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The Matthew effect and the halo effect in research funding

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ABSTRACT

The Matthew effect and the halo effect have been elaborated upon, applied, and occasionally misused. Inspired by prior studies, this study aims to revisit this important issue. Specifically, this study not only reexamines the association between both effects and scholars' future research funding but also investigates the moderation effect of scholars' experience on this association. The data are collected from three different sources, including data from 1085 research projects from the Ministry of Science and Technology in Taiwan. The results show that the Matthew effect and halo effect are indeed advantageous to scholars seeking an increase in research funding, and these effects increase both the amount and the duration of research funding. In addition, the proposed associations are partially moderated by the scholar's experience in applying for research funding. The findings have several theoretical and practical implications that are relevant to funding in science.

1. Introduction

This study is inspired by Liao's (2017) study, which indicated that outstanding scholars have generally been considered to have social influences, as seen in the Matthew effect and halo effect. The Matthew effect refers to the phenomenon in which outstanding scholars acquire rare resources and cumulative advantages in their fields, which they use to improve their work and continuously obtain more resources in the future. The halo effect can be explained as the following phenomenon: since human perception is easily affected by a given impression, readers have a tendency to presume that the articles of outstanding scholars are of high quality due to those scholars' reputations.

Influenced by this idea, this article conducts a follow-up study and aims to further explore whether research funding is influenced by these two effects. Although this work is a follow-up study, the proposed model and research subjects are entirely different from prior work. More specifically, this study proposes that all scholars (not just outstanding ones) could have Matthew and halo effects and that only the extents of these effects vary among scholars. Based on the operational definitions of this study, the Matthew effect is measured by the number of research projects and the total research funding in the past five years. These measurements reflect the notion of cumulative advantage and research resources when scholars pursue one or more new projects. The halo effect is measured by the scholar's number of publications in the past five years, the university rankings of his or her affiliation, and the research awards he or she has received. These three indicators can reflect the readers' (or reviewers') first impressions of the scholar's research quality or potential and thereby capture the concept of the halo effect. The purpose of this study is to explore the impacts of these effects on research funding in the future.

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Most importantly, this topic is closely associated with the competitiveness of scholars, institutions, and governments (Auranen & Nieminen, 2010). Based on the findings of prior studies, support from research grants is strongly related to scholars' academic performance (Gulbrandsen & Smeby, 2005). However, many ambiguous determinants affect whether scholars obtain research funding. The results of this study are beneficial for understanding the unknown associations among the Matthew effect, the halo effect, and research funding. This study makes practical contributions to our understanding of the scientific performance of scholars and the allocation of scientific resources, and these findings are relevant to both academic institutions and government. The specific research questions are as follows:

- ***RQ1***: Do the Matthew effect and halo effect have significant impacts on research funding?
- ***RQ2***: For multiyear research projects (with higher financial subsidies and inputs), which effect is critical?
- ***RQ3***: With respect to these effects, is there a difference between senior and junior scholars?

2. Literature

2.1. Revisiting the Matthew effect and halo effect

Merton (1968) first proposed the term '*Matthew effect*' and explained the two phenomena it describes. The first phenomenon is the over-recognition of those researchers who are at the top of the scientific profession, while the second is a bias against acknowledging the achievements of women scientists. The Matthew effect is defined as an eminent scientist often receiving more credit than a comparatively unknown researcher even if their work is shared or similar (Rossiter, 1993). Merton (1988) further pointed out that the Matthew effect is based on the process of cumulative advantage in science, resulting in a case of 'the rich get richer'. Liao (2017) also interpreted this effect from the resource-based view; perhaps eminent scientists hold rare resources and have a competitive advantage with regard to resources, enabling them to improve their work and further obtain more resources in the future. More importantly, the Matthew effect has been indicated to exist in education (Walberg & Tsai, 1983), network science (Barabási, 2012), journal impact factors and citations (Larivière & Gingras, 2010).

However, more discussion is needed of how to properly evaluate the cumulative advantage as a manifestation of the Matthew effect. Bask and Bask (2015) used disposable personal income data to examine whether people who are initially advantaged (high income) will ultimately have higher savings and better postretirement benefit income. Following this logic, a good operational definition is to treat past advantages or resources as cumulative advantages. In the context of this study, early research funding can be regarded as a good anchor that reflects someone's advantage. Indeed, Bol, de Vaan, and van de Rijt (2018) performed a test of the Matthew effect in early career academic funding in the Netherlands. These scholars found that winners accumulate more than twice the funding of nonwinners. In this vein, this study treats the Matthew effect as (1) the number of research projects and (2) the total amount of research funding that applicants have obtained in the past five years, reflecting an applicant's early research funding and cumulative advantage in the field.

The '*halo effect*' refers to a tendency for supervisors' ratings to exhibit a consistently high correlation with their global impression of the subordinate being rated (Leuthesser, Kohli, & Harich, 1995). Especially in the field of education, teachers often use students' performance in one course to form their overall performance evaluation at school. When the evaluation attributes are difficult to obtain or evaluate, the overall evaluation may be affected by experience attributes that are easier to assess, resulting in a halo effect (Wirtz, 2003). The halo effect has a powerful influence on impression formation in daily life, such as in job interviews, dating and political judgments (Forgas, 2011). This effect has been proven to be associated with raters' global evaluation of products (Manrai, Lascu, & Manrai, 1998), customer satisfaction (Wirtz, 2003), the firm performance (Rosenzweig, 2007), and the store image (Wu & Petroshius, 1987).

Based on the above discussion, the halo effect is determined by the overall performance and first impression, and its measurement is usually linked with the scholar's prestige, reputation, and prior performance. For instance, Chan, Gleeson, and Torgler (2014) collected data from 466 Nobel laureates to predict the award's impact on the number of other major awards. Moreover, Sine, Shane, and Gregorio (2003) treat university prestige as the influence of the halo effect on university inventions because buyers prefer to conduct transactions with more prestigious organizations. Brown and Perry (1994) mentioned that firm reputation ratings by industry experts are often influenced by a firm's prior financial performance. However, disentangling the effects of prestige from past performance is important. Sine et al. (2003) indicated that some researchers argue that the perceptions of the halo effect emerge directly from past performance, while other researchers argue that these perceptions are strongly associated with a person's general prestige. Accordingly, the prestige (or reputation) and past performance are both considered. In this study, the halo effect is treated as (1) the reputation of the applicant's affiliation (i.e., the university ranking), (2) the number of academic publications that the applicant had in the past five years, and (3) whether the applicant has previously won research awards. More specifically, the reputation of the applicant's affliction captures the idea of institutional prestige, while research awards directly reflect personal prestige. Similarly, the number of publications in the past five years refers to the notion of prior performance. In conclusion, Table 1 illustrates how this study treats these two effects from the definitions to the measures.

It should be noted that the Matthew effect and halo effect are easily confused and occasionally misunderstood. For example, some studies have mentioned that the Matthew effect allows scholars to enhance their reputations and thereby obtain more resources. However, this argument is based on two effects, not just the Matthew effect. Liao (2017) specifically

Table 1
The measures of the Matthew effect and the halo effect.

Definition	Concept	Measures by prior studies	Measures in this study
The Matthew effect is based on the process of cumulative advantage in science (Merton, 1988).	Accumulative advantage	Early career academic funding (Bol et al., 2018)	The number of past research projects The total amount of research funding that applicants obtained in the past five years
The halo effect refers to the phenomenon whereby evaluators tend to be influenced by their first impressions and previous judgments of performance (Leuthesser et al., 1995; Wirtz, 2003).	Prestige or reputation	Institutional reputation (Sine et al., 2003)	The reputation of the applicant's affiliation
	Prior performance	Research awards (Liao, 2010)	The MOST research awards
		Prior performance and achievements (Brown & Perry, 1994; Sine et al., 2003)	The number of academic publications that the applicant had in the past five years

notes that these effects' notions are quite different: "*the Halo effect emphasizes the internal impact on individual perception, while the Matthew effect highlights the external impact on accumulative advantage.*" A plausible explanation for why the two effects are often cited together and misinterpreted is that they are interrelated and affect each other.

2.2. Research funding in Taiwan

As mentioned above, research funding makes a positive contribution to improved academic performance (Gulbrandsen & Smeby, 2005), research collaborations with industry (Muscio, Quaglione, & Vallanti, 2013), and institutional or national competitiveness (García & Sanz-Menéndez, 2005). However, government funding-allocation systems vary in different countries (Auranen & Nieminen, 2010). In Taiwan, the Ministry of Science and Technology (MOST) is the largest scientific funding agency and evaluates whether to subsidize scientific and technological research. The funding models for MOST research projects can be classified into two categories. One category is general research projects conducted by scholars who have served in universities, colleges, or research institutions, and the other category consists of research projects conducted by junior scholars. Applicants who have held a dedicated researcher position for over five years will not qualify as junior scholars. Scholars may submit their proposals for a research project in accordance with their field of research specialization.

Corresponding to the situation in many countries, the academic committee that evaluates research projects is composed of senior researchers (Benner & Sandström, 2000). The MOST determines if the project will be approved based on the results of a review by the academic review committee. Several review criteria are used to evaluate applicants, including scholars' competence in their research performance and project execution, the significance and innovative characteristics of the project, and the feasibility of the research content and methodology. Applicants can apply for a one-year or multiyear project grant based on their needs. Of course, multiyear projects will consume more subsidies and have larger scientific budgets. The review committee will review multiyear project applications with due prudence and stringent standards. The number and duration of research grants are the outcomes with which scholars are concerned. In this vein, the outcome, which could be affected by the Matthew effect or halo effect, is treated as (1) the amount of research funding and (2) the duration of the research project (i.e., a one-year or multiyear period).

3. The proposed research model

The research model used to address the proposed research questions is shown in Fig. 1. The hypothesized associations among the Matthew effect, halo effect, type of scholar, and future research funding are developed below.

3.1. The Matthew effect and research funding

First, this study proposes that the resource advantages accumulated by scholars in the past will increase their chance of obtaining more resources in the future according to the rationale of the Matthew effect. Indeed, Bol et al. (2018) argue that the Matthew effect is particularly dominant in the accumulation of individual research funding. The rationale is that research grants provide a resource that can be invested to improve the quality of subsequent work. Thus, obtaining an early grant will enable and motivate scholars to compete for funding again. Grant acquisition is based on a Matthew effect by rewarding richly funded researchers and hindering entry or continuous funding for others (Laudel, 2006; Wang, 2014). Therefore, this study predicts the following hypotheses.

H1a. A greater number of past research projects will lead to more research funding in the future.

H1b. A greater number of past research projects will lead to longer durations of research projects in the future.

H2a. A greater total amount of past research funding will lead to more research funding in the future.

H2b. A greater total amount of past research funding will lead to longer durations of research projects in the future.

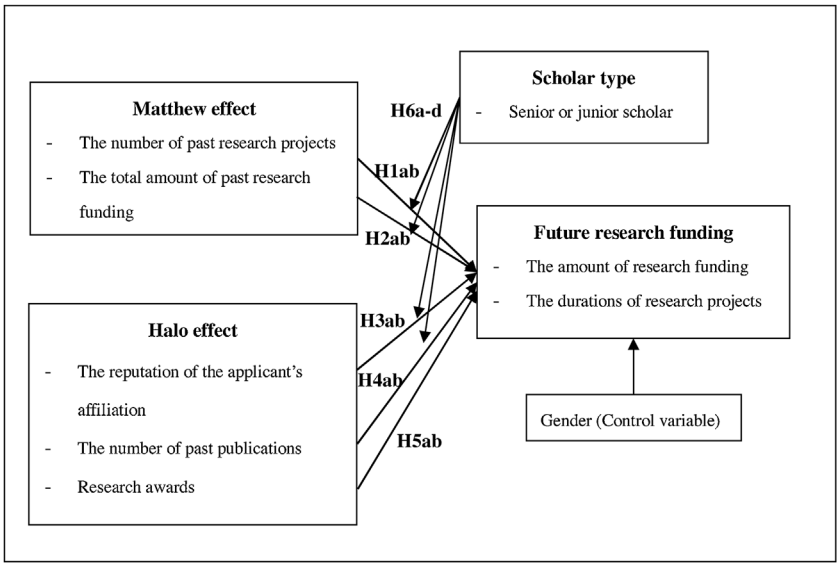

Fig. 1. The proposed research model.

3.2. The halo effect and research funding

Furthermore, the halo effect is defined as the tendency for the overall evaluation to be affected by the experience attributes and prestige (Wirtz, 2003). As mentioned in the literature, the prestige and past performance are both treated as manifestations of the halo effect. Prestige comes from a variety of sources, including the scholars themselves (Egghe, Guns, & Rousseau, 2013), the institutional reputation (Garfunkel, Ulshen, Hamrick, & Lawson, 1994; Sine et al., 2003), and research awards (Feldman & Kelley, 2003; Liao, 2010). Here, prestige is measured by the reputation of the applicant's affiliation and the research awards he or she has received, as the institutional reputation is strongly associated with faculty outcomes (Volkwein & Sweitzer, 2006) and past research awards explicitly demonstrate the applicant's achievements and reputation (Ding & Cronin, 2011). Both measures reflect the applicant's future potential and expected research outcomes. Most importantly, scholars with strong reputations have more opportunities to obtain larger research budgets due to their distinguished research track records (Liao, 2017). The reason is that because these scholars have already published high-quality articles, received research awards, or received endorsements from trustworthy institutions, they are expected to produce high-quality work in the future. In the context of this study, the review committee may face these situations when evaluating proposals for research projects. Determining the soundness of a research project involves many uncertainties. Given this uncertainty, the review committee members are more impressed with trustworthy scientists or scientists who have achieved better past performance because these indicators signal future performance. Therefore, this study proposes the following hypotheses.

H3a. An applicant who has an affiliation with a strong reputation will receive more research funding in the future.

H3b. An applicant who has an affiliation with a strong reputation will receive a longer duration of research projects in the future.

H4a. A higher number of past publications will lead to a greater amount of research funding in the future.

H4b. A higher number of past publications will lead to a longer duration of research projects in the future.

H5a. A history of winning research awards will lead to more research funding in the future.

H5b. A history of winning research awards will lead to a longer duration of research projects in the future.

3.3. The moderating role of the scholar type

In this study, the scholar type is defined as the scholar's experience applying for research funding, and this category is divided into junior and senior applicants (scholars). Indeed, prior experience has been empirically shown to be strongly correlated with performance (Bragaw & Misangyi, 2017; Dokko, Wilk, & Rothbard, 2009). Wasko and Faraj (2005) suggest that experienced members in a community are likely to better understand how their expertise is relevant, which makes them better able to apply their knowledge. Applying for funding for a new research project may require a certain extent of knowledge and expertise. Thus, scholars' experience in a discipline will be useful for developing their research idea and proposal.

Experienced scholars are more likely to effectively apply their knowledge when developing research projects, as they can, e.g., write an innovative proposal, allocate their existing resources onto new projects, and implement a reasonable and feasible plan. As mentioned in the previous sections, the Matthew and halo effects refer to scholars' invisible impacts. However, efficient use of these effects may depend on the scholar's experience. For example, a reputable and high-profile young scholar may not necessarily know how to use his reputation to apply for research grants. In contrast, a senior scholar with many resource advantages can effectively use those resources to increase the probability of obtaining funding for a new research project. In addition to cumulative resources and reputation, this study proposes that experience could be a moderating factor that influences the funding outcome of research projects. That is, the more experience a scholar has applying for project funding, the greater his or her ability will be to use the Matthew effect or halo effect to obtain research funding. Therefore, this study predicts the hypotheses below. It is noteworthy that this study did not propose "*H6e: the scholar type plays a positive moderating role between the research awards previously won and the amount of research funding*"; because no junior scholar has won the MOST research award, hypothesis H6e cannot be tested.

H6a. The scholar type (in terms of experience) plays a positive moderating role between the number of past research projects and the amount of research funding.

H6b. The scholar type plays a positive moderating role between the total past research funding and the amount of research funding.

H6c. The scholar type plays a positive moderating role between the reputation of the applicant's affiliation and the amount of research funding.

H6d. The scholar type plays a positive moderating role between the number of past publications and the amount of research funding.

4. Methodology

4.1. Data sources and collection

The data were from three different sources and were collected in several steps. The first data source is the website of the MOST in Taiwan. The MOST website provides information on all of the research projects that have been approved. These data include the approved project's name, applicant name, affiliation, grant, and duration of the research project. This study manually collected the raw data of 1085 research projects from this website in the category of 'management science' during the period from 2015 to 2019. This category is defined by the MOST, and its research covers such areas as marketing, management science, operations research, qualitative methods, and transportation. Moreover, this study also collected the past research project data of the applicants from these 1085 records during the period of 2010–2018, including the number of research projects and the total amount of research funding that the applicants received in the past five years.

The second source is the talent database provided by the MOST. This database records information on all scholars and research applicants. All research applicants must be registered in the database before they can apply for research funding. This study collected the number of academic publications that the applicants produced in the past five years from each record. By using five-year means of funding and publications, it is possible to eliminate year-to-year fluctuations and create a simple and more solid figure for general trends.

Finally, the third source is the website of the QS world university ranking. The QS website provides the top 500 university rankings annually, which comprises the global overall and subject rankings alongside five independent regional tables. From this website, this study collected the university rankings of applicants' affiliations to represent their institutional reputation.

To clearly distinguish the causal relationships between the independent and dependent variables, the time periods of these research variables were separated (see Table 2). For instance, for research projects approved in 2019, the dependent variables (i.e., the quantities of research funding) were calculated in 2019, while the independent variables were collected from 2014 to 2018. More specifically, the values of the institutional reputation were measured by the QS university ranking during the last year (2018) when applicants applied for research projects that year. The values of the research awards were calculated by whether the applicants had ever won any MOST research awards before that year (2018). The value is divided into yes or no values. The MOST research award is the most prestigious research award in Taiwan, and only a few winners are selected each year, including the outstanding research awards and the Ta-You Wu memorial awards for young research talent under the age of 42. Furthermore, the other independent variables were calculated by using the research outcomes over the past five years (2014–2018), including the number of research projects, the total amount of research funding, and the number of academic publications. Regarding the scholar type, this variable was determined by whether applicants had more than five years of experience applying for research funding as of the last year under consideration (2018).

4.2. Methods

Because many research variables are single-item measures, the reliability and validity of these measures cannot be estimated (Wanous & Hudy, 2001). However, it is commonly accepted practice to measure objective-reported facts with a single item, such as the age, gender, and number of publications (Wanous, Reichers, & Hudy, 1997). The descriptive statistics

Table 2
The time periods of the research variables.

Research variable	Time period				
Dependent variables	**2015**	**2016**	**2017**	**2018**	**2019**
Future research funding					
The amount of funding from research grants	2015	2016	2017	2018	2019
The duration of the research project	2015	2016	2017	2018	2019
Independent variables					
Matthew effect					
The number of past research projects	2010~2014	2011~2015	2012~2016	2013~2017	2014~2018
The total amount of past research funding	2010~2014	2011~2015	2012~2016	2013~2017	2014~2018
Halo effect					
The reputation of the applicant's affiliation	2014	2015	2016	2017	2018
The number of past publications	2010~2014	2011~2015	2012~2016	2013~2017	2014~2018
Whether the applicant has won the MOST research award	2014	2015	2016	2017	2018
Moderation variable					
Scholar type					
More than five years of experience applying for research funding	2014	2015	2016	2017	2018

Table 3
Descriptive statistics.

Variable	n	Minimum	Maximum	Mean	S.D.
The number of past research projects	1085	0	13	3.4	2.052
The total amount of past research funding	1085	0	47,916,026	2,919,791	3,474,957
The reputation of the applicant's affiliation	336	68	900	366.34	234.292
The number of past publications	1085	0	85	9.98	8.547
Research awards	1085	0	1	.05	.208
The amount of research funding	1085	163,000	5,671,000	848,092.4	696,293.4
The duration of the research project	1085	1	4	1.35	.624
The scholar type	1085	1	2	1.87	.339

and correlation analysis of the variables are performed using SPSS software. The hypothesized associations from H1 to H5 are examined by using hierarchical regression analysis. To avoid measurement errors in a multiple regression analysis, this study also examines whether multicollinearity is present or not, and we follow the statistical suggestions of Cortina (1993). In addition, the moderating effects (i.e., hypotheses H6a–d) are evaluated by using the two-way interaction approach by Dawson and Richter (2006). The detailed discussion is given below.

5. Results and discussion

5.1. Descriptive statistics

The descriptive statistics of the research variables are listed in Table 3. For the reputation of the applicant's affiliation, only 366 records have the values of the QS university ranking. The remaining affiliations do not have ranking data on the QS website, such as rankings above 1,000. There are no missing values for the other research variables. Of the 1085 application records, 72.4 % were from males and 27.6 % were from females. Senior scholars with more than 5 years of application experience accounted for 86.7 % of the applications, while junior scholars accounted for 13.3 % of them. Only 49 applicants (4.5 %) had won at least one MOST research award.

5.2. Main effect

This study adopts hierarchical regression analysis to examine the proposed hypotheses in the following two steps. First, gender is treated as a control variable in the research model. This study will incorporate the gender variable into the first layer of the regression analysis and examine its explained variance on the dependent variable. Next, this study includes the independent variable in the second layer of the regression analysis and examines its coefficient on the dependent variable after controlling for the variance of the gender variable, i.e., excluding the covariance between gender and the dependent variables. Each hypothesis is examined independently.

Table 4 illustrates the results of hypotheses H1–H5. The dependent variable for hypotheses H1a to H5a is the amount of research funding, while the dependent variable for hypotheses H1b–H5b is the duration of the research project. In Table 4, the values of the corresponding variables are the coefficients and the significance (p value) in the regression analysis. In contrast, as expected, the number of past research projects is not positively associated with the amount of research funding ($\beta = .019$; $p > .05$) and the year or period of the research project ($\beta = -.03$; $p > .05$), indicating H1 is not supported. One possible explanation is that the number of past research projects does not explicitly reflect the amount of capital and resources. Indeed, after checking the data, this study found that some applicants had a small number of past research projects, but

Table 4
The results of the regression analysis.

Variable	H1a	H1b	H2a	H2b	H3a	H3b	H4a	H4b	H5a	H5b
Gender	−.036	−.005	−.036	−.005	−.024	−.028	−.036	−.005	−.036	−.005
The number of past research projects	.019	−.03								
The total amount of past research funding			**.379*****	**.265*****						
The reputation of the applicant's affiliation					**−.116***	−.044				
The number of past publications							**.152*****	**.106****		
Research awards									**.478*****	**.27*****
F value	.93	.51	91.4***	40.83***	2.6	.5	13.29***	6.05**	160.17***	42.19***
R squared	.002	.001	.145	.07	.014	.003	.024	.011	.228	.072

H1a–H5a: The dependent variable is the amount of research funding.
H1b–H5b: The dependent variable is the duration of the research project.
* $p < .05$; ** $p < .01$; *** $p < .001$.

most of them are multiyear and have high subsidies. In contrast, some scholars applied for a research project every year (i.e., the number of past research projects is high), but their total numbers of grants are relatively low. This result reveals that the number of past research projects may not be a reliable measure for capturing the nature of the Matthew effect.

Nevertheless, the total amount of the past research funding is positively related to the amount of research funding (β = .379; $p < .001$) and the year or period of the research project (β= .265; $p < .001$), which supports H2. This finding corresponds with the argument of prior studies (Bol et al., 2018; Merton, 1988). Having cumulative resources in the past is advantageous for receiving more resources in the future.

Regarding the halo effect, the results show that the reputation of the applicant's affiliation (QS ranking) is negatively associated with the amount of research funding (β= −.116; $p < .05$). The larger the value of the QS ranking (i.e., the lower the ranking) of an institutional reputation is, the lower the amount of research funding that the applicant earned will be. That is, a stronger institutional reputation will lead to more research grants, supporting H3a. However, the institutional reputation is not significantly related to the duration of the research project (β= −.044; $p > .05$), indicating that H3b is not supported. The results reveal that the institutional reputation is a slight predictor of the research funding compared with the other variables. A plausible explanation is that when assessing the representativeness of a scholar's reputation, the institutional reputation is much lower than the individual reputation. In other words, the halo effect from the affiliation is not a strong endorsement of the expected research performance. Because of its small impact, this halo effect will not help scholars obtain multiyear project funding or a higher subsidy.

Moreover, the number of past publications (the past performance) is significantly related to the amount of research funding (β = .152; $p < .001$) and the duration of the research project (β= .106; $p < .01$). Therefore, H4 is supported. Consistent with our expectations, the halo effect derived from past performance provides an effective signal for predicting future performance. This finding corresponds with the argument by Brown and Perry (1994) and Sine et al. (2003). Similarly, the results show that having won the MOST research award is positively associated with the amount of research funding (β = .478; $p < .001$) and the duration of the research project (β= .270; $p < .001$), which supports H5. This study empirically confirms the impact of research awards on the future performance, showing that winning academic rewards is beneficial not only for obtaining higher research grants but also for securing research projects of longer duration.

To examine *RQ2*, this study also incorporates all of the variables into the stepwise regression model to determine which variable is the most important predictor. In this regression model, the highest value of the variance inflation factor (VIF) in the regression model is 1.628 and all of the VIF values are less than 5, indicating that there is no concern about multicollinearity among the research variables. The results show that research awards are the strongest determinant of the amount of research funding ($F = 131.32$; $p < .001$; $R^2 = .265$) and the duration of the research project ($F = 29.72$; $p < .001$; $R^2 = .075$). The findings reveal that the research award is the most effective indicator and creditable endorsement that the review committee is willing to believe. A reasonable explanation is that the research award should be the most difficult goal to achieve compared with the other variables. Such concrete and explicit achievements have the most powerful and convincing effect on review committees.

5.3. Moderation effect

This study adopts Dawson and Richter's (2006) approach to test for two-way interactions (i.e., for a relationship between an independent variable (IV) and a dependent variable (DV) that is moderated by a third variable) and to plot the interaction effects. First, this study tests the model difference between two regression coefficients derived from two separate samples, i.e., senior and junior scholars. Second, unstandardized regression coefficients, means, and standard errors in two models are recorded. Third, a significance test (*T*-test) of the differences between the two models is conducted to check whether the moderation effect is significant and if it is greater than 1.96. The moderator effect can be achieved by plotting the regression of the DV on an IV at each level of a continuous moderator; these plots are called *simple regression slopes* (Cohen, West, & Aiken, 2014; Wu & Zumbo, 2008).

After comparing two regression models, the results show that the number of past research projects is significantly related to the amount of research funding for junior scholars (β = .230; $p < .01$), but it is not significant for senior scholars (β= −.031;

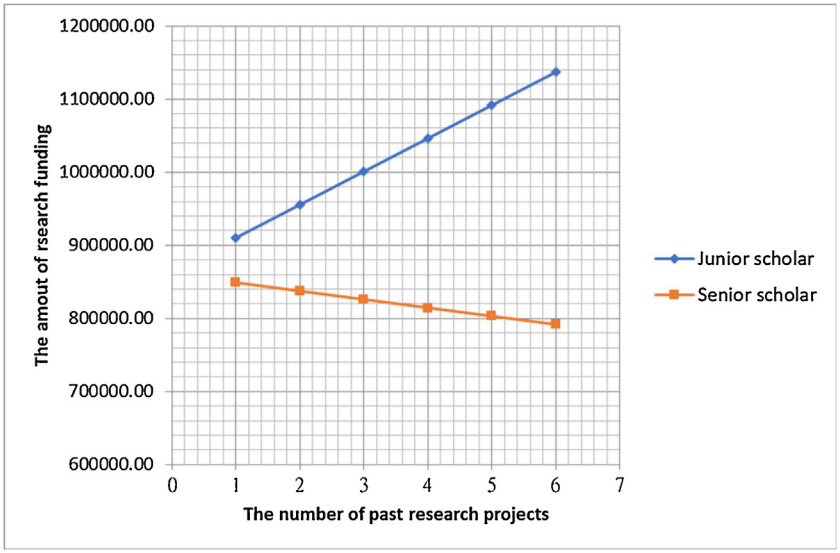

Fig. 2. The result of the H6a test.

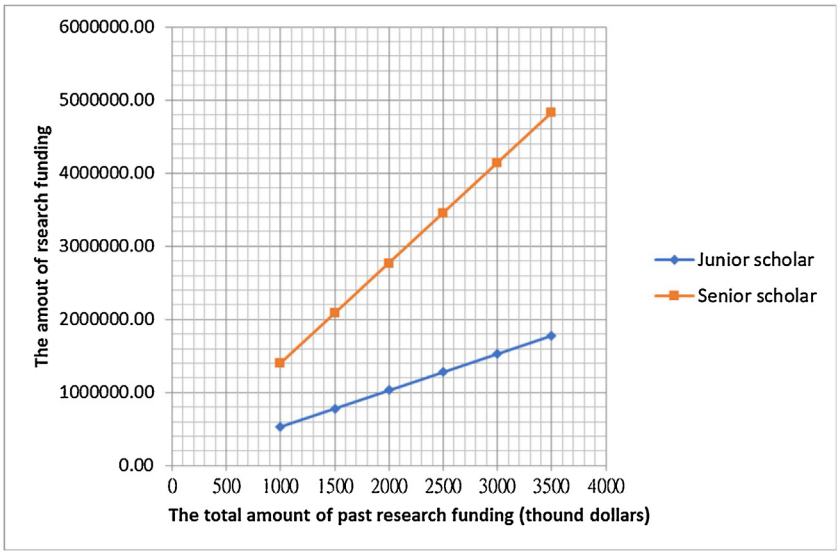

Fig. 3. The result of the H6b test.

$p > .05$). The difference between the two models is significant ($T = -2.79$; $p < .01$), as shown in Fig. 2. Even though H1 is not supported, its association could be affected by some latent variables. The finding suggests that the scholar type is one of the moderators affecting the association, but this effect is negative against the expectation of the hypothesis. Hence, H6a is not supported. A plausible explanation is that for junior scholars without any actual outcomes, the number of past research projects will become the reference target for the review committee; when junior scholars become senior scholars, the number of past research projects becomes a valueless indicator. Instead, the committee must be persuaded by the applicant's actual research performance.

Interestingly, the results illustrate that the total past research funding is significantly associated with the amount of research funding for junior scholars ($\beta = .265$; $p < .01$), and this association is even stronger for senior scholars ($\beta = .376$; $p < .001$). The difference in the regression slopes is significant as well ($T = 4.61$; $p < .001$) and can be seen in Fig. 3. Therefore, hypothesis H6b is supported. This finding corresponds with our expectations, indicating that senior scholars are wiser than junior scholars in using existing resources to enlarge their research grants. A plausible explanation is that the use and mastery of research resources are not easy for anyone, and this process requires the accumulation of experience. Another explanation is that young scholars usually use research funds more prudently in the early stages of their careers. Once they fail or cannot attract more funding, they have to exit science. In contrast, senior scholars are in a relatively safe or comfortable situation, and they can continue trying innovative research and attracting more input in science. This study reveals that the impact of

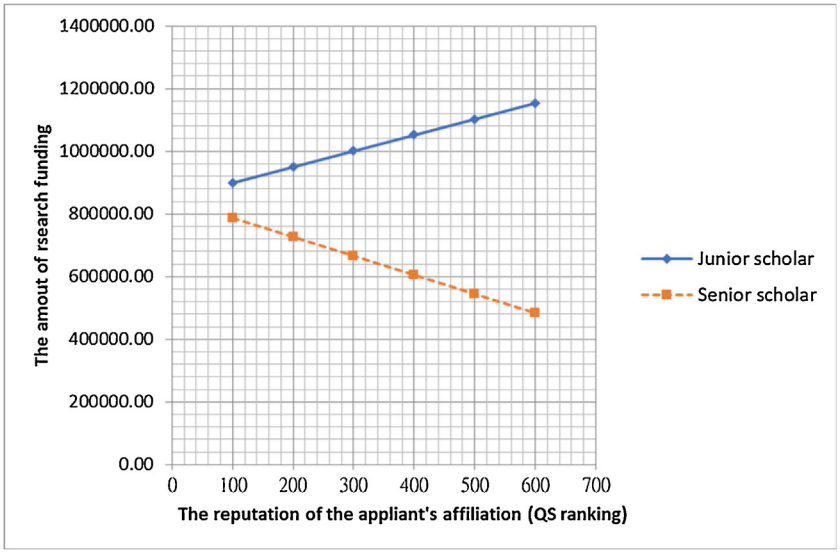

Fig. 4. The result of the H6c test.

the Matthew effect on research grants is indeed closely interrelated with scholars' own experience in applying for research funding.

Surprisingly, the results show that the reputation of the applicant's affiliation (QS ranking) is negatively related to the amount of research funding for senior scholars ($\beta = -.142$; $p < .05$), but this association is positive for junior scholars ($\beta = .320$; $p < .05$). The difference between the two groups is significant ($T = -3.34$; $p < .001$), as shown in Fig. 4. However, the QS ranking is an ordinal scale in which larger numbers imply worse rankings. In simple words, the higher the rank is (i.e., the lower the QS score is), the easier it will be for senior scholars to obtain larger research grants. However, for junior scholars, the lower the rank is (or the higher the score is), the easier it will be to obtain larger grants. This finding suggests that the positive impact of the institutional reputation on senior scholars is stronger than the corresponding effect on junior scholars. Therefore, H6c is supported. This result can be explained in two ways. For senior scholars, working at a reputable institution is expected to correlate with better research performance, and therefore, they will receive larger research grants. The result reveals that senior scholars can enjoy the "halo effect" derived from the institutional reputation. For junior scholars, the institutional reputation does not seem to be a very important factor. Even more surprisingly, reviewers are willing to give more opportunities to scholars who serve at lower-ranked institutions. One possible rationale is that the review committee is willing to give more chances to young scholars, including scholars from lower-ranked schools, to encourage them to engage in scientific research. The present study calls this pattern the "reverse halo effect" for junior scholars, whereby junior scholars serving at well-known institutions may not derive advantages from them, whereas scholars serving at lower-ranked institutions will be positively encouraged.

Finally, the difference between senior and junior scholars with regard to the impact of the number of past publications on research grants is not significant ($T = 1.35$; $p > .05$), showing that H6d is not supported. This finding indicates that the halo effect from past publications directly reflects the actual past performances of scholars. Perhaps the impacts of past performances rely on the quality and quantity of the journal publications and are not affected by the scholar's experience.

6. Conclusions and implications

This study explores the associations among the Matthew effect, halo effect, scholar type, and future research funding. The findings lead to some theoretical and practical implications. First, the Matthew effect and halo effect are easily confused and misused. This study provides a detailed explanation of both effects and develops measures for them. Thus, this study potentially expands our understanding of the existing literature on research funding. In addition, the measurements can be applied by future researchers when they conduct similar studies.

Second, the results show that research awards are the most convincing determinant of the project evaluation. Although winning an academic award is not easy, it definitely conveys an advantage when applying for new project funding. In this vein, this study suggests that scholars with strong performance must apply for national research awards to ensure more stable research subsidies in the future. Regarding the academic implications, the findings indicate that the halo effect from a research award is much more powerful than the Matthew effect. Perhaps due to their rarity and identifiability, research awards build up a solid reputation that leads to endorsements in project evaluations. Nevertheless, this study recommends that the review committee should formulate clear evaluation indicators and weights to avoid excessive influence by halo effects derived from research awards.

Table 5
The hypothesis results.

Hypothesis	T value	P value	Result
H1a: The number of past research projects → research funding	.64	$p > .05$	Not supported
H1b: The number of past research projects → duration	−.99	$p > .05$	Not supported
H2a: The total amount of past research funding → research funding	13.46	$p < .001$	Supported
H2b: The total amount of past research funding → duration	9.04	$p < .001$	Supported
H3a: The reputation of the applicant's affiliation → research funding	−2.23	$p < .05$	Supported
H3b: The reputation of the applicant's affiliation → duration	−.84	$p > .05$	Not supported
H4a: The number of past publications → research funding	5.01	$p < .001$	Supported
H4b: The number of past publications → duration	3.48	$p < .01$	Supported
H5a: Research awards → research funding	17.85	$p < .001$	Supported
H5b: Research awards → duration	9.18	$p < .001$	Supported
H6a: The number of past research projects (experience)→ research funding	−2.79 (Negative)	$p < .01$	Not supported
H6b: The total amount of past research funding (experience)→ research funding	4.61	$p < .001$	Supported
H6c: The reputation of the applicant's affiliation (experience)→ research funding	−3.34	$p < .001$	Supported
H6d: The number of past publications (experience)→ research funding	1.35	$p > .05$	Not supported

Third, the impacts of the Matthew effect and halo effect may interact with other latent variables. At a minimum, this study suggests that the scholar type (i.e., the experience in applying for research projects) is one of the moderation variables. This study combines psychological theories with social science issues but also provides novel findings, enriches the related literature, and extends the scope of theories to other fields. In addition, future researchers are encouraged to explore more latent variables as they relate to the hypothesized associations.

Fourth, for junior scholars with fewer than five years of application experience, the number of past research projects is also a determining factor in new project evaluations. In other words, when junior scholars have not shown research potential or long-term performance, the review committee will likely evaluate their past projects. Therefore, for young scholars, the number of past projects and their effectiveness or efficiency must be addressed. This study recommends that junior scholars emphasize the effectiveness of their past research when applying for a new project, which will render their records more impressive to review committees.

Fifth, the findings also reveal that the ability to effectively use existing resources to increase research grants is related to scholars' experience. Based on this finding, this study suggests that government or academic institutions can analyze the effectiveness of the funding per applicant and give recognition to scholars who use funds appropriately. Additionally, academic institutions can allocate more resources to hold workshops, which will help senior scholars guide junior scholars in funding management. These approaches may encourage scholars to value the use of existing resources and lessen the learning curve for junior scholars regarding funding management.

Finally, while the institutional reputation has a slight halo effect on senior scholars, it has a "reverse halo effect" on junior scholars. This study posits that such a funding strategy is good for a healthy academic environment. That is, senior scholars serving at higher-ranked institutions are expected to perform better and are given slightly higher research grants, while junior scholars serving at lower-ranked institutions are also encouraged and given higher research subsidies. Regardless of the institution where the scholar serves, the institutional reputation has only a slight impact and does not stifle the opportunities of junior scholars. The project review committees of government or academic institutions can continue adhering to this approach. In addition, this study reveals that young scholars should have a more optimistic attitude when applying for research funding, as resources do not appear to be received only by specific scholars. Instead, opportunities will be fairly distributed among senior and junior scholars, and external conditions or facts that cannot be changed (e.g., the affiliation or institution) are not key determinants.

In brief, the findings suggest that the Matthew effect and halo effect are indeed beneficial to receiving research funding, including the amount and duration of research funding. In addition, the causal relationships above are partially moderated by the scholar's experience in applying for research projects. Senior scholars are skilled at applying the knowledge gained from past research funding and at using their existing institutional reputations to increase future research grants. In contrast, junior scholars are not restricted by the institutional reputation; rather, they should emphasize the effectiveness of their past projects in recent years. The complete results are listed in Table 5.

7. Limitations

Despite the above contributions, this study may have some limitations. First, this study only addresses one moderation variable and several exogenous variables in the research model. The variation explained by these variables with respect to the amount of research funding is only 26.5 %. There could be other latent variables that affect the proposed associations, such as personal reputations, subsidies from industries, and institutional support. More specifically, future research could examine how these latent variables alter the associations between the Matthew effect, the halo effect, and research funding. Such research will surely enrich the understanding in the literature.

Second, this study only included research project data that have been approved, and the unapproved data were not included. As in Barabási (2018), we only examine the performances of the successful projects; we overlook the failed cases.

Hence, the generalizability of the findings could be biased and only suitable for scholars who have approved research projects. This study examined the MOST to acquire information about unapproved projects. However, unapproved data cannot be obtained due to privacy restrictions. Perhaps future research can overcome this problem and provide more comprehensive research results. In addition, the data were collected in Taiwan, and the findings may not reflect the situations in other countries. Future researchers could improve the reliability of the findings by replicating the study with different data sources.

Third, because no junior scholar has won the MOST research award, the moderation effect of the scholar's experience on the association between research awards and research grants has not been examined. Future studies are encouraged to collect the required data and examine their effects, which would fill this void in the research model.

Author contributions

Chien-Hsiang Liao: Conceived and designed the analysis; Collected the data; Contribution data or analysis tools; Performed the analysis; Wrote the paper.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.joi.2020.101108.

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