Does Monetary Support Increase the Number of Scientific Papers? An Interrupted Time Series Analysis

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Abstract

One of the main indicators of scientific production is the number of papers published in scholarly journals. Turkey ranks 18th place in the world based on the number of scholarly publications. The objective of this paper is to find out if the monetary support program initiated in 1993 by the Turkish Scientific and Technological Research Council (TÜBİTAK) to incentivize researchers and increase the number, impact and quality of international publications has been effective in doing so. We analyzed some 390,000 publications with Turkish affiliations listed in the Web of Science (WoS) database between 1976 and 2015 along with about 157,000 supported ones between 1997 and 2015. We used the interrupted time series analysis technique to test if TÜBİTAK's support program helped increase the number of publications. It appears that the support program has had negligible impact on the increase of the number of papers. We discuss the implications of findings along with the possible causes of the ineffectiveness of the support program.

Conference Topic

Country level studies

Introduction

The number of scholarly papers and citations thereto are indirect indicators of the level of scientific development of countries. The number of scholarly papers with Turkish affiliations listed in citation indexes has increased tremendously over the years and Turkey ranks 18th in the world in terms of number of publications. Over 36,000 papers were published in 2015 alone, although their scientific impact in terms of the number of citations they gather is well below the average of the world, the European Union (EU) and the OECD countries.

In 1993, the Turkish Scientific and Technological Research Council (TÜBİTAK) has initiated a monetary support program (UBYT) to incentivize researchers and increase the number, impact and quality of international publications authored by Turkish researchers. Considerable percentages of papers with Turkish affiliations were supported in the early years of this program, even though the rate of support has gradually decreased (to *c*. 30%) over the years due to the steep increase in the number of published papers with Turkish affiliations. As part of the program, some 157,000 publications (93% of which were papers/articles) were supported between 1997 and 2015. The amount of support paid for each paper has been determined on the basis of the impact factor of the journal in which it was published.

The total amount of support was about 124 million Turkish Liras (in 2015 current prices; equal to *c*. 35 million USD). The number of papers supported, the total number of publications, and the amount of support increased four-, 10- and 13-fold, respectively, during this period.

The support program has been in place for almost a quarter century. Yet, its impact has not been evaluated in the past. We have been asked by TÜBİTAK to evaluate the effectiveness of the program and given the payment records of 157,000 supported publications. They included, among others, journal information (name, year, its class based on Journal Citation Reports' subject categories), type of contribution (e.g., article, review) and the amount of support.

Based on the payment records provided, the characteristics (i.e., impact factors) of journals in which supported papers with Turkish affiliations appeared have been analyzed, the functioning of the support algorithm has been studied, and the effectiveness of the overall

support program has been evaluated. Findings indicate that the authors of mediocre papers published in journals with relatively low impact factors have mostly been supported due to the use of skewed distributions of journal impact factors in determining the amount of support. The existing support algorithm, on the other hand, does not seem to function as conceived.
This paper presents only the findings of the interrupted time series analysis with a view to find out if the support program has had any impact on the increase of the number of papers with Turkish affiliations. It is organized as follows: The Literature Review section briefly discusses the findings of relevant studies including those that provide some background on the Turkish case. The Data and Method section describes the data used and provides information on interrupted time series analysis. The detailed findings are presented thereafter (Findings and Discussion), followed by Conclusions and Recommendations.

Literature Review

Performance-based research funding systems (PRFSs) came into being in 1980s. Based on rewarding the outputs, the rationale of PRFSs is to provide more support to institutions (or individuals) with higher performances so that the ones with lower performances will strive to improve theirs in order to get more support (Herbst, 2007, p. 90). Yet, it is not clear if PRFSs based on outputs and competition increase the scientific productivity and the impact of outputs. In a relatively recent study comparing PRFSs and outputs of eight countries, countries with less competitive PRFSs such as Denmark turned out to be as effective as the ones with more competitive PRFSs such as the UK and Australia (Auranen & Nieminen, 2010, p. 830). Some researchers drew attention to the potential "side effects" of PRFSs based on competition, as they tend to "homogenize" research outputs, discourage experiments using new approaches, and reward researchers playing "safe" even though their contributions may not have any societal impact (Geuna & Martin, 2003, p. 296). The idea of increasing productivity on the basis of outputs and competition seems more complicated than what decision-makers have initially thought (Auranen & Nieminen, 2010).
There are mainly two types of PRFSs in use: (1) the ones based on peer review or informed peer review supported with bibliometric measures; and (2) the ones based solely on bibliometric measures such as journal impact factors. The UK's Research Excellence Framework (REF) is the largest research assessment system in the world (De Boer et al., 2015, p. 113). Based on peer review, REF has been used since 1986 to distribute funds to research institutes and universities on the basis of their performances. Despite their shortcomings, PRFSs based on bibliometric measures only are on the rise, as they are, in comparison to peer review, easier and less costly to apply as a "proxy" to assess performance. Therefore, they tend to get preferred by increasingly more countries lately.
PRFSs and publication support systems based on bibliometric measures generally use the number of papers published in refereed journals and their impact in terms of citations as the main criteria to determine the research institutes and researchers to be supported. Impact factors (IF) and article influence scores (AIS) of journals are the two most commonly used metrics.
Journal IF was originally proposed by the late Eugene Garfield (1972) to help librarians in their selection of journals for subscription. It is an indicator of the quality of a journal in general and measures the citation impact of an "average" paper published therein. It does not say anything about the quality of an individual paper in that journal and how many citations, if any, it would gather in a certain period of time after its publication (e.g., two years).
Citation distributions used to calculate the IFs of journals are quite skewed, indicating that few papers published in a given journal get cited much more frequently while the majority get unnoticed or rarely cited (Marx & Bornmann, 2013). This is the case even for the most prestigious journals with the highest IFs such as *Nature* (IF=38) and *Science* (IF=35). As high as 75% of articles published in these journals get cited fewer times than their journal IFs

indicate (Larivière et al., 2016, p. 4, Table 2). Journal IFs vary by scientific discipline, too, as the number of researchers in each field, publication types (i.e., journal articles as opposed to books) and scholarly communication patterns tend to differ. In general, some 9%-10% of all the articles listed in Web of Science collect 44% of the total number of citations (Albarrán, Crespo, Ortuño & Ruiz-Castillo, 2011). More importantly, there exists no positive relationship between the number of citations an article gets and the IF of the journal in which it is published (Zhang, Rousseau & Sivertsen, 2017, p. 14), and a large body of literature detailing the shortcomings of the use of journal IFs as a performance measure is readily available (e.g., Seglen, 1997; Glänzel & Moed, 2002; Van Raan, 2005; Marx & Bornmann, 2013; Casadevall & Fang, 2012; Wouters et al., 2015). Yet, rather than checking the number of citations to the papers of individual researchers, PRFSs based on bibliometric measures continue to use journal IFs to assess the performance of individuals. Journal IFs are quite misleading in predicting the number of citations that any given article might get. What follows are a few examples of PRFS using journal IFs as a research assessment tool.

PRFSs are reviewed by several researchers (e.g., Geuna & Martin, 2003; European Commission, 2010; Hicks, 2012; De Boer et al., 2015). Most EU countries, Norway, USA, Australia, New Zealand and China have some PRFSs in place. We provide a few examples of PRFSs that either solely use journal IF or use it in combination with peer review (excluding the ones based only on peer review such as REF in the UK).

Italy uses a PRFS where an expert panel decides whether to use citation analysis or peer review (or both) for each publication. Universities are ranked on the basis of a quality score consisting of citations and other journal metrics, which determine the amount of support each university gets. Some 30% of the research funds are distributed according to the outcome of this evaluation (Abramo, D'Angelo & Di Costa, 2011, p. 930; Abramo & D'Angelo, 2016, p. 2055; Abramo & D'Angelo, 2011, p. 348).

Similarly, Spain uses a mixed system, although researchers are encouraged to publish in journals that are listed in the top quarters of JCR's subject categories. Researchers who publish in such journals receive monetary support that ranges somewhere between 3% and 15% of their monthly salaries (Osuna, Cruz-Castro & Sanz-Menéndez, 2011).

A number of countries such as Czech Republic, China, Finland, and Australia use journal IF exclusively to support research institutes and individual researchers. Finland, for instance, linked journal IF directly with research support by legislation (Adam, 2002, p. 727). Similarly, Australia and the Czech Republic make direct linkage between research evaluation and funding by counting scholarly outputs and assigning a score to each on the basis of bibliometric measures. These scores are then used to determine the amount of monetary support and papers that appear in refereed journals or journals with relatively higher IFs get the highest scores (Butler, 2004; Butler, 2003, p. 147-151; Good et al. 2015, p. 92, 96, Table 3). Norway also has a similar system based on weighting journals on the basis of various criteria and created three different journal lists (Schneider, 2009). China, on the other hand, uses journal IF most comprehensively in that academic recruitments and promotions, university rankings (and the amount of research support they get), support of Chinese journals that are listed in Chinese Citation Indexes all rely on journal IFs. The procedure seems to have been automated, as a researcher publishing in a journal with a certain IF knows how much support s/he would get. For instance, the author of a paper published in a journal with IF higher than 15 receives 300,000 Yuan (*c*. 43,000 USD) (Shao & Shen, 2012)!

Turkey is no exception: journal IFs are considered as an indicator of quality and have been used as an important criterion in academic promotions since early 1990s. In addition to individual universities, TÜBİTAK has initiated a nationwide monetary support system based exclusively on journal IFs. Journals classified under Q1, Q2, etc. in JCR's subject categories have been used to determine the monetary compensation. More recently (2016), Turkish

Higher Education Council (HEC) started a new support scheme based mostly on journal IFs and the faculty whose scores are above a certain threshold in terms of number of academic activities (mostly publications) during the previous year get an additional 10% to 15% on top of their regular monthly salaries throughout the year.

It should be noted that performance-based research funding and publication support systems based on quantitative measures tend to have some adverse effects. Researchers seem to adjust to the requirements very easily and change their publication patterns and behaviors. Such systems are prone to "gaming", too, and researchers become more "opportunistic" (e.g., publication "inflation") and less ethical (e.g., "fake" citations) in time. Unintended consequences of PRFSs in several countries (e.g., Australia, Czech Republic, and Spain) were reported in the literature (Butler, 2003; Butler, 2004; Good et al., 2015; Osuna, Cruz-Castro & Sanz-Menéndez, 2011). For example, more papers tend to get published in journals with relatively lower IFs. A similar trend has also been observed in Turkey (Yurtsever et al., 2001, 2002; Önder et al., 2008; Kamalski et al., 2017, p. 298-301). As the Goodhart's Law states, "When a measure becomes a target, it ceases to be a good measure".[1]

It should also be noted that correlation between competitive PRFSs and the research productivity is not clear-cut (Auranen & Nieminen, 2010, p. 831). Excessive competition seems to reduce the time and energy otherwise to be expended for research. In this paper, we test the conjecture if TÜBİTAK's publication support system has had an impact on the increase of number of publications listed in citation indexes with Turkish affiliations.

Data Sources and Method

We performed a search on Web of Science (WoS) (December 19, 2016) to identify all the publications with Turkish affiliations listed in Science Citation Index (SCI), Social Sciences Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI) between 1976 and 2015. More than 390,000 records were retrieved, 81% of which were full papers (articles) while the rest were other types of publications (e.g., reviews, notes, and letters to the editor).

TÜBİTAK provided the payment data for about 157,000 supported publications (93% of which were papers). These records were first cleaned, then coded as either "full papers" (articles) or "other" types of publications, classified under various criteria (e.g., year, class of journal, amount of support paid), ranked and combined, if necessary.

We used MS Excel and SPSS 23 for the detailed analysis of data and prepared both WoS and TÜBİTAK records for interrupted time series analysis outlined below (Interrupted, 2013).[2]

The interrupted time series (ITS) analysis technique (also known as quasi-experimental time series analysis or intervention analysis) is used in this paper to measure the impact of TÜBİTAK's support program. ITS analysis measures if an "event" occurring at any given stage has an immediate or delayed effect on the time series data. For instance, an unexpected political development in a given country may increase the exchange rates, or a terrorist attack may reduce the number of tourists. These "events" (called "interventions") may be planned or not planned. As ITS analysis is a quasi-experimental method, it is possible (by means of using a control group) to verify if the change has occurred because of the intervention.

ITS analysis is based on the following statistical model:

$$Y_t = \beta_{pre} + \beta_{post} + e_t \quad (1)$$

[1] See https://en.wikipedia.org/ s.v. "Goodhart's Law".

[2] Time series data prepared for interrupted time series analysis can be had from the author.

[3] This percentage should ideally be 0 (zero) in order for it to function as a true control group. Yet, we think that

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where Y_t represents the t'th observation in the time series, β_{pre} and β_{post} represent the levels of series before and after the intervention, respectively, and e_t is the error related with Y_t. The null hypothesis

$$H_0 = \beta_{pre} - \beta_{post} = 0 \quad (2)$$

states that there is no statistically significant difference between the levels of series before and after the intervention (i.e., it has no impact on dependent variable (McDowall et al., 1980, p. 12). It is assumed that the parameters in time series models stay the same before and after the intervention and that no other events that affect the parameters take place. ITS analysis can be applied to both static and dynamic ("ergodic") time series. The ARIMA model is used for non-static series whose arithmetic means, variances and co-variances change as time passes. This model is expressed as ARIMA (p, d, q) where p, d and q represent the autoregressive operator (AR), the integrated operator (I), and the moving average operator (MA), respectively. If time series data is not stationary (d), it will first be made stationary to make its mean and variance constant over the years studied.

We have WoS data of publications with Turkish affiliations (1976-2015) and data of supported publications by TÜBİTAK (1997-2015). The program ("intervention") started in 1993 and enough data points exist both before (1976-1992) and after (1993-2015) the intervention so as to be able to apply ITS analysis to time series data (Cochrane, 2002, p. 7-8). As relatively fewer researchers benefited from the support program in the early years, we thought that the effect of the program might be observed with some delay (lag). Therefore, we measured its impact one (1994), four (1997) and 10 years (2003) after of its start.

We have no data on papers (full articles) whose authors have not been supported. However, a relatively small group of authors of other types of contributions can function as a control group, as only 3% of the total amount of support on average was set aside for such contributions even though 19% of publications were of such nature. The authors of other types of contributions were paid half of what the authors of the full papers were, and a mere 1% of the support budget was allocated to them in 2013, for example.[3] In other words, we can find out if TÜBİTAK's support program has had any impact on the increase in the number of papers by comparing it with that of other types of contributions. If the number of other types of contributions that were not well supported did not increase but the number of papers supported increased, we can deduce that the source of the impact was the support program. Conversely, if, despite lack of support, the number of other types of contributions increased along with the number of papers receiving full monetary support, then the increase in the latter cannot be attributed to the program, suggesting that some factor(s) other than the support program may have played a role in this increase.

Findings and Discussion

The descriptive data about the number of papers and the total number of publications originating from Turkey are presented in Table 1 and Fig. 1. The rate of increase is quite steep, especially starting from 2000s. This rate of increase made Turkey in those years one of the fastest growing countries in the world in terms of number of papers, and Turkey moved up the ladder very quickly from 45th in 1983 to 25th in 1999 to 18th in 2008 in the world, contributing to 1.56% of the overall scientific production in the world.

A considerable percentage of these publications were supported by TÜBİTAK's support program when it was first initiated in 1993. However, the support program seems to have not

[3] This percentage should ideally be 0 (zero) in order for it to function as a true control group. Yet, we think that it can be used as a control group with some caution and the generalization should be interpreted accordingly.

kept up with the pace of increase of papers and the percentage of papers supported went down from 70% in early 2000s to below 30% in recent years (Table 2, Fig. 2).

Table 1. Number of publications with Turkish affiliations (1976-2015)

Year	Papers		Other		Total	Year	Papers		Other		Total
	N	%	N	%	N		N	%	N	%	N
1976	216	80	53	20	269	1996	3359	84	623	16	3982
1977	229	72	91	28	320	1997	3844	83	796	17	4640
1978	272	72	108	28	380	1998	4460	82	1001	18	5461
1979	256	71	106	29	362	1999	5201	83	1078	17	6279
1980	343	74	123	26	466	2000	5462	84	1059	16	6521
1981	299	73	110	27	409	2001	6684	84	1271	16	7955
1982	315	70	132	30	447	2002	8985	86	1434	14	10419
1983	354	72	141	28	495	2003	10662	84	1978	16	12640
1984	420	77	129	23	549	2004	13199	84	2488	16	15687
1985	447	76	145	24	592	2005	14194	83	2877	17	17071
1986	506	77	151	23	657	2006	15070	79	4099	21	19169
1987	588	77	174	23	762	2007	17853	80	4414	20	22267
1988	672	75	227	25	899	2008	19327	82	4379	18	23706
1989	829	80	209	20	1038	2009	21655	82	4627	18	26282
1990	912	78	261	22	1173	2010	22833	83	4760	17	27593
1991	1134	80	290	20	1424	2011	23588	82	5325	18	28913
1992	1351	77	406	23	1757	2012	25254	82	5607	18	30861
1993	1519	76	482	24	2001	2013	26526	79	7200	21	33726
1994	1754	73	643	27	2397	2014	27242	79	7315	21	34557
1995	2233	72	885	28	3118	2015	28662	79	7530	21	36192
						Total / Avg.	**318709**	**81**	**74727**	**19**	**393436**

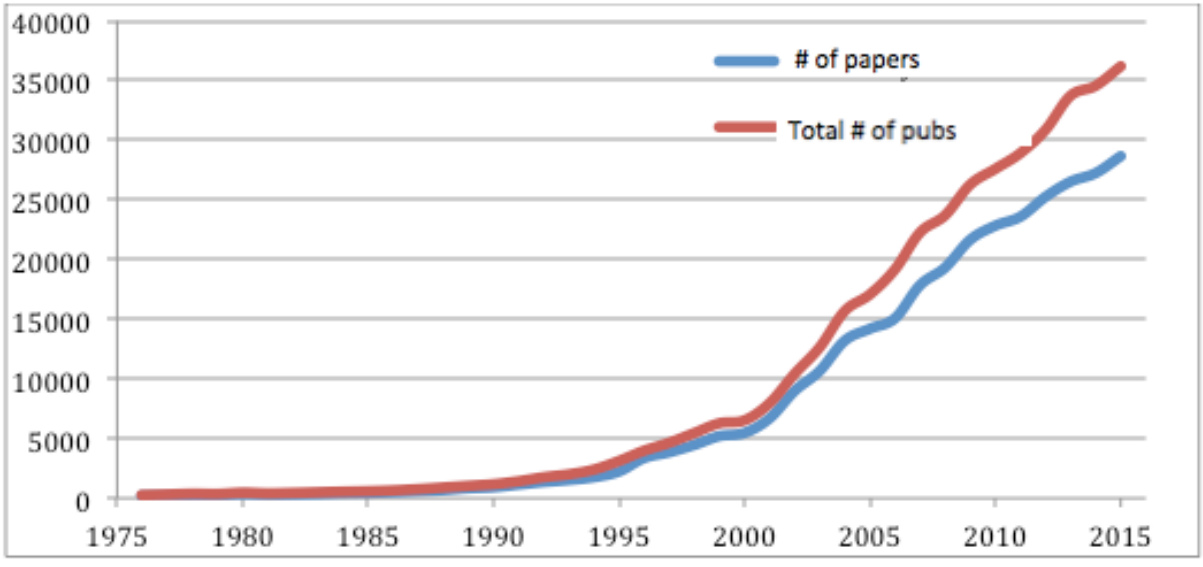

Fig. 1. Number of papers and total number of publications with Turkish affiliations (1976-2015)

Table 2. Number of papers supported by TÜBİTAK (1997-2015)

Year	# of papers supported by TÜBİTAK	# of papers with Turkish affiliations (WoS)	Percentage supported (%)
1997	2247	3844	58
1998	2657	4460	60
1999	3088	5201	59
2000	3298	5462	60
2001	4216	6684	63
2002	5888	8985	66
2003	7517	10662	71
2004	9511	13199	72
2005	7036	14194	50
2006	8122	15070	54
2007	10551	17853	59
2008	10411	19327	54
2009	11554	21655	53
2010	11592	22833	51
2011	9574	23588	41
2012	10641	25254	42
2013	10203	26526	38
2014	10257	27242	38
2015	8014	28662	28
Total	**146377**	**318709**	**46**

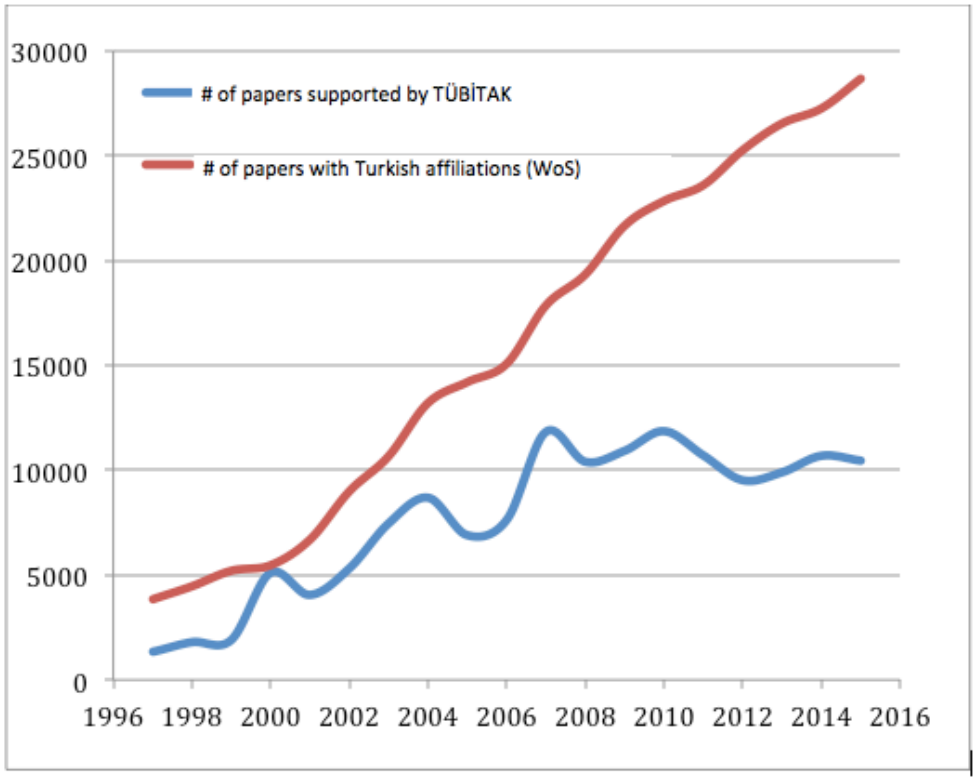

Fig. 2. Number of papers listed in WoS with Turkish affiliations and supported by TÜBİTAK (1997-2015)

The detailed analysis of changes in TÜBİTAK's support policies over the years is beyond the confines of this paper. Instead, we concentrate on whether TÜBİTAK's support program has actually played a role in the steep rate of increase of papers by Turkish researchers. The time path of the number of papers listed in the Web of Science (WoS) originating from Turkey between 1976 and 2015 is given below (Fig. 3). The intervention point (1993) is marked on the graph. As there exists a trend of increase in the number of papers both before and after the intervention, we took the difference of the time series from the 1st level (d=1) to make it stationary. Consequently, the auto-correlation function (ACF) and partial auto-correlation function (PACF) of the time series became static within the confidence intervals (Fig. 4).

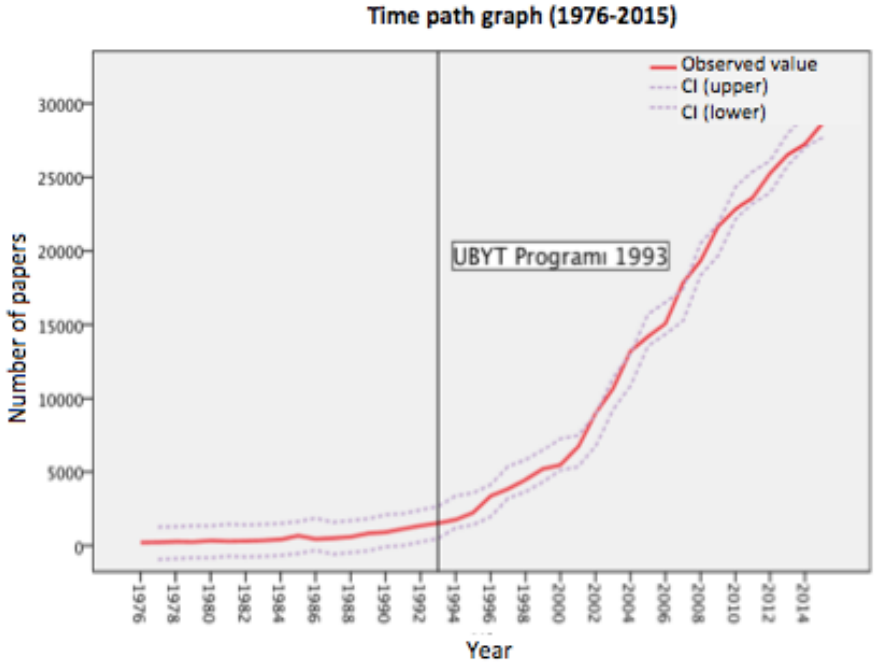

Fig. 3. Time path of papers with Turkish affiliations (1976-2015)

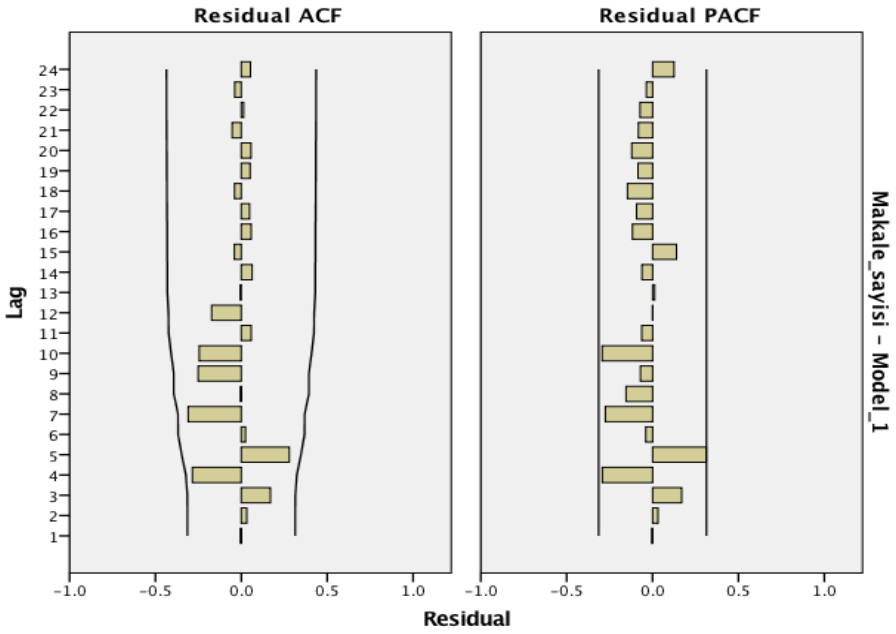

Fig. 4. Correlograms of autocorrelation (ACF) and partial autocorrelations (PACF) functions

We then defined ARIMA (1,1,0) model for interrupted time series data and wanted to see the impact of TÜBİTAK's support program in 1994, 1997 and 2003 (after one, four and 10 years of its start, respectively). The test statistic of the ARIMA model shows that the defined model is suitable for the time series data (X^2 = 23.531, DF = 17, p = .133) (Table 3). The parameters of the ARIMA model (estimates, SE, t- and p- values) are given in Table 4. The ARIMA Model did not produce statistically significant results (coefficient = .153, SE = .170, t = 0,899, p = .375). The coefficient for "Time series" in Table 4 gives the slope of the regression line before the intervention (14.051), which is used to analyze the different time points by taking into account the existing trend in data before calculating the effect of the intervention. The coefficient for "Before/after Support Program" represents the slope of y- axis when x is equal to 0 (zero) and is used to measure the effect of the intervention in later time points. The coefficient for "Effect" (29.091) gives the difference between slopes before and after the intervention. By adding this difference to the value of pre-intervention slope (14.051), the value of the post-intervention slope (44.142) can be calculated (Interrupted, 2013).

Table 3. Test statistic (Ljung Box)

Model Statistics

Model	Number of predictors	Model Fit statistics	Ljung Box Q (18)			Number of Outliers
		Stationary R-squared	Statistics	DF	Sig.	
Makale sayısı-Model_1	3	.607	23.531	17	.133	0

Table 4. ARIMA Model Parameters

					Estimate	SE	t	Sig.
# of papers Model 1	# of papers	No transformation	Constant	Lag 0	-57.138	334.811	-.171	.866
			AR	1	.153	.170	.899	.375
			Difference		1			
	Time series	No transformation	Numerator	Lag 0	14.051	29.910	.470	.642
	Before/after Support Program	No transformation	Numerator	Lag 0	11.258	708.202	.016	.987
	Effect	No transformation	Numerator	Lag 0	29.091	36.715	.792	.434

In order to see the effect of the support program on the number of papers with Turkish affiliations, we continued with this model. The slopes of pre- and post-intervention are the same for all analyses. It is possible to see the direct effect of the intervention on the number of papers with Turkish affiliations (Table 5). According to the model, an additional 554 papers were published in 1994 because of the support program. However, the effect of the support program is not statistically significant (p = .157). The delayed effect of the program has not been materialized in later years, either, as additional number of papers published due to the program were limited (651 papers in 1997, and 826 in 2003) and the effect is not statistically significant (p > .05). As the effect of the program has been negligible, the formula of the effect of the intervention is not given.

Despite the fact that other types of contributions have been supported very little during the period of analysis, the rate of their increase is greater than that of generously supported papers (see Fig. 1). As a control group, the rate of continuous increase in other types of publications seems to confirm the results of the interrupted time series analysis. For instance, some 4,000-

7,000 other types of publications have been published annually in recent years, of which only a few hundreds got supported. Yet, the number of other publications continues to increase regardless of support, suggesting that TÜBİTAK's support program is probably not the main factor causing the increase in the number of papers with Turkish affiliations.

Table 5. Values showing the delayed effect of TÜBİTAK's support program

Year	Predicted increase	SE	t-value	p-value
1994	563.633	390.084	1.446	.157
1997	651.241	431.129	1.510	.140
2003	825.784	571.279	1.446	.157
2015	1,174.941	947.761	1.240	.224

It should be noted though that interrupted time series analysis has some limitations. The assumption that no other "event" or "events" occurred during the period of analysis that might have affected the time series data is one of them. For example, the prerequisite of having papers published in journals listed in citation indexes for academic promotion may have triggered this increase, as more than 90% of research in Turkey has been carried out in universities, and the number of academic personnel in universities has increased tremendously over the years. Moreover, in addition to the number of research personnel in universities, the number of papers may be increasing due to a number of other factors such as the number of researchers per 10,000 capita, and the share of R&D expenditures within the Gross National Product (GDP). As indicated earlier, even though some positive correlation between PRFSs and the number of papers has been observed, this may not necessarily point to a strong causality between the two. As was the case in Spain (Osuna, Cruz-Castro & Sanz-Menéndez, 2011), the number of papers with Turkish affiliations continues to increase perhaps not because of TÜBİTAK's support program but because of other factors such as the growth in and the maturity of universities' research systems including academic personnel.

We should also note that we carried out a multiple regression analysis and observed fairly strong correlation between the number of papers with Turkish affiliations and the number of academic personnel as well as the number of supported papers. However, we decided not to report the results of the multiple regression analysis, as the Durbin-Watson statistic was rather small (0.921), probably indicating the existence of serial autocorrelation between variables and thereby making the results less reliable. This can to some extent be observed from Fig. 2: the correlation between number of papers with Turkish affiliations and the supported papers was positive and statistically significant between 1997 and 2006 whereas it was negative and not statistically significant between 2007 and 2015.

Conclusion

As part of TÜBİTAK's support program, the authors of over 157,000 publications received more than 124 million Turkish Liras (in 2015 current prices, *c*. 35 million USD) as monetary support between 1997 and 2015. Yet, two thirds of all payments were less than 826 liras (or *c*. 230 USD). These "micropayments" might be one of the reasons why, according to the test results of the interrupted time series analysis, the program did not seem to have direct impact on the increase of the number of papers published by Turkish authors. It is likely that small amounts of payments were not much of an incentive for authors to publish more.

We should point out that the objective of the support program is not to increase the number of papers *per se* but to increase their impact and quality, as stated in the By-Law of TÜBİTAK's support program (TÜBİTAK, 2016). Some authors may find the small payments satisfactory. Yet, if such small payments do not help achieve the program's objectives, precautions should be taken to correct it. The support program seems to have functioned as a mechanism to transfer

small amounts of payments to authors without any considerable improvement in the impact and quality of the papers. Transaction costs of such small payments should be borne in mind as well as the costs of missed opportunities of increasing the impact and quality of papers.

Acknowledgments

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References

Abramo, G. & D'Angelo, G.A. (2011). National-scale research performance assessment at the individual level. *Scientometrics*, 86, 347-364.

Abramo, G. & D'Angelo, G.A. (2016). Refrain from adopting the combination of citation and journal metrics to grade publications, as used in the Italian national research assessment exercise (VQR 2011-2014). *Scientometrics*, 109, 2053–2065.

Abramo, G., D'Angelo, G.A. & Di Costa, F. (2011). National research assessment exercises: A comparison of peer review and bibliometrics rankings. *Scientometrics*, 89(3): 929-941.

Adam, D. (2002, February 14). Citation analysis: The counting house. *Nature*, 415, 726-729. DOI:10.1038/415726a.

Albarrán, P., Crespo, J.A., Ortuño, I. & Ruiz-Castillo, J. (2011). The skewness of science in 219 subfields and a number of aggregates. *Scientometrics*, 88(2): 385-397.

Auranen, O. & Nieminen, M. (2010). University research funding and publication performance—An international comparison. *Research Policy*, 39(6): 822-834.

Butler, L. (2003). Explaining Australia's increased share of ISI publications—the effects of a funding formula based on publication counts. *Research Policy*, 32(1): 143-155.

Butler, L. (2004). What happens when funding is linked to publication counts? In H.F. Moed et al. (ed.). *Handbook of Quantitative Science and Technology Research: The Use of Publication and Patent Statistics in Studies of S&T Systems* (p. 389-405). Dordrecht: Kluwer.

Casadevall, A. & Fang, F.C. (2012). Causes for the persistence of impact factor mania. *mBio*, 5(2). Retrieved April 28, 2017 from: http://mbio.asm.org/content/5/2/e00064-14.full.pdf.

Cochrane Effective Practice and Organisation of Care Review Group. *Data Collection Checklist.* (2002). Retrieved April 28, 2017 from: http://bit.ly/2pygx2N.

De Boer, H. et al. (2015). *Performance-based Funding and Performance Agreements in Fourteen Higher Education Systems*. Enschede: University of Twente. Retrieved April 28, 2017 from: http://bit.ly/2pldmdX.

European Commission (2010). *Assessing Europe's University-Based Research*. Retrieved April 28, 2017 from: http://bit.ly/2oNukmM.

Garfield, E. (1972). Citation analysis as a tool in journal evaluation. *Science*, 178, 471-479.

Geuna, A. & Martin, B. (2003). University research evaluation and funding: An international comparison. *Minerva*, 41(4): 277-304.

Good, B., Vermeulen, N., Tiefenthaler, B. & Arnold, E. (2015). Counting quality? The Czech performance-based research funding system. *Research Evaluation*, 24(2): 91-105.

Glänzel, W. & Moed, H.F. (2002). Journal impact measures in bibliometric research. *Scientometrics*, 53, 171-193.

Herbst, M. (2007). *Financing Public Universities: The Case of Performance Funding*. Dordrecht: Springer.

Hicks, D. (2012). Performance-based university research funding systems. *Research Policy*, 41(2): 251-261.

Interrupted time series analysis. (2013). Retrieved April 28, 2017 from: http://bit.ly/2qtEx48.

Kamalski, J. et al. (2017). *World of Research 2015: Revealing Patterns and Archetypes in Scientific Research.* Elsevier Analytic Services. Retrieved April 28, 2017 from: http://bit.ly/2pMTWjE.

Larivière, V. et al. (2016). A simple proposal for the publication of journal citation distributions. *biorxiv.* Retrieved April 28, 2017 from: http://biorxiv.org/content/biorxiv/early/2016/09/11/062109.full.pdf.

McDowall, D., McCleary, R., Meidinger, E.E. & Hay, R.A. (1980). *Interrupted Time Series Analysis*. Newbury Park: Sage.

Osuna, C., Cruz-Castro, L. & Sanz-Menéndez, L. (2011). Overturning some assumptions about the effects of evaluation systems on publication performance. *Scientometrics*, 86(3): 575-592.

Önder, C., Şevkli, M., Altınok, T. & Tavukçuoğlu, C. (2008). Institutional change and scientific research: A preliminary bibliometric analysis of institutional influences on Turkey's recent social science publications. *Scientometrics*, 76(3): 543-560.

Schneider, J.W. (2009). An outline of the bibliometric indicator used for performance-based funding of research institutions in Norway. *European Political Science*, 8(3): 364-378.

Seglen, P.O. (1997, February 5). Why the impact factor of journals should not be used for evaluating research. *British Medical Journal*, 314(7079): 498-502. Retrieved April 28, 2017 from: http://www.dcscience.net/seglen97.pdf.

Shao, J. & Shen, H. (2012). Research assessment: the overemphasized impact factor in China. *Research Evaluation*, 21(3): 199-203.

TÜBİTAK Türkiye Adresli Uluslararası Bilimsel Yayınları Teşvik (UBYT) Programı Uygulama Usul ve Esasları. (2016). Retrieved April 28, 2017 from: http://cabim.ulakbim.gov.tr/wp-content/uploads/sites/4/2015/09/2016-Y%C4%B1l%C4%B1-UBYT-Program%C4%B1-Uygulama-Esaslar%C4%B1.pdf.

Tonta, Y. (in press). *TÜBİTAK Türkiye Adresli Uluslararası Bilimsel Yayınları Teşvik (UBYT) Programının Değerlendirilmesi*. Ankara: TÜBİTAK ULAKBİM.

Van Raan, A.F.J. (2005). Fatal attraction: conceptual and methodological problems in the ranking of universities by bibliometric methods. *Scientometrics*, 62(1): 133-43.

Wouters, P. et al. (2015). *The Metric Tide Literature Review: Supplementary Report I to the Independent Review of the Role of Metrics in Research Assessment and Management.* Retrieved April 28, 2017 from: http://bit.ly/1Hliq1e.

Yurtsever, E., Gülgöz, S., Yedekçioğlu, Ö.A. & Tonta, M. (2001). *Sosyal Bilimler Atıf Dizini'nde (SSCI) Türkiye 1970-1999* (Turkey in Social Sciences Citation Index (SSCI): 1970-1999). Ankara: Türkiye Bilimler Akademisi.

Yurtsever, E., Gülgöz, S., Yedekçioğlu, Ö.A. & Tonta, M. (2002). *Sağlık Bilimleri, Mühendislik ve Temel Bilimlerde Türkiye'nin Uluslararası Atıf Dizinindeki Yeri 1973-1999* (Turkey's Place in Health Sciences, Engineering and Basic Sciences in International Citation Index). Ankara: Türkiye Bilimler Akademisi.

Zhang, L., Rousseau, R. & Sivertsen, G. (2017). Science deserves to be judged by its contents, not by its wrapping: Revisiting Seglen's work on journal impact and research evaluation. *PLoS ONE*, 12(3): e0174205. Retrieved April 28, 2017 from: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0174205.