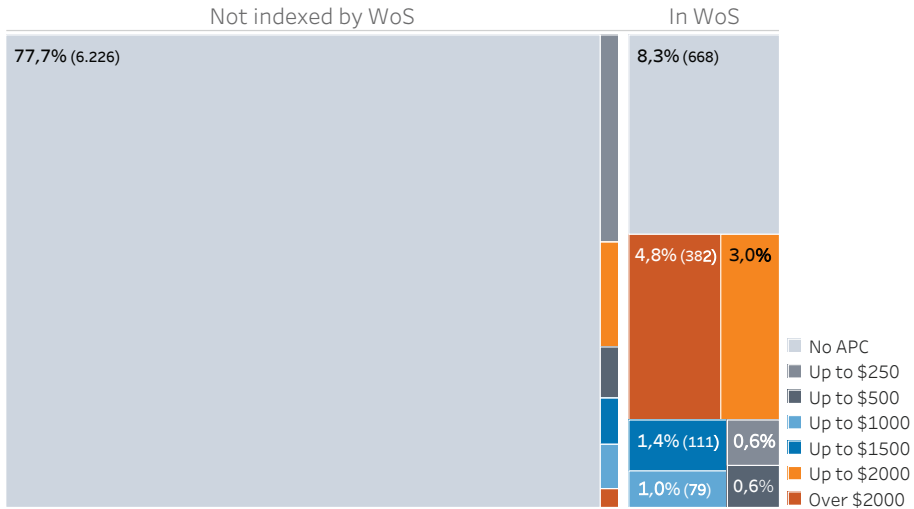


Figure 9.3.: Journals with Brazilian OA output according to APC costs and whether they are indexed by WoS (2015 – 2018).

Figure 9.3 reveals that it is not possible to measure the impact of Brazilian OA publications by only looking at the Web of Science, as the database indexes less than 20% of OA journals used by the country’s researchers. Coverage is always an issue to evaluate research performance, especially when economic inequalities are mostly neglected in scholarly publishing practises. For Brazil, that means finding different ways of financing the publication system, so that open publishing alternatives can be provided without costs for authors.

9.4 Publication quality and accessibility

As described in a previous study, indicators are not always sufficient to capture the complexity of some national science systems (Brasil, 2021e). In Brazil, part of the solution to improve evaluation practises came from the implementation, in 1998, of a journal classification system known as Qualis. Such a system

combines quantitative evidence from multiple data sources with a qualitative perspective provided by peer review. Therefore, while indicators such as h-index, impact factor, Scopus percentile, and others may be used to calculate provisional classifications, disciplinary peer review committees can challenge these indications and reclassify journals according to what each discipline considers to be of quality. [Table 9.1](#) shows the distribution of the 8010 journals analysed in this study according to the percentile of the Qualis classification.

Table 9.1.: Journals with Brazilian OA output and articles published, according to the APC costs and percentile of the national classification of journals (2015 – 2018).

	Percentile of the Brazilian Classification (Qualis)									
	Top 12,5		12,5-25		25-50		50-75		Bottom 25	
	J	P	J	P	J	P	J	P	J	P
No APC	340	36.689	557	61.191	1221	82.536	1978	84.131	2798	48.521
Up to \$250	8	1292	29	16.060	56	16.353	31	3502	17	237
Up to \$500	6	2180	16	6260	29	1511	15	88	5	8
Up to \$1000	18	2043	18	4276	36	1682	17	68	9	24
Up to \$1500	25	1496	38	1801	40	554	17	88	11	33
Up to \$2000	102	9010	84	1579	60	972	24	145	15	90
Over \$2000	210	11.009	111	2984	44	529	19	88	6	32
Total	709	63.719	853	94.151	1486	104.137	2101	88.110	2861	48.945

[Table 9.1](#) shows the number of journals (J) and articles (P) published from 2015 to 2018, grouped by the percentile ranges of the Qualis classification results and the APC cost categories adopted earlier in the study. The data displayed confirm a general perception in the country’s academic community that there is a high volume of lower quality journals within the Diamond Open Access system. This becomes clear from the 4776 APC free journals classified in the bottom 50 percentile of Qualis, accounting for almost 60% of all OA journals used by Brazilian researchers in the period of analysis. Furthermore, more than 130.000 papers have been published in such journals in the period, around 33% of the open access papers in the period.

A whole study could be produced around the journals considered to be of lower quality and about the criteria used by peer review committees to classify them as such. For example, a valuable analysis could depart from the work of [Van Noorden \(2017\)](#), who argues that the usefulness of scientific work is not

always captured by citations, and Sugimoto and Larivière (2018), who highlight that most bibliometric databases focus mainly on papers, thus being unable to capture the impact of papers in other types of output, such as policy documents.

However, Table 9.1 also allows for the investigation of the top percentiles of Qualis classification. As can be seen, 340 APC-free journals are ranked among the top 12,5% best, a similar number to the 312 journals with APCs above US\$ 1500 at the same level. However, the number of articles published in Diamond OA journals is almost twice that of paid counterparts. Expanding the analysis to the top 25% or 50% journals in the classification, the difference becomes even more significant, as highly priced APCs seem to be paid primarily for those journals considered to have the highest impact.

Diamond OA journals contribute to reduce asymmetry in scholarly communication, as opening research results becomes possible for those unable to pay for exorbitant APCs. But being open is about more than access, and Brazilian Open Access Journals are also a space to publish in Portuguese, the local language. As described by Brasil (2021b), English literacy rates in the country are low even among academics, and publishing in English often restricts the possibilities to produce and consume science. To understand the role of Diamond and low-cost OA journals in this dimension, Figure 9.4 displays the language of publication of the articles listed in Table 9.1.

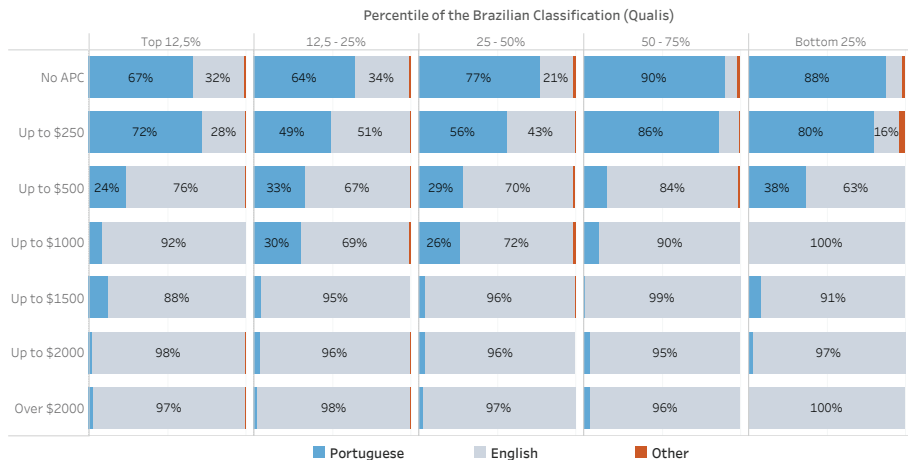


Figure 9.4.: Percentage of Brazilian OA papers, by language, according to APC costs and percentile of the national journal classification (2015 – 2018).

Figure 9.4 shows most Brazilian publications are in Portuguese or English, as the percentage of other languages is negligible. For high-APC journals, English publication dominates, as would be expected for international journals. However, moving towards the top of the chart with low-APC or Diamond OA journals, the number of papers in Portuguese increases significantly. Higher percentages are seen in the lower percentiles of the classification, but are progressively replaced by English in the top percentiles. Considering the nearly 100.000 papers published in Diamond OA by the top 25% of journals, around 65% are in Portuguese, considered to be of as much value as the English publications in expensive journals.

9.5 Conclusion

The analysis of APCs and Gold OA publishing suggests that there may be a significant correlation, at the country-level, in APC expenses and the citation impact of resulting publications. High APC values are then a disadvantage for low- and middle-income countries, and they are even worse than what their nominal value reveals, as exchange rates based on purchase power parity indicators show how much more costly it can be to publish in US dollars. Thus, while OA publishing was intended to further equality, we now witness a higher chance of scholars being excluded from publishing.

As the results of this study show, countries like Brazil are not able to make the same level of investment seen in the Global North, developing alternative publication paths that are not only more coherent with its economic reality, but are also able to value high-quality output even in local language. The problem, as argued by (Brasil and Waltman, 2022), is that metrics from regional publication databases are often invisible in the international context, and unless research analytics become globally inclusive, part of that work remains invisible in evaluation processes and hence is less appreciated.

Although this research has already generated additional results – some available interactively at <https://tabsoft.co/3F2mc5y> – the format of the short article is a limiting factor. Therefore, an extended version of the study is already underway, for example, to include a historical analysis of the development of Open Science both in Brazil and in the Netherlands, highlighting milestones that helped shape

the different approaches of the countries to Open Access. The study will also replicate, for the Dutch system, some of the data exploration performed for Brazil, although recognising that information systems are not as developed or transparent in the Netherlands.

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