Pricing De Solla Price's Circumvent

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Opinion Article

ABSTRACT

Aims: This study examines the foundations of modern scientometrics as laid down by Derek De Solla Price who is reputed to be the founding father of scientometrics.
Methodology: A brief overview of the study of network structures was made. This was used to identify the onset of erroneous assumptions in the premise laid by De Solla Price. Established similarities between citations and voting was exploited and used to quantify the extent of the errors made in De Solla assumptions.
Conclusion: It was found out that the assumptions of De Solla Price are about 78% in error.

1. INTRODUCTION

Some methodologies used in research evaluation include bibliometrics and scientometrics. Bibliometrics involves approaches to evaluating scientific publications, while scientometrics evaluates science in general. Fundamental to the practical application of these approaches is the involvement of various types of citation analysis.

The core principle of the methodologies of citation metrics is the assumption that citation of an author/article/journal is an express indication

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of quality of the cited source. This opinion, in the general is not true [1-5]. While a significant proportion of scholars believe that citation analysis is suitable as used in evaluation of a number of academic endeavours [6-9], however, now, there is increasing critical view to this standpoint. Many critiques have emerged to this effect [1-4,10-13]. The adoption that citation expresses quality of the cited work forms the basis of scientometrics. This foundation was laid by Derek De Solla Price when he made assumptions to circumvent the entire purpose of citation in his work on Cumulative Advantage [14,15]. His assumptions are erroneous in two parts. Firstly, the assumption that citing an article/author indicates that the cited work is quality is erroneous. Secondly, the assumption that the probability that an author would be cited is proportional to the number of existing citation to the author is also erroneous. Expositions on the error made by the second assumption will be made later on in another article. However, the error in the first assumption is dealt with herein.

This study – "Pricing De Solla Price Circumvent" attempts to quantify the extent of the error in De Solla Price first assumption. The significance of this quantitative analysis coincide with the goals and importance of scientometrics, bibliometrics, research evaluation and evaluations in general which is to assess aims, realizable concepts/proposal in decision making or to ascertain the degree of achievement or value in regard to aim and objectives.

2. HOW THE ERROR WAS MADE

The mechanism for network structures has been studied severally over the past century. Some interesting applications of the network and digital filters can be seen in Mishra [15] and Deepmala [16]. The mechanism for network structures was first studied by Udny Yule in 1925 [17,18], when he modeled the distribution of the size of biological taxa. The work of Udny Yule has been severally adapted under various titles to model other networks which were considered similar to the original network used in Yule's study. One of such adapted study was made by Herbert Simons to study wealth distribution. Simon showed mathematically that the rich gets richer. He alluded to the Bible passage of Matthew 25:29 [17,18]. The work of Simons had tremendous effects which earned him a Nobel Prize in Economics in 1978 [17]. The work is popularly referred to as the "Matthew Effect". Unfortunately, there are two (2) Matthew effects.

There is the Mathew 19:30 as well! Adoption of only Matthew 25:29 is circumventing of Matthew 19:30 which came afore.

De Solla Price popularly known to be the father of scientometrics also adopted the Simon Matthew Effect to Citation networks. He renamed the mechanism as Cumulative Advantage. He assumed that when new papers cite previously published paper, the effect will be an advantage which is cumulative. New papers citing an existing paper does not necessarily indicate an advantage. If the network structure is analyzed in the context of volume, yes, each new vertex joining the network leads to a volumetric growth. However, when qualitative analysis is made, addition of a new vertex to an existing network does not necessarily connote quality. Herein, error was introduced by assuming that each new addition to the network signifies quality.

3. QUANTIFYING DE SOLLA PRICE'S CIRCUMVENT

Saha et al. [19] established similarities between citation counts and votes. Their opinion is that by citing articles from another publication in their own manuscripts, authors of academic writings are in essence casting votes for the primary literature [19]. They see impact factor as a tally of those votes. However, Adedayo [2] identified that votes are not always generally positive. Sometimes, votes are made to support an argument, and at other times votes can be made against an argument. A clear indication of this situation is seen during a legislative decision making process. Votes are either "aye" or "nay". Adedayo [2] extended the nature of votes to include validity/invalidity of the votes cast. Nine (9) different natures of votes cast were identified in all (see Fig. 1).

Fig. 1 can be taken as the sample space, which is the set of all possible outcomes of votes cast, i.e.:

S = {Democrat, Republican, Unionist, Anarchist, Progressives 1, Progressives 2, Confusionist 1, Confusionist 2, Confusionist 3}   (1)

It can also be represented as:

$$S = \{D, R, U, A, P1, P2, C1, C2, C3\} \quad (2)$$

Where D, R, U, A, P1, P2, C1, C2, and C3 are the sample points of the sample space. D, R, U, A, P1, P2, C1, C2, and C3 are the first letters of

the words: Democrat, Republican, Unionist, Anarchist, Progressives 1, Progressives 2, Confusionist 1, Confusionist 2, and Confusionist 3 of Figs. 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h and 1i respectively. The sample points are events which are mutually exclusive.

The probability of an event in the sample space is given as:

$$P \text{ (Event)} = n/N \qquad (3)$$

Where N is the total number of the sample points and n is the number of possible outcome of the event. Where:

$$0 \leq P \text{ (Event)} \leq 1 \qquad (4)$$

In Fig. 1, the total number of the sample points is 9. Each of the outcomes is equally likely to occur. The assumption of De Solla Price is that Citation of a primary article (votes cast) is positive and valid. The number of possible outcome for this event is: P (D) or P (P1).

$$P \text{ (D)} = 1/9 \qquad (5)$$

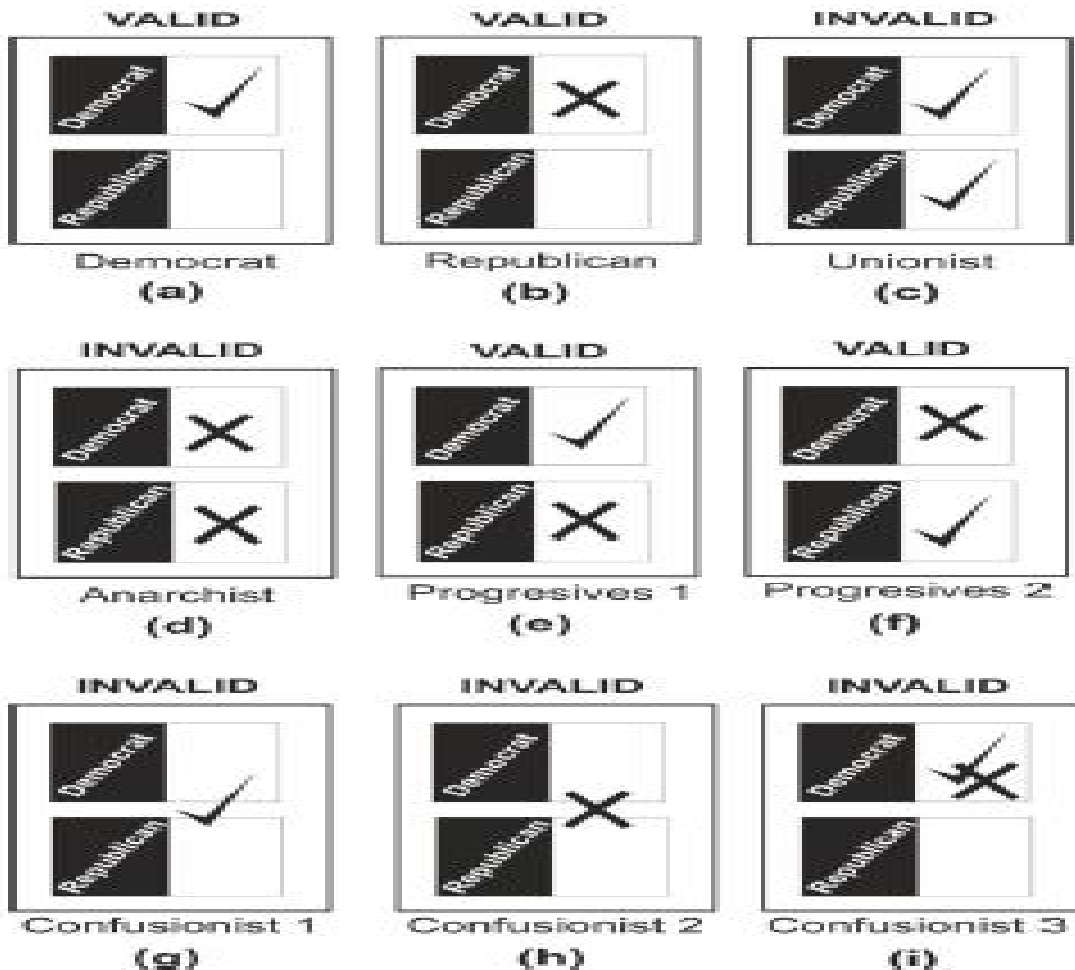$$P \text{ (P}_1\text{)} = 1/9 \qquad (6)$$

Fig. 1. True nature of votes

Therefore; the probability that a vote cast will be positive and valid is calculated as thus:

$$P(D) + P(P1) = 1/9 + 1/9 = 2/9 \qquad (7)$$

$$\text{i.e.} \qquad P(D) + P(P1) = 0.22 \qquad (8)$$

$$= 22.22\% \qquad (9)$$

In essence, De Solla Price assumption is about 78% erroneous.

4. CONCLUSION

The assumptions made by Derek de Solla Price to establish that citation to an article leads to cumulative advantage were identified to be erroneous. By alluding to voting systems, quantitative analysis of the extent of error made in de Solla Price assumptions was made, and it was found out that the assumptions are about 78% in error.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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