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Meritocracy in the awarding of research grants? Evidence from Social Science Korea

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Abstract In 2010, the Korean government launched a new funding scheme for social scientists, Social Science Korea (SSK). Contrary to conventional grant programs, the SSK adopted a competition scheme among research teams by eliminating those who failed to pass annual evaluations, while, at the same time, emphasizing cooperation and interdisciplinary research. Substantial research has documented the determinants of receiving research grants in Western countries, but little is known about how these determinants operate in Korean academia. Using results from the stage evaluations of the SSK, we estimate logistic regression models. The results indicate that factors of meritocracy, such as publication record, strongly affect the likelihood of success, but so do political factors, such as a PI obtaining his or her doctoral degree from a foreign institution. The importance of a PI's gender and age, and of being located in Seoul, is not supported by the data.

Introduction

Interest in research and development (R&D) has been increasing steadily worldwide, and many developed countries are taking more seriously the need to invest in R&D as a means of boosting economic performance and remaining competitive in a globalized market. Over the last decade, R&D investment increased from 1.76 to 1.97 % of GDP in the European Union, from 3.12 to 3.34 % in Japan, and from 2.55 to 2.79 % in the United States (OECD 2014). As the move toward a global economy accelerated in the late 1990s, the Korean

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government aggressively invested in R&D (Shin and Jang 2013) and became the world's most R&D-intensive country in 2012 (OECD 2014).

While most of the research funds were allotted to scientific and technological fields, in 2010, the Korean government launched two large grant programs for the humanities and social sciences, Humanities Korea (HK) and Social Science Korea (SSK) (Ministry of Education, Science and Technology 2011). Contrary to typical funding schemes, which do not require an evaluation until the end of the project, the SSK requires an evaluation every year and withdraws funding from those projects that do not pass the annual evaluation. Moreover, the SSK is designed so that all surviving teams must undergo three stages: the research team phase from years 1 to 3, the research group phase from years 4 to 6, and the research center phase from years 7 to 10. Because the principal objectives of the SSK are competition and cooperation, all teams are strongly encouraged to conduct interdisciplinary research and form consortiums, *while they are competing with one another*. This extraordinary system was adopted in the belief that it will distribute limited resources most efficiently.

Despite its potential to advance social science in Korea, the SSK hinders progress by keeping the factors that help SSK teams survive largely unknown, thus undermining its own foundational principle of meritocracy. This study is principally concerned with shedding light on this secretive process by focusing on the extent to which the structures of SSK teams, such as the number of doctoral researchers and the level of institutional prestige, and the level of SSK teams' performance, such as number of publications, affect the likelihood of success in the evaluation at the end of the third year. Further, we analyze the degree to which a principal investigator's individual attributes, such as gender, age, holding a doctoral degree from an overseas university, or graduating from a prestigious university in Korea, influence the odds of passing the evaluation.

Literature review

In an attempt to explain predictors of the resource distribution process, Mitroff and Chubin (1979) suggested three models: an accumulative advantage model, a merit model, and a political model. The accumulative advantage model postulates that reputation is the central asset in science (Merton 1968) and that scientists who succeed in the early phase of their career enjoy a favored position for earning subsequent recognition and resources, thereby generating higher productivity than other researchers. In turn, this productivity cements a favorable position for future recognition and greater resources, and so on, in a cyclical manner (DiPrete and Eirich 2006; Merton 1968). In short, one who has developed a good reputation based on past work accrues disproportionately more advantages than those lacking such a good reputation. This builds over time in a manner akin to "the rich get richer."

This theory has framed numerous studies into stratification within the scientific community, and the results have empirically verified its tenets (Cole and Cole 1973; Viner et al. 2004). However, there have been comparatively fewer empirical studies on the effects of cumulative advantage within Korea's scientific community than in Western nations: among the handful that have studied this factor, Cho (2007) found no evidence of inequality in the 10th year after graduating from a doctoral program, but a sharp increase in inequality in the 20th year and beyond. More recently, Kim and Kim (2016) found that, among Korean scholars, inequality in research productivity decreases among both

humanities scholars and social scientists at 10 years after they earn doctorates. After 10-year postdegree, the inequality index rises among social scientists, while it does not change much among humanities scholars. As a consequence, when tracked for 25 years, the inequality index forms a *U* shape among social scientists and an *L* shape among humanities scholars.

The merit model suggests that the scientific community should recognize and reward individuals based on the quality of their contributions to scientific knowledge, and not on the basis of their personal attributes, such as age, gender, class, or race/ethnicity (Merton 1973). Thus, the merit model suggests that research grants should be awarded competitively according to universalistic criteria which favor, above all, the applicant's current ability to perform, thereby preempting the potential for bias in the awarding process. Cole et al. (1978), for example, examined the possibility of biases in the actual operation of the National Science Foundation of the U.S. (NSF) peer review system, and argued that the granting process is actually quite open and not similar to the academic caste system. However, they found that scientists with many scientific publications, a high frequency of citations, a record of having received grants from the NSF, and ties to prestigious universities, are more likely to receive NSF grants than other applicants lacking those attributes.

The political model posits that scientists at elite institutions have disproportionate access not only to scarce scientific resources, such as information and research funding, but also to governmental agencies such as NSF in the U.S. or NRF in Korea, which play the crucial role of gatekeeper in implementing science policies and distributing research funds (Mitroff and Chubin 1979). Most faculty members in Korean universities graduated from the most prestigious universities in Korea: Seoul National University, Korea University, and Yonsei University, commonly referred to as the "SKY" universities.[1] Through these universities and their strong alumni networks, professors continue to recruit scholars from their alma maters. This strong preference for peer alumni drove the emergence of a Korean "academic caste system" (Lee and Park 2013), in which one's undergraduate institution asserts a considerably stronger influence on academic appointment than in Western countries. The elites who graduated from SKY universities hold hegemony not only in Korean academia, but also in most social realms (Kwon 2009). Thus, it is possible that applicants whose fellow alumni are in decision-making positions at the NRF or the Ministry of Education, Science, and Technology are more likely to receive research grants than those from non-elite groups. Further, one of the most consistent findings in past research is that doctoral degrees earned from overseas institutions, particularly in the U.S., have a decisive impact on receiving academic rewards, including academic employment and research funds (Kim and Kim 2015; Kwon 2009; Lee and Park 2013). Since the early 2000s, the emphasis on the global competiveness of scholars has led to an increasing demand for English-speaking faculty, who are predominantly educated in the U.S. In a sense, doctoral degrees earned in foreign countries are equivalent to reliable evidence of academic potential and future productivity, rather than a simple manifestation of preference based on particularism. Consequently, it is expected that applicants who earned their doctoral degrees from foreign institutions are more likely to receive funds than those who completed their PhD at Korean universities.

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[1] "SKY" is not only an acronym of the three universities, but also, metaphorically, it implies that those three universities are hard to reach, like the sky.

Social Science Korea (SSK)

The SSK project was launched in 2010 because of a societal consensus that social advancements had lagged significantly behind economic development in Korea. The key objectives that the SSK pursues are strengthening academic viability through expanding the knowledge base of social science research, bolstering the research capacity of the next generation of social scientists through systematic support, and fostering excellent research groups. From 2010 to 2013, 92, 71, 42, and 23 teams, respectively, were selected for the program. As of 2015, approximately 1000 faculty, doctoral researchers, and graduate students throughout all fields of the social sciences were supported through funding from the SSK (Ministry of Education, Science and Technology 2011).

A comparison between the conceptual model of the SSK and that of the standard model is illustrated in Fig. 1. In principle, the SSK model resembles a pipeline model (van Arensbergen and van den Besselaar 2012), in which a large number of research teams begin the process, but are whittled away as each stage moves along, with only a minority successfully reaching research center status at the end of the process. Another distinguishing characteristic of the SSK model is that research teams must undergo an evaluation every year; the same total amount of grant funding is provided every year (approximately $28 million USD), with the grants previously allocated to failing teams being redistributed to those that pass the evaluation. As a result, the amount of money granted to each successful team will increase every year.

While each team is subject to an evaluation every June, there are two additional and more prominent evaluations that occur periodically, which are called stage evaluations. The first stage evaluation requires that individual research *teams* become research *groups* by the end of the second year by passing the annual evaluations; this forced growth occurs either by merging with another research team(s) or by increasing the number of collaborators. The second stage evaluation occurs at the end of the sixth year, at which time the research *groups* are required to become research *centers*, which is the ultimate goal of the
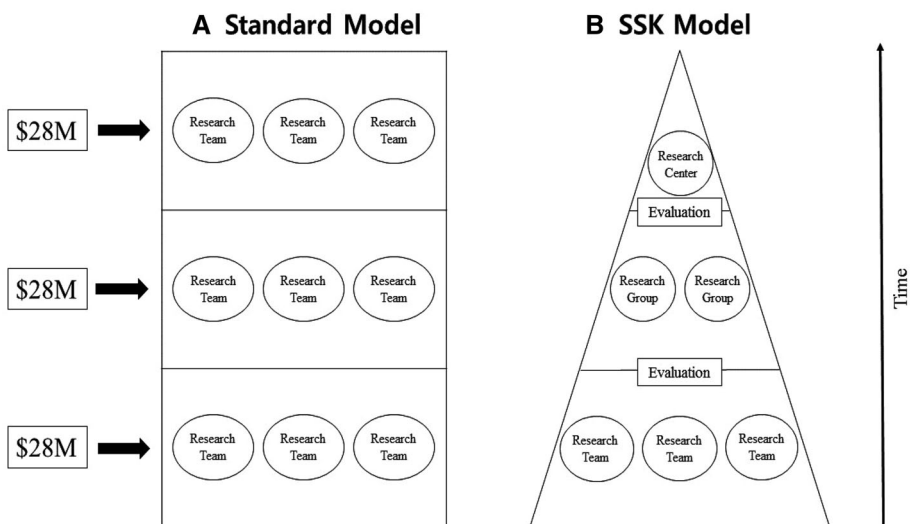

Fig. 1 Comparison between the standard and SSK models of research funding

SSK. Once research centers are established, they are not subject to evaluation until the 10th year of SSK.

In addition to the regular and rigorous evaluations, the SSK model distinguishes itself from standard models of research grant allocation in that it commissioned the SSK Networking Support Team (SNST), whose principal objective is to facilitate networking activities among the SSK research teams and groups. To that end, the SNST is required to hold conferences, forums, and seminars at least four times in a year. The SSK is an evolutionary research grant that encourages excavation of research agendas, as well as competition and cooperation with teams pursuing similar research.

Discussion about the three models of resource distribution in academia and the SSK program leads to the following hypotheses:

H1 As the merit model suggests, a SSK team's research performance will affect the likelihood of passing the stage evaluation.

H2 As the political and accumulative advantage models suggest, an SSK team led by PI with greater social capital and political power will be more likely to pass the stage evaluation than those led by PIs without such resources.

H3 The number of participations in the SNST symposiums will be positively associated with the likelihood of passing the stage evaluation.

Data and measurement

Data

This study draws on data submitted by research teams to the National Research Foundation of Korea (NRF) for the stage evaluation. At the end of their third year, each research team must submit to the NRF a report on their research performance, in which they must specify how they will form a research group for the second stage of the SSK; i.e., either by forming a consortium with one or two other SSK teams or by expanding the existing team independently. These reports are sent to a review board, composed of experts in the field of the research team's agenda. The number of board members varies between three and six per proposal. The review board interviews every team's principal investigator (PI) before assigning a final evaluation score.

Personal information about the PI for each research team was drawn from the Korea Researcher Information (KRI) database maintained by the NRF. In addition to detailed information on publications and patents, the KRI database includes basic demographic information, such as gender and date of birth. It also provides detailed information about the scholars' postsecondary education at the baccalaureate, master's, and doctoral levels, including the date that each degree was granted, institution name and country, and field of specialization (i.e., major).

Measures

Number of publications

Following past studies (Jang et al. 2009; Park 2007), we enumerated articles published only in journals listed in the Social Science Citation Index (SSCI) and Korean Citation Index

(KCI). We excluded from our measure published books, book chapters, book reviews, non-academic reports, and essays, because we had no way of ascertaining whether these publications underwent rigorous peer review.[2]

We measured the number of publications as the average number of publications per annum per research team until the stage evaluation at the end of the third year. This measure was used because some research teams failed to pass the annual evaluation, and exposure to the risk of elimination therefore differs across teams. Thus, summing all publications that were produced until the stage evaluation would potentially overestimate the effect of publication on the likelihood of survival.[3]

Number of participations in SSK networking activities

Because the number of participations enumerated by the SNST is used for research team evaluation, networking activities among SSK teams which were not reported to the SNST are excluded from the analysis. Furthermore, the SNST conferences provide numerous opportunities for teams to exchange ideas and form consortiums through agenda symposiums, one-on-one meetings, seminars, and other activities. Regardless of the number of participations in such activities at one conference, participation in an SNST conference was counted as one participation. Because the SNST provides four conferences in a year, the minimum value for this variable is zero and the maximum is four. As with number of publications, we took an average value (i.e., number of participations per team per year) for the number of participations in the SNST events.

Characteristics of the SSK team

The number of PhD researchers is constructed by calculating the annual number of full-time doctoral researchers per research team. The number of co-investigators, who are typically faculty at universities, is not used because monetary compensation for their research effort is quite small (about USD 250 per month) and they are expected to produce only one or two KCI-level papers per year. Hence, the full-time PhD researchers, who are directly hired and supervised by the PI, play a crucial role in generating research outcomes.[4]

Because one of the goals of the SSK is to build up next-generation social scientists who can lead cutting-edge research and compete with scholars in the globalized market, the SSK provides opportunities for PhD students, typically the doctoral students of the PI, to spend one or two semesters at world-renowned universities. Because many of the PhD students participate in the SSK as research assistants (ABD), the study abroad opportunity

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[2] It should be noted that if researchers who attain PI status are more likely to write books about their work, our findings might be underestimated. However, there were no significant differences in the number of book publications between PIs and non-PIs.

[3] Although it would be worthwhile to examine the relationship between co-authorship among team members and success in passing evaluations, we were unable to do so because of a lack detailed data on the authors for each article.

[4] Nevertheless, we tested the effect of number of co-investigators (results not shown here), since it is possible that teams with many co-investigators may experience difficulties in cooperation among team members. The coefficients from the models with the number of co-investigators were nearly identical with the main results with only one exception. The coefficient for the number of KCI journal articles failed to reach statistical significance when the variable entered the model. Hence, we present the results excluding the number of co- investigators.

may enhance the RAs' motivation and, ultimately, increase the team's research productivity and likelihood of passing the stage evaluation.

"SKY universities" indicates whether the managing team is located at one of the SKY universities. In most cases, the managing university coincides with the university that currently employs the PI. The vast majority of the most prestigious universities are located in the Seoul metropolitan area in Korea. Because Seoul, as capital city of the nation, is the center of economic, political, and cultural functions in Korea, universities located in the Seoul metropolitan area have been drawing not only the brightest faculty and students, but also a disproportionate share of research resources. It is important to take this effect into account, and we created a dummy variable that indicates 1 if the university that employs the PI is located in the Seoul metropolitan area and 0 otherwise.

Principal investigator (PI) characteristics

The PI's characteristics are provided for five variables: gender, age, academic ranking, doctoral degree from a foreign university, and bachelor's degree from a SKY university. Female was coded as 1 for female and 0 for male. Age of the PI was measured as a year. Assistant professor is a dichotomous variable, which was coded 1 if the PI was an assistant professor, 0 otherwise. To measure the prestige of doctoral institutions that the PI graduated from, we distinguished domestic institutions from foreign institutions, coding 0 for the former and 1 for the latter. Similarly, we created a dichotomous variable that can measure the prestige of the PI's undergraduate institution: 1 for SKY universities and 0 for all other universities.

Results

Descriptive statistics for all variables in the analysis are presented in Table 1, delineated by the results from stage evaluations. In the sample of 2010 and 2011 cohorts of SSK teams, those that passed the stage evaluation produced an average of 12.7 KCI journal articles per year while their failed counterparts published 8.28 papers, with this difference being statistically significant ($p < 0.01$). However, there is no significant difference in the number of SSCI publications between the groups.

While the number of participations in SNST events is slightly higher for teams that pass a stage evaluation, the difference failed to reach a statistically significant level. The results also indicate that SSK teams that passed the evaluation employed approximately 0.7 full-time doctoral researchers per year, whereas their failed counterparts had about 0.4 PhD researchers per year, a difference that was statistically significant ($p < 0.01$). The mean differences for all of the remaining variables between the successful and failed teams did not reach statistical significance. In particular, the proportion of failing teams on which the PI was an assistant professor was approximately double that of the passing teams, but this difference is not significant.

Taken together, the results from descriptive analysis suggest that the number of KCI publications and the number of full-time doctoral researchers matters for the likelihood of success in the stage evaluation. This may reflect the typical pattern of conducting research among the SSK teams on daily basis. That is, a PI hires full-time doctoral researchers, frequently their former PhD students, and publishes papers in KCI journals with them,

Table 1 Sample characteristics for the variables used in the analysis of the SSK research teams by evaluation results

	Fail		Pass	
	Mean	SD	Mean	SD
Number of publications				
KCI Journals	8.28	7.45	12.71	10.27
SSCI Journals	1.40	2.28	2.11	3.21
SNST networking	2.81	1.17	2.96	0.89
Number of participations				
Characteristics of the SSK team				
Seoul metropolitan area	0.81		0.77	
Number of PhD researchers	0.41	0.58	0.69	0.61
ABD overseas study	0.83		0.85	
SKY universities	0.36		0.35	
PI characteristics				
Female	0.15		0.21	
Age	49.00	7.60	48.59	5.21
Assistant professors	0.15	0.36	0.08	0.27
Doctoral degree from foreign institution	0.70		0.78	
BA from SKY University	0.66		0.75	
Year of starting research				
2010	0.55		0.59	
2011	0.45		0.41	
N	47		103	

while the co-investigators publish one or two papers per year in either KCI or SSCI journals.

To determine which of the variables best predict whether an SSK research team will pass the stage evaluation, we conducted a stepwise logistic regression analysis (see Table 2). Model 1 includes only research performance (defined as the number of publications in SSCI and KCI journals), the number of participations in SNST activities, and the starting year of the research project. The second model adds four characteristics of the SSK team. The last model introduces the PI's individual attributes to the second model.

The results for Model 1 suggest that, as expected, the number of publications significantly increases the odds of passing the stage evaluation. That is, one more publication in a KCI journal is associated with a 5.1 % increase in the odds of passing the stage evaluation, all other variables being equal. However, somewhat unexpectedly, the results also indicated that the number of publications in SSCI journals does not seem to raise the odds of success in progressing to the second stage of the SSK—though there is a positive association.

It is probable that there are no significant variations in the number of SSCI publications across SSK research teams, for a number of reasons. One reason is that it typically takes 1 or 2 years to complete the entire peer review process at SSCI journals, while most of the KCI journals, on average, complete the review process within a considerably shorter period

Table 2 Odds ratios from the logistic regression of passing the SSK evaluation

	Model 1		Model 2		Model 3	
	OR	SE	OR	SE	OR	SE
Number of publications						
KCI journals	1.051*	(0.024)	1.037	(0.024)	1.056*	(0.028)
SSCI journals	1.069	(0.077)	1.082	(0.081)	1.083	(0.090)
SNST networking						
Number of participations	1.033	(0.201)	0.996	(0.206)	1.079	(0.241)
Characteristics of the SSK team						
Seoul Metropolitan Area			0.702	(0.356)	0.621	(0.348)
Number of PhD researchers			1.982†	(0.699)	2.152*	(0.835)
ABD overseas study			1.159	(0.702)	0.991	(0.648)
SKY Universities			1.142	(0.495)	0.631	(0.316)
PI characteristics						
Female					2.684	(1.621)
Age					0.943	(0.035)
Assistant professors					0.275†	(0.186)
Doctoral degree from foreign institution					2.689*	(1.339)
BA from SKY University					2.910*	(1.512)
Year of starting research						
2011	0.988	(0.388)	1.063	(0.477)	1.471	(0.714)
Constant	1.066	(0.704)	0.994	(0.947)	3.160	(6.485)
N		150		150		150
Log-likelihood		−89.07		−86.83		−80.66
Nagelkerke R^2		0.076		0.115		0.217

Standard errors in parentheses. The reference category for year of starting research is 2010

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$

of time. Also, it is much more difficult to get published in SSCI journals than KCI journals because of language issues and a substantially tougher peer review standard. Because of these differences, it is therefore highly likely that the SSK researchers, PIs in particular, strategically submit their papers to KCI rather than SSCI journals. Furthermore, the SSK requires that every team must report annual progress in their research, which means that SSK teams must produce some research output within a year. Taken together, these circumstances likely discourage the SSK teams from submitting their work to SSCI journals, which may result in little variation in the number of publications in SSCI journals.

The results also indicate that participation in SNST activities is not associated with the likelihood of success in passing the stage evaluation. Perhaps the null effect of participation in the SNST conferences and seminars is related to the fact that the scores for the SNST participation compose only a small fraction (about 0.1 %) of the total evaluation score. Hence, research teams that did not actively participate in SNST events are not significantly impaired overall. An alternative interpretation is that the primary objective of the SNST is not to help SSK teams pass the stage evaluation, but to help form consortiums

and exchange information among the SSK teams. Either way, this result indicates that our third hypothesis is not supported by the data.

The results from Model 2 indicate that only the number of full-time PhD researchers is significantly associated with the odds of success: one additional PhD researcher nearly doubles the odds of passing the stage evaluation, all else being equal. Although opportunity for ABDs to study in foreign countries and research teams housed in the SKY universities were positively associated with the likelihood of passing the evaluation, their impact failed to reach statistical significance. In addition, location in the Seoul metropolitan area was not significantly associated with the odds of success. The NRF has previously been criticized for disproportionate allocation of research funds to universities located in Korea's capital city, relative to other areas, but these critics apparently have not accounted for location in this way.

The last model controlled for several of the PI's individual characteristics, and the results suggest that the odds of success are significantly reduced if the PI is an assistant professor. Indeed, it decreases the odds of success by 72.5 %. Numerous prior studies have documented that the duration of research experience is positively associated with research productivity, as well as success in securing research grants (Ginther et al. 2011; Pohlhaus et al. 2011). Because the SSK does not restrict the experience level of the PI, similar to the P01 grant from the NIH in the U.S., it appears that PIs at the rank of assistant professor who have less experience and smaller networks are significantly disadvantaged. Indeed, Bazeley (1998) argued that the peer review process for grant applications may both inhibit the acceptance of innovative research proposals and limit opportunities for new and younger scholars to enter a field. Furthermore, the results for Model 3 also suggest that SSK teams with PIs who obtained their doctoral degrees from non-Korean universities or who graduated from the most prestigious universities in Korea are roughly 2.7 times and 2.9 times more likely, respectively, to pass the stage evaluation than those with PIs who do not have those academic credentials. This may reveal the unique features of Korean academia that have developed over the past several decades: doctoral degrees earned from overseas institutions, particularly in the U.S., have consistently shown a significant impact on securing scarce resources such as academic employment or research grants in Korea (Jang et al. 2009; Kwon 2009; Lee and Park 2013). One possible explanation for this impact is that U.S.-trained scholars, who often play leadership roles in Korean academia, maintain their high social status by excluding those who earned doctorates elsewhere (Lee and Park 2013). Another potential pathway is that doctoral degrees earned in foreign countries are considered reliable evidence of academic potential and future productivity, rather than a simple manifestation of preference based on particularism. Similar explanations can be offered for the effect of graduating from the SKY universities.

It should be noted that the results indicated that research teams that were led by female PIs are not significantly disadvantaged relative to those helmed by males. Rather, the odds ratio suggests a positive association, though it was not significant. This is consistent with Pohlhaus et al. (2011) who found a comparable rate of success for NSF grants between male and female applicants. In Korea, Jang et al. (2009) also found that the success rates for male and female applicants were not significantly different, whereas the total amount of grant funding was. In addition, seniority is a core principle of organizational norms in Korean society more broadly, playing an important role in both public and private sector organizations. Following suit, higher education institutions in Korea have long maintained wage and promotion systems based on seniority (Konrad and Pfeffer 1990; Shin 2012).

Hence, it was expected that an older PI might increase the odds of success for the SSK teams. However, the results suggest that it is not case for the SSK. It is noteworthy that the coefficient of determination (R^2) value for Model 3 is only 0.217, meaning that 78.3 % of the total variation

cannot be explained by the predictors in the model. However, it is not uncommon to find small R^2 value in similar studies (Masso and Ukrainski 2009), and, more importantly, these may imply that evaluation procedures are contextualized (van Arensbergen and van den Besselaar 2012). In other words, evaluation processes are often subject to a variety of external factors and are influenced by the ways of organizing peer review committees (Horrobin 1996).

Discussion and conclusion

Allocation of research grants has been shifting from recurrent and stable funding to competitive funding, not only in Western countries such as the U.S., U.K., or Germany (Laudel 2006), but also in Korea, which has experienced an unprecedented rate of economic growth and R&D investment in recent decades. The rationale behind implementing competitive funding is to use scarce resources most efficiently, by providing resources to the best researchers, because they will produce optimal results with the available money. Reflecting this trend, the NRF of Korea started the SSK project, perhaps the most competitive funding scheme in the history of Korean R&D, in 2010. What really distinguishes the SSK from other funding projects is that it employs an audition-like system of competition. That is, a relatively large number of research teams are selected in the first year of the SSK, but a portion of these teams is eliminated every year through annual evaluations. Also, at the end of the third and sixth years of the project, a cohort of teams that started in the same year must go through stage evaluations. Only survivors can proceed, and in this third stage—between the seventh and tenth years—research groups are expected to establish world-class research centers (Ministry of Education, Science and Technology 2011). More interesting is that the same amount of money is allotted each year throughout the SSK project, and that grants for surviving teams are designed to grow from re-allocations of failing teams' funds. Despite the unique features of the SSK and its potential for advancing social science in Korea, little research has been conducted on the determinants of survival in the system. The results from the current analysis of the first two cohorts of SSK teams are largely in accordance with past studies: both particularistic and universalistic elements can strongly affect the likelihood of success in passing the stage evaluation.

Overall, our analyses suggest that number of publications in KCI journals significantly escalates the likelihood of passing the stage evaluation, though the number of publications in SSCI journals does not. Moreover, one additional full-time doctoral researcher more than doubles the odds of success, even after accounting for other relevant factors. This may be related to the fact that doctoral researchers are the primary actors who write research papers under the supervision of the PI. These results lend support to the merit model, which emphasizes that academic resources should be allotted only by the quality of research (Long and Fox 1995).[5] Hence, our first hypothesis was supported.

At the same time, our results indicate that particularistic factors also exert a strong influence on the probability of success in the stage evaluation (Hypothesis 2). For instance, SSK teams led by PIs who earned their doctoral degree from a foreign institution, particularly those in the U.S., or graduated from a SKY university are roughly three times more likely to

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[5] It should be noted that it is possible that the number of doctoral researchers may support the political model if PIs with more political power in fact tend to hire the most qualified researchers in the market. Furthermore, if PIs with political power hire the best researchers and produce many research outputs, then they would draw more funding. If this is the case, then the number of doctoral researchers would reflect both the political and cumulative advantage models.

succeed at the stage evaluation than the teams headed by PIs without those academic credentials. This may be related to the historical development of Korean academia: most of the first generation of Korean scholars were trained in the U.S., partly because of Korea's economic, political, and cultural dependence on the U.S. after the Korean War. Those U.S.-trained PhDs returned home and played leadership roles, both in academia and in various professional fields. Hence, in Korea, degrees earned from abroad began to be considered as the certificate of academic potential for the scholar. Under these circumstances, PIs who obtained their doctoral degree might be considered as more competitive by the grant-awarding institution than those who completed doctoral programs in Korea. Alternatively, PIs with foreign doctoral degrees are more likely to be connected with other high-ranking scholars, who often serve on the review committee, and are likely to have more extensive and powerful social networks in funding agencies. Moreover, most faculty members in Korean universities graduated from SKY universities and, through their strong alumni networks, these professors continue to recruit scholars from their alma maters. This strong preference for peer alumni drove the emergence of a Korean "academic caste system" (Burris 2004), in which one's undergraduate institution asserts a considerably stronger influence on academic appointments than in Western countries. Hence, as the political model posits, it might be that teams headed by PIs who graduated from those elite universities are more likely pass the stage evaluation due to their hegemony and political influence in Korean academia.

As with any research study, the current study is not without limitations. First, due to data limitations, we could not examine the effect of track record (e.g., previous grants and publications) on the likelihood of success. Some past research has found that scientists with many scientific publications, a high frequency of citations, a record of having received grants, and ties to prestigious universities have a higher probability of receiving grants than other applicants do (Bazeley 1998; Cole et al. 1978; Mitroff and Chubin 1979). Thus, track record would be an important avenue for future research to examine as a determinant of research funding. Second, we were not able to explore the effect of field of study. Although some prior literature has reported a significant effect of research area on allocation of grant funds (Cheon et al. 2013), the current analysis could not account for the effect because the SSK strongly encourages inter-disciplinary research and the specialty areas of investigators may differ even within an individual team. Nonetheless, it is still possible that certain fields of study within the social sciences, such as economics or management, might draw a disproportionate share of research funds. It would therefore be interesting to examine the likelihood of getting research funding across individual researchers or teams, and across disciplinary boundaries.

In an era of globalization, higher education institutions in Korea face unprecedented pressure to improve the quality of their research capacity. Thus, a significant effect of particularistic traits on the likelihood of obtaining research grants would not only weaken the global competitiveness of Korean universities and research institutes over the long run, but also undermine the integrity of the scientific community as a whole. If these patterns persist, R&D and higher education for future generations might be at stake. Therefore, Korean academics should reflect on the fundamental principles of the institution of science, and collective efforts should be made to restore the spirit of universalism to research funding decisions.

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