

Report Part Title: Impact and Innovation: Grant-Level Findings

Report Title: An Outcome Evaluation of the National Institutes of Health (NIH) Director's Pioneer Award (NDPA) Program, FY 2004–2006

Report Author(s): Bhavya Lal, Alyson G. Wilson, Seth Jonas, Elizabeth C. Lee, Amy M. Richards and Vanessa I. Pena

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4. Impact and Innovation: Grant-Level Findings

This chapter presents evaluation findings with respect to the impact of research and the innovativeness of research approaches. It compares the NDPAs first to the matched R01 set of grants and then to the random R01 portfolios. For the matched R01 grants, the first eight bibliometric indicators are discussed here; the final four are discussed in Chapter 7. In addition, this chapter provides the results from analyses of expert assessments of the impact and innovativeness of the top five publications. For the random R01 portfolios, the findings from the analyses of three bibliometric indicators are discussed.

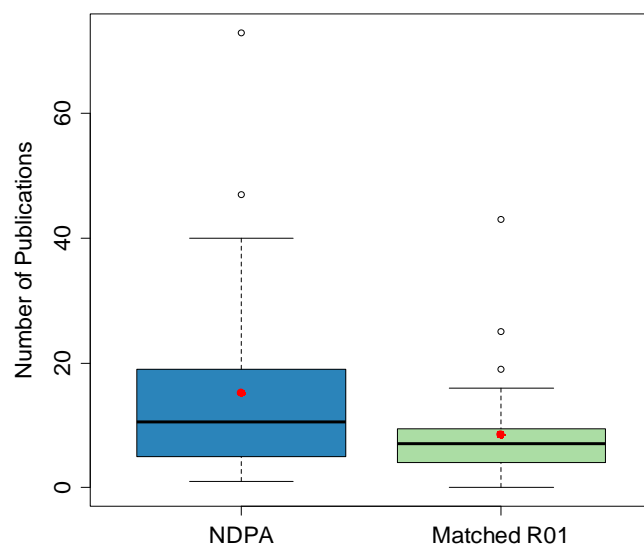
A. Matched R01 Grants

The study team compared impact and innovation of the matched R01 grants to impact and innovation of the NDPAs through bibliometrics and expert review. The results are presented graphically as box plots that show the relative distributions. Kolmogorov-Smirnov (K-S) tests were performed to determine whether the group distributions differ significantly.

1. Bibliometric Findings

a. Number of Publications

NDPAs produced more grant-attributed publications than the matched R01 grants ($K-S, p = 0.04$) (Figure 15).

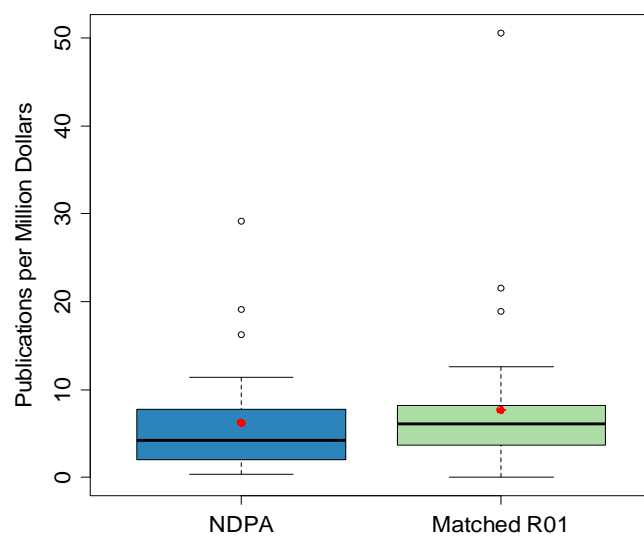


Note: One observation equals one grant.

Figure 15. Grant-Level Publications

b. Number of Publications per Grant Funding Amount

When accounting for grant size (as measured by direct cost), there was no difference in the number of publications output by the two grant mechanisms (K-S, $p = 0.31$) (Figure 16).

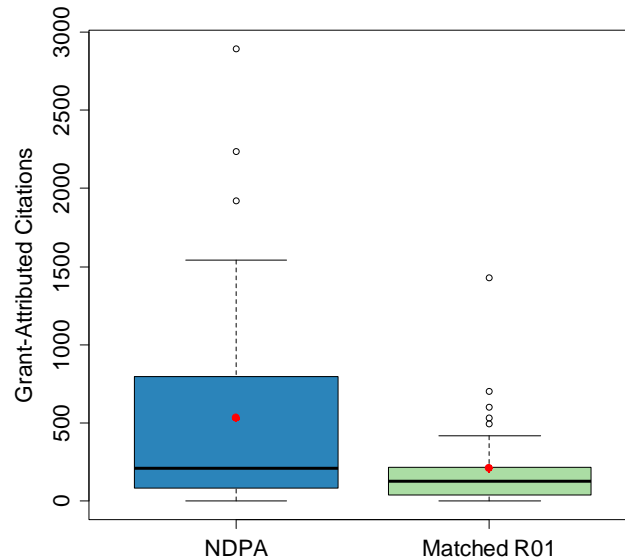


Note: One observation equals one grant.

Figure 16. Grant-Level Publications per Million Dollars in Direct Costs

c. Number of Citations

There was no statistical difference between the Pioneers and the matched R01 PIs in citations to grant-attributed publications (K-S, $p = 0.06$) (Figure 17).

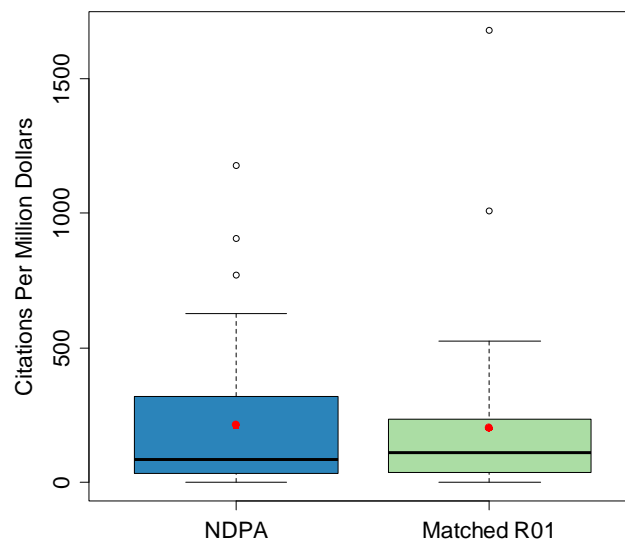


Note: One observation equals one grant.

Figure 17. Grant-Level Citations

d. Number of Citations per Grant Funding Amount

When accounting for grant size, there continued to be no difference in the citations to grant-attributed publications (K-S, $p = 0.89$) (Figure 18).

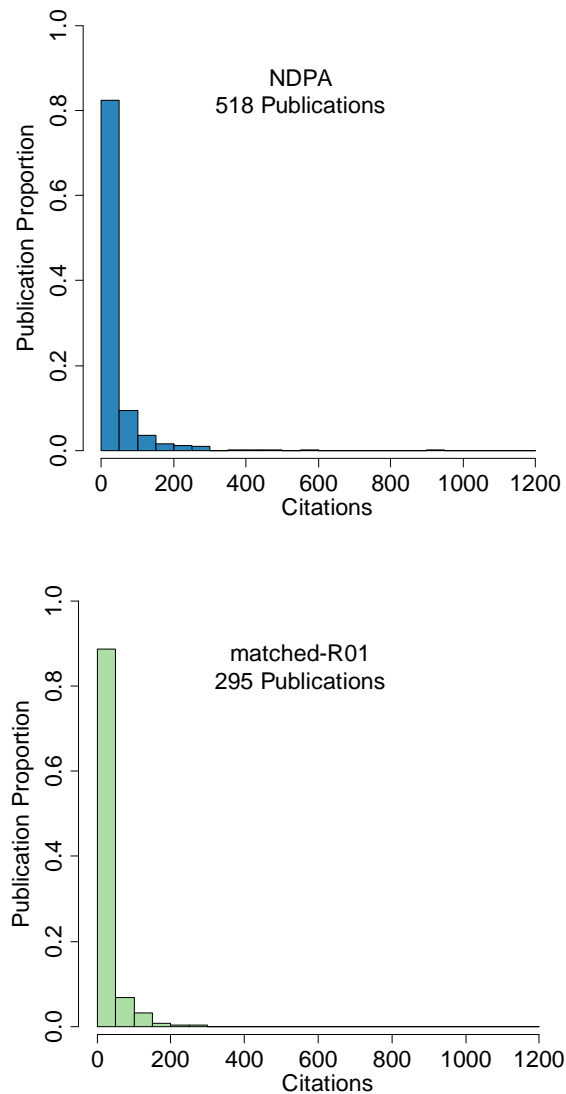


Note: One observation equals one grant.

Figure 18. Grant-Level Citations per Million Dollars in Direct Costs

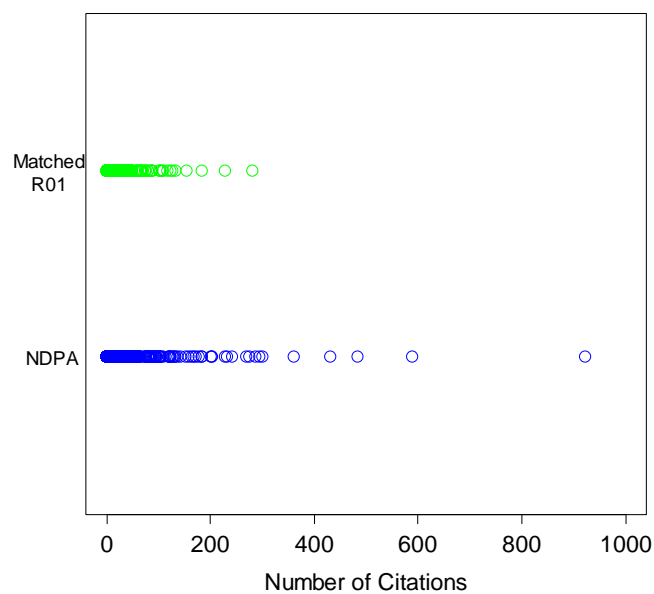
e. Number of Citations per Publication

At the publication level, NDPAs and matched R01 grants had statistically similar citation distributions (K-S, $p = 0.34$) (Figure 19 and Figure 20). Nevertheless, it is notable that the NDPA distribution of citations has a longer positive tail. Several NDPA publications had 400 or more citations, while the matched R01 publications had no more than 281 citations. This might suggest that the most successful NDPAs had a greater impact than the most successful matched R01 grants.



Note: One observation equals one publication.

Figure 19. Grant-Level Citations per Publication—Histogram



Note: One observation equals one publication.

Figure 20. Grant-Level Citations per Publication

f. Additional Analysis on Publications and Citations

Calculations show that NDPAs produced publications more slowly than the matched R01 grants (chi-sq, $p < 0.0001$) (Figure 21), but their publications, once released, were cited more rapidly (chi-sq, $p < 0.0001$) (Figure 22). These plots are a snapshot of publications and citations through the end of 2011. Figure 22, in particular, will continue to change as publications accrue citations.

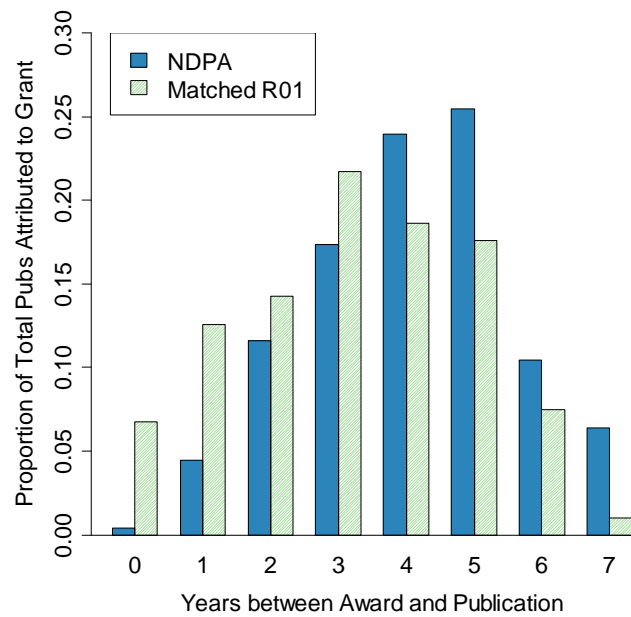


Figure 21. Lag time between Publication and Award Year

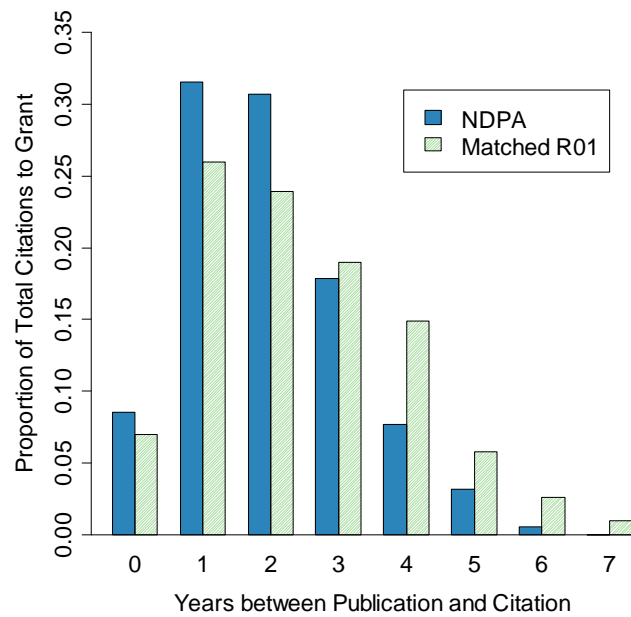
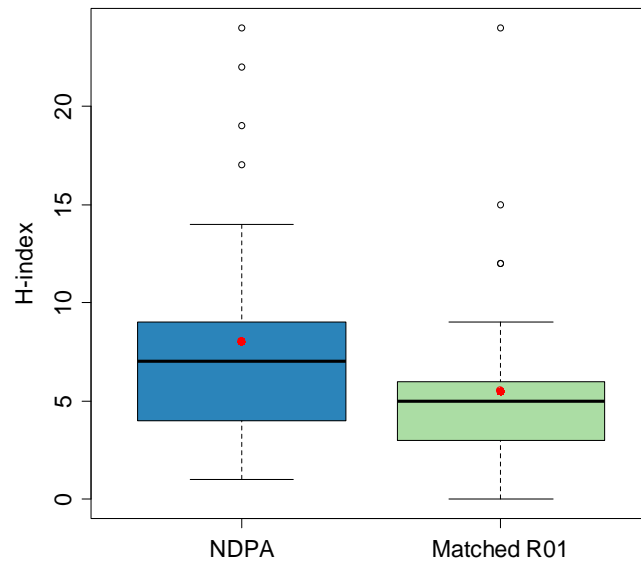


Figure 22. Lag Time between Citation and Publication Year

g. H-index

NDPAs have larger h-index values than matched R01 grants (K-S, $p = 0.003$) (Figure 23).

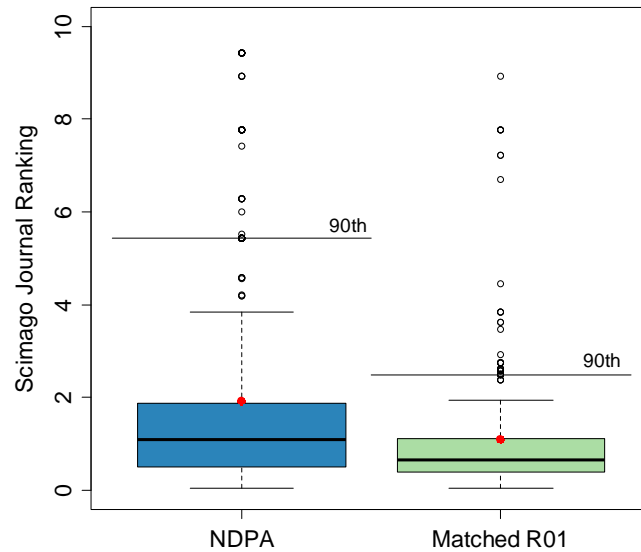


Note: One observation equals one grant.

Figure 23. Grant-Level H-Index

h. SCImago Journal Rank

NDPA publications appeared in journals with higher journal impact factors than those of matched R01 publications, and there was a notable difference between the 90th quantiles in the distributions of the two groups (K-S, $p < 0.0001$) (Figure 24).



Note: One observation equals one publication.

Figure 24. Grant-Level Journal Impact Factors

i. Proportion of Publications by Journal Percentiles

Approximately 25% of NDPA-attributed publications appeared in the top 0.5% of all SCImago-indexed journals, approximately 50% of NDPA publications appeared in the top 1% of all SCImago-indexed journals, and just over 30% of the matched R01 publications appear in the top 1% (chi-sq, $p < 0.0001$) (Figure 25).

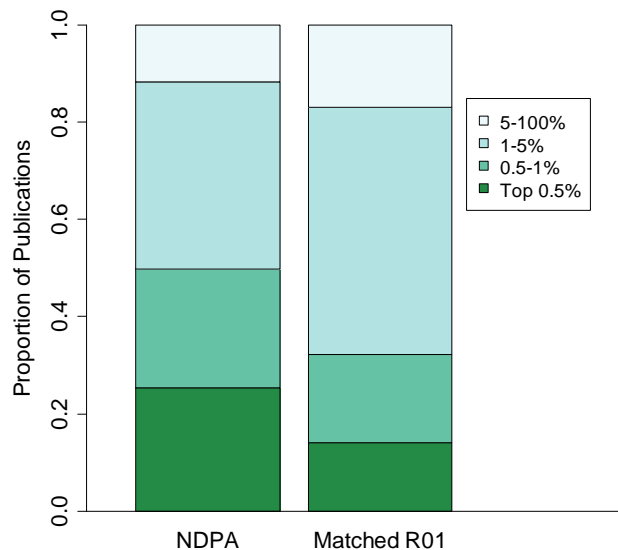
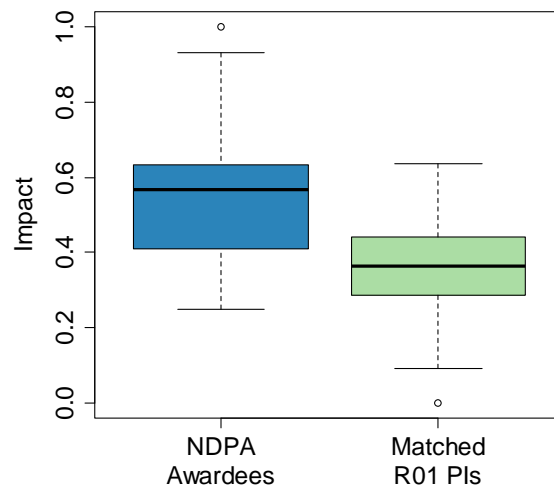


Figure 25. Grant-Level Proportion of Publications by Journal Percentiles

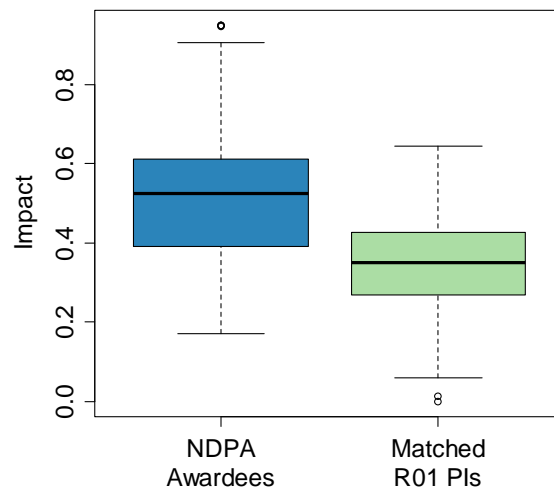
2. Expert Review Findings

The expert review assessed impact and innovation of both packets and papers. Figure 26 is a box plot of the estimated impact for NDPA and matched R01 packets. The Pioneers had a significantly higher impact (t-test, $p < 0.0001$, K-S $p = 0.0002$). Similar results are seen for papers (t-test, $p < 0.0001$, K-S, $p < 0.0001$) in Figure 27.



Note: One observation equals one grant.

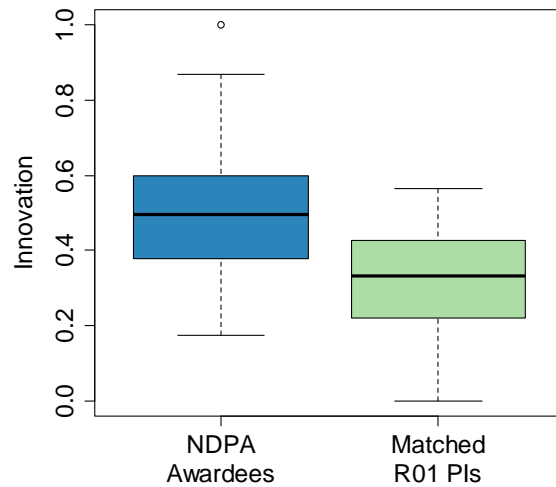
Figure 26. Expert-Assessed Packet Impact



Note: One observation equals one paper.

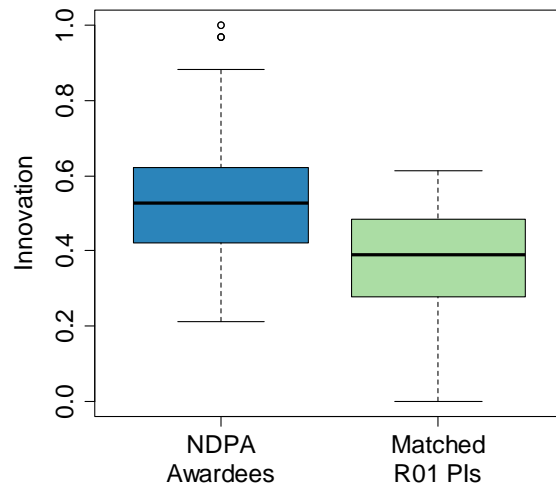
Figure 27. Expert-Assessed Paper Impact

Figure 28 and Figure 29 summarize the results for packet and paper innovation. Again, the experts assessed NDPA packets (t-test, $p < 0.0001$, K-S, $p = 0.0005$) and papers (t-test, $p < 0.0001$, K-S, $p < 0.0001$) to be significantly more innovative than the matched R01s.



Note: One observation equals one grant.

Figure 28. Expert-Assessed Packet Innovation



Note: One observation equals one paper.

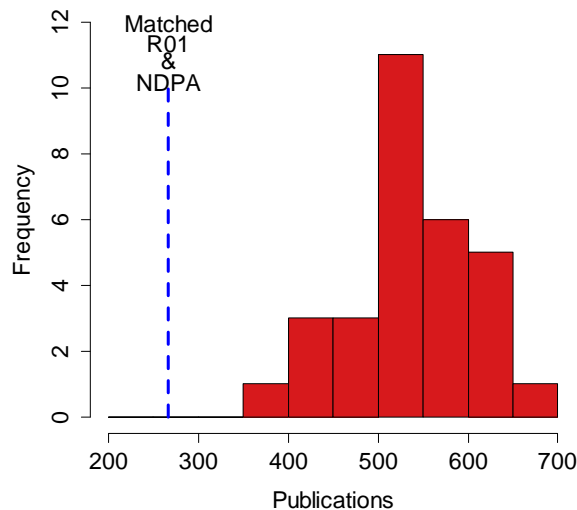
Figure 29. Expert-Assessed Paper Innovation

B. Random R01 Portfolios

The impact of the random R01 portfolios was compared to that of the NDPA and matched R01 portfolios in a limited bibliometric analysis. Figure 5 and Figure 6 (presented previously in Chapter 3) are plots of the total direct costs of each randomly selected portfolio and the number of grants in each portfolio (the range is from 66 to 96 with a median of 86).

1. Number of Publications

Each random R01 portfolio consists of a greater number of grants than the NDPA portfolio (Figure 6) with similar direct costs (Figure 5). Figure 30 shows the number of publications in the 30 random R01 portfolios, compared to that of the NDPA portfolio and the matched R01 portfolio.

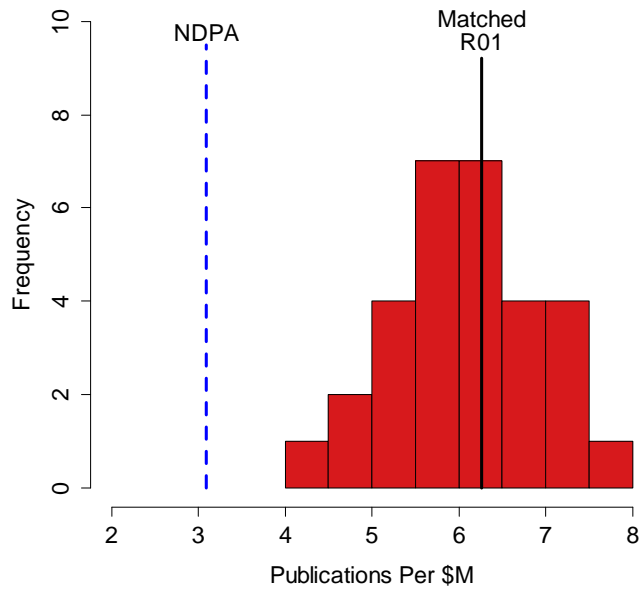


Note: One observation equals one portfolio.

Figure 30. Random R01 Portfolio Grants and Publications

2. Number of Publications by Portfolio Funding Amount

Figure 31 shows the number of publications for NDPA and the matched R01 portfolios when divided by the total direct costs of the portfolio. While the NDPA portfolio has fewer publications per dollar, the matched R01 portfolio is quite comparable to the random portfolios.

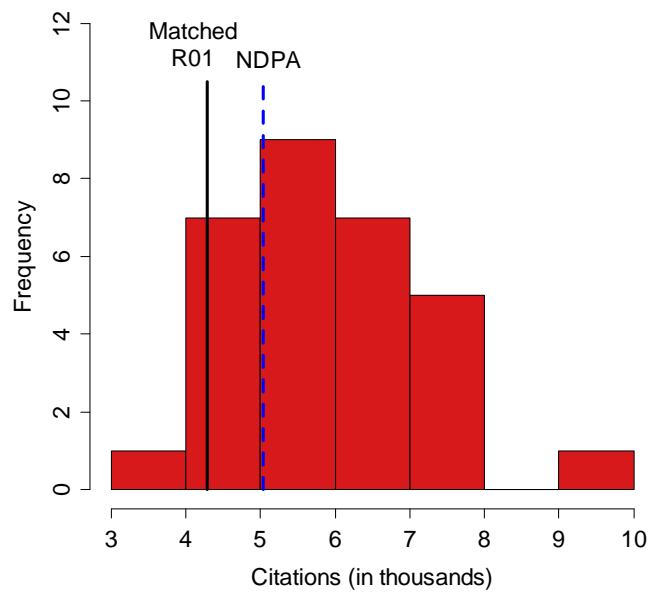


Note: One observation equals one portfolio.

Figure 31. Number of Publications Divided by Total Direct Costs of Portfolio

3. Number of Citations

Despite having fewer publications, the NDPA portfolio of grants received a similar number of citations as the matched R01 portfolio (Figure 32).

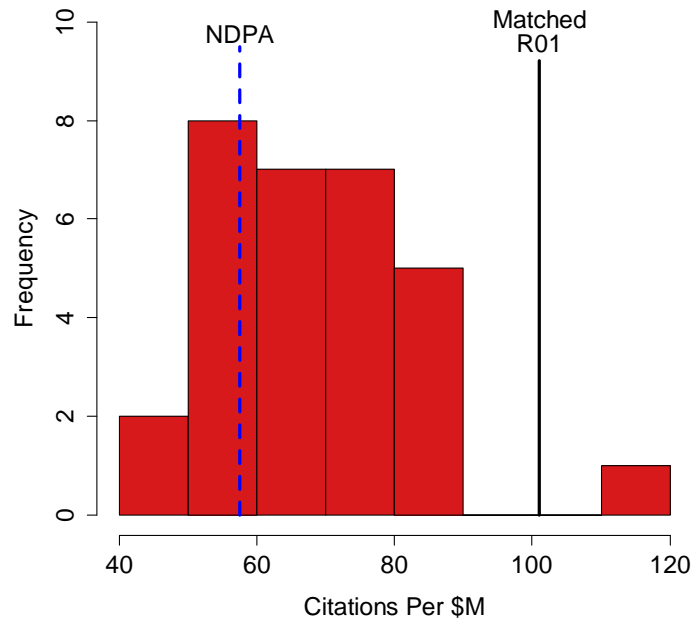


Note: One observation equals one portfolio.

Figure 32. R01 Portfolio Citations

4. Number of Citations per Portfolio Funding Amount

Figure 33 shows that when normalized by total direct costs of the portfolio, the NDPA and matched R01 portfolios still have similar numbers of citations as the random R01 portfolios.



Note: One observation equals one portfolio.

Figure 33. Number of Citations Divided by Total Direct Costs of Portfolio

5. Citations per Publication

The density estimations of the distributions of citations per unique publication displays a shift in the right side of the distributions for the NDPA and matched R01 portfolios when compared to the combined random R01 portfolio distribution (Figure 34).

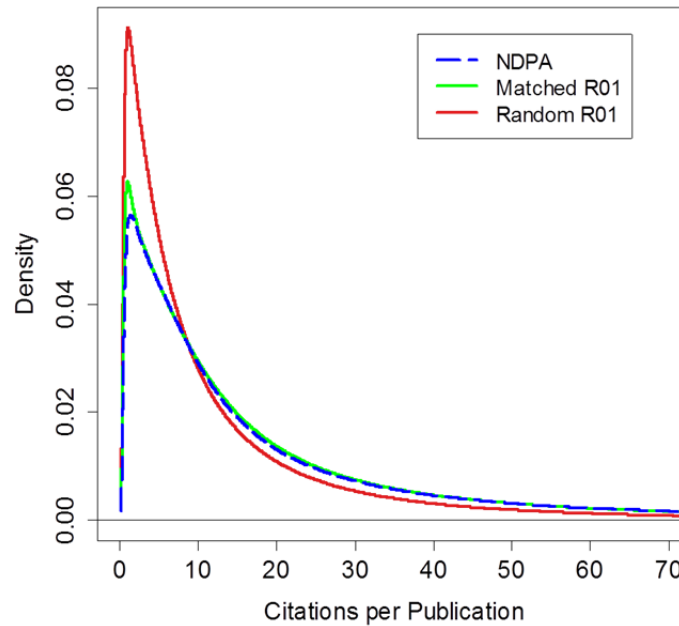
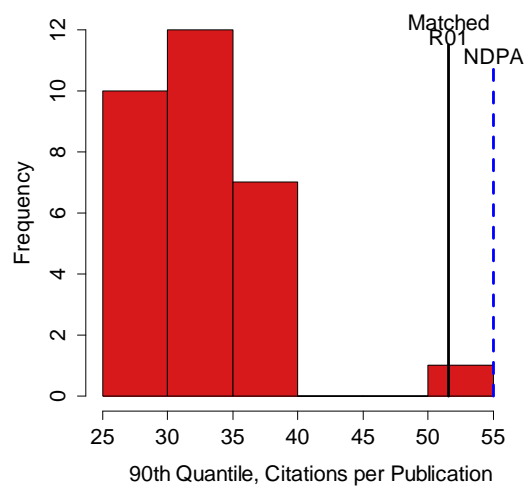
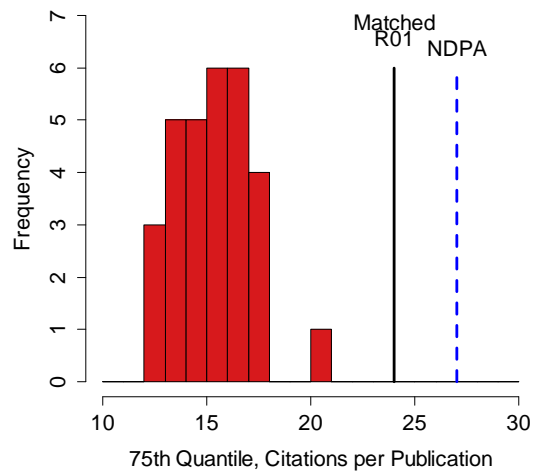
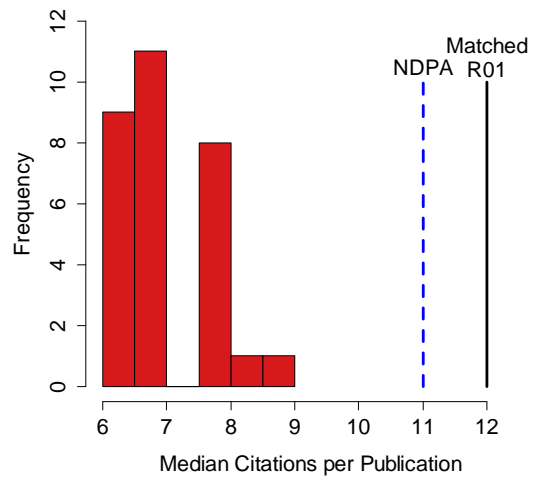


Figure 34. Density Estimations of the Distributions of Citations per Unique Publication for the NDPA, Matched R01, and Random R01 Portfolios

When considering the distribution of citations over publications, the NDPA portfolio had a higher median, 75th quantile, and 90th quantile than the R01 portfolios (Figure 35). The matched R01 portfolio, similarly, had a higher median, 75th quantile, and 90th quantile than the random R01 portfolios; the NDPA portfolio performed better than the matched R01s at the higher quantiles. Table 7 shows the spread in values (minimum/maximum) at each of the reported quantiles for the random R01 portfolio, the NDPA, and the matched R01 portfolios.



Note: One observation equals one portfolio.

Figure 35. Distribution of R01 Portfolio Citations per Publication (Median, 70th, and 90th Quantile)

Table 7. Spread in Values (Minimum/Maximum) at Each Reported Quantile of Comparison among Groups

	Median		75th Quantile		90th Quantile	
	Min	Max	Min	Max	Min	Max
NDPA	--	11	--	27	--	55
Matched R01	--	12	--	24	--	52
Random R01	6	7	13	15	21	51

6. SCImago Journal Ranking

NDPA eSPA publications have higher journal impact factors than those of matched R01 and random R01 portfolio eSPA publications (K-S, $p = 0.02$, <0.0001 respectively) (Figure 36). In addition, the 90th percentile of NDPA publications has a higher impact factor than the 90th percentiles of the matched R01 and random R01 portfolios.

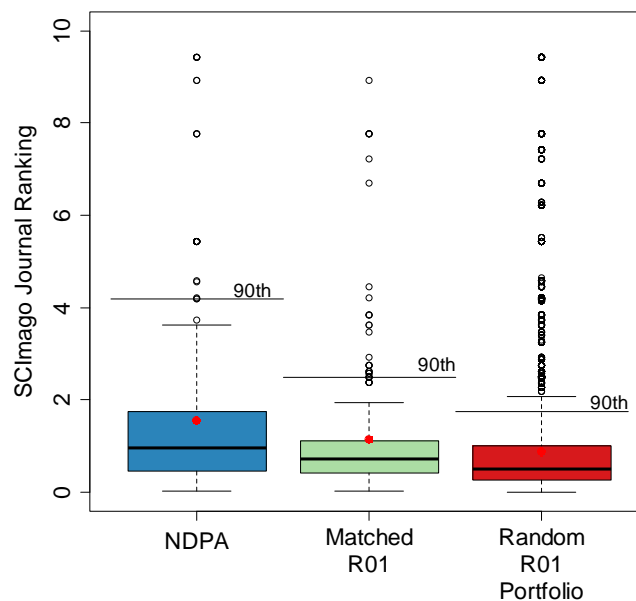


Figure 36. Journal Impact Factors for NDPA, Matched R01, and Random R01 Portfolios

7. Proportion of Publications by Journal Percentiles

Approximately 21% of NDPA eSPA publications appeared in the top 0.5% of all SCImago-indexed journals, and approximately 44% of NDPA publications appeared in the top 1% of all SCImago-indexed journals (Figure 37). The distribution for the random R01 portfolios differs from that of NDPA (chi-sq, $p < .0001$); only 7% and 21% of random R01 portfolio publications appeared in the top 0.5% and top 1% of journals,

respectively. NDPA and matched R01 publications had similar distributions, with 15% of matched R01 publications in the top 0.5% and 35% in the top 1% (chi-sq, $p = 0.14$). (Note that the comparison of NDPA and matched R01s differs from that presented previously in Figure 25 because of the different data set that was used for portfolio comparisons.)

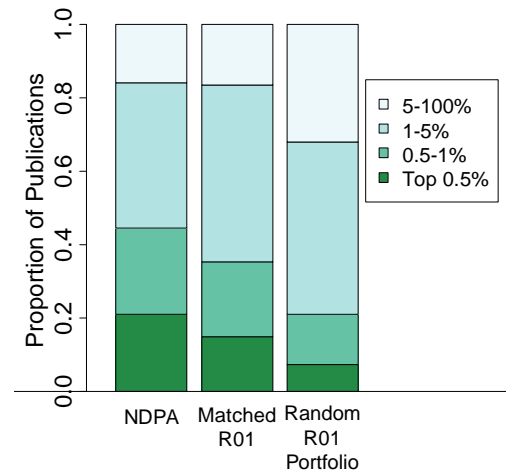


Figure 37. Proportion of Publications by Journal Percentiles for NDPA, Matched R01, and Random R01 Portfolios

