

Article

How to Maintain Sustainable Research Productivity: From Talents Mobility Perspective

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Abstract: Maintaining sustainable progress in knowledge and technology is essential in building a sustainable society. The transnational or transregional mobility of talents is one of the important channels for the flow and sustainability of knowledge and technology. Based on the social network theory, we attempt to investigate whether scholars' mobility experience will effectively improve their future scientific research productivity. Empirical studies were conducted based on the academic curriculum vitae of faculties in a leading research university in China from 2008 to 2023. The results suggest that the mobility experience of scholars does not have a significant influence on the total number and quality of papers when we consider both domestic and international publications due to diversified publication channels in the social science disciplines. However, in terms of the number of papers published in international journals and international collaborations, the existence of mobility experiences in their past education or working experience has a significant positive impact on scholars' later research productivity. In addition, scholars flowing through joint training programs at their doctoral phase tend to produce more co-authored papers. This research provides a reference for the wellbeing and sustainable productivity of university scholars, which is essential in higher education and social environments, and provides universities in developing countries with inspiration for building a sustainable academic talent flow system. It is important to note that this empirical study mainly focuses on researchers and publications in the social sciences, and the behavioral pattern and impact on research outputs might be different for scholars in the natural science disciplines. Due to the limitations with regard to data acquisition, this paper has not further discussed building an international academic network, which needs more in-depth research in the future.

Keywords: university scholars; transnational or transregional mobility; sustainable research productivity; social science disciplines



Citation: Bao, C.; Zhao, X.; Li, Y.; Li, Z. How to Maintain Sustainable Research Productivity: From Talents Mobility Perspective. *Sustainability* **2023**, *15*, 11506. <https://doi.org/10.3390/su151511506>

Academic Editors: Michela Cortini, Stefania Fantinelli, Teresa Galanti and Ferdinando Toscano

Received: 9 June 2023

Revised: 19 July 2023

Accepted: 20 July 2023

Published: 25 July 2023



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1. Introduction

The competition among countries is ultimately the competition for talents. Talents are the key to innovation and the development of science and technology. Sustainable talents and their productivity are fundamental for the sustainable development of a society and play an important role in maintaining future sustainability for technologies, resources, and environmental and social productivity. With the globalization of the knowledge economy, academic talents' transnational or transregional migration has gradually become an important way for emerging countries to be deeply involved in international scientific developments and narrow the gap between their scientific research levels and those of developed countries [1]. An individual's transnational or transregional mobility is one of the most important channels for the flow of knowledge and technology among countries. In these exchanges, developing countries send their scholars to developed countries for further

study or exchange visits so that they can have access to the advanced scientific systems and technological knowledge of developed countries. The traveling scholars' return to their home countries helps to improve the future research and innovation capabilities of developing countries [2]. Within this context, many countries have taken active measures to send their scholars abroad or cross-regionally and to attract overseas scholars to return by implementing various talent policies, plans, and systems, such as the Erasmus+ program of the European Union, the Spanish "Ramón y Cajal" program, and the JANUS project [3]. Such programs can bring the intellectual capital and international cooperation network of researchers back into the scholar's home country so that, on the one hand, "brain circulation" can be carried out to improve the level of scientific research and innovation in the country; on the other hand, "ties circulation" can be achieved to strengthen international knowledge exchange and cooperation [4].

The sustainable development of skills and the sustainability of society are intertwined. With the largest number of overseas scholars and students in the world, the Chinese government introduced a series of policies to attract talents from abroad that began in the 1980s, such as the "National Science Fund for Distinguished Young Scholars", the "Hundred Talents Program", the "Changjiang Scholars Program", the "National Thousand Talents Plan", and the "National Youth Thousand Talents Plan" [5]. By the end of 2018, the total number of Chinese students and scholars studying abroad was about 5,851,700, of which around 3,651,400 individuals chose to return to China after completing their studies or visits [6]. Given these data, we are interested in investigating the effect of attracting overseas scholars back to their home countries: does the return of overseas scholars further contribute to the academic atmosphere at universities? Does it further improve the quantity and quality of research output and the volume of international co-authorships? Such questions have been discussed in the literature, but the relevant research mainly focuses on the natural science disciplines, while the effect of introducing talents in social science fields, such as finance and economics, has not been clearly determined. The sustainable development of talents focuses on how to properly treat academic talents and scholars, including training, recruitment, and motivation. Maintaining high-level research productivity, together with constantly increasing the outputs and extending academic career length of talents, will lead to a sustainable system of talent flows.

This paper focuses on the impact on scientific research outputs introduced by the transnational flow of social science scholars. We selected a top-level research university in China concentrating on the social sciences as the research sample and conducted qualitative and quantitative analysis on members of the research faculty who have been employed by the university since 2008. Based on econometric analysis, we attempted to answer the following questions: Does the recruitment of scholars with mobility experiences improve their scientific research output? What is the specific impact on the quality and quantity of scientific research outputs in colleges and universities? Do scholars with mobility experiences strengthen international academic collaboration and increase the chances of co-authored papers appearing in international journals? Will different mobility destinations affect scholars' scientific research output? Based on the results of the discussion, in the perspective of talent sustainability, this paper attempts to summarize the possible problems and issues that should receive attention when recruiting scholars with mobility experiences, to provide ideas and empirical experience for developing countries and their universities when evaluating scholars with mobility experiences in combination with their own disciplinary characteristics, and to help universities improve their scientific research innovation ability and scientific research output.

2. Literature Review and Hypotheses Development

The research on talent mobility began in 1963, when the Royal Society found that there was a directional mobilization of scientists from Europe and other places to the United States. Since then, a significant amount of research has been carried out on this kind of "talent mobility" [7–10]. The transnational flow of talents was first referred to

as the migration of highly educated talents—that is, the behavior of scientists leaving their home countries and permanently settling in another country [11]. In the early stage of research, it is generally believed that talents move in one direction, which is from underdeveloped scientific countries to scientifically and economically developed countries and regions. However, some follow-up studies have found that with the rise in emerging economies and developing countries, a large number of immigrants in the talent groups that previously moved to other places subsequently returned to their home countries [12]. This phenomenon is called “brain circulation”, based on which the talent circulation theory was put forward [13], i.e., developing countries send their talents to developed countries for a period of training or learning and then attract them back to the home country after they complete their studies [14]. This process includes not only long-term immigration and settlement but also frequent short-term transnational mobility [15,16], during which researchers conduct research visits or study tours to establish research networks. This kind of behavior usually has a clear schedule, not necessarily short-term but also including long-term or multiple visits [17]. In this context, such mobilizing scholars (diasporas or returnees)—those who once received education, worked, or had research visits in more-developed countries—then returned to their less-developed home countries [9,18]. From the perspective of mobility timing, the mobility experience usually occurs in the advanced education stage and the early career years of scholars [19]. In view of the above research background and China’s talent policy, this paper further considers the transnational or transregional mobility of scholars, including those returning from foreign countries and from Hong Kong, Macao, or Taiwan to mainland China.

At present, the research on mobilizing scholars is mainly divided into three categories. The first category includes research on the talent policies of various countries, such as China’s “Thousand Talents Plan” and the European Union’s “Marie Skłodowska-Curie Actions”. This kind of literature mainly analyzes whether there are regional or disciplinary differences in the degree of recruitment of high-end scholars [20] and the impact of local policies after the recruitment of talent [21]. The second kind of literature is mainly aimed at motivating the mobilizing scholars to return to their home country and further discusses the factors driving their return [22]. It has been found that the mobility of scholars results from the interaction of a series of comprehensive factors, including political, economic, cultural, and geographical environments and policies [23]. Moreover, the development of science and technology has created a great information revolution. The popularity of English and the development of smart industries have reduced the cost of international communication [24], and the international scientific network has been expanding, which has facilitated the mobility of scholars in different countries [25,26]. The talent policies introduced by different countries have also greatly affected the mobility of scholars. For example, Canada and other countries have proposed to provide more convenient permanent residence channels for immigrant scientists [23]. At the microeconomics level, many studies have found that family factors, job opportunities, and interpersonal relationships have an impact on scholars’ mobility [27–29]. However, some studies also point out that the above factors are not significant enough, while factors such as career development and the construction of academic networks have a greater influence, and that transnational mobility at different career stages is decided after full consideration of personal, family, and social life aspects [30].

The third kind of research focuses on the performance and function of the mobility of scholars. It has been found that mobility can improve researchers’ scientific research productivity [31]. Scholars with mobility experiences often have greater output and stronger influence in the scientific research community; their papers are cited more frequently [32], and they tend to publish articles in journals with higher average impact factors, so the quality of scientific research output is higher [33]. More recent studies can be found in related articles [34–37]. Considering the literature, this paper proposes the following hypotheses:

H1: *Scholars with mobility experiences publish more papers.*

H2: *Scholars with mobility experiences publish papers of higher quality.*

In addition, the mobility experience often makes scholars prefer international academic collaboration. Against the current background of globalization, the improvement of a country's scientific research quality not only depends on its investment in scientific research [4] but also requires the establishment of contact with the international academic environment to grasp the latest research trends [38,39]. Scholars with mobility experiences make the establishment of this connection possible. From the perspective of social capital, people's social capital can be mainly divided into strong ties and weak ties [40], and transnational academic cooperation comes from the joint action of both ties. Specifically, the weak ties created by transnational mobilizing scholars mainly convey academic information from other countries, while strong ties may enable international cooperation through transmission mechanisms [4]. Therefore, compared with local scholars, scholars with mobility experiences are more inclined towards international cooperation, with more international partners and stronger international knowledge networks [41–43], which in turn affects their international cooperation after returning to their home countries [44]. The number of co-authored papers in international journals is one of the few concrete manifestations of the social capital of scholars, which includes scholars' intellectual capital, information capital, and physical resources [45], so the number and proportion of co-authored papers can represent the degree of international social capital movement of scholars to a certain extent. Related research also points out that scholars with mobility experiences tend to have more international joint publications [46,47], and the academic relationships they establish in foreign scientific research systems significantly affect their international cooperation and scientific research output after returning to their home countries [44]. However, some studies believe that although the mobility of scholars can help obtain international funding and expand academic networks, it does not have a significant impact on scientific research productivity [48–50]. Additionally, different research disciplines, institutions, and nationality backgrounds may lead to different mobility patterns [51], thus producing different effects. Based on this, we further introduce the following hypotheses:

H3: *Scholars with mobility experiences publish more papers in international journals.*

H4: *Scholars with mobility experiences prefer to publish with an international co-author.*

To summarize, the existing literature has researched the types, directions, influencing factors, policies, and effects of the mobility of scholars to a certain depth. Although there is literature discussing the effects of the mobility of scholars, most of the research samples are concentrated on the natural science disciplines, with little literature on the humanities and social sciences. The publication of scientific research achievements in the humanities and social sciences has some differences compared with the natural sciences due to its strong ties to social and public environments. Taking China as an example, scholars in the fields of the humanities and social sciences not only display their research results in international journals but also have a certain authority in their papers published in domestic core journals. Therefore, based on the above analysis, this paper takes professionals specialized in the humanities and social sciences in China as a sample.

3. Research Methodology

The rest of the paper is structured as follows (See Figure 1):

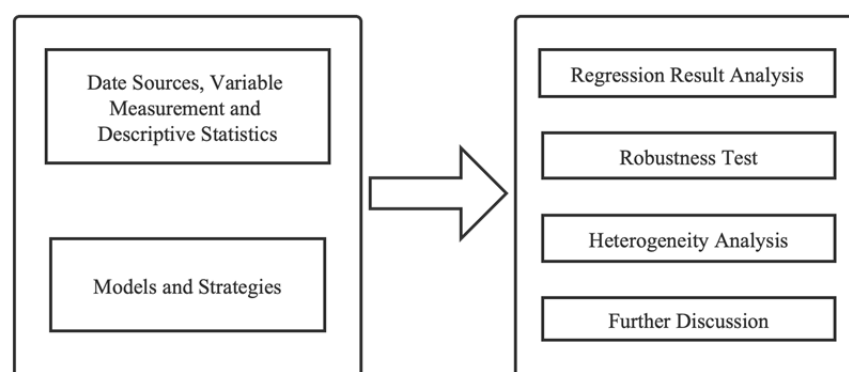


Figure 1. Research flow chart.

3.1. Data Sources, Variable Measurement, and Descriptive Statistics

3.1.1. Data Sources

The Chinese government began to implement the “Thousand Talents Plan” in 2008. Since then, a large number of researchers with overseas backgrounds have returned to the Chinese mainland. Considering that the Web of Science database was not able to match authors and their addresses one by one before 2008, this study defines the researchers in a “double-first class” university in Beijing who obtained doctoral degrees after 2008 as the research scope. On this basis, bibliometric and CV analysis methods were used to sort out the data to obtain basic information about the research sample, such as gender, graduate school, and mobility experience.

Furthermore, different from the natural sciences, the scope of research publications by scholars in the humanities and social sciences in China includes not only the journals with high impact factors in SCI and SSCI catalogs but also the Chinese Social Sciences Citation Index (hereinafter referred to as “CSSCI”) developed by the Institute for Chinese Social Sciences Research and Assessment of Nanjing University, China. In this context, this paper combines the Web of Science database and CNKI database to find all the papers of research samples in SCI, SSCI, and CSSCI citation catalogs. At the same time, in order to improve retrieval accuracy, the study learns from existing practice [4] to obtain the accurate spelling of the authors’ names and paper names of the research objects through the paper list on the personal homepage of the scholars’ universities; combines and retrieves them in the above database; and extracts information such as the nationality of the co-authors and the quality of the paper. If an author with the same name could not be matched or distinguished, the sample was abandoned. After data cleaning, the personal information of 199 scholars in social science areas was obtained.

3.1.2. Variable Measurement

Explained Variables

According to the hypothesis mentioned above, this paper sets up three explained variables: the total number of published papers (num), the quality of published papers (quality), and the proportion of internationally co-authored papers (Co_pub). Among them, the total number of published papers (num) is defined as the number of papers published by the scholar as of January 2023, which can be retrieved from the Web of Science database and CNKI database. In terms of high-quality published papers, these were defined as the number of papers published by scholars in Q1–Q3 in the JCR categories for SSCI-indexed journals and in the CSSCI citation catalog as of January 2023. Previous studies have usually chosen internationally co-authored papers as the measurement variable of international scientific cooperation [52], so this paper refers to the existing practice and defines internationally co-authored papers (Co_pub) as the proportion of the number of papers co-authored with scholars from other countries to the total number of publications. Furthermore, this paper discusses the number of international journal papers published

by scholars (F_num) separately, which is defined as the number of international papers published by scholars as of January 2023.

Explanatory Variables

Based on the above analysis and hypotheses, this paper selects three variables as the explanatory variables: whether there is a mobility experience (M_exp), the mobility phase (M pha), and the graduate school (G_sch). Among them, “whether there is a mobility experience (M_exp)” is a dummy variable. If there is a transnational or transregional visit or studying-abroad experience in the scholar’s personal CV, it is assigned a value of 1, and 0 otherwise. The “mobility phase (M pha)” is used to measure at which stage the scholar moves across the country or region. In this aspect, 3 is assigned to long-term experiences studying abroad during or before the doctoral phase, 2 is for a doctoral student’s joint training or short-term exchange experience for 6–24 months [53], 1 is for a working visit phase, and 0 is for no mobility. “Graduate school (G_sch)” is a dummy variable. If the scholar obtained their highest degree from a foreign institution, it is assigned a value of 1, and it is assigned 0 otherwise.

Control Variables

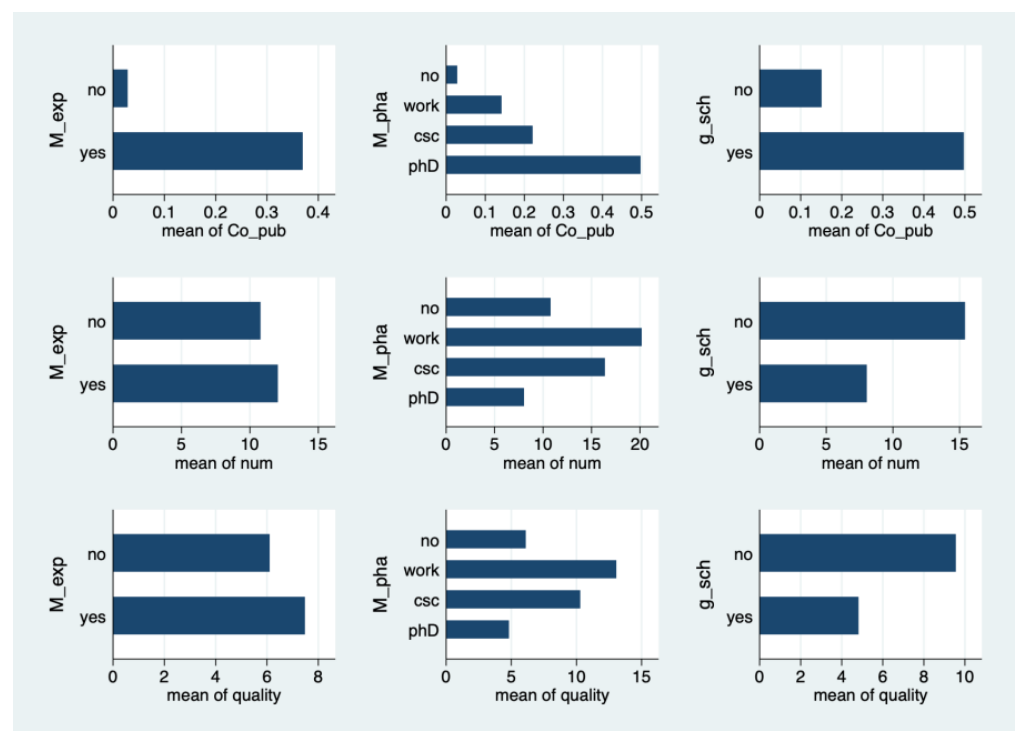
The previous literature has suggested that the length of the academic career affects scientific research publication [54], so this paper includes “academic time (ace_t)” as one of the control variables and defines the year when the scholar published his or her first academic paper as the starting year for calculating their academic career length. Moreover, the “gender” factor will also affect the research publications of researchers [55], so this paper selects the gender of scholars as one of the control variables and defines females as 0 and males as 1. In addition, whether there is funding support will have an impact on the research activities of scholars and further affect the publication of papers [56], so this paper defines “research fund (fund)” as the amount of research funds obtained by scholars. Finally, scholars’ scientific research ability often plays an important role in scientific research publication. Scholars with greater scientific research ability often have higher professional titles and academic statuses, so this paper sets “academic ability (ability)” as one of the control variables, which is assigned a value of 2 for professors, 1 for associate professors, and 0 for assistant professors and lecturers.

3.1.3. Descriptive Statistics

Combined with the previous text, the selected variables and descriptive statistics of each variable are shown in Table 1. According to their personal characteristics, the average academic career length of the 199 scholars in social sciences is about 9 years, of which about 38.2% did not receive research funds. The overall gender distribution is relatively even, with 94 females accounting for 47.24% of the total sample. The data show that 96 scholars obtained doctoral degrees from universities or research institutions overseas and in Hong Kong, Macao, and Taiwan regions. A total of 84.93% of total scholars have more than one year of overseas research experience, with short-term joint training comprising the vast majority of such experiences. Based on Figures 2 and 3 as shown below, the proportion of internationally co-authored papers published by scholars with mobility experiences is higher, and scholars with doctoral degrees in foreign or special administrative region universities are more inclined to publish internationally co-authored papers. In terms of the quantity and quality of the published papers, the total number of papers and high-quality papers published by scholars who have exchange experiences or joint training experiences during their working phase are relatively large, but the quality and quantity of papers published by scholars who studied in non-domestic universities during their doctoral years are not outstanding. This is probably because the assessment system of scholars’ professional titles in China includes not only SCI and SSCI journals but also journals in the CSSCI catalog. Scholars who pursue doctoral degrees in non-domestic universities tend to publish papers in SCI and SSCI journals instead of CSSCI journals in China.

Table 1. Descriptive statistics of main variables.

Variables		Mean	Standard Deviation	Min	Max	Value Description
Dependent variables	num	11.8442	12.0047	1	101	Total number of published papers
	quality	7.2663	8.1019	0	70	Quality of published papers
	Co_pub	0.3179	0.2735	0	1	Internationally co-authored papers i.e., the proportion of the number of co-authored papers to the total number of published papers
	F_num	6.2613	8.7676	0	89	Number of internationally published papers
	M_exp	0.8492	0.3587	0	1	With or without a mobility experience With = 1; Without = 0
Independent variables	M_pha	2.0905	1.0833	0	3	Mobility phase During and before the doctoral phase = 3; PhD joint training = 2; Working phase = 1; None = 0
	G_sch	0.4824	0.5010	0	1	Graduate school The university where the highest degree is obtained is located abroad = 1; If not = 0
	ace_t	8.9849	4.4682	1	24	Academic time From the year when the first academic paper is published to 2023
Control variables	ace_t ²	100.5930	95.5518	1	576	Square of the academic time
	gender	0.5276	0.5005	0	1	Gender Female = 0; Male = 1
	fund	1.2462	1.3275	0	6	The amount of funds received
	ability	0.8040	0.7764	0	2	Academic ability Professor = 2; Associate professor = 1; Lecturer = 0

**Figure 2.** Scientific research publication distribution of scholars with different mobility characteristics.

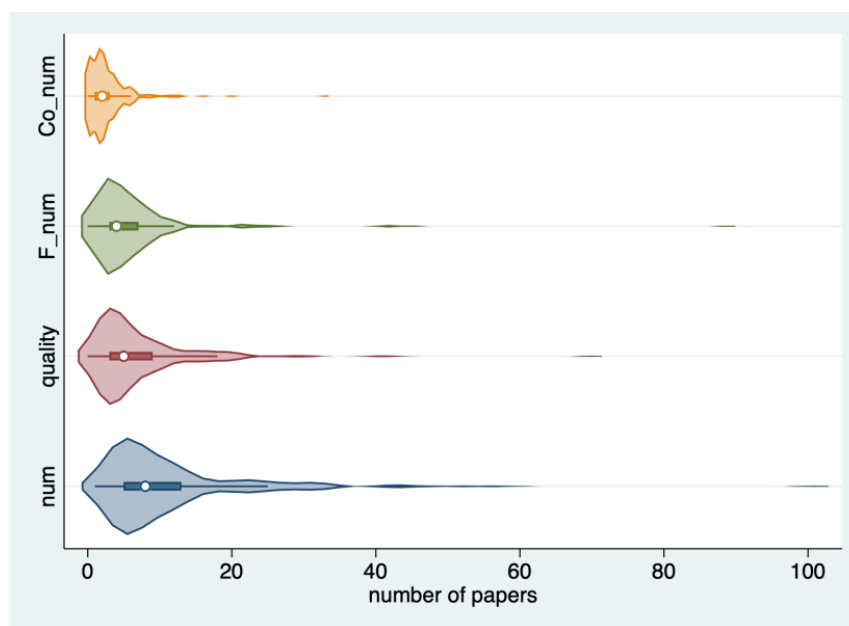


Figure 3. Violin plot of the indicators of scientific research publications.

3.2. Models and Strategies

The explained variables of this paper are the “Number of papers published”, “Quality of papers published”, and “Co-authored papers”, among which the “Number of papers published” and “Quality of papers published” are counting variables, and the negative binomial model is adopted for the above-explained variables because of the high dispersion of the sample data. It is also assumed that y_i is the frequency of events occurring per unit time.

$$\ln(\hat{y}_i) = \log(n_i) + \beta_0 + \beta_1 X_{i1} + \cdots + \beta_m X_{im} + \log k_i$$

Since the variable “Co-authored papers” is presented in the form of a percentage, whose value is between 0 and 1, the bilaterally merged Tobit model is adopted, in which $u_i \sim N(0, \sigma^2)$.

$$y_i^* = \beta' x_i + u_i$$

$$y_i^* = \begin{cases} y_i, & \text{if } y_i^* > 0 \\ 0, & \text{if } y_i^* \leq 0 \end{cases}$$

$$y = \max(0, \beta' x_i + u_i)$$

4. Results and Analysis

4.1. Regression Result Analysis

Table 2 and Figure 4 illustrate the corresponding impacts of the three explanatory variables, i.e., M_{exp} , M_{pha} , and G_{sch} , in terms of both the total number (num) and the quality of published papers, and Table 3 demonstrates the influence of the above explanatory variables on Co_{pub} in the bilaterally merged Tobit model. The result of Model (1) shows that having mobility experiences does not exert a significant influence on the total number and quality of a scholar’s published papers. Meanwhile, data relating to M_{pha} and G_{sch} show that the explanatory variable coefficients of Model (2) and Model (3) are both negative and significant—that is, the earlier mobility phase of scholars or their overseas graduate school studies will have a negative impact on the number and quality of the produced papers. Therefore, Hypothesis 1 and Hypothesis 2 are invalid. On this basis, this paper further discusses the impact of scholars’ mobility experiences on the number of published international papers (F_{num}). According to the results in Table 4, the

three main explanatory variables are all significant at the level of 1%, which indicates that scholars' mobility experiences and their overseas graduate school where they obtained the highest academic degree have a significant positive impact on the number of published international papers. Furthermore, the earlier the scholars' mobility phase is, the more international papers are published, which confirms Hypothesis 3.

Table 2. Results of baseline regression on the number and quality of papers published.

Variables	Num						Quality					
	(1)		(2)		(3)		(1)		(2)		(3)	
	a	b	a	b	a	b	a	b	a	b	a	b
M_exp	0.1114 (0.78)	0.0382 (0.35)	-	-	-	-	0.2031 (1.29)	0.0960 (0.80)	-	-	-	-
M pha	-	-	-0.1929 ** (-3.39)	-0.0743 ** (-2.23)	-	-	-	-	-0.1918 ** (-3.11)	-0.0698 * (-1.95)	-	-
G_sch	-	-	-	-	-0.6509 *** (-4.86)	-0.3824 *** (-3.69)	-	-	-	-	-0.6857 *** (-4.68)	-0.4129 ** (-3.36)
ace_t		0.1153 ** (3.20)		0.1088 ** (3.01)		0.0882 ** (2.61)		0.1420 ** (3.39)		0.1319 ** (3.12)		0.1090 ** (2.63)
ace_t ²		-0.0029 ** (-1.96)		-0.0028 * (-1.83)		-0.0021 (-1.47)		-0.0041 ** (-2.24)		-0.0039 ** (-2.03)		-0.0032 * (-1.65)
gender		0.3202 ** (3.15)		0.3079 ** (3.13)		0.3059 ** (3.50)		0.3405 ** (3.11)		0.3289 ** (3.08)		0.3302 ** (3.46)
fund		0.2236 *** (5.12)		0.2176 *** (5.04)		0.2041 *** (4.84)		0.2587 *** (6.30)		0.3541 *** (6.22)		0.2371 *** (5.90)
ability		0.1709 ** (2.06)		0.1890 ** (2.29)		0.2082 ** (2.61)		0.2128 ** (2.31)		0.2397 * (2.56)		0.2737 ** (2.94)

Z-values in parentheses. ***, **, and * are significant at the level of 1%, 5%, and 10%, respectively.

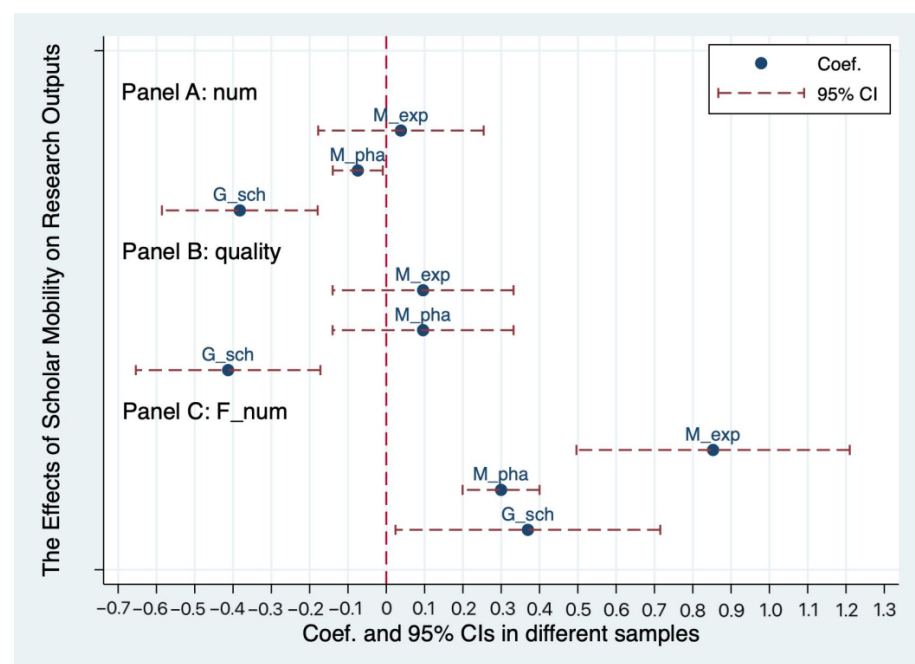


Figure 4. Forest map of basic regression coefficients.

Table 3. Results of baseline regression on the proportion of co-authored papers.

Variables	Co_pub					
	(1)		(2)		(3)	
	a	b	a	b	a	b
M_exp	0.6443 *** (7.77)	0.6176 *** (8.05)	-	-	-	-
M_pha	-	-	0.2333 *** (11.70)	0.2168 *** (10.87)	-	-
G_sch	-	-	-	-	0.4128 *** (10.77)	0.2168 *** (10.87)
ace_t		-0.0212 (-1.13)		-0.0070 (-0.43)		-0.0070 (-0.43)
ace_t^2		0.0003 (0.33)		0.0001 (0.15)		0.0001 (0.15)
gender		-0.0337 (-0.83)		-0.0428 (-1.19)		-0.0428 (-1.19)
fund		-0.0385 * (-1.87)		-0.0267 (-1.46)		-0.0267 (-1.46)
ability		-0.0054 (-0.14)		-0.0021 (-0.06)		-0.0021 (-0.06)

Z-values in parentheses. *** and * are significant at the level of 1% and 10%, respectively.

Table 4. Results of baseline regression on number of international publications.

Variables	F_num					
	(1)		(2)		(3)	
	a	b	a	b	a	b
M_exp	0.9506 *** (4.80)	0.8531 *** (4.69)	-	-	-	-
M_pha	-	-	0.2424 *** (3.72)	0.2996 *** (5.85)	-	-
G_sch	-	-	-	-	0.2086 (1.02)	0.3696 ** (2.10)
ace_t		0.0938 * (1.74)		0.1179 ** (2.18)		0.1171 ** (2.08)
ace_t^2		-0.0046 * (-1.68)		-0.0053 ** (-1.99)		-0.0055 * (-1.95)
gender		0.3664 ** (2.50)		0.3917 ** (2.58)		0.3720 ** (2.43)
fund		0.1339 ** (2.00)		0.1482 ** (2.23)		0.1521 ** (2.10)
ability		0.2691 ** (2.22)		0.2810 ** (2.24)		0.2882 ** (2.19)

Z-values in parentheses. ***, **, and * are significant at the level of 1%, 5%, and 10%, respectively.

As for co-authored papers, Hypothesis 4 indicates that scholars with mobility experiences prefer to publish internationally co-authored papers, which is supported by the results shown in Table 3, where the three main explanatory variables, M_exp, M_pha, and G_sch, all exert a significant positive effect on the explained variable Co_pub. It is easy to see from the control variable that scholars produce fewer internationally co-authored papers as their academic age increases and academic ability enhances. This may be because that scholars with certain academic achievements are more likely to build their own academic teams and gradually turn from external cooperation to cooperation within the team.

4.2. Robustness Test

This study mainly adopts three methods to test the robustness of the above results.

First, this paper attempts to use the Poisson model to re-evaluate the impact of scholars' transnational or transregional mobility on the total number (num) and the quality of published papers, since the two variables are both counting variables. A box plot is drawn based on the two variables, num and quality (See Figure 5), and then the data are winsorized due to the abnormal data in Figure 2. On this basis, under the condition that the core explanatory variable and other variables remain unchanged, the results obtained by changing the regression model are basically consistent with the baseline regression.

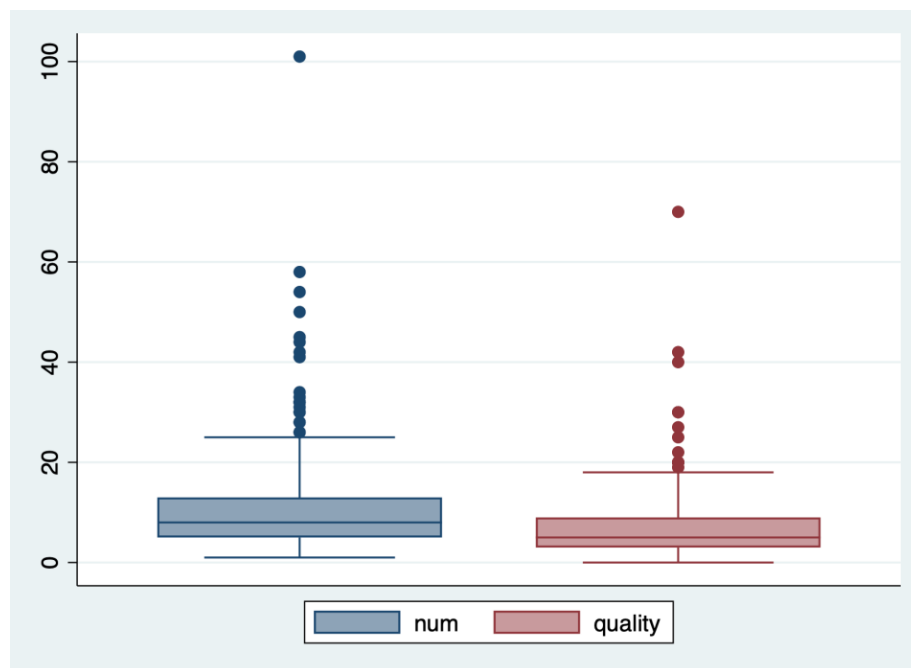


Figure 5. Box plots of the total number and quality of published papers.

Second, for the variable Co_pub and the variable F_num, this paper attempts to carry out regression by substituting core explanatory variables. Co_pub is substituted with Co_pub2 and defined as “the proportion of the number of co-authored papers to the total number of international papers”. For the variable F_num, “the proportion of the number of international papers to the total number of papers” is used in this paper to construct F_num2, an international paper publication index, in the robustness test. By using substitution variables to repeat the regression steps of the aforementioned bilaterally merged Tobit model while keeping other conditions unchanged, the results obtained are the same as the original results.

Third, given that deciding whether to publish papers in international journals is up to scholars' self-selection, which may cause sample self-selection problems, this paper adopts propensity score matching to study the publication of papers in international journals among non-mobile scholars with similar characteristics to test whether transnational or transregional mobility has a robust influence on the number of scholars' papers published in international journals. Three propensity score-matching methods, i.e., kernel matching, nearest-neighbor matching, and caliper matching, are adopted in this paper, of which ATT values all passed the test at the significance level of 10%. The conclusions obtained by the different matching methods are basically the same—that is, after using propensity score matching to reduce sample selection bias, having mobility experiences still has a significant positive impact on scholars' publications in international journals, and the basic regression result is robust.

4.3. Heterogeneity Analysis

In many cases, people's innate characteristics (gender) influence their personality, mindset, etc. Meanwhile, different genders introduce different motherhood penalty effects, which lead to differences between different gender groups. Therefore, this paper conducted a heterogeneity analysis of the gender of scholars.

As shown in Table 5, M_pha has a more significant negative effect on the total number and quality of published papers for male scholars, while there is no significant effect for female scholars. That is to say, female scholars who gained the highest academic degree in an overseas school prefer to publish papers in international journals, while male scholars are not significantly affected by their graduate school.

Table 5. Heterogeneity analysis results (by gender).

Variables	Num		Quality		Co_pub		F_num	
	Male	Female	Male	Female	Male	Female	Male	Female
M_exp	0.0232 (0.16)	0.0502 (0.30)	0.1262 (0.80)	0.0393 (0.18)	0.6903 *** (6.00)	0.5275 *** (4.98)	0.8640 *** (3.59)	0.7603 ** (2.74)
M_pha	−0.1044 ** (−2.34)	−0.0406 (−0.76)	−0.0875 * (−1.84)	−0.0538 (−0.85)	0.2226 *** (7.39)	0.2117 *** (7.94)	0.2243 ** (3.22)	0.4289 *** (4.93)
G_sch	−0.5669 ** (−3.37)	−0.2102 ** (−2.19)	−0.6024 ** (−2.87)	−0.2332 ** (−2.30)	0.3783 *** (5.83)	0.3759 *** (7.92)	0.0621 (0.24)	0.7619 *** (4.99)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	105	94	105	94	105	94	105	94

Z-values in parentheses. ***, **, and * are significant at the level of 1%, 5%, and 10%, respectively.

4.4. Further Discussion

Existing studies suggest that Western Europe and North America have always been the regions attracting the most scholars across all academic fields [48]. For example, about 60% of postdoc scholars in the United States hold temporary visas [57]. In addition, these regions attract scholars in developing countries as well as those in developed countries [32]. Why do these regions have such great talent attraction? We are interested in whether researchers' travels to such countries and regions lead to higher productivity or efficiency in scientific research publication.

To address the above questions, this study, based on the previous analysis, attempted to further examine the impact of scholars' mobility destinations on their scientific research publications (See Figure 6). The variable M_area was constructed (see Table 6) to discuss its respective impact on the total number of published papers, quality of published papers, proportion of co-authored papers, and the number of papers published in international journals. As shown in Table 7, when scholars move to North America and Europe, the proportion of co-authored papers and the number of published international papers skyrocket, which may result from the different scientific research environments of the regions. There are more high-level scientific research institutions in Europe and America than in other regions, which provides scholars with more opportunities for international cooperation, thus facilitating more international scientific research cooperation and more papers published in international journals.

Table 6. Descriptive statistics of variables.

Variables	Mean	Standard Deviation	Min	Max	Value Description
M_area	2.1055	1.1564	0	3	Transnational mobility destinations North America = 3; Europe = 2; Other regions = 1; No flow = 0

Table 7. Results of regression.

Variables	Num		Quality		Co_pub		F_num	
M_area	0.0118		0.0259		0.1148 ***		0.1877 **	
	(0.29)		(0.55)		(5.61)		(2.95)	
Other variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Z-values in parentheses. *** and ** are significant at the level of 1% and 5% respectively.

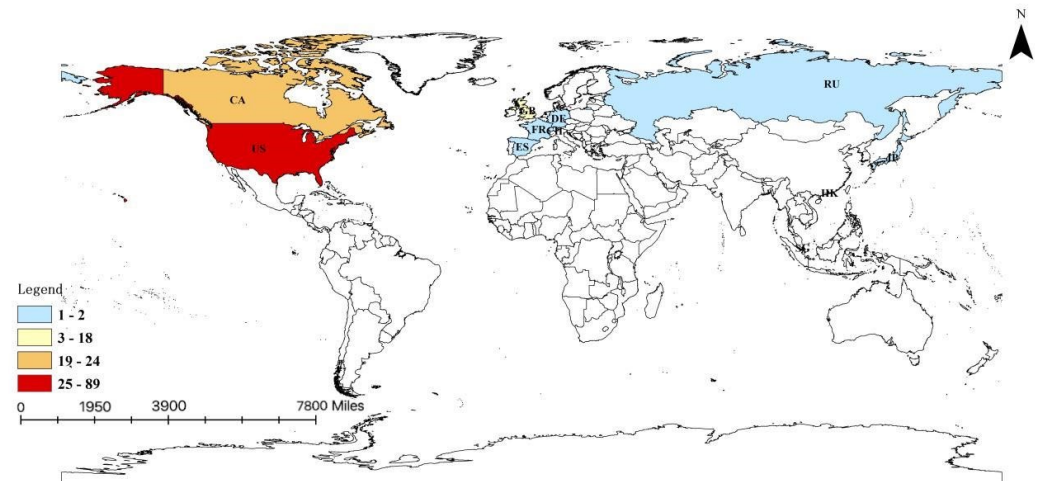


Figure 6. Distribution of scholars' transnational mobility destinations. Note: Sample flow countries and regions mainly include the United States, the United Kingdom, Germany, France, Spain, Japan, Singapore, Canada, Hong Kong, Macao, Russia, and Switzerland. Because the sample size of some countries was too small when the empirical analysis was conducted according to country classification, in order to ensure the validity of the empirical results, we classified these countries and classified the United States, Canada, and other countries into North America. The United Kingdom, Germany, France, Russia, Spain, Switzerland, etc., were classified as part of the European region. The rest of the countries, such as Japan, Hong Kong, Singapore, and Macau, were uniformly classified into other regions.

5. Conclusions and Significance

The keys to innovations and advances in a society are talents and a sustainable system for talent flows. Based on the social capital theory, we adopted CV analysis methods, econometric analysis models, and other methods to explore—from the perspective of social science—the efficiency of scientific research output produced by the circulation of scholars in the field of social science disciplines. The findings are summarized below.

First, the basic regression result denies Hypothesis 1 and Hypothesis 2. Such a phenomenon may result from the diversified channels involved in publishing social science papers. The diversified channels of publication, domestic or international journals, reduce the efficiency of producing papers with transnational communication. Second, this paper further discusses the impact of mobility experiences on the number of published papers in international journals and internationally collaborating papers. The empirical results corroborate Hypothesis 3 and Hypothesis 4 and coincide with previous research results [44,46]. The analysis further shows that in view of the mobility phase, scholars who move to other countries through joint training programs in the doctoral stage produce more co-authored papers than scholars who spend the whole doctoral stage in foreign countries. This may result from the particularity of research in social sciences—that is, such research often requires knowledge of special aspects of political, social, cultural, and environmental backgrounds. Joint training programs enable scholars to acquire internationally advanced research methods while becoming more familiar with the local or domestic social background of their home countries. Moreover, heterogeneity analysis indicates that graduate school exerts a significant effect on the number of papers published by female scholars in international journals. In other words, female scholars who obtained their

highest academic degree in an overseas school preferred to publish papers in international journals, but there was an insignificant effect on their male counterparts. Third, this study attempted to further discuss whether different mobility destinations affect scholars' scientific research outputs. It was found that when scholars moved to North America and Europe, the proportion of co-authored papers and the number of published international papers dramatically increased. This may be because the above regions often have more advanced scientific research systems, thus creating more opportunities to cooperate with top international scholars.

These findings are of certain significance for colleges and universities in developing countries and can be used to formulate talent-training and -recruiting plans. The previous studies relating to brain gain in the natural sciences often proposed that transnational or transregional mobility experiences can significantly enhance the productivity of scientific research and lead to a larger quantity and higher quality of published papers [32,58]. Meanwhile, for social science-related disciplines, transnational mobility experiences may not affect the total number of published papers or the overall quality, but they will affect the number of papers published in international journals and co-authored international papers. This also confirms the conclusion of existing literature that travel experience will break the original cooperation network and help build a new online cooperation pattern [34,47]. Such findings indicate mobility experiences are an important driving force in expanding academic networks and strengthening international cooperation in both the natural sciences and the social sciences, which partly responds to the academic debate that brain gain will not dramatically affect the overall scientific research productivity but exert a significant influence on the establishment and expansion of international cooperation and the academic network. Moreover, this study found that transnational or transregional mobility through a joint training doctoral program or postdoctoral program may introduce the advantages of international cooperation to future scientific research because social science research often has specific social, political, and cultural backgrounds.

The novelty of this study lies in using scholars' mobility experiences, mobility phase, graduate school, and mobility destination as indices to analyze scholars' scientific research output effect in multiple dimensions, from the perspective of talent sustainability, which complements previous relevant studies and provides a reference for colleges and universities in developing countries to train or recruit talents in social science-related disciplines and to build a sustainable developing system for talent flows. Meanwhile, there are also some limitations in this study. To be specific, this paper mainly adopts a CV analysis method while collecting data as samples from the previous talent databases, which are mainly scholars in the natural sciences, and extracts necessary data from scholars' public resumes on official websites. This method required a heavier workload but acquired fewer effective data, leading to a limited total number of samples. In the future, there might be further discussion on whether academic networks are built in the international community after scholars travel due to the limitation of data acquisition and whether online learning and blended learning introduced by the post-pandemic era will change the cross-border mobility of scholars.

Author Contributions: C.B. contributed to the conception and design of the study, organized the database, performed the statistical analysis, and wrote the first draft of the manuscript. X.Z. contributed to the manuscript's resources, revision, methodology, and approved the submitted version. Y.L. validated the statistical analysis and visualized and revised sections of the manuscript. Z.L. contributed to manuscript's investigation, supervision, project administration, and approved the submitted version. All authors have read and agreed to the published version of the manuscript.

Funding: This research is supported by "the Fundamental Research Funds for the Central Universities" in UIBE, with grant number: 20QN04, and "Funds for the Graduate Think Tank Project of Beijing Open Economy Research Institute" in UIBE, with grant number: 2023YJS05.

Institutional Review Board Statement: This article does not contain any studies with human participants or animals performed by any of the authors.

Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Data Availability Statement: The labeled data set used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest: The authors declare no conflict of interest.

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