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## Does Monetary Support Increase Citation Impact of Scholarly Papers?\*

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### Abstract

One of the main indicators of scientific development of a given country is the number of papers published in high impact scholarly journals. Many countries introduced performance-based research funding systems (PRFSs) to create a more competitive environment where prolific researchers get rewarded with subsidies to increase both the quantity and quality of papers. Yet, subsidies do not always function as a leverage to improve the citation impact of scholarly papers. This paper investigates the effect of the publication support system of Turkey (TR) on the citation impact of papers authored by Turkish researchers. Based on a stratified probabilistic sample of 4,521 TR-addressed papers, it compares the number of citations to determine whether supported papers were cited more often than those of not supported ones and published in journals with relatively higher citation impact in terms of journal impact factors (JIF), article influence scores (AIS) and quartiles. Both supported and not supported papers received comparable number of citations per paper and were published in journals with similar citation impact values. The results of the hurdle model test showed that monetary support is related with reducing the number of uncited papers, and with slightly increasing the citation impact of papers with positive (i.e., non-zero) citations. Journal-level metrics of JIF, AIS and quartiles are not associated with papers' getting their first citations nor with receiving higher citation counts. Findings suggest that subsidies do not seem to be an effective incentive to improve the citation impact of scholarly TR-addressed papers. Such support programs should therefore be reconsidered.

**Keywords:** Citations · impact factor · article influence score · journal quartiles · hurdle model

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# Does Monetary Support Increase Citation Impact of Scholarly Papers?

## Introduction

The number of refereed papers that appears in scientific journals along with citations thereto is considered to be the main indicators of scientific productivity and quality of a given researcher, a research organization or a country. Many countries introduced what is called performance-based research funding systems (PRFSs) to streamline the scientific production process and improve the research performance (Jonkers and Zacharewicz 2016).

PRFSs aim to assess the performances of researchers in a given time period. Some countries provide monetary incentives directly to researchers in the form of “piece rates” or “cash-for-publication” schemes (Heywood et al. 2011) while others prefer to reward researchers’ organizations by allocating funds to them (De Boer et al. 2015). Both “ex ante” and “ex post” assessments are being used for this purpose. Compared with peer review requiring labor-intensive evaluation processes prior to funding allocation, it is relatively easier, and less costly, to carry out ex post quantitative assessments on the basis of bibliometric measures.

Notwithstanding the type of assessment carried out, research organizations or countries tend to eagerly incentivize their researchers because they in turn expect return on investment (RoI), usually as an increase in the number of papers published by their researchers as well as the citation impact of their papers. However, such monetary incentives do not necessarily produce the intended outcomes, as the existence of PRFSs does not correlate well with the research productivity or quality (Auranen and Nieminen 2010). The effect of PRFSs on the increase in the quantity of publications is “temporary and fades away after a few years” while the average effect on the quality of publications is “nil” (Checchi et al. 2019: 45, 59).

This paper aims to evaluate the effect of the publication support system currently used in Turkey on the citation impact of papers published in scientific journals. We address the following research question: “Does monetary support increase the citation impact of scholarly papers?” We test the hypothesis that supported papers have greater citation impact than that of not supported ones. In addition, we explore if monetary support and journal-level parameters increase the probability of papers not only getting their first citations but also that of receiving higher citation counts. Finding answers to these research questions is expected to shed some light on whether the support system fulfills its objectives by increasing the citation impact of papers published by authors based in Turkey (TR). Moreover, the results of hypotheses tests will likely provide valuable feedback that can be used to improve the current subsidy system and increase its effect, thereby incentivizing researchers to publish in high impact journals to benefit from higher subsidies and increasing RoI for Turkey at the same time.

The rest of the paper is organized as follows: The next section reviews relevant studies. The Study Design, Methods and Data Sources section briefly describes the current Turkish subsidy system first and then provides the details of the study design, methods and data sources along with the sampling technique used to select the TR-addressed papers and matching algorithms written to identify the supported ones. The Findings and Discussion section presents detailed findings along with the limitations of the study. The paper ends with Concluding Remarks and Further Research.

## Literature Review

Performance-based research funding systems (PRFS) based on monetary rewards have been introduced in 1980s (Quan et al. 2017). The rationale behind PRFSs is to reward researchers or institutions with higher performances (in terms of publishing more papers, for instance) so that the ones with lower performances strive to improve themselves to get rewarded (Herbst 2007). The Research Excellence Framework (REF) of UK is one of the oldest PRFSs based on peer review and has been in use since 1986 (De Boer et al. 2015: 113). Yet, bibliometric measures such as JIF have become the dominant method used for research evaluation purposes within the last two decades and they are readily available through Journal Citation Reports (JCR) published annually by Clarivate Analytics. JIF coefficients are sometimes applied to calculate the amount of payment formulaically (Quan et al. 2017; Shao and Shen 2012; Sombatsompop and Markpin 2005: 676-677). JIF seems to be so popular in some countries (e.g., China) that authors who publish in indexed journals get up to 30% discount in local restaurants (the greater the JIF, the higher the discount) (Hongyang 2017). However, there is no correlation between the citation impact of a paper and its JIF (Zhang et al. 2017), and the disadvantages of using JIF as a performance indicator have been reviewed in a number of studies (e.g., Casadevall and Fang 2012; Glänzel and Moed 2002; Marx and Bornmann 2013; Moed and Van Leeuwen 1996; Seglen 1997; Wilsdon et al. 2015; Wouters et al. 2015). De Rijcke et al. (2016) reviewed the literature on the effects of

metrics use on research assessment practices along with the implications and negative effects thereof on institutions (e.g., goal displacement, bias against interdisciplinarity, and reduction of task complexity).

It should also be pointed out that metrics do not usually work well in Social Sciences and Humanities (SSH), as knowledge generation, publication patterns and outlets, and citation and collaboration behaviors of SSH researchers are different from those of Science researchers (Sivertsen 2016). The use of, and attitudes towards, metrics in Humanities vary, and many Humanities scholars are critical of metrics (Hammarfelt and Haddow 2018; Ochsner et al. 2014). While the journal articles and conference papers are used predominantly as outlets in many Science disciplines, monographs and books are preferred over journal articles in SSH disciplines. Moreover, national and non-scholarly literatures written in vernacular languages play an important role in SSH (Hicks 2004). Books are selectively covered by citation indexes such as WoS and Scopus whereas non-English and non-scholarly literatures are usually not covered (Nederhof 2006; Van Leeuwen et al. 2001; Van Leeuwen 2013). Despite the existence of a sizable literature against the use of journal-based metrics in SSH (e.g. see reviews in Nederhof 2006, and De Rijcke et al. 2016), such metrics as JIF continue to be used in PRFSs to evaluate the impact of contributions of researchers in SSH disciplines and put them in an unenviable position.

Nonetheless, several countries have developed primarily metrics-based PRFSs where JIF values are used (sometimes in combination with peer review) to determine the amount of monetary support per paper (usually without paying much attention to their potential effects in SSH). The PRFS use around the world has been reviewed in a number of studies (e.g., Auranen and Nieminen 2010; De Boer et al. 2015; European Commission 2010; Geuna and Martin 2003; Hicks 2012; Pajić 2014). The practices tend to vary from country to country. Some reward researchers directly through what is called “cash-for-publication” schemes (e.g., China and Turkey) while others support the affiliated research units or universities (e.g., UK and South Africa) (Hedding 2019; Heywood et al. 2011; Lee and Simon 2018; Quan et al. 2017; Tonta 2017a).

Muller (2018) provides striking examples of negative effects of metrics used in various sectors ranging from education to medicine and from business to government. The field of scholarly communication is no exception. PRFSs tend to produce unintended consequences or “side effects” (Geuna and Martin 2003) and cause researchers to develop “opportunistic behaviors” (Abramo et al. 2019; Good et al. 2015). For instance, due to the cash reward policies instituted in early 1990s in China, researchers were faced with “the golden rule of academia in China: publish or impoverish”, and they were eager to produce quick and “cashable” papers. As the stakes are quite high,<sup>1</sup> some researchers resort to “plagiarized or fabricated research, purchase ghostwritten papers, or sell authorship” (Quan et al. 2017: 498-499). Hence, PRFSs have eventually become “perverse incentives” (Tomaselli 2018).

Some researchers tend to target metrics such as number of citations and h-index measuring the quantitative impact of their research and manipulate them to their advantage, thereby making such metrics useless and further reinforcing the Goodhart’s Law (“When a measure becomes a target, it ceases to be a good measure”). The results of a recent large-scale analysis of more than 120 million scientific papers seem to support Goodhart’s Law (Fire and Guestrin 2019). Moreover, counting seems to change what is counted and metrics tend to “commodify and disempower” what they measure (Sætnan et al. 2019: 81).

Muller (2017) studied the subsidies from the viewpoint of “rent seeking” theory in economics and explored the impact of distorted incentives on academia, academics and society at large. According to rent seeking theory, academics “compete for artificially contrived transfers” in various forms (e.g., grant funding, monetary incentives for publications and citations). These transfers are usually redirected by public institutions from social surplus to rent seeking academics on the basis of bibliometric measures that are thought to measure academic success better and “provide greater reassurance of quality” (p. 59). Such measures are therefore increasingly supplanting (rather than supporting) peer review used to judge the quality of scholarly output, and universities are “creating institutional rules and practices that actively incentivize rent-seeking behavior” (Muller 2017: 61). In South Africa, for instance, the amount of monetary support per paper (which may be as high as 10,000USD per a single-authored paper) is the same, regardless of where the paper has been published as long as the outlet is “accredited” by the Department of Higher Education and Training. Thus, one can submit their work to lower quality journals with relatively lower standards of peer review in order to collect subsidies quickly and more often. This may, in turn, have created a “powerful perverse incentive” and encouraged at least some researchers to “game” with the system and produce “fraudulent –or ethically questionable– publications”

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<sup>1</sup> A professor may earn the equivalent of 20 years’ salary for a *Nature* or *Science* paper, and the maximum amount can be as high as 165,000USD for a single paper (Quan et al. 2017: 491, 494). However, it is worth noting that China has apparently experienced the dire consequences of this policy and recently decided to ban cash rewards for publishing papers in journals listed in citation indexes (Mallapaty 2020). With the new policy, China plans to say farewell to WoS-based indicators (so called “SCI worship”) by moving to “a balanced combination of qualitative and quantitative research evaluation” with stronger local relevance (Zhang and Sivertsen 2020a: 7; Zhang and Sivertsen 2020b).

(Muller 2017: 63-64). Perverse effects of “citation gaming” can even be detected in country-level citation analysis studies (Baccini et al. 2019). Muller (2017) underlines the dilemma of such incentives as follows:

Under the rent seeking conceptualization of such systems, appeals to individual or institutional integrity are not likely to be successful. The system directly creates incentives for the activities cautioned against, undermining cultures of ethical practice, and therefore only measures that carry suitable material punishment are likely to counteract these undesirable effects. (p. 64)

The side effects of PRFSs are not limited only with researchers publishing in lower quality outlets or “seeking out ‘easier’ publication types” (Sile and Vanderstraeten 2019: 86). Subsidies tend to discourage types of research that require more time to carry out using novel experiments prolonging the publication process, thereby giving way to papers with little or no societal impact whatsoever (Geuna and Martin 2003; Tonta 2017b: 27-30). Moreover, some researchers simply prefer to publish in “predatory journals” and set up what is called “citation circles” to benefit more from PRFS (Good et al. 2015; Teodorescu and Andrei 2014: 228-229). As payouts tend to encourage professors to publish in predatory journals, South African researchers, for instance, published as much as five times more papers in them than those in the United States or Brazil did (Hedding 2019). While the number of South African publications has doubled (as pointed out earlier) after the introduction of the subsidy program, the ones published in predatory journals increased 140 times during the same period (2004-2010) (Mouton and Valentine 2017).

Turkey does not have a very good reputation, either, as it ranks third (after India and Nigeria) in the world among 146 countries in terms of number of papers published in predatory journals (Demir 2018a: 1303). Beall’s (now defunct) list of predatory journals includes 41 such journals originating from Turkey, second highest after India (Akça and Akbulut 2018: 264). Some researchers indicated that the academic incentive system of the Turkish Higher Education Council (HEC) that has been in place since 2016 is one of the factors encouraging them to publish in predatory journals (Demir 2018a: 1307). Not surprisingly, the number of TR-addressed papers published in predatory journals and presented in dubious conferences has significantly increased since then (Demir 2018b: 2057-2058). HEC has recently taken some measures to curtail such attempts by researchers but they are not stringent enough. Fortunately, papers published in predatory journals would no longer count towards tenure and promotion (Koçak 2019: 200). However, it is not yet totally clear at this point in time as to which criteria to apply in order to identify such papers and exclude them from tenure and promotion process, from HEC’s academic incentive system as well as from TÜBİTAK’s support program. Although no such study has so far been carried out, it seems that the numbers of TR-addressed papers published in predatory journals have already been subsidized in the past by TÜBİTAK under its support program. For example, more than 80% of the subsidies for papers in anthropology in 2015 went to a single predatory journal in this field in which Turkish researchers have published a total of 127 papers, most of which had had nothing to do with anthropology (Tonta 2017b: 80).

Despite the side effects and undesired outcomes of PRFSs, there appears to be a commonly held belief in research funding and research performing institutions that subsidies would increase the number of papers and their citation impact. Researchers motivated by such subsidies would produce more papers with higher quality. However, the relationship between subsidies and the increase in productivity and quality is not clear-cut (Auranen and Nieminen 2010). While there appears to be some evidence that subsidies increase the number of papers to some extent, this is not reciprocated with a similar increase in the quality of papers in terms of their citation impact (Butler 2003, 2004; Good et al. 2015; Osuna et al. 2011). For instance, the number of South African publications has almost doubled in seven years (2004-2010) after the implementation of the subsidy system. Yet, their citation impact (number of citations per paper) has decreased steadily (Pillay 2013: 2). A small-scale study carried out at the University of Cape Town after the implementation of PRFS showed that the number of outputs is negatively correlated with both the number of citation counts of papers and their field-weighted citation impact. Although the variance explained was relatively modest, findings indicate to some extent that greater subsidy seems to be “associated with lower citation impact,” which may, in part, be due to the fact that the PRFS currently in use “does not factor in research quality and impact” (Harley et al. 2016). Similarly, the number of TR-addressed papers listed in citation indexes has increased 19-fold between 1993 (when TÜBİTAK’s support program began) and 2015 (from 1,500 papers to more than 28,000) (Tonta 2017b: 32). Turkey has jumped from 37<sup>th</sup> place in 1993 to 18<sup>th</sup> in 2008 in the world ranked by the number of indexed publications. Yet, findings of an interrupted time series analysis based on 390,000 TR-addressed publications listed in the WoS database between 1976 and 2015 (of which close to 157,000 or 40% were subsidized between 1997 and 2015) showed that the support program seems to have had no impact on the increase in the quantity of TR-addressed publications (Tonta 2017a). Moreover, the citation impact of TR-addressed papers has constantly decreased throughout the years and is well below (40%) that of the world average of all papers (Çetinsaya 2014: 127; Kamalski et al. 2017: 4).

It appears that PRFSs do not help much in terms of improving the quality of research. In fact, PRFSs based on cash rewards are considered to be “the enemy of research quality”, as there appears to be a negative correlation between subsidies and the number of citations and field-weighted impact of publications (Harley et al. 2016; Hedding 2019). The pressure of “publish or perish” tends to force researchers to choose between “cash or quality” (Hedding 2019), which “is making science perish” along the way as well (Şengör 2014: 44).

We test this conjecture of “cash or quality” with reference to Turkey and see if the subsidy system currently in use in Turkey has improved the citation impact of TR-addressed papers. We present below the study design, methods of data analysis and data sources along with some information on the current subsidy system in place in Turkey.

## **Study Design, Methods and Data Sources**

### ***TÜBİTAK’s Support Program of International Publications (UBYT)***

Before we delve into the details of the study design, methods and data sources that we used to analyze and interpret the data, a brief explanation on the current publication support system used in Turkey is due.

The support system currently used in Turkey is administered by the Turkish Scientific and Technological Research Council (TÜBİTAK) and has been in place since 1993. The support system first aimed to increase the number of TR-addressed papers published in international journals by rewarding their authors between 1993 and 2012 (Tonta 2017b: 24). Since 2013, its main objective has been to “increase the impact and visibility (quality) of TR-addressed international scientific publications” (TÜBİTAK 2020: 1). More than 156,000 publications that were indexed in the Web of Science (WoS) with at least one author who is based in Turkey were supported between 1997 and 2015. Authors have been paid a total of 124 million Turkish Lira (or *circa* 45 million US dollars in 2015 exchange rates) (Tonta 2017b: 34-36).

The subsidy system is based on the concept of “cash-for-publication”. The authors of papers get rewarded on the basis of Journal Impact Factors (JIFs) and, more recently, Article Influence Scores (AISs) of journals in which their papers are published (see below). TÜBİTAK uses the JCR journal lists to make the payment decisions and the amount to be paid. The higher the JIF or AIS values of journals, the more money the authors get paid, with a cap of 15,000 Turkish Lira per paper in 2020. The authors of eligible papers who choose to apply are usually supported (with some exceptions such as the amount to be paid per author being too small for papers with many co-authors). To increase the number of TR-addressed papers in Social Sciences and especially in the Arts and Humanities, papers published in journals with no JIFs or AISs get supported as well (TÜBİTAK 2015: 4).

### ***Study Design and Methods of Analysis***

The main research question we address in this paper is: “Has the subsidy system used in Turkey increased the citation impact of TR-addressed papers?” The “citation impact” of a TR-addressed paper is measured by four interrelated metrics: the number of times it is cited by other papers in a specified period, and the Journal Impact Factor (JIF), Article Influence Score (AIS) and Journal Citation Reports (JCR) quartile of the journal in which it is published.

We conceptualized and operationalized the research question as follows: If the support system has had any effect, supported papers should reflect this and have higher citation impact than not supported ones. It can be argued that it is the authors, not the inanimate papers, who can react to incentives, and that some authors of the eligible papers may not wish to apply for support for various reasons. However, what matters for the purposes of support is the metrics of journals (JIF, AIS, and quartile) in which papers were published, not those of authors (i.e., h-index). We have the payment data matched with the supported papers but not with the author(s) who applied for support. Our underlying assumption here is that the TR-addressed papers can be used as a “proxy” to represent their authors. If the authors of papers get incentivized enough, they would strive to publish in high impact journals in order to reap higher monetary benefits from the support system. Should the support system have any effect, supported papers would then collect more citations in time and be published gradually in journals with higher journal-level impact than the not supported ones would as a result. Hence, we test the following two hypotheses.

H1: “The TR-addressed supported papers receive higher numbers of citations per paper than not supported papers do.”

H2: “The (a) JIFs, (b) AISs, and (c) JCR quartiles of journals in which TR-addressed supported papers are published are higher than those of not supported ones.”

We also test these two hypotheses for the subsets of Science and Social Science papers separately. We compare supported and not supported papers published between 2006 and 2015 and indexed in WoS to see whether supported papers received more citations and were published in higher impact journals in terms of JIFs, AISs and quartiles (Q1 through Q4). Note that to test the first hypothesis, we use the “TR-addressed paper” as the unit of analysis. The response (dependent) variable is the “number of citations per paper”. The units of analyses for the second hypothesis are the journal-level citation impact parameters of JIF, AIS and JCR quartile for each journal in which a TR-addressed paper is published in a given year. JIF, AIS and JCR quartile are also the response variables of the second hypothesis (a), (b), and (c), respectively. The explanatory (independent) variable of both first and second hypotheses is whether the TR-addressed paper (hence its author or authors) is supported by TÜBİTAK or not.

We first used MS Excel and SPSS 23 for data analysis and visualization; chi-square for test of independence; and independent samples *t*-test for significance to find out if support, JIF, AIS and JCR quartiles have had any effect on the number of citations that TR-addressed papers received. We used *t*-tests for non-normal, skewed distributions, as our sample size (4,521) was quite large (see the “Data Sources” subsection below). Lumley et al. (2002) experimented with the normality assumption in *t*-tests using a skewed distribution of outpatient cost data with a very long right tail (actual costs ranging from zero to several thousand dollars with a variance more than twice as large as its mean). “[T]he sampling distribution of 1000 means of random samples of size 65, 129, 324, and 487 from this very non-Normal distribution” was “close to Normally distributed even with these very extreme data and with sample sizes as low as 65” (Lumley et al. 2002: 157). In addition to their own simulation study, they also reviewed the relevant literature and concluded that “in large samples they [*t*-tests] are valid for any distribution” including “extremely non-Normal data” (Lumley et al. 2002: 151).

Yet, in addition to *t*-tests, we decided to further analyze the data using a different method. As is well known, the distribution of citation data is usually overdispersed (with its variance greater than its mean) and many papers do not get cited at all (zero citations), uncitedness ratios ranging between 19% (Physics and Astronomy) and 38% (Arts and Humanities) depending on the subject areas of papers (Nicolaisen and Frandsen 2019: 1231). The fact that many papers go uncited led us to conceptualize the above research question (whether the subsidy system has increased the citation impact of TR-addressed papers) from a different angle. Note that the response variable (“number of citations per paper”) given above is count data that exhibits both overdispersion and zero citations. The explanatory variable is whether the paper is supported or not. So, we asked the same research question somewhat differently: “Which factors make a TR-addressed paper get its first citation as well as higher citation counts, thereby increasing its citation impact?” “Is ‘support’ the main explanatory variable along with JIF, AIS and quartiles of journals in which TR-addressed papers were published?” Note that the response variable (citation counts) and explanatory variables (support, JIF, AIS and quartile) are the same as above.

In order to analyze the skewed distributions with inflated zero counts, two-component count models are used (i.e., hurdle and zero-inflated models). One component is used to model the positive counts using “truncated Poisson or negative binomial regression (with log link)” while the other to model the occurrence of zero counts. “Thus, for most models, positive coefficients in the hurdle component indicate that an increase in the regressor increases the probability of a non-zero count” (Jackman et al. 2020: 27).

We decided to use the hurdle model with negative binomial logistic regression rather than the zero-inflated model because we do not have “structural” zeros in our data (i.e., any TR-addressed paper listed in WoS may get cited in time). It is “also intuitively a good choice because it seems reasonable to assume that it is a significant hurdle for a paper to receive its first citation but after this it is more likely to be cited in the future” (Didegah and Thelwall 2013a: 865). In addition, the hurdle model explains the effect of each explanatory variable on the response variable by providing (1) the odds of decreasing papers with zero citations and (2) the effect size on collecting positive citations. We used the *countreg* (v. 0.2-1) package available in R to analyze the count data and zero hurdle model (Zeileis et al. 2008). Coefficients (including exponentiated ones) were used to interpret the relationship between the response variable and the regressor variables along with the results of *z* tests and confidence intervals.

We thought using two different methods of analysis (*t*-tests and the hurdle model) would enable us to analyze the data more comprehensively, thereby comparing the statistical test results obtained through the hurdle model with those of the *t*-tests to find out to what extent they corroborated. To reduce the Type I error, we used an alpha level of .01 for all statistical tests. We discussed the findings accordingly.

We used the well-known bibliometric measures to compare the citation impact of supported and not supported TR-addressed papers. JIF is defined as the “average” citation impact of papers published in a given journal within a given time period. AIS takes into account five years’ worth of citation data for a given journal and weights citations on the basis of JIFs. If citations come from high impact journals, they are weighted more heavily. AIS is similar to Google’s PageRank algorithm in that it uses the whole JCR citation network to

calculate the AIS for a given journal. Unlike JIF, AIS indicates if each article in a journal has above- or below-average influence, 1.000 being the average of all journals included in JCR's citation network (Article 2019). AIS is more stable and can therefore be used in interdisciplinary comparisons where journals have varying publication and citation patterns, although both metrics are highly correlated ( $r = .9$ ) (Arendt 2010).

JIF is used to categorize journals under at least one subject category, and journals under each subject category are divided into four quartiles based on their JIF values as a field normalized indicator (the first 25% of the journals with highest JIFs constitutes Q1, the second 25% Q2, etc.). Some journals are listed under two or more subject categories, hence sometimes under different quartiles. In this case, we categorized such journals under their highest quartiles. Journals in the Q1 quartile are deemed "high impact journals" with impact factors in the top 25% of the JIF distribution of journals in a certain field while the ones in the Q4 quartile representing the bottom 25% are considered "low impact journals". Journal titles are, by definition, more or less evenly distributed to JCR quartiles. Yet, publications are not evenly distributed by JCR quartiles (Liu et al. 2016; Liu et al. 2018; Miranda and Garcia-Carpintero 2019). For instance, according to the 2015 JCR-Science Edition based on more than 8,500 journals, somewhere between 36%-46% of more than 1.3 million publications appeared in high impact Q1 journals compared to that of only 13%-17% that were published in low impact Q4 journals in 2014, and the distributions in other years were similar (Liu et al. 2016).

We used "articles" as publication type in this study, as some 98% of all TR-addressed publications indexed in Web of Science (WoS) have been of this type. We excluded "reviews" because (1) they made up less than 2% of all TR-addressed publications; (2) the amount of cash paid by TÜBİTAK to the authors of reviews (as well as to those of "notes" and "discussion papers") was half that of articles; and (3) except the number of citations per paper, we use journal-level parameters of JIF, AIS, and JCR quartiles as the unit of analysis for comparison of supported and not supported TR-addressed papers. As for the number of citations per paper, the citation impact of the exclusion of citations generated by a small number of reviews seems to be negligible.

### **Data Sources**

In order to identify all TR-addressed papers (articles only) published between 2006 and 2015 and indexed in WoS, we used the following advanced search query (December 2, 2017):

**AD**=(Turkey OR Turquie OR Türkiye OR Türkiye OR Turquia)

**Timespan:** 2006-2015. **Indexes:** SCI-EXPANDED, SSCI, A&HCI. **PubType:** Article

We found a total of 225,923 TR-addressed papers<sup>2</sup> and downloaded them. We obtained the payment information for 100,919 supported papers whose authors sought financial support from TÜBİTAK. Altogether some 44% of all papers were supported between 2006 and 2015 (range: 59% in 2006; 28% in 2015).

The list of 225,923 papers was our sampling frame. We then stratified all papers by year and wrote a macro to select every 12th and 75th records (these numbers were randomly chosen) out of the stratified list.<sup>3</sup> Sample size being 2% of the population, we obtained a total of 4,521 records in the sample using the stratified probability sampling technique. The sample size for each year ranged between 1.86% and 2.05%, average being 1.99% (quite close to 2%).

Once the sample was selected, we then wrote a second macro to match up paper-level and journal-level data from InCites and JCR to find out the number of citations that each paper in the sample received (if any) as of February 2, 2018, and to identify bibliometric characteristics of journals (e.g., JIF, AIS, Times Cited, Quartiles and so on) in which papers were published in respective years. These data were then added to all the records in the sample (seven journals did not match due to inconsistencies in journal names, which were added manually).

Finally, we wrote a third macro to match 4,521 papers in the sample with the list of 100,919 papers supported by TÜBİTAK to find out which ones in the sample were supported (or not supported). (Some 64 records out of 4,521 did not match due to inconsistencies in paper titles, which were added manually.) This enabled us to compare both paper-level and journal-level characteristics of supported and not supported papers (e.g., number of citations for papers, and JIF, AIS and quartile for journals). The matching algorithm seems to have worked quite well, although the percentage of supported papers in the sample was somewhat lower (1,679 out of 4,521, or 37%) than that of the population (44%). The difference (7%) is due to inconsistencies in data (such as punctuation marks and abbreviations used in titles of papers and journals). Supported papers appeared in 2,336

<sup>2</sup> In this study, we use "papers" or "TR-addressed papers" in general instead of "articles" or "TR-addressed articles", unless otherwise indicated.

<sup>3</sup> We actually selected three different samples (every 50th and 99th record; every 12th and 77th record; and every 12th and 75th record) with the same sample size and compared the descriptive statistics such as means and medians to make sure the stratified probabilistic sampling technique worked properly. As sample statistics were quite similar in all three cases, we report here the findings based on the last one.



different journal titles between 2006 and 2015, of which 2,153 journals (or 92%) were represented in the sample. The percentage is similar for non-supported ones. We do not expect such relatively small fluctuations to have any considerable impact on the analysis that follows.

## Findings and Discussion

### Descriptive Statistics and Test Results

As indicated earlier, the number of all TR-addressed papers published between 2006 and 2015 is 225,923. The median JIFs of journals in which TR-addressed papers were published ranged between 0.998 (2012) and 1.379 (2015) while median AISs did between 0.321 (2012) and 0.457 (2010). Close to half the papers were published in low impact journals (i.e., JIF and AIS values were below 1.000 and 0.400, respectively). A slight increase is observed in recent years in median JIFs and AISs of papers, probably due to do continuing increase in JIFs over the years in general (Fischer and Steiger 2018).

What follows are the findings based on the stratified probability sample of 4,521 papers (2006-2015) directly addressing the research question and hypotheses.

All papers in the sample (4,521) were cited a total of 54,975 times. The average number of citations per paper was 12 ( $SD = 42$ ). Half the papers received five or fewer citations (min. = 0, max. = 2,246). Only 1% (or 45 papers) received 100 or more citations while 32% received 10 or more. As indicated earlier, 37% (1,679) of papers in the sample were supported by TÜBİTAK and collected 43% (23,654) of all citations while not supported ones (63%) did 57% (31,321). The great majority (90%) of the papers in the sample were Science papers. Social Science and Arts and Humanities papers constituted about 9% and 1% of all papers, respectively. As expected, Science papers received the overwhelming majority of the total number of citations (over 92%) followed by Social Science papers (7%) and Arts and Humanities papers (less than 1%).<sup>4</sup>

Table 1 provides descriptive statistics and statistical test results for papers in the sample. On average, supported papers were cited slightly more often ( $M_{all} = 14.1, SD = 22.5$ ) than not supported ones ( $M_{all} = 11.0, SD = 49.8$ ). Yet, the difference was not significant  $t_{all}(4,519) = -2.39, p > .01, r = .04$ . Similarly, supported Science and Social Science papers were cited somewhat more frequently on average ( $M_{sci} = 14.5, SD = 22.7; M_{ssci} = 10.6, SD = 20.1$ ) than not supported ones ( $M_{sci} = 11.3, SD = 52.1; M_{ssci} = 8.7, SD = 13.8$ ). Again, the differences were not significant in both cases ( $t_{sci}(4,081) = -2.28, p > .01; r = .04; t_{ssci}(436) = -1.18, p > .01, r = .05$ ).

Table 1. Descriptive statistics and test results

Paper type	# of papers (N)	Citation impact	Supported papers			# of papers (N)	Citation impact	Not supported papers			Test results		
			Mdn	M	SD			Mdn	M	SD	t	p	r
All papers	1679	# of cit.	7.0	14.1	22.5	2842	# of cit.	4.0	11.0	49.8	-2.39	.02	.04
	1624	JIF	1.2	1.6	2.3	2696	JIF	1.1	1.5	2.0	-1.07	.28	.02
	1520	AIS	.4	.5	.9	2405	AIS	.4	.5	.9	-.39	.70	.01
Sci. papers only	1508	# of cit.	7.5	14.5	22.7	2575	# of cit.	4.0	11.3	52.1	-2.28	.02	.04
	1482	JIF	1.3	1.6	2.4	2473	JIF	1.1	1.5	2.0	-1.17	.24	.02
	1388	AIS	.4	.5	.9	2218	AIS	.4	.5	.9	-.48	.63	.01
Soc. Sci. papers only	171	# of cit.	4.0	10.6	20.1	267	# of cit.	3.0	8.7	13.8	-1.18	.24	.05
	142	JIF	1.2	1.3	1.0	223	JIF	1.0	1.4	1.3	-.43	.67	.02
	132	AIS	.4	.4	.3	187	AIS	.4	.5	.5	.52	.61	.03

Notes: # of cit.: Number of citations; Mdn: Median; M: Mean; SD: Standard Deviation; t: t-test; p: p value; r: effect size; cit.: citation; JIF: Journal Impact Factor; AIS: Article Influence Score.

Fig. 1 provides a comparative view of the number of citations per paper for all papers as well as for Science and Social Science papers separately. Boxplots show the means, medians, and first and third quartile values for both supported and not supported papers in each group. As the boxplots show, a supported paper received, on average, about three more citations than a not supported one did between 2006 and February 2, 2018 (the average citation window for a given paper being about six years). This can hardly be considered a substantial difference. Hence, H1 is not supported: the TR-addressed supported papers do not seem to receive higher numbers of citations per paper than not supported papers do.

<sup>4</sup> Note that 49 Arts and Humanities papers that received a total of 289 citations were excluded from further analysis as bibliometric characteristics of Arts and Humanities journals are not listed in JCR.



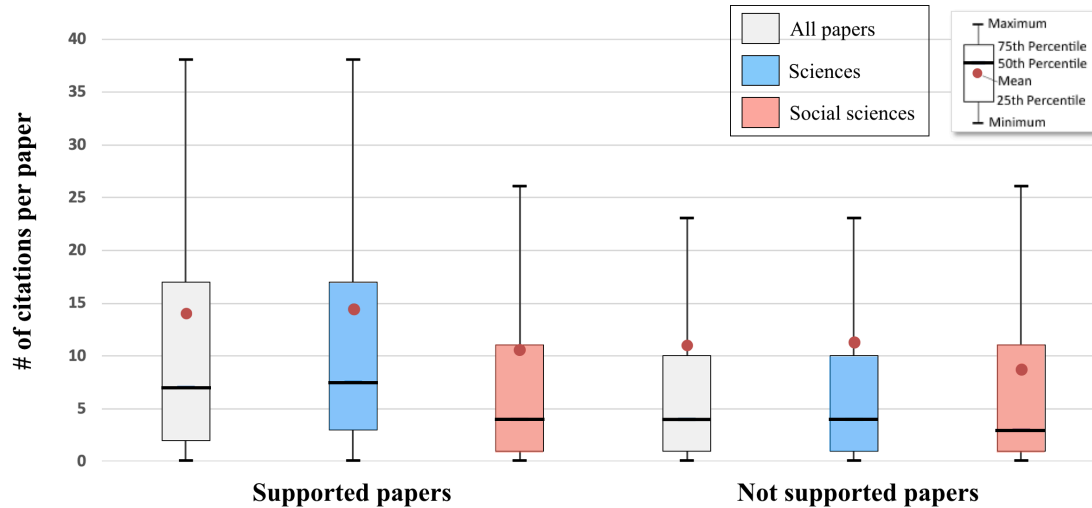


Fig. 1. Number of citations per paper for supported and not supported TR-addressed papers

Table 1 also provides data on journal-level citation impact values (e.g., JIF and AIS) of journals in which TR-addressed papers were published. On average, the JIF values of journals publishing all supported papers ( $M_{all} = 1.6$ ,  $SD = 2.3$ ), supported Science papers ( $M_{sci} = 1.6$ ,  $SD = 2.4$ ), and supported Social Science papers ( $M_{ssci} = 1.3$ ,  $SD = 1.0$ ) were quite similar to those publishing not supported ones ( $M_{all} = 1.5$ ,  $SD = 2.0$ ;  $M_{sci} = 1.5$ ,  $SD = 2.0$ ; and  $M_{ssci} = 1.4$ ,  $SD = 1.3$ , respectively). (The median JIFs of supported and not supported papers were also very close to each other.) The differences were not statistically significant in all three cases ( $t_{all}(4,318) = -1.07$ ,  $p > .01$ , effect size  $r = .02$ ;  $t_{sci}(3,953) = -1.17$ ,  $p > .01$ ,  $r = .02$ ; and  $t_{ssci}(363) = -0.43$ ,  $p > .01$ ,  $r = .02$ , respectively). Likewise, the differences between the AIS values of supported and not supported papers were not statistically significant, either (see Table 1 for details). Fig. 2 provides the boxplots for JIF and AIS values of journals publishing both supported and not supported papers for all papers as well as for Science and Social Science papers. JIF and AIS data of both supported and not supported papers were highly skewed with heavy tails, indicating that papers were mostly published in relatively mediocre or low impact journals.

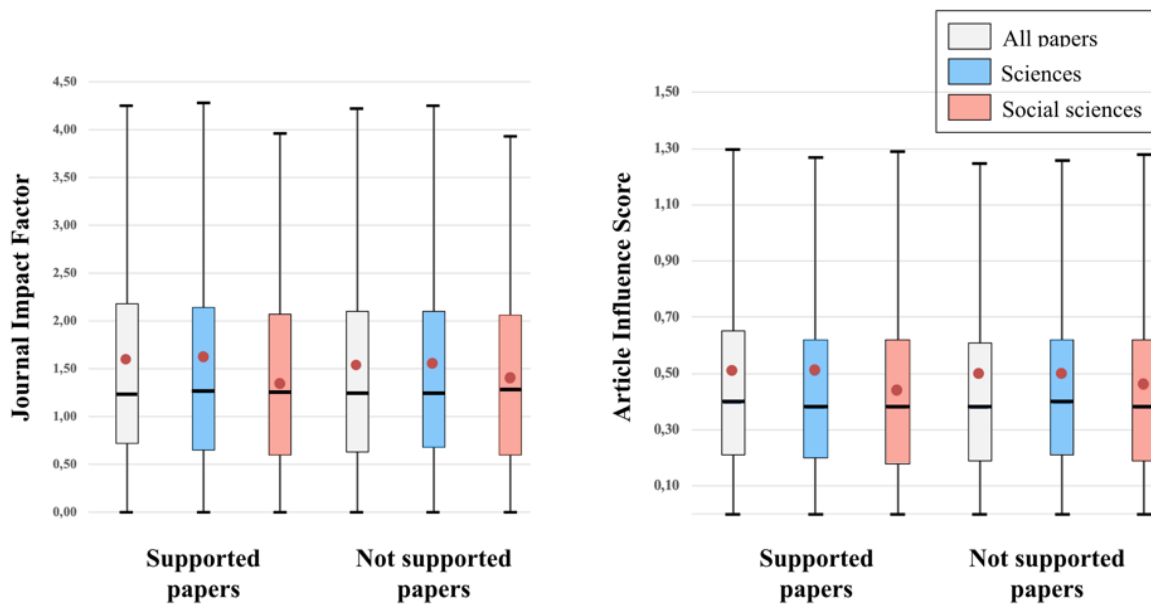


Fig. 2. Journal Impact Factors (left panel) and Articles Influence Scores (right panel) of journals publishing supported and not supported TR-addressed papers

Fig. 3 below provides the percentage distributions of JIF values of supported and not supported papers. Note that the percentages of supported and not supported papers were quite similar to each other, supporting the results of the statistical tests further. Correlation between JIF and AIS values of journals publishing TR-

addressed papers was quite high (Pearson's  $r = .946$ ), explaining 90% of the variance in the data<sup>5</sup> and confirming the findings of similar studies (e.g., Arendt, 2010). We therefore do not provide the distributions of JIF and AIS values of supported and not supported Science and Social Science papers separately, as they are similar to those in Fig. 3. Percentages of supported Science and Social Science papers in the sample were 37% and 39%, respectively.

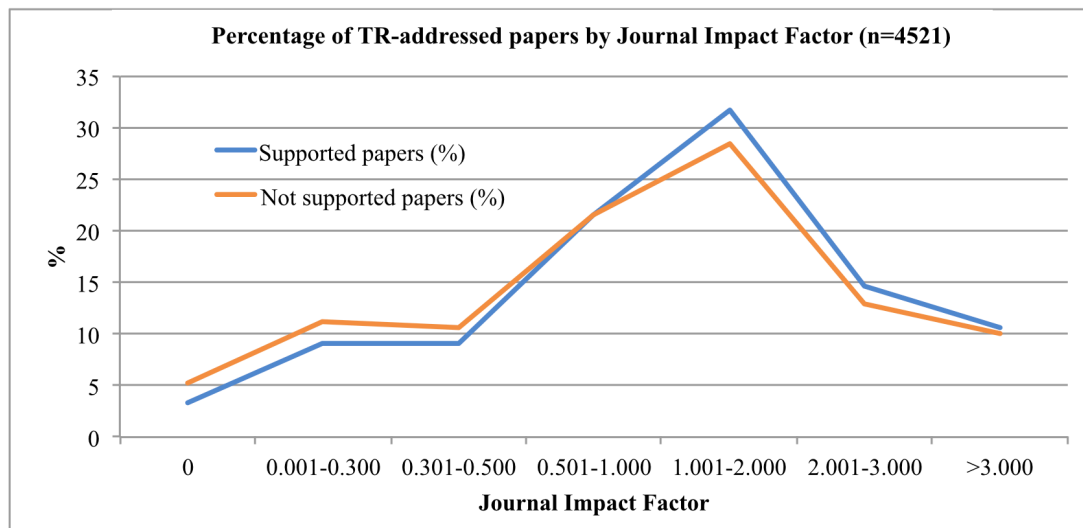


Fig. 3. Percentage of TR-addressed papers by Journal Impact Factor (n=4521)

We also looked at the distribution of the TR-addressed papers by JCR quartiles to find out if supported papers were published in journals listed in higher JCR quartiles under their respective subject categories. First, we analyze the distribution of the TR-addressed papers published in 2015 by JCR quartiles and compare it with that of JCR data representing all papers published in the same year.

Recall that over 40% of publications gets published in the high impact Q1 journals in comparison to that of about 15% in the low impact Q4 journals (Liu et al. 2016). However, the distribution of the TR-addressed papers published in 2015 by JCR quartiles is quite different: 21%, 20%, 23%, and 31% of them appeared in Q1, Q2, Q3, and Q4 journals, respectively (Table 2).<sup>6</sup> The percentage of TR-addressed papers published in high impact Q1 journals is less than half the percentage of papers published in all Q1 journals listed in JCR. In contrast, the percentage of TR-addressed papers published in low impact Q4 journals is twice that of all JCR Q4 journals.

The difference is even more striking when one considers the distribution of publications (articles and reviews) by quartiles according to 2016 JCR data (representing journals published in 2015). Some 44%, 27%, 16%, and 13% of all articles and reviews listed in Science Citation Index Expanded (SCI-E) in 2015 were published in Q1, Q2, Q3, and Q4 journals, respectively (Liu et al. 2018). The distribution by quartiles was somewhat similar for articles and reviews indexed under SCI-E's largest 25 research areas representing more than half of all publications in the database (Miranda and Garcia-Carpintero 2019). The corresponding percentages for TR-addressed Science papers are as follows: 22% in Q1, 20% in Q2, 24% in Q3, and 31% in Q4 journals (Table 2).<sup>7</sup>

The percentage of TR-addressed papers published in low impact Q4 journals is more than twice that of all JCR Q4 journals. Note that our data does not include reviews, although it is unlikely that the distribution of reviews by journal quartiles would differ much from that of articles in general, and that a small percentage (*ca.* 2%) of TR-addressed reviews would significantly change the distribution of journals by quartiles in this study in particular. We observe a somewhat similar relationship for TR-addressed papers listed in SSCI. Some 36%, 29%, 20%, and 15% of SSCI publications were published in Q1 through Q4 journals, respectively (Liu et al. 2018). Yet, corresponding percentages for TR-addressed papers are 15% (Q1), 20% (Q2), 19% (Q3), and 29% (Q4). That the percentage of TR-addressed Social Science papers published in low impact Q4 journals is

<sup>5</sup> Not all journals in which TR-addressed papers were published had both JIF and/or AIS values listed in JCR. The correlation coefficient is based on 3,961 papers with both values. Papers that were published in journals with no JIS and/or AIS were also excluded.

<sup>6</sup> Note that 4% of all TR-addressed papers were published in journals with no assigned JCR quartiles in 2015 (i.e., journals with no JIFs).

<sup>7</sup> Note that 3% of all TR-addressed Science papers indexed in SCI were published in journals with no assigned JCR quartiles in 2015 (i.e., Science journals with no JIFs).

relatively lower (29%) compared to that of TR-addressed Science papers (31%) is due to the fact that an additional 17% of TR-addressed Social Science papers were published in journals with no JCR quartiles assigned (Table 2).

Table 2. Distribution of TR-addressed papers by JCR quartiles (n=4521)

Subject	Papers	Quartiles											
		N/A		Q1		Q2		Q3		Q4		Total*	
		N	%	N	%	N	%	N	%	N	%	N	%
Science	Supported	26	2	391	26	332	22	329	22	430	29	1508	101
	Not supported	102	4	495	19	494	19	633	25	851	33	2575	100
	<i>Subtotal</i>	<i>128</i>	<i>3</i>	<i>886</i>	<i>22</i>	<i>826</i>	<i>20</i>	<i>962</i>	<i>24</i>	<i>1281</i>	<i>31</i>	<i>4083</i>	<i>100</i>
Social Sciences	Supported	29	17	24	14	38	22	35	21	45	26	171	100
	Not supported	44	17	41	15	48	18	50	19	84	32	267	101
	<i>Subtotal</i>	<i>73</i>	<i>17</i>	<i>65</i>	<i>15</i>	<i>86</i>	<i>20</i>	<i>85</i>	<i>19</i>	<i>129</i>	<i>29</i>	<i>438</i>	<i>100</i>
All	Supported	55	3	415	25	370	22	364	22	475	28	1679	100
	Not supported	146	5	536	19	542	19	683	24	935	33	2842	100
	<b>Total</b>	<b>201</b>	<b>4</b>	<b>951</b>	<b>21</b>	<b>912</b>	<b>20</b>	<b>1047</b>	<b>23</b>	<b>1410</b>	<b>31</b>	<b>4521</b>	<b>99</b>

\* Some total percentages in the rightmost column differ from 100% due to rounding.

Fig. 4 provides the JCR quartile distributions of all TR-addressed papers published in journals listed in JCR in 2015 (left panel) as well as that of supported and not supported ones (right panel). The percentage of papers decreases as we go from low impact Q4 journals to high impact Q1 journals for both Science and Social Science papers. Some 58% and 65% (including the percentage of papers published in journals with no quartiles assigned) of the TR-addressed Science and Social Science papers were published in low impact Q3 and Q4 journals whereas only 42% and 35% of Science and Social Science papers, respectively, were published in high impact Q1 and Q2 journals (Fig. 4, left panel). The opposite is the case for all publications (articles and reviews) listed in SCI-E and SSCI: About 70% and 65% of all Science and Social Science papers, respectively, were published in high impact Q1 and Q2 journals (Liu et al. 2018; Miranda and Garcia-Carpintero 2019).

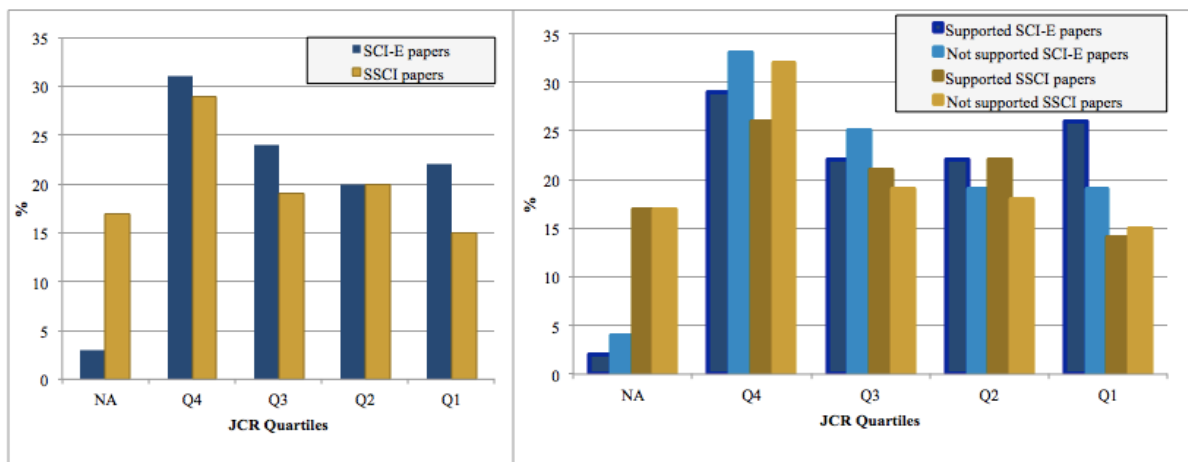


Fig. 4. JCR quartile distributions of TR-addressed papers. Left panel: all papers; right panel: supported and not supported papers (based on figures in Table 2 above).

As for the comparison of the distributions of supported and not supported TR-addressed papers by JCR quartiles, some 53% and 64% of supported Science and Social Science papers, respectively, were published in low impact Q3 and Q4 journals or in journals with no JIF values (hence no quartiles) (Fig. 4, right panel). The percentage of supported Social Science papers that appeared in journals with no (zero) JIF values (17%) was much higher than that of Science papers (2%) because Social Science papers got supported more generously to increase their number (Tonta 2017b). Almost half (48%) the supported Science papers appeared in Q1 and Q2 journals (as opposed to 36% of supported Social Science papers). The percentage of supported Science papers

published in Q1 journals (26%) is almost twice that of Social Science papers (14%). The percentage of supported Social Science papers with no quartiles was the same as those with no JIFs (17%).

The difference between quartile distributions of supported and not supported Science papers was statistically significant ( $\chi^2(4) = 39.6, p < .01, r = .01$ ). This may be due to the more restrictive support policy towards Science papers published in the lowest quartile of journals, as authors who published papers in Q3 and Q4 journals could apply for support only once a year starting from 2008 (Tonta, 2017b: 23).

The percentages of supported papers by quartiles in general suggest that the support system seems to have failed to be more selective, thereby rewarding more papers that were published in journals with lower JCR quartiles and thus lower citation impact.

The preceding analyses, statistical test results, and findings do not provide sufficient evidence to accept H2 in that there is no statistically significant difference between (a) JIS, (b) AIS, and (c) JCR quartiles of journals in which supported and not supported TR-addressed papers were published. Hence, H2 is not supported. These journal-level impact values do not differ for supported and not supported Science and Social Science papers, respectively, either.

### ***Test Results of the Hurdle Model Based on the Sample***

In this subsection we present the hurdle model test results. Recall that the citation data of TR-addressed papers was overdispersed with variances larger than means (Table 1). Moreover, the sample data had considerable number of papers with zero citation counts (603 or 13.3% of all papers in the sample) as well as journals without AIS (597 or 13.2% of all papers), JIF -and hence quartile- values (201 or 4.4% of all papers). Nine percent of the supported papers and 16% of the not supported ones received zero citations.

As the citation data for both supported and not supported papers is skewed with many zero citation counts, we used the hurdle model to analyze the data to find out if the explanatory variables have any effect on the outcome variable. The two-component hurdle model generates both the zero citation and positive (i.e., non-zero) citation counts. The model tests if factors such as support and journal-level parameters increase the likelihood of papers' "crossing the hurdle" bar of receiving their first citations or not (a binary outcome). It also tests if the same factors are likely to increase the number of positive citations once papers cross the hurdle bar of uncitedness. To put it somewhat differently, the hurdle model enables us to explore whether monetary support and journal-level parameters of JIF, AIS and quartile as regressors are associated with uncitedness and the number of citations that papers receive.

We first checked if the hurdle model fits the citation count data in our sample by using rootograms as a visual aid. A "rootogram compares observed and expected values graphically by plotting histogram-like rectangles or bars for the observed frequencies and a curve for the fitted frequencies, all on a square-root scale" (Kleiber and Zeileis 2016: 297). The  $x$ -axis of the "hanging rootogram" in Fig. 5 represents the number of times cited (truncated at 100 citations) while the  $y$ -axis represents the square-root of papers receiving that many citations. Both axes include zero. As the rootogram shows, the negative binomial hurdle model seems to fit the citation data quite well, although there is some slight over-fitting at count 1 and at higher citation counts ( $> 27$ ) as well as some under-fitting at counts 3 and 5 to 11.

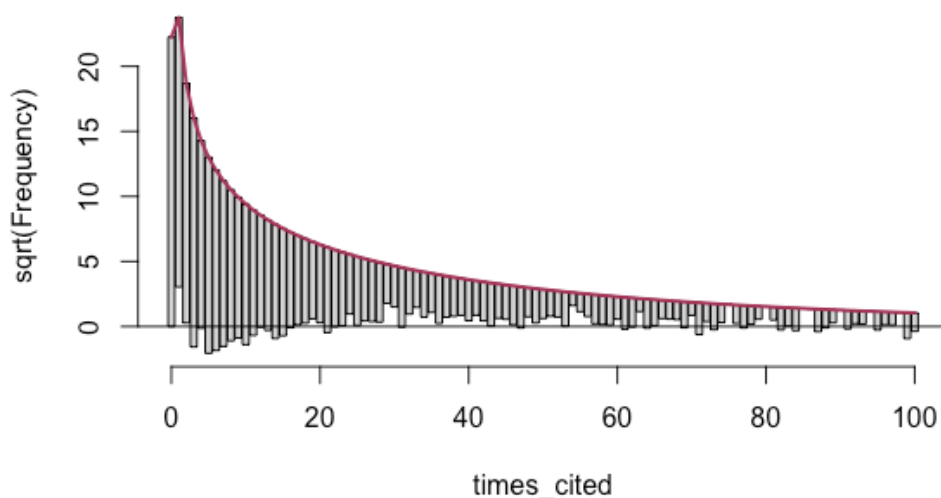


Fig. 5. Hanging rootogram for citation counts (truncated at 100)

Table 3 below provides the results of the hurdle model along with the dispersion and log-likelihood parameters and information criteria (AIC and BIC). The top and bottom parts of the table contain coefficients, standard errors,  $z$  and  $p$  values, and confidence intervals (CI) for the count data for papers with positive citations and for the zero hurdle model, respectively.

Table 3. The results of the hurdle model

<b>Count model coefficients (negative binomial with log link)</b>							
<b>NB</b>	<b>Coef</b>	<b>Exp (coef)</b>	<b>Std. Err.</b>	<b>z value</b>	<b>p</b>	<b>95% confidence intervals</b>	
support	0.170	<b>1.185</b>	0.061	2.793	<b>0.005</b>	1.052	1.335
JIF	0.070	1.072	0.045	1.559	0.119	0.982	1.170
AIS	-0.019	0.981	0.105	-0.180	0.857	0.798	1.206
Quartile	0.001	1.001	0.031	0.039	0.969	0.943	1.063
(Intercept)	2.006	<b>7.436</b>	0.121	16.585	<b>0.000</b>	5.867	9.426
N = 3918							
<b>Zero hurdle model coefficients (binomial with logit link)</b>							
<b>Logit</b>	<b>Coef</b>	<b>Exp (coef)</b>	<b>Std. Err.</b>	<b>z value</b>	<b>p</b>	<b>95% confidence intervals</b>	
support	0.573	<b>1.774</b>	0.107	5.354	<b>0.000</b>	1.438	2.188
JIF	-0.005	0.995	0.076	-0.069	0.945	0.858	1.153
AIS	-0.019	0.981	0.176	-0.107	0.915	0.695	1.385
Quartile	-0.117	0.889	0.050	-2.350	0.019	0.806	0.981
(Intercept)	2.072	<b>7.938</b>	0.175	11.828	<b>0.000</b>	5.631	11.189
N = 603							
Dispersion parameter (theta): 0.278							
Log-likelihood: -1.349e+04 on 11 Df							
AIC: 26999							
BIC: 27068							

Note: "Coef" stands for Coefficient; "Exp (coef)" for Exponentiated coefficient; and "Std Err" for Standard error.

The count model (negative binomial with log link) shows that support has a significant effect on the positive number of citations that papers collect. Papers that have positive citations, those that were supported receive 18.5% more citations (95% CI: 5.2% to 33.5%) than not supported ones. To put the difference into a better perspective, assuming that any given paper had on average of six years to collect citations between 2006 and early 2018, a supported paper received about two more citations than a not supported one did. However, there was no statistically significant relationship between the number of citations and JIF, AIS and quartiles of journals in which TR-addressed papers were published for papers with positive citations (see the top part of Table 3 for coefficients and  $p$  values).

As for the results of the zero hurdle model (binomial with logit link), supported papers have 1.77 times (95% CI: 1.44 to 2.19) the odds of receiving their first citations (i.e., crossing the hurdle) compared to that of not supported ones. In other words, papers that have zero citations, those that were supported have 77% more chance to have their first citations compared to that of not supported ones. However, as was the case for papers with positive citations, JIF, AIS and quartiles of journals in which TR-addressed papers were published do not significantly contribute to the odds of papers receiving their first citations (see the bottom part of Table 3 for coefficients and  $p$  values).

Although "support" as the main explanatory variable contributes significantly to the odds of a paper collecting its first citation (i.e., reducing the number of papers with zero citations), its effect on the increase in the positive number of citations is negligible, which is confirmed by the low correlation coefficient (0.177) between support and the positive number of citations (not reported in detail here).<sup>8</sup> Thus, the answer to the research question of whether support increases the likelihood of papers receiving their first citations is positive. Yet, the effect of

<sup>8</sup> In fact, the mean JIF and AIS values of not supported papers with zero citations were even slightly higher than those of supported ones with zero citations.

support on the likelihood of supported papers having higher citation counts than those of not supported ones is insignificant. Journal-level parameters of JIF, AIS and quartiles as regressors do not contribute to the response variable in that they neither increase the likelihood of papers receiving their first citations nor that of receiving higher positive citations.

In summary, support is the main explanatory variable determining whether a paper gets its first citation or not along with slightly increased citation counts. Yet, its effect on citation counts is rather small, confirming to some extent the findings of an earlier work by Gök et al. (2016: 723). JIF, AIS and quartiles of journals in which papers are published are not related with papers' having their first citations or higher citation counts. There should be some other factors such as discipline, authorship, and readability of papers that might determine increased citation counts (Didegah and Thelwall 2013a).

### ***Comparison of the Test Results***

The two-component hurdle model enabled us not only to corroborate the earlier findings based on *t*-tests but also to analyze papers with zero and positive citation counts more comprehensively. Recall that the mean numbers of citations for all supported and not supported TR-addressed papers were 14.1 and 11.0 citations, respectively (Table 1), and the difference was not statistically significant. The hurdle model test results corroborate this to some extent. Supported papers have 1.77 times the odds of crossing the hurdle (of uncitedness) and collect 18.5% more citations than that of not supported ones. The difference is statistically significant for papers with zero citations as well as positive citations. Although support reduces the number of uncited papers, it does not seem to amount to much in terms of supported papers having higher citation counts. Supported papers with positive citations received, on average, two more citations in 12 years than that of not supported ones with positive citations, reinforcing the findings that we obtained from the *t*-tests.

The rest of the explanatory variables (JIF, AIS, and quartiles) in the hurdle model have no effect on either increasing the odds of papers having their first citations or, once papers crossed the hurdle bar, collecting more citations compared to not supported papers. This finding, too, corroborates the earlier ones reported above, indicating that supported and not supported TR-addressed papers tend to get published in journals with similar JIF, AIS and quartile values.

Findings also indicate that the *t*-tests work rather well on overdispersed citation count data with considerable number of papers with zero citations, as the hurdle test produced somewhat similar results based on the same data. This is in congruence with earlier findings that the *t*-tests can also be used in skewed distributions with non-normal data provided the sample size is large enough (Lumley et al. 2002: 151), as is the case in our study.

### ***Discussion***

The main findings of this study with regards to about 226,000 TR-addressed papers published between 2006 and 2015 are then as follows: They were published in relatively low impact journals. More than half appeared in journals with relatively low JIF and AIS values. TR-addressed papers did not get cited very often, as half the papers received between zero (13%) and five citations within the study period. Supported and not supported papers collected comparable number of citations per paper. Papers were not significantly different from each other in terms of journal-level citation impact parameters, either. Both supported and not supported papers were published in journals with similar JIFs, AISs and JCR quartiles. The distributions of the supported and not supported Science and Social Science papers by citation impact values did not differ much, either. Findings indicate that there is no difference between the supported and not supported papers in terms of: the number of citations per paper (H1); and of JIFs, AISs, and JCR quartiles of journals in which they were published (H2). This relationship (or lack thereof) holds true for the supported and not supported Science and Social Science papers, respectively, as well.

The results of the hurdle test corroborate these findings to a certain extent. As the only regressor with positive coefficients in the hurdle model, "support" increases both the probability of non-zero and positive citation counts of papers. Yet, its overall effect is rather limited. Journal-level parameters of JIF, AIS and quartile have no effect on uncitedness and positive citation counts of papers.

In summary, according to *t*-test results we did not find sufficient evidence that monetary support is associated much with papers' collecting higher number of citations. According to hurdle model test results, support is related with reducing the number of papers with zero citations and with slightly increasing the citation impact of papers with positive citations. The quantity of uncited papers and citation counts of cited papers are not associated with journal-level metrics, either, a finding that reinforces the results of *t*-tests.

Findings of the current study corroborate the findings of earlier studies of PRFSs to some extent (Auranen and Nieminen 2010; Butler 2003, 2004; Checchi et al. 2019; Didegah and Thelwall 2013a; Geuna and Martin 2003;



Good et al. 2015; Gök et al. 2016; Osuna et al. 2011; Quan et al. 2017). We have not observed a negative correlation between JIFs, AISs, and quartiles of supported and not supported TR-addressed papers. Yet, the average number of citations per paper and JIF, AIS and quartile values were quite similar not only for all supported and not supported papers, but also for supported and not supported Science and Social Science papers, respectively.

It appears that the support system of TÜBİTAK has not increased the citation impact of TR-addressed papers appreciably, in terms of both paper-level (i.e., number of citations per paper) and journal-level citation impact parameters (i.e., JIFs, AISs and quartiles). This confirms, to some extent, the findings of an earlier study on TÜBİTAK's support system (Tonta 2017b). It is reasonable then to suggest that the subsidy system does not seem to have fulfilled its intended objective of increasing the impact of TR-addressed international scientific publications, at least not during the study period (2006-20015).

### ***Limitations of the Study***

Some of the limitations of our study should also be noted. We lack empirical data as to why the support system did not have considerable effect on increasing the citation impact of TR-addressed papers. One reason might be that researchers have had to write papers for tenure and academic promotion anyway, and they do not pay much attention to TÜBİTAK's support program (Yuret 2017). Or, they may have found support through other sources (e.g., project budgets or other academic incentives). Yet another reason might be that the amount of support (based primarily on JIF values) was perhaps not attractive enough for some researchers, especially when we consider the fact that many TR-addressed papers were published in relatively low impact journals and the total amount of payment per paper has to be divided by the number of co-authors (Tonta 2017b).

As our findings are based on the citation impact of supported and not supported TR-addressed papers in general, we do not know whether monetary support has actually incentivized some researchers to publish in high impact journals or not. For this, privacy issues need to be resolved first in order to match the payment data with authors who received support. Thus, the research output of supported authors can be tracked and compared with that of not supported ones in terms of citation impact of their papers. Using the hurdle model, the potential impact of other explanatory variables such as disciplinary, collaborative (i.e., national vs. international) and authorship characteristics of papers on both uncitedness and positive citation counts of TR-addressed papers can be explored further (Chen 2012; Didegah and Thelwall 2013a, b; Gök et al. 2016).

### **Concluding Remarks and Further Research**

So, does monetary support increase the citation impact of scholarly papers? As explanatory variables, do monetary support, JIF, AIS and quartile values of journals have any effect on papers getting their first citations as well as collecting higher citation counts? Analyzing the citation count data using two different methods, we show that this does not seem to be the case. Findings indicate that both supported and not supported TR-addressed papers were somewhat similar in terms of average number of citations per paper they received. They were published in journals with similar JIFs, AISs, and JCR quartiles. This applies to both Science and Social Science papers, respectively, as well. Despite the support system's positive attitude towards rewarding more Social Science papers, they numbered in few and were affected more heavily by the use of paper- and journal-level citation impact parameters, further reinforcing the fact that they are not the best metrics to assess Social Science papers. Monetary support reduces the number of uncited papers to some extent, although it does not substantially increase the positive citation counts of supported papers in comparison to not supported ones. Journal-level citation impact parameters of JIF, AIS and quartiles are not associated with papers' getting their first citations nor with receiving higher citation counts.

Contrary to the expectations of the research funders, payments transferred to researchers through the support program do not seem to have played much role in improving the citation impact of TR-addressed papers. This suggests that subsidies based on bibliometric measures, as is the case in TÜBİTAK's support system, function poorly as incentives to increase the citation impact of scholarly papers. The graded incentives based on journal quartiles do not seem to work, either, indicating that institutions or countries thinking of introducing such support systems based on graded incentives need to reconsider their plans. The support system seems to have rewarded the authors of papers who published in mediocre or low impact journals relatively more often. Despite comparatively lower "piece rates" paid for papers published in such outlets, many researchers sought financial support nonetheless.

In conclusion, the support program of TÜBİTAK does not have much effect on the citation impact of TR-addressed papers published in scholarly journals. It does not seem to have incentivized authors to publish in high impact journals to collect higher cash rewards. Therefore, TÜBİTAK's support system based on



bibliometric measures should be reconsidered and perhaps discontinued. Similar incentives of the Turkish Higher Education Council and individual universities should be reconsidered as well.

As for further research, more comprehensive studies need to be carried out to find out what factors increase the likelihood of TR-addressed papers receiving their first citations as well as higher number of citations. It is also worthwhile to study the reasons of why it is that increasingly more researchers in Turkey are inclined to publish in relatively low impact journals. Could this be an indication that subsidies may have encouraged some researchers to develop “opportunistic behavior” so that they may have acted like “rent seekers” interested only in reaping the relatively modest monetary benefits of the support program without much consideration for the impact of their papers? Or, does the support system function mainly as an additional source of modest income for some researchers who get rewarded perhaps more for their papers anyway through academic tenure or increasing grant opportunities? These questions beg further research.

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