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IS THERE GENDER GAP IN RESEARCH GRANT SUCCESS IN ECONOMICS? CASE STUDY OF SLOVAKIA[4]

Da li postoji rodni jaz u uspehu istraživačkih grantova u ekonomiji? Studija slučaja Slovačke

ABSTRACT: *Numerous studies have highlighted the existence of gender disparities in various dimensions of men's and women's scientific careers. The question is whether these gaps result from individual choices or from various factors that may limit their opportunities. This study aims to explore one such factor—specifically, access to grants. Success in obtaining grants is frequently a pivotal condition for career advancement within the scientific community. Despite the extensive body of research, few studies focus on post-communist countries, which exhibit unique dynamics in the perception of gender equality. This article analyses gender differences in grant applications submitted to the SGA, the largest grant agency in Slovakia, specifically within the field of economics. This field presents a compelling area for research, particularly given that, in contrast to many other countries, there is a majority of women within this field. The findings reveal that the most significant discrepancies occur during the application phase, where the number of women applying for these grant resources is lower than anticipated. In the evaluation phase, while the success rate for women is marginally higher than that of their male counterparts, women ultimately receive slightly lower evaluation scores when other relevant factors are considered. Furthermore, in the grant implementation phase, teams led by women demonstrate a slightly higher performance in terms of scientific output compared to teams led by men. These results suggest some hidden forms of gender biases.*

KEYWORDS: *research grants, gender differences, government subsidies, public expenditures*

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APSTRAKT: *Brojne studije ukazale su na postojanje rodnih razlika u različitim aspektima naučnih karijera muškaraca i žena. Pitanje je da li ove razlike nastaju usled individualnih izbora ili usled različitih faktora koji mogu ograničiti njihove mogućnosti. Cilj studije je da istraži jedan od tih faktora – konkretno, pristup grantovima. Uspeh u dobijanju grantova često predstavlja ključni uslov za napredovanje u naučnoj zajednici. Uprkos opsežnom broju istraživanja, malo je studija koje se fokusiraju na postkomunističke zemlje koje imaju specifičnu dinamiku u percepciji rodne ravnopravnosti. Ovaj članak analizira rodne razlike u prijavama za grantove podnete SGA, najvećoj agenciji za grantove u Slovačkoj, konkretno u oblasti ekonomije. Ova oblast predstavlja zanimljivu temu za istraživanje, naročito jer, za razliku od mnogih drugih zemalja, u ovom polju većinu čine žene. Nalazi pokazuju da se najznačajnije razlike javljaju u fazi prijave, gde je broj žena koje se prijavljuju za ove grantove manji od očekivanog. U fazi evaluacije, dok je uspešnost žena marginalno viša nego kod njihovih muških kolega, žene na kraju dobijaju nešto niže ocene prilikom razmatranja drugih relevantnih faktora. U fazi implementacije grantova, štaviše, timovi koje vode žene pokazuju nešto bolje rezultate u pogledu naučnih dostignuća u poređenju sa timovima koje vode muškarci. Ovi rezultati ukazuju na postojanje skrivenih oblika rodnih predrasuda.*

KLJUČNE REČI: *istraživački grantovi, rodne razlike, državne subvencije, javni rashodi*

1. Introduction

Gender disparities in academic careers and long-term research outcomes are observable across numerous countries and fields. In particular, a significant gender imbalance is apparent in the upper echelons of university administration and leadership, where men largely outnumber women in senior positions. Moreover, research productivity among women is generally reported to be lower compared to their male counterparts, as evidenced by the total number of academic publications produced (Abramo et al., 2009). While these disparities are evident, the underlying reasons remain less clear.

Such differences may stem from objective factors (e.g., variations in cognitive abilities or biological characteristics), subjective factors (related to individual preferences), or systemic gender biases prevalent throughout academic careers (including job recruitment and promotion processes). Regarding objective factors, a consensus exists among studies indicating the absence of significant differences in research performance that could justify the male predominance in the field (Hyde & Linn, 1988; Weiss et al., 2003; Ceci et al., 2014). In the case of subjective factors, it is a question of individual choice (self-selection) of the person. Although self-selection can often be conditioned by external factors, current research is predominantly focused on the latter category, identifying factors such as historical barriers to entry, differential access to resources, mentorship opportunities, and the difficulties associated with balancing academic responsibilities alongside personal or professional commitments (Aiston & Jung, 2015; Nielsen, 2017; Rissler et al., 2020).

One potential discriminatory factor pertains to the unequal access to research grants, a critical element for a successful academic career. Gender differences in grant activities may occur at various stages of the grant process, including discrepancies in the application phase, differences in evaluation and selection of grant applications (notable variations in success rates), the amounts of funding requested or awarded, and differing performance during grant implementation.

Most studies on this subject have been conducted in the United States and Western European countries, which are leaders in promoting gender equality. Conversely, research focusing on grant schemes in countries with pronounced differences in gender status perceptions is significantly underrepresented. In Central and Eastern Europe, the understanding and achievement of gender equality diverge from those in more developed countries. These nations face unique challenges that adversely affect the position of women in research. A notable issue is the limited availability of resources for research and development in these regions, resulting in heightened competition for funding. This, paired with the increasing trend towards the internationalization of research based on performance metrics, exacerbates difficulties for women while lacking adequate financial backing.

The prevailing societal norms in these countries further complicate the situation, as they often prioritize women's roles in domestic settings while shaping the operational structures of academic institutions (Linková et al., 2023). This setting does not openly lead to gender biases, but it significantly complicates, for example, the return of women to research after maternity leave (Vohlídová, 2021) and often leads to the fact that even women themselves do not perceive these problems as gender-focused (Lendák Kabók et al., 2024). Institutional frameworks and policies frequently regard the mere absence of barriers to female education and research careers as sufficient, neglecting the necessity for proactive support for women's career development (Cidlinská et al., 2018).

The objective of this article is to investigate gender differences within the Scientific Grant Agency scheme implemented in the Slovak Republic, specifically in the field of economic sciences. This focus contributes valuable insights to the existing literature for several reasons. Firstly, it presents a study from an EU member state that does not rank among the leaders in gender equality, as indicated by its position at 45th in the UN Global Inequality Index. Slovakia also exhibits one of the highest gender wage gaps in Europe (Christofides et al., 2013), suggesting the presence of concurrent disparities could be also in research grant allocation. Notably, in the field of economics in Slovakia, the number of women in academic positions, including full professorships, surpasses that of men, which distinguishes this context from findings in other countries (Van Arensbergen et al., 2012). This scenario provides an opportunity to explore whether the increased representation of women may help mitigate the aforementioned gender biases, as underrepresentation has been identified as a significant driver of gender gaps in science (Lundberg & Stearns, 2019; Astegiano et al., 2019). Additionally, unlike most studies that analyze singular aspects of the grant process (such as gender differences in grant success or publication outcomes), this article evaluates the entire continuum from grant submission, through evaluation, to implementation.

2. Literature review

Grants are a critical component of scientific work and outcomes, making them a focal point for research aimed at identifying potential areas of gender discrimination or bias. Prior studies examining gender differences in grant awards have yielded inconsistent results, with the majority primarily analyzing only the application phase of the grant process. Some investigations have reported negligible or no significant differences in funding success rates. For instance, Ley and Hamilton (2008) conducted a comprehensive analysis of NIH grant funding from 1996 to 2007, revealing nearly equal funding success rates across six biomedical categories in the United States. Similarly, several other studies have reported minimal gender disparities when controlling for relevant factors such as age, discipline, and experience. Notable examples include Yip et al. (2020), who focused on social sciences in Hong Kong, Marsh et al. (2009), whose meta-analysis encompassed multiple studies, and Rissler et al. (2020) in the United States. In Belgium, Beck and Halloin (2017) also found that gender had no significant effect on success rates or the likelihood of obtaining funding across most funding schemes, with the sole exception of the Research Credit Scheme (RC), where success rates diverged notably in the Humanities and Social Sciences, with male applicants constituting the majority of the applicant pool.

Conversely, numerous studies have identified gender differences, particularly when examining the entire grant award process more closely. While earlier mentioned studies focused solely on the evaluation of outputs did not find significant gender disparities, those addressing the selection and evaluation process itself frequently identified some form of gender bias. The primary issue lies in the evaluation of women as project leaders rather than the quality of the project proposals themselves. For example, a study by Van der Lee and Ellemers (2015) in the Netherlands illustrated that male applicants received significantly more favorable evaluations in terms of „quality of researcher," although evaluations for „quality of proposal" remained comparable. Male applicants also had markedly higher success rates than female applicants. Gender disparities were most pronounced in scientific disciplines with a high volume of applications and an equal gender distribution among applicants, such as the life sciences and social sciences. This differential treatment of proposals versus researchers was further corroborated by Witterman et al. (2019) in their study of health sciences in Canada. Additionally, gender differences may manifest in the amount of funding allocated to individual grants, as demonstrated by Larrègue and Nielsen (2023) in their examination of grants in the social sciences in Western Europe. Bornman et al. (2007) identified gender bias in peer review processes in their meta-analysis of 21 related studies.

Some research suggests that while direct discrimination within the grant application process may be minimal or nearly absent, attention should focus on the conditions affecting women's entry into grant competitions, such as their comparatively limited resources or networks for project preparation (Ceci & Williams, 2011). Ley and Hamilton (2008) supported this by finding

no significant differences in evaluation outcomes but noted a gradual decline in project submissions by women with increasing age. Other studies have also documented a lower participation rate among women (Witterman et al., 2019; Rissler et al., 2020), which may indicate barriers to accessing necessary resources for grant submissions. Schmaling and Gallo (2023) identified in their meta-analysis that fewer women applied for grants than were eligible across the majority of examined studies.

One possible explanation for these disparities is that women are disproportionately engaged in underappreciated but essential activities within universities. Rissler et al. (2020) found that women in the United States are more likely to be involved in educational and support roles, which may consume time that could otherwise be devoted to research, particularly evident in the social, economic, mathematical, and physical sciences. This phenomenon may also be linked to the quality of the working environment, as some studies have reported a lower representation of women in institutions recognized for high-quality research (Blagojević-Hughson, 2013; Conti & Visentin, 2015; Rissler et al., 2020). Shauman (2017) also noted that women are less represented in research-related roles compared to other academic positions. This underrepresentation could influence the access to proper mentors or networks, which is another important source of advantage in grant preparation for men (Ceci & Williams, 2011; Lendák Kabók et al., 2024). Over the long term, this reduced emphasis on research can result in fewer grant submissions, potentially leading to delays in promotions and subsequently exacerbating gender inequities in academia.

3. Methodology

The main aim of the research is to examine gender differences in the process of supporting research projects at universities in the field of economics in Slovakia. These are projects of the Scientific Grant Agency (SGA), which is historically one of the most important supporting institutions of research and development in Slovakia. Grants provided by this institution make up the vast majority of support funds for universities. The present research deals with three aspects of gender inequalities, which we examine based on the time dimension and phases of the project cycle. We first analyzed gender inequalities in the grant application process. The second aspect was the evaluation process of applications submitted by the agency committee. The third aspect examined the outputs achieved by the supported projects. The main research question is whether there are gender differences in the process of grant application, evaluation and outcomes at universities in Slovakia. In this context, we pursue three sub-questions:

1. Are there any gender differences in submission of grant proposals (grant application)?
2. Are there any gender differences in evaluation of the grant proposals (grant evaluation)?
3. Are there any gender differences in achieved results of the supported projects (grant outcomes)?

Descriptive statistics will be used to answer the first sub-question. To address the second question, linear regression analysis will be applied to identify the dependence of selected factors influencing the initial quality of the projects as evaluated by the committee of the grant agency. Finally, to answer the third sub-question, negative binomial regression (Ebadi and Schiffauerova, 2016) will be performed to examine the factors influencing the overall quality and quantity of publications produced by the supported project teams. We will explain the research methodology in more details in the subsequent section of the article, including a description of the analysed data.

3.1. Dataset Characteristics

The projects funded by the Scientific Grant Agency are among the most sought-after by researchers in Slovakia. These grant schemes have been in operation for over 20 years and primarily consist of relatively smaller grants for which researchers can apply annually. The duration of a project ranges from a minimum of 2 years to a maximum of 4 years. Researchers from all Slovak universities, as well as those from the Slovak Academy of Sciences, are eligible to apply. A single researcher may participate in a maximum of two projects of this type. Regarding the application process, the project team may consist of a maximum of 20 research members. The project leader, who serves as the principal investigator, must possess at least a third-degree university education, while the other team members are required to have at least second-level university education. Project documentation must be submitted by a specified date and should include a project description (detailing objectives, phases, and steps of the solution, as well as planned outputs), scientific characteristics of the research team, and the project budget.

The first dataset we used contains information about grant submissions. We examined 886 grant submissions, of which 425 were led by women. During the initial evaluation of project quality, the Agency Commission awards points based on the submitted project documentation. Grant applications may be rejected in the first round due to formal deficiencies. Subsequently, points are awarded on a scale of 0 to 100 by two independent evaluators, who consider the project's quality and the research team's qualifications. The projects are then ranked according to the number of points obtained, with the threshold between successful and unsuccessful applications determined by the available financial resources for that year. Projects are funded based on their scores until the financial resources are exhausted.

To address the second research sub-question in this article, we analyzed the point-based initial evaluations of project quality, provided by the Scientific Grant Agency for the years 2008 to 2018. We supplemented this dataset with other characteristics of the projects and the project teams.

For the third research sub-question, we analyzed all supported projects (423 projects) in the field of economics from 2008 to 2014. We examined the research outputs associated with these projects. Since the maximum duration of a project is 4 years, we selected 2014 as the final year of project approvals

for our analysis. The final quality of the project is assessed only at the project's conclusion, evaluating whether the project was executed appropriately and whether it achieved the planned results in terms of publications. A total of 3,061 researchers from the field of economics participated in the 423 projects analyzed during the period from 2008 to 2018. To meet our research objectives, we collected their publication outputs from the Central Register of Publication Activity (CREPC) in Slovakia.

3.2. Models and variables

Table 1 presents the variables utilized in the econometric models to analyze gender differences and other factors influencing both the initial quality of grant applications and the final quality of approved projects, as measured by researchers' publication outputs.

To address the second research sub-question, we examine gender differences during the evaluation phase of research project proposals. We employed linear regression analysis to identify the factors influencing the initial scores assigned to grant applications by the grant agency committee. Our dependent variable (Prev_Evalu) represents the number of points awarded by the evaluation committee and reviewers to submitted applications in the field of economics during the period from 2008 to 2018. These data were published by the Scientific Grant Agency.

The independent variables were selected based on the criteria used by the Scientific Grant Agency for evaluating grant submissions, primarily including the average publication activity of the research team (AvgArtNo) and the prior experience of the principal investigator with research projects (PrevProj). The quality of the project proposal is also a crucial factor in the evaluation; however, it cannot be directly quantified. Consequently, we adopted an alternative measurement for quality, referred to as „future quality," which utilizes the achieved results of the project in the form of total publication outputs from the projects (TotalOutputs). While we acknowledge that future results may not perfectly reflect the quality of the proposal, our analysis confirms a robust reciprocal relationship, indicating that projects with higher ratings tend to achieve better outcomes.

To further refine our estimation of project quality, we categorized total outputs into two distinct groups to differentiate the quality of publications: high-quality publications and low-quality publications. Publications in journals indexed in the Web of Science and Scopus databases (HighQ_Art) are considered high-quality, whereas articles in proceedings and non-indexed journals are deemed lower quality (LowQ_Art). The division of publications into higher and lower quality categories is inherently subjective; however, this approach is justified given that publications indexed in these databases are valued significantly higher by the Ministry of Education of the Slovak Republic, which allocates funding to universities based on these outputs. Thus, it is reasonable to assume that researchers are more motivated to publish in indexed journals if they have corresponding quality of research. One potential limitation of this division is the

significant variability in the quality of outputs within each database. However, given the low total number of outputs associated with projects, further subdivision does not yield meaningful insights. Additionally, from a financial perspective, the most substantial distinction lies between indexed and non-indexed outputs rather than among different qualities of indexed outputs. As such, we replaced the total output variable with this categorization in models 1 and 3.

To examine gender differences, we included the variable Gender (1 = male, 0 = female) in the model. In addition, we incorporated other variables that may influence the points awarded for project proposals during the selection and evaluation of grant applications. Previous studies indicate that the level of collaboration among participating institutions correlates with improved outcomes (Ebadi & Schiffauerova, 2015; Holman & Morandin, 2019). Therefore, a variable representing cooperation activity (dCoop) was included in the model. Project characteristics are also a vital component of potencial size of output, particularly the project's duration (Last) and team size (TeamSize). Moreover, the academic environment from which the project originates plays an important role (Giladi et al., 2014; Jung et al., 2017). To assess this aspect, we incorporated a variable (dBrat) indicating whether the project is located in the most developed area of Slovakia – the Bratislava metropolitan region. The academic environment is quantified using a quality coefficient (coefA) assigned to the faculty where the project is implemented, which reflects the overall quality of that institution as determined during the national accreditation process.

We assume that the academic rank of the principal investigator itself should not significantly impact the score (number of points) of the submitted grant applications. However, just as gender biases may be present, academic rank biases could also influence the final evaluation of applications. Therefore, we included variables that identify whether the principal investigator holds the title of associate professor (Assoc) or full professor (Prof). To assess the impact of these potential biases, we formulated two models that incorporate these academic rank variables and two additional models that do not.

Final equation of model 2 is follows:

$$Prev\_Evalu_i = f\ (Gender_i + LowQ\_Art_i + HighQ\_Art_i + TeamSize_i + Last_i + dCoop_i + dBrat_i + coefA_i + PrevProj_i + Assoc_i + Prof_i + AvgArtNo_i)$$

To summarize, we used four models, whose differ with two by different measures of quality of project (two models used total output and two models differentiate total output into two categories). Second division is related to used academic rank (which normally should not play a role in selection), so we use models with and without these categories.

To answer third research sub-question, we proceed negative binomial regression analysis to estimate gender differences in project outcomes. Dependent variable is represented by the total publication outputs of the examined selected supported projects (TotalOutputs). In alternative model, we used instead of it the total number of high quality articles (HighQ_Arti) as alternative depended variable. This allows us to look at the quality of project outputs from different

perspectives. Given that when using a variable focused on high quality output, there are many observations with zero (no higher quality publications within the project), we had to choose negative binomial regression in this case (Ebadi and Schiffauerova, 2015).

We used the same independent variables as in case of previous models, as we expected that these should not differ. Only exceptions are variable (Enviro), used to control for overall changes in research productivity and variable (Fund), related to budget of projects. These two indicators do not play role in grant evaluation, but could affect the grant outcomes. The final equation is follows:

$$TotalOutputs_i = f\ (Fund_i + Gender_i + Assoc_i + Prof_i + TeamSize_i + AvgArtNo_i + Last_i + dCoop_i + PrevProj_i + coefA_i + dBrat_i + Enviro_i)$$

Table 1. List of Variables and Description

Abbreviation	Description and unit	Source	Coverage
Prev_Evalu	Number of points in the project evaluation process added by a commission of the Scientific Grant Agency	Scientific Grant Agency	2008-2014
Gender	Dummy variable for the gender of the principal investigator of the project, 1 = male, 0 = female	Scientific Grant Agency	2008-2018
LowQ_Arti	Number of scientific articles published under the project i, that is not indexed in any publication database	Scientific Grant Agency	2008-2018
HighQ_Arti	Number of scientific articles published under the project i, that is indexed in Scopus and Web of Science databases, as required in Slovak academic environment	Scientific Grant Agency	2008-2018
$TotalOutputs_i$	Number of all publications (sum of *Low and HighQ_Art*) related to the project i, article	Scientific Grant Agency	2008-2018
$TeamSize_i$	Size of the research team, persons	Scientific Grant Agency	2008-2018
$Last_i$	Duration of the project, in years	Scientific Grant Agency	2008-2018
$dCoop_i$	Dummy variable for all kind of cooperation with universities and institutions (external and internal) in the project i, 0 = no cooperation, 1 = cooperation with other universities and institutions	Scientific Grant Agency	2008-2018
$dBrat_i$	Dummy variable for the location of the institution where the project is implemented, 1 = location in Bratislava, the capital city, 0 = location not in Bratislava	Scientific Grant Agency	2008-2018
$coefA_i$	Dummy variable, 1 = if the accreditation coefficient of the faculty is the highest "A"; 0 = if the accreditation coefficient of the faculty is "B, C, D";	Accreditation Commission, an advisory body to the Government of the Slovak Republic	2015
$PrevProj_i$	Dummy variable for previous principal investigator´s experience with leading other SGA project over since 2004, 0 = no previous projects, 1 = experience with previous projects	Scientific Grant Agency	2004-2018

Abbreviation	Description and unit	Source	Coverage
Assoc	Dummy variable for the principal investigators academic title, 1 = if associate professor	Universities Official Websites	2018
Prof	Dummy variable for the principal investigators academic title, 1 = if full professor	Universities Official Websites	2018
$AvgArtNo_i$	Number scientific articles of the research team published in Scopus and Web od Science databases three years before the project started to be implemented, number of articles	Central Register of Publication Activity (CREPC)	2005-2013
$Fund_i$	Volume of support in Eur	Scientific Grant Agency	2008-2018
$Enviro_i$	Average number of publications in the databases WoS and Scopus published by the authors from Slovakia in the field of economics during the duration of the project, number of articles	Web of Science Database, Scopus Database	2008-2018

Source: Own elaborations.

4. Results

The main aim of the presented research is to identify gender gaps in the process of academic research projects realization in the field of economics around Slovakia projects. Specific attention is paid to three different phases of grant application, grant evaluation and grant publication outputs.

4.1. Gender Representation in Research Project Applications

First, we will look at the representation of different sexes in the submission of research projects in the field of economics. Table 2 provides an overview on all project applications with respect to gender share. From all 886 applications submitted in economics, a comparable number of men (461) and women (425) applied, in percentages 48 for projects where female principal investigator applied and 52 for male applicants.

In Slovakia, a total of 869 academic staff were active in the field of economics in this period. Of the total number 60.64 %, they were women, i.e. 527 female workers, and 342 men in the share of 39.36 %. Although there are more women in academia, men are more willing to apply for a grant under the SGA scheme.

In terms of gender differences, it is worth looking at these statistics on the basis of the academic degrees available to the grant applicants. All academics in the field of economics are divided into assistant professors (357), associate professors (125) and full professors (45). Within Assistant professors, 62.41 % are women, and among associate professors, the proportion of women is 58.69 %. As for full professors, women have a share of 53.57%.

When looking at the grant applications submitted under the SGA scheme, out of the total number of 886 applications, 296 were submitted by assistant professors, 427 by associate professors and the remaining 163 by full professors. Within the assistant professors' projects, 52.40% of principal investigators were women. Within the associate professors, out of the total number, 48.5% were women.

Table 2. Research Projects Applications by Gender – SGA scheme.

	Total	Female	Female share	Male	Male share
Project applications	886	425	48,00%	461	52,00%
Prof	163	63	38,70%	100	61,30%
Assoc	427	207	48,50%	220	51,50%
Assist	296	155	52,40%	141	47,60%
Rejected applications	211	96	45,50%	115	54,50%
Prof	29	8	27,60%	21	72,40%
Assoc	85	40	47,10%	45	52,90%
Assist	97	48	49,50%	49	50,50%
Granted applications	679	329	48,50%	346	51,00%
Prof	134	55	41,00%	79	59,00%
Assoc	342	167	48,80%	175	51,20%
Assist	199	107	53,80%	92	46,20%

Source: Scientific Grant Agency, 2018.

When looking at gender representation at the highest level of academic career, in projects where the principal investigator was a professor, only 38.7% were women. Although there are generally more female professors in the Slovak academic community, men have a higher tendency to apply. Of the total number of registered grant applications, 211 were rejected and 679 were supported. Of all 211 applications rejected, 96 were projects with a female principal investigator, representing 45.5 %. Men also submitted more projects, so the remaining 115 rejected applications belonged to them, which represents 54.5 %. In terms of gender differences and differences in academic careers, it is also possible to observe differences. Of the rejected assistant professors' projects, 49.5 were principal investigators women, and 50.5 % were men, which really suggests that we do not see gender differences in this case. In the case of associate professors, this difference is slightly larger, 47.10 % of projects with a female project leader were rejected and the remaining 52.9 % belonged to men. Among full professors, this difference is most pronounced, with 72.4 % of professors rejected applications belonging to men and 27.6 % to women, which may indicate that women prepare better project proposals than men in general.

Similar trends apply to successful applications. Within the successful assistant professors, 53.8 % were female principal investigators, and 46.2 males. Within the successful associate professors, 48.8 % were women and 51.2 % were men. And in the highest category of full professors, only in 41 % of cases were women project leaders and 59 % of cases were men.

In general, it can be stated that in the project activity measured by success of grant applications, we observe only slight gender differences. However, the main issue here is that women do less grant submission as is their share on employment, confirming one the main problems related to gender differences (Schmaling and Gallo, 2023). These facts suggest the need to look at further on the outcomes and results of projects based on gender and academic degree, as shown in Table 3.

In the case of assistant professors, men receive an average of three points more in the initial evaluation of project applications (Prev_Evalu) that were submitted to the SGA. Male assistant professors received and asked for an average of 2,000 euros more money for their research activity (Fund). The previous publishing activity in projects where man was the project leader was higher than in projects where the principal investigator was a woman. However, in a more detailed analysis of the final results of the projects, in projects was a female leader, the project shows more publications in average (Total_Outputs).

Table 3. *Average Research Project Outputs by Gender and Academic Degree*

	Total Outputs (number of articles	LowQ_Art (number of articles	HighQ_Art (number of articles	Fund (in Eur)	AvgArtNo (number of articles	Prev_Evalu (number of points)
Assis_Fem	21,88	21,09	0,78	7 670,34	0,09	79,45
Assis_Male	20,86	19,31	1,55	9 941,37	0,21	82,97
Assoc_Fem	33,16	32,01	1,15	9 780,68	0,09	82,34
Assoc_Male	30,59	28,66	1,93	11 808,99	0,15	83,16
Prof_Fem	29,90	28,88	1,02	13 517,67	0,13	85,40
Prof_Male	26,17	25,41	0,76	13 196,43	0,14	86,42

Source: Own elaborations.

Closer look at these projects in terms of the quality of project outputs suggests that in projects with male leader, more publications of higher quality (HighQ_ Art) were reported. These slight gender differences also apply to the category of associate professors. A slight deviation can be observed in the highest category of full professors, women's professors' projects achieve higher quality results.

4.2. Observation of Factors Influencing Evaluation of Project Proposals in Economics

Descriptive statistics of the data above indicated slight gender differences in various other aspects of the application, especially in lower level of grant application by women. To answer our second question, we run a multiple linear regression analysis of the factors (Table 4) that may affect the Scientific Grant Agency's scoring in the evaluation of grant applications. Four models were constructed explaining the variables affecting the commission of the agency, however, the basic idea was to include key factors that the commission is aware of and decides on. Model 1 and model 3 distinguishes between high– and low– quality scientific articles as project outputs, Models 2 and 4 count with a package of total number of scientific articles (Total_Outputs) of the investigated projects in economics. The results of the regression partly indicate a confirmation of expectations, that gender is playing role in the grant application awarding process. Models 2,3 and 4 suggest that the gender factor is significant in the award of points for grant applications. Projects where men are the main leaders of the project received up to 2 points more compared to projects where women were principal investigators, controlling for other factors. The quality of

the project itself (measured by the final project outputs (LowQ_Aart, HighQ_Art, TotalOutputs)) proves to be a significant factor in evaluation of grant applications. This is what was expected, whereas projects that proved to be better ultimately also received a better initial evaluation from the commission. The cooperating activity, the quality and the location of the host institution of the project proved to be an insignificant factor, while expected that this aspect should play no role in awarding points for the grant application. The previous publishing activity of the project team as well as the previous project success of the principal investigator play an important role, which was also expected as the Agency declares its importance in the list of evaluation criteria for grant applications. Whether the principal investigator is an assistant professor, an associate professor or a full professor has also not been shown to be significant, implying that commission did not discriminate on the basis of what scientific degrees the project leader has already achieved.

Table 4. Results of linear regression capturing the influence of variables on evaluation outcomes of project proposal applied to Scientific Grant Agency in the field of economics between 2008 – 2014.

	(1)	(2)	(3)	(4)
	Prev_Evalu	Prev_Evalu	Prev_Evalu	Prev_Evalu
Gender	1.466	1.793*	1.770*	2.004*
	(0.097)	(0.043)	(0.044)	(0.023)
LowQ_Art	0.0545*		0.0509*	
	(0.023)		(0.032)	
HighQ_Art	0.840**		0.731**	
	(0.001)		(0.004)	
TeamSize	0.0895	0.0910	0.118	0.114
	(0.363)	(0.359)	(0.227)	(0.247)
Last	-1.154	-0.712	-1.171	-0.772
	(0.240)	(0.468)	(0.236)	(0.432)
dCoop	1.394	1.570	1.302	1.476
	(0.104)	(0.070)	(0.131)	(0.088)
dBrat	1.138	0.754	1.379	0.991
	(0.224)	(0.421)	(0.141)	(0.287)
coefA	1.015	1.460	1.260	1.608
	(0.260)	(0.105)	(0.162)	(0.073)
PrevProj	3.292***	3.654***	4.129***	4.302***
	(0.001)	(0.000)	(0.000)	(0.000)
Assoc	-0.234	-0.135		
	(0.831)	(0.903)		
Prof	2.333	1.863		
	(0.077)	(0.159)		
AvgArtNo	2.416	4.425*	2.777	4.496*
	(0.233)	(0.023)	(0.171)	(0.021)
TotalOutputs		0.0678**		0.0636**
		(0.004)		(0.007)

	(1)	(2)	(3)	(4)
	Prev_Evalu	Prev_Evalu	Prev_Evalu	Prev_Evalu
_cons	78.20***	76.93***	78.01***	76.93***
	(0.000)	(0.000)	(0.000)	(0.000)
N	423	423	423	423
AIC	3032.0	3039.5	3033.9	3039.1
R^2	0.1572	0.1380	0.1454	0.1306
Adj R^2	0.1325	0.1149	0.1246	0.1116
F	6.37	5.98	7.01	6.89
Root MSE	8.5836	8.6701	8.6224	8.6862
Prob>F	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses.
$^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$
Source: Own elaborations.

4.3. Observation of Factors Influencing Grants Publication Outputs

In out last sub-question, we try to identify gender differences in project outcomes. This analysis is necessary because if the actual results of projects were significantly different for men and women, it would be logical that these results would also be different in the selection and evaluation of projects themselves. The results of negative binomial regression in models 5 and 6 indicate the importance of selected factors on the final results of the projects, as shown in Table 5.

In model 5 where we examine all the scientific outputs of a project, regardless of their quality, women achieved better results. When considering only quality journals, men outperformed women article publication. Thus, there are differences in the quality of publications between women and men, whether they are assistant professors, associate professors, or full professors. We must point out that the agency itself did not differentiate the results in this way, so it is not possible to draw conclusions about the success of the projects from this analysis. This difference rather indicate a different publication strategies of women and men than significant differences in the publication performance of men and women within our results. The results also confirm that the differences in the evaluation of applications measured in the previous regression are not supported by different outcomes and therefore there is a hidden form of gender bias here.

Regarding other factors, the amount of the grant itself is only significant in the first two cases, but its impact is very small in all models. The size of the team plays a role, if we do not distinguish between the quality of the projects' scientific outputs. Another important implication is that projects solved at high-quality university faculties, which were measured by the national coefA coefficient, produce significantly more outputs of higher quality. The opposite is also true, relatively lower quality articles are published by projects where a relatively lower national quality coefficient was measured in this institution.

These results suggest that the environment where new knowledge is created is very important, i.e. the quality of universities and their faculties. Regarding the importance of the other external environment, being from metropolitan region play a role in production of total outputs.

Table 5. Negative binomial regression outputs capturing the influence of variables on the production of publication outputs within projects in economics.

	(5)	(6)
	TotalOutputs	HighQ_Art
	(number of publications)	(Number of publications in WoS and Scopus)
Fund	0.0000136**	0.0000131
	(0.001)	(0.099)
Gender	-0.142*	0.263*
	(0.029)	(0.047)
Assoc	0.250**	0.216
	(0.003)	(0.201)
Prof	0.0569	-0.354
	(0.577)	(0.100)
TeamSize	0.0370***	0.00813
	(0.000)	(0.587)
AvgArtNo	-0.0278	1.166***
	(0.851)	(0.000)
Last	0.166*	0.264
	(0.031)	(0.098)
dCoop	0.0824	0.177
	(0.195)	(0.183)
PrevProj	0.0198	0.225
	(0.802)	(0.151)
coefA	-0.275***	0.393**
	(0.000)	(0.004)
dBrat	0.244***	-0.256
	(0.000)	(0.083)
Enviro	0.000117	0.00255***
	(0.614)	(0.000)
_cons	2.069***	-2.696***
	(0.000)	(0.000)
lnalpha	-1.002***	-0.421*
	(0.000)	(0.035)
N	423	423
AIC	3492.8	1155.7
LR chi^2	135.79	131.39
Pseudo R^2	0.0377	0.1044
Prob>$Fchi^2$	0.0000	0.0000

Standard errors in parentheses

*p<0.05, **p<0.01, ***p<0.001

Source: Own elaborations.

5. Discussion

Upon examining the research findings, the most pronounced gender disparity is observed in the submission of grant proposals. Across all academic ranks—assistant professor, associate professor, and full professor—the proportion of grant proposals submitted by women is approximately 10% lower than their representation in these positions at universities. These findings align with other studies. Schmaling and Gallo (2023), in their meta-analysis, identified that in 54% of studies, fewer women applied for grants than were eligible, while in 24% of studies, the proportions were equal. Similarly, Rani and Luthra (2011) in India reported the largest discrepancy in grant applications, noting comparable resource volumes and success rates. Bedi et al. (2012) found in their UK study that although success rates for grants were the same for men and women, fewer women applied than expected. Notably, these disparities persist throughout women's careers, in contrast to Symonds (2006), who found that such differences diminished over time in the UK and Australia. A possible explanation lies in varying perceptions of gender equality across countries. In nations with lower gender biases, career interruptions due to maternity leave do not permanently affect women's professional trajectories. Conversely, in countries where women are expected to manage domestic responsibilities primarily, gender disparities in career progression endure, with also older women professors due to the culture expectations potentially prioritizing family over career (Bedi, 2012). Alternatively, inadequate conditions for grant preparation and a lack of mentors might be contributing factors. Moreover, women more frequently hold roles demanding significant teaching or administrative responsibilities (Rissler et al., 2020), limiting their capacity to engage in grant submissions.

In the second part of the study, we closely examined the grant evaluation process. At first glance, there appears to be no gender bias in success rates, as women slightly outperform men. However, regression analysis reveals that men receive, on average, 1.7 points more in evaluation scores than women, when controlling for other factors. This constitutes a 1.7% advantage on a 100-point scale. While seemingly minor, this discrepancy can heavily influence the overall distribution of funding, as most projects score between 80 and 95 points. This suggests a „hidden" form of discrimination, independent of objective criteria. Intriguingly, this disparity exceeds differences in academic ranking, where full professors might be expected to score higher due to reputational factors. The underrepresentation of men among evaluators suggests that linguistic factors (such as the ambition and style evident in grant proposals) may influence perceptions of proposal quality. Another explanation could be systemic bias that unfairly favors male principal investigators because of cumulative advantage that could not be directly seen in evaluated statistics (such as academic status (e.g. being a dean) or membership in important government bodies, etc.). Unfortunately, a lack of detailed reviewer data impedes further analysis of these potential biases.

Analyzing the results of the grants, additional gender differences emerge, particularly in publication outcomes. Men tend to publish more frequently in prestigious journals, significantly impacting their careers. Other studies corroborate the higher number of publications by men in WoS and Scopus databases (Van Arensbergen 2012; Bendels 2018). Women generally publish less in top-tier journals, often due to additional responsibilities such as family care or teaching commitments, as illustrated in studies by Manchester and Barbezat (2013) or Ceci et al. (2014). Gender bias might also play a role; for example, Hengel (2017) found that economic research papers by female authors spend six months longer under review in top journals, despite higher readability scores. Interestingly, while women in our research produce more publications overall, indicating no lack of research activity, they tend to pursue shorter-term publications for quicker achievements. This focus could reflect university evaluation standards, such as biennial performance reviews at many Slovak institutions. Women anticipating potential family obligations (e.g., caring for a sick child) may prefer short-term research, which is harder to publish in prestigious journals. Amano-Patiño's (2020) in their sample from four different articles databases related to economics supports this hypothesis; during the COVID-19 crisis, women published less on new topics, likely due to increased family responsibilities. These findings underscore the necessity of examining gender disparities in academia from a broader perspective, considering both workplace and societal conditions.

Our findings indicate that even with women constituting a majority in economic research in Slovakia, gender biases persist. This suggests a deeper issue concerning the perception of women's roles in both the academic and society culture of the country, echoing the findings of Linková et al. (2023) regarding the Czech Republic. This underscores the necessity for not only acceptance but also active and supportive policies to enhance the status of women in research. Furthermore, implementing measures to encourage greater participation of women in research activities is essential. Effective strategies could include fostering networking and mentoring opportunities (Ceci et al., 2014; Lendák Kabók, 2024), which may increase the proportion of women submitting research proposals.

6. Conclusion

This article aims to investigate gender differences within the Scientific Grant Agency scheme in the Slovak Republic in the field of economic sciences, by examining three stages: grant application, grant evaluation, and grant outcomes. The findings reveal that the most significant disparities occur during the grant application stage, where women apply for grants less frequently than men (first research sub-question). These findings imply that elements of the academic environment may perpetuate gender differences. Previous studies (Ceci and Williams, 2011; Blagojević-Hughson 2013; Rissler et al., 2020) suggest

that these disparities could be linked to differential access to resources for grant preparation or the additional academic burdens placed on women, limiting their grant application frequency. Future research should aim to identify the underlying causes of these disparities.

In the grant evaluation stage (second research sub-question), women slightly outperform men in terms of success rates. However, under equivalent conditions and controlling for proposal quality, women receive slightly fewer points in evaluations. This occurs even though men do not predominate among evaluators, suggesting a potential hidden gender bias in the evaluation process. While no overt gender discrimination is observed in terms of grant success rates or average scores, some hidden disparities are evident, such as the slightly lower evaluation scores for women's proposals of equivalent quality and the lesser rate of grant applications by women.

Regarding grant outcomes (third research sub-question), women produced slightly more outputs, but these were predominantly in lower-tier journals. Overall, however, there are no significant differences in grant outcomes that could be used as an argument for a lower number of female applications or their lower scores in the evaluation of applications. This therefore confirms the existence of gender differences in the entire process.

This study has several limitations that also point to areas for future research. One limitation is the focus on a single domestic grant scheme. A comprehensive analysis would benefit from evaluating all key grant opportunities available, particularly EU grants, which are significant and often more competitive than domestic grants in Central and Eastern European countries. Another limitation is the limited data available on evaluators. Lee et al. (2013) highlight three primary areas of gender bias in grant evaluations: errors in assessing the „true quality" of projects, the socioeconomic characteristics of the applicant, and those of the reviewer. While our study addressed the first two areas, we lacked individual data on the evaluators. Bol et al. (2022) suggest that a higher representation of men among evaluators or their perceptions of gender biases could contribute to the evaluation differences observed.

Additionally, the measurement of project output quality was only roughly estimated based on the number of outputs and their inclusion in indexed databases. Incorporating other variables for quality publication measurement like citation counts could enhance this assessment, though accurate citation measurement necessitates a significantly longer timeframe from publication.

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