Back on track: Factors influencing returnee scholars' performance in reintegration process

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Abstract: Various resources and policies have been pooled by Chinese universities to attract and retain overseas talents, making return migration of academics a common phenomenon in contemporary China. Although previous studies have identified some institutional factors causing reintegration problems upon overseas scholars' return, very few studies have focused on returnee scholars' reintegration process itself. Using a unique sample of 249 returnee scholars retrieved from Changjiang Scholars Program in the fields of natural and life sciences, this study examines the impact of returnees' transnational capital on their performance in reintegration process. We find that established returnee scholars are more likely to have gap periods and reductions of research quality during the post-return period than other groups of returnees. However, established returnees tend to have smaller research quality reduction than other returnees. We also find that returnees with higher pre-return research quality or longer years of overseas experiences are less likely to have a successful reintegration process. Our findings provide implications for Chinese universities to make policies regarding returnee talents' recruitment, retaining and evaluation.

Key words: return migration; transnational capital; reintegration; research quality; China

1. Introduction

Scholars with overseas experiences have been considered as important academic resources in Chinese universities. To compete for overseas faculty, various government-run talents programs and favorable polies have been used by Chinese universities to attract and retain overseas talents. Meanwhile, Chinese universities also encourage domestic scholars to go abroad for further training via visiting scholars programs or postdoctoral programs. By writing the ownership of at least one year overseas experience into the basic requirement of faculty promotion, Chinese universities, especially those state key universities, are pushing junior faculty with domestic PhD degrees to study and work at a foreign institute for at least one continuous year(Zeng and Qiu 2016). The enthusiasm for scholars with overseas experience not only derives in Chinese universities' ambition of achieving academic excellence, but also results from the national academic rating system. One typical example is the national evaluation of Chinese universities' disciplines implemented by China Academic Degrees and Graduate Education Development Center (CDGDC). In the most recent 2016 evaluation, CDGDC used the number of faculty members who have overseas experiences lasting for at least ten months as an indicator of faculty strength and internalization(CDGDC 2016). This will lead to increasing efforts to send out domestic scholars and bring back overseas scholars in Chinese universities.

Both Chinese government and universities have made sustainable investments to reverse the brain drain, and thus caused a rapid increase in the return migration of overseas scholars. To date, faculty members with overseas experiences have constituted a large proportion of total faculty counts in Chinese universities, especially those state-owned research universities(Shi 2015; Welch and Jie 2013). According to the 2014 Faculty Survey conducted by Huazhong University of Science & Technology, two thirds of faculty members in Chinese universities have been abroad at least once(Shen 2016). Furthermore, both the administrative and academic leadership positions in state key universities have been dominated by returnees. 78% of university presidents working at key universities under direct administration of Ministry of Education(MOE) have at least one-year overseas experience, and 72% of the directors of state key research laboratories are returnee scholars as well(Chen 2012).

Along with the speeded up growth of overseas scholars returning to work at Chinese universities, there has been an increasing amount of scholarly investigation of the performance of returnee scholars over the last two decades. Overall, the studies of returnee scholars have focused on three topics: motivations to return, post-return status and impact of returnees(Hao et al. 2017). Regarding the post-return status of Chinese returnee scholars, a few studies have investigated their post-return performance in research impact(Chen et al. 2015; Jonkers and Tijssen 2008; Tian 2016; Wu 2015), international collaboration(Jonkers and Tijssen 2008; Li et al. 2015; Velema 2012; Yang et al. 2015), career advancement(Lu and McInerney 2016) and teaching skills(Choi and Lu 2013; Zweig et al. 2004). Among these studies, many aimed to reveal perceived value of overseas experience by examining performance differentials between returnees and locals(Hao et al. 2017), while to our best knowledge, very few studies focused on the changing academic performance during the entire process of return mobility. Though some studies have claimed that returnee scholars may face challenges of reintegration into domestic academic community(Chen and Li

2013; Hao et al. 2016), we know little about both the reintegration process and factors of a successful reintegration. It is also reported that overseas scholars tend to have transitional periods during the first few years upon return(Chen and Li 2013), when they usually have a hard time to fully utilize their transnational capital accumulated through years of overseas experiences. However, there has been little attention to the evaluation of the utilization of transnational capital after scholars' return from overseas. Our study aims to fill some of these research gaps by examining the factors behind changing dynamics of returnee scholars' academic performance.

We base our empirical examination on a group of extinguished returnee professors recruited by one of China's flagship talents program (Changjiang Scholars Program). We investigate how returnee professors change their research quality before and after their return. Various personal characteristics have been included to test who tend to have a successful reintegration process in which returnee scholars face the least loss of transnational capital. Our study offers two main contributions to the literature. On first hand, by tracking the changes in research quality, we try to give a better understanding of the reintegration process of returnee scholars. On the other, we offer a new angle to evaluate returnee performance. Rather than proving the superiority of returnee scholars by comparing the post-return performance of returnees to that of locals, we propose a few new measures to evaluate returnee scholars' performance in reintegration process.

The rest of this article proceeds as follows: **Section 2** will review the relevant literature and present the research gap; In **Section 3** we introduce the data resource; **Section 4** defines a list of measures and proposes a set of hypotheses followed by descriptive statistics; Later, our empirical results are presented in **Section 5**, and finally, the discussion and conclusion is given in **Section 6**.

2. Literature

2.1 Researcher mobility and academic performance

The mobility of researchers is becoming significant for the development of individual academic career as well as overall research system(Fernández-Zubieta et al. 2015). Researchers accumulate both human capital and social capital through moving across countries and moving between institutions(Horta and Yonezawa 2013; Jacob and Meek 2013). Mobility helps a researcher build a diverse background, which brings more benefits than detriments to researchers in the advancement of academic careers(Morano‐Foadi 2005). In a broader sense, by connecting academic resources worldwide, researchers' mobility helps create an open and collaborative culture in modern research system(Trippl 2013).

The rising awareness of scientific mobility has led to a surge of scholarly investigation. Apart from the intention of mobility(Fontes 2007; Netz and Jaksztat 2016), the primary stream of literature focuses on the impact of mobility. Scrupulous attention has been paid to the impact of scientific mobility on researchers' earnings(Barbezat and Hughes 2001; Saarela 2015), career trajectory(Lu and McInerney 2016; Lutter and Schröder 2016), and academic performance, such as performance in research production(Bolli and Schläpfer 2015; Fernandez-Zubieta et al. 2013), research impact(Bäker 2015; Halevi et al. 2016), research collaboration(Jacob and Meek 2013; Scellato et al. 2015) and knowledge transfer(Edler et al. 2011). Considering the theme of our study, we will only review extant literature with regard to the relationship between researcher mobility

and academic performance (mainly research production and impact).

First and foremost, types of mobility matter and different mobility patterns may exhibit different impact on academic performance(Geuna et al. 2015). The typology of researcher mobility has been discussed in several studies. Unlike educational mobility (mobility of students), researcher mobility usually refers to job-to-job mobility of researchers after the completion of a PhD(Aksnes et al. 2013). Fernández-Zubieta et al. (2015) have proposed a most comprehensive classification. According to different definitions of changes, they have identified five types of researcher mobility as follows: occupational mobility (change of professional status), sectoral mobility (mobility between university and business), geographic mobility (change of location), social mobility (change of social status) and disciplinary mobility (change of research direction). Some of these mobility types can be broken down into smaller categories. For examples, some scholars further distinguished occupational mobility between voluntary mobility and forced mobility, where forced mobility is referred to mobility before researchers' getting permanent positions while voluntary mobility is the one after permanent positions(Fernández-Zubieta et al. 2015; Geuna et al. 2015). As for geographic mobility, international mobility across counties and mobility inside countries have been discussed respectively(Bäker 2015; Cruz-Castro and Sanz-Menéndez 2010). Meanwhile, by measuring the prestige of affiliated universities (or departments) both before and after mobility, some other studies have recognized social mobility as upward mobility and downward mobility(Allison and Long 1990; Bolli and Schläpfer 2015; Fernandez-Zubieta et al. 2013; Fernández-Zubieta et al. 2016).

To date, there have been mostly mixed evidences on the relationship between mobility and academic performance. Some scholars reported that mobility increased research productivity and quality(Aksnes et al. 2013; Horta and Yonezawa 2013), while some other found that the impact of mobility on research productivity and quality was insignificant(Bolli and Schläpfer 2015; Fernandez-Zubieta et al. 2013; Fernández-Zubieta et al. 2016; Rotolo and Messeni Petruzzelli 2013). When we look at some specific mobility types, results can also be bewildering. Most studies have reached the same conclusion that international mobility has positive impact on both research productivity and quality(Aksnes et al. 2013; Jonkers and Cruz-Castro 2013; Jonkers and Tijssen 2008; Yamashita and Yoshinaga 2014). However, a few other scholars have reported different results. Gibson and McKenzie (2014) found that return migrants in three island countries didn't have greater research impact than locals without overseas experiences. Halevi et al. (2016) analyzed top producing scholars in seven disciplines and noticed that mobility inside countries rather than international mobility had positive impact on research productivity and quality. Similarly, inconclusive evidences are presented in studies about upward mobility and downward mobility. An early study found that upward mobility increased both research productivity and impact while downward mobility had opposite effects(Allison and Long 1990). Bolli and Schläpfer (2015) had similar but different findings. In their study, upward mobility and downward mobility had similar opposing effects on research productivity; however, both effects were statistically insignificant. Recently, Fernández-Zubieta et al. (2016)'s study found upward mobility had positive impact on research productivity while its impact on research impact was insignificant.

Apparently, in order to clarify the ambiguous results yielded by past literature, more empirical studies need to be done about the impact of mobility on researchers' academic performance. Most importantly, existing studies have been largely targeted at researchers from

western countries. Since researchers from different countries usually exhibit different academic behavior(Scellato et al. 2015), it's hard to tell whether Chinese researchers have similar effects to researchers from other countries. No doubt, more empirical evidence gathered from Chinese researchers will add valuable insights to the current discussion.

2.2 Return migration and reintegration

As one particular type of geographic mobility, return migration usually refers to the phenomenon that people move back to work at their country of origin after spending a period of time in another country(Gill 2005; Xiang 2014). The returns of academics have been reported to be the most visible returnees in China(Wang et al. 2015). Beyond the consensus on the significance of return migration in reducing brain drain in home countries, increasing studies have focused on barriers to return intention(Cao 2008; De Haas and Fokkema 2011; Ma and Pan 2015) and challenges facing returnees during their post-return period(Chen 2016; Gill 2010; Hao and Welch 2012; Hao et al. 2016). Reverse culture shock and intercultural reintegration have been claimed as the biggest challenges for returnee talents(Hao et al. 2016; Szkudlarek 2010). In some early interviews, Hao and coauthors found that high-skilled returnees usually had an incomplete and narrow understanding of Chinese culture, which inhibited a successful reintegration(Hao and Welch 2012; Hao et al. 2016). Particularly, the cultural differences between China and western countries manifest themselves in guanxi networks (networks based on interpersonal relationship) heavily embedded in Chinese society(Cao 2008; Gill 2016) and different thinking styles influenced by traditional Chinese culture(Hao and Welch 2012). Recently, Chen (2016, pp65-74) pinpointed two major issues facing Chinese academic returnees during the reintegration process. One is the bureaucratic governance structure of Chinese universities and problematic academic system (e.g., evaluation and funding policies, quantity-oriented research culture), and the other is local politics and complicated interpersonal relationships.

The above-mentioned literature has clarified some facts of reintegration issues. On one hand, scholars have confirmed the existence of reintegration during the process of return migration, and major challenges facing Chinese returnees in the reintegration process have been identified. On the other, scholars have expressed unanimous view that a successful reintegration depends on how returnees manage to balance and integrate cultural differences between the sending countries (where they had overseas experiences) and the home countries(Franken et al. 2016; Gill 2016; Hammer et al. 2003).

Based on the classic U-curve theory, process of intercultural adjustment comprises of four distinctive phases: (1) state of euphoria in which a feeling of excitement about a new environment is experienced; (2) state of culture shock caused by surprising, mostly negative feelings; (3) state of acculturation in which people learn to adapt to the new environment; and lastly, (4) a stable state when a successful reintegration is achieved(Oberg 1960). As a specific form of intercultural adjustment, does the reintegration process of returnee scholars also have similar stages? If so, how do academic returnees behave in these different stages of reintegration process? Unfortunately, answers to these questions are unclear. Existing studies have mostly centered on explaining why returnee scholars are facing reintegration issues, while few asked how they behave during the process of reintegration. So far, there has been little attention paid to understand how reintegration process shapes academic returnees' behaviour and outcomes in research activities. For all we

know, only a few scholars have tried to analyze the impact of mobility on scholars' research activities in various stages of post-mobility period. Some scholars have noticed that mobility has negative impact on researchers' short-term research productivity(Bäker 2015; Fernández-Zubieta et al. 2016), and Li et al. (2015) have found that the return of overseas Chinese scholars is accompanied by a continuous decrease in the tendency towards international research collaboration.

Furthermore, earlier studies have identified several institutional factors causing reintegration issues. However, little research has addressed the personal characteristics of returnees which may also affect the reintegration process(Szkudlarek 2010). In her recent book, Chen (2016, pp51-55) analyzed how different groups of returnees (established scholars, recent PhD graduates, and postdoctoral fellows) negotiate their career prospects, and found different groups had different calculations in return motivations. But unfortunately, she didn't dig deeper into how returnees with different personal characteristics perform in the later reintegration process. Our research is developed on the basis of Chen (2016)'s work and mainly focus on the examination of personal factors impacting returnee scholars' reintegration process.

3. Data

3.1 Returnee scholars

Our sample is selected from the talent pool of Changjiang Scholars Program (CJS Program for short), which was initiated by MOE in 1998 and has become one of the most influential national talents programs. During the period from 1998 to 2015, CJS Program recruited a total number of 1991 distinguished professors. We built a CV database including the education background and working experience of each professor based on information listed on their personal websites. All data have been cross-checked and coded by two independent teams. According to the complete CV data, about 90% of scholars have some sort of overseas experiences and about half are recruited by the program directly from overseas institutions. The statistics are in line with the common knowledge that returnee scholars have constituted a considerable proportion of top-notch scholars in China.

By using a narrow definition of overseas experience, our research only considered returnee scholars with full-time overseas experience lasting for at least one continuous year, while those with only short-term international visits or overseas experience less than one year were not covered. Meanwhile, careful consideration has been given to the selection of research fields. Since we plan to measure returnees' performance in reintegration process based on their performance in international publication, scholars in some research fields (e.g., social sciences, humanities, engineering, etc.), whose research outputs are mainly books, domestic publication or patents other than international publication, may not be ideal samples for our study. Therefore, we only choose scholars in the fields of natural and life sciences where international publication is a strong predictor of research capacity(Bornmann and Marx 2014). Four specific fields included in this study are: mathematics (MATH), physics (PHY), earth and environmental sciences (EES), and life sciences (LIFE). In the next step, we exclude some other scholars with invalid information. Three scholars originally from foreign countries were removed; 43 scholars who didn't return full-time

or only worked full-time until recently were also removed since we are unable to track their long-term post-return research publication; another five scholars were removed because of their incomplete publication data. The selection process leads to a final sample of 249 scholars (see **Table 1**).

Table 1. Sample selection

Research Fields	**MATH**	**PHY**	**EES**	**LIFE**
Total number of scholars recruited by CJS Program (1998-2015)	118	137	108	116
Number of scholars with at least one year of full-time overseas experience	67	87	53	93
Number of scholars selected into the final sample	56	74	45	74

3.2 Publication data

Since the number and impact of international publications is widely used in university ranking and government funding decisions(Yang and Welch 2012), Chinese universities are pushing their faculty members to publish internationally. The expectation for returnee faculty members to publish in top international journals is usually much higher than that for local faculty(Chen 2016, pp100). Therefore, we chose international publication over domestic publication to measure the research performance of returnee scholars. The international publication data of each scholar was retrieved from Elsevier's Scopus database during the period from June 22rd to September 25th, 2016. The search has been confined to article-type publications written in English. Name disambiguation remains the biggest challenge, especially for Chinese scholars. We have developed a procedure to collect and clean the publication data.

Firstly, in the data collection process, we have tried to collect as many relevant publications as possible. Scopus database allows us to use its "Author ID" (author identification) function which eliminates most of the inaccuracy caused by name ambiguation(Kawashima and Tomizawa 2015). However, we found that Scopus Author ID was not good enough. We further included both the abbreviation of scholars' names and each of scholars' organizations listed in their CVs into the search condition, and collected the publication data omitted by Author ID.

Next, in the data cleansing step, we checked each publication manually. Each affiliation of targeted scholars was confirmed by using the affiliation list sourced from their CVs as reference. Also, some CVs contain a list of publications provided by scholars themselves. We used these self-reported publication data to prove the integrity of publication data collected from Scopus database. The ultimate goal of data cleansing process is to make sure each publication belongs to the exact scholar.

3.3 Describing returnee scholars' mobility process

The mobility of scholars can be tracked in two different ways. One is CV analysis(Cañibano

et al. 2011; Cañibano et al. 2008), and the other is analyzing the changes in author affiliations retrieved from publication data(Appelt et al. 2015; Dubois et al. 2014; Ganguli 2015). Both methods are reported to have (dis)advantages(Geuna et al. 2015). Based on our observations, CV data may have problems of incompleteness as informed by Cañibano and Bozeman (2009). Some mobilities or the timeline of mobility may be left out in a scholar's CV. Also, the types of mobility are sometimes unclear in CV data so that we are unable to distinguish long-term mobility from temporary mobility. On the other side, through strict data cleansing processes, author affiliations turn out to be a more accurate and reliable source than CV data. Therefore, we decided to use bibliometric data instead of CV data to measure the mobility process as suggested by Laudel (2003).

International mobility can be identified if a scholar's affiliation changes from a domestic institution to a foreign institution (and vice versa). Chinese returnee scholars usually have three types of affiliations in their career publications. Apparently, Chinese affiliations and foreign affiliations in publication data indicate that scholars are working at domestic institutions (either before going abroad or after return) and foreign institutions respectively. In addition, mixed affiliations which include both Chinese and foreign affiliations appear to be a third type of authorship. Mixed affiliations can be explained by two possible reasons. One is that the returnee scholar having mixed affiliations is actually working at a Chinese institution and a foreign institution at the same time, and the other is that a scholar conducted and submitted the research at a Chinese (foreign) institution and subsequently moved to a foreign (Chinese) institution when the research was published(Frenken et al. 2009). Both explanations indicate that mixed affiliations appear mostly when a scholar is in the process of international mobility.

Following the underlying meaning of affiliation changes in publication data, we divide each returnee scholar's career publications into five time periods (see **Table 2**). To define each period, we first looked at his/her affiliation type in each publication year and decided which time period this publication year belongs to. Then, the beginning year of each time period was coded in a sequential order from the pre-abroad period to the post-return period, and at last, the finishing year of each time period was determined by the previous publication year before the following time period. To examine post-return changing dynamics, we divide the whole post-return period into three successive overlapping 3-year segments.

The actual affiliation patterns are more complicated than the criteria used to classify different time periods. A few additional criteria are added during the coding process. Firstly, some scholars may have mixed affiliations during the pre-abroad period or the post-return period. By referring to CV data, we found that these mixed affiliations were usually caused by international temporary mobility (e.g., short-term visits, student exchange programs). Since we only consider foreign doctoral and post-doctoral training in this study, these mixed affiliations were treated as domestic affiliations. Secondly, as we classify time periods based on affiliation types in each publication year, the missing of some affiliation types may lead to the vacancy in some time periods. For example, a scholar may only have a stay-abroad period and a post-return period. Lastly, a gap period is usually recognized between a transition period (if there is one) and a post-return period. Sometimes, scholars have no publications with a foreign affiliation, and the gap period is found between a pre-abroad period and a post-return period.

Table 2. Five time periods throughout the entire process of return migration

Time periods	Definition	Beginning year
Pre-abroad period	Publication years when the targeted scholar is affiliated to Chinese affiliations.	Year of first international publication with Chinese affiliations.
Stay-abroad period	Publication years when the targeted scholar is affiliated to foreign institutions.	Year of first international publication with foreign affiliations.
Transition period	Publication years when the targeted scholar has a combination of different affiliation types (Chinese, foreign or mixed affiliation).	The first publication year when the targeted scholar has a combination of different affiliation types.
Gap period	Years when the targeted scholar has no publications.	N/A
Post-return period	Publication years when the targeted scholar affiliate to only Chinese institutions.	The first publication year when the targeted scholar affiliate to only Chinese institutions.

4. Measures and hypotheses

4.1 Defining a successful reintegration process

Chinese universities have high expectations for returnee scholars to produce high quality research(Hao and Welch 2012; Pella and Wang 2013). Returnee scholars are supposed to produce research with at least the same quality as they do while they are abroad, however, the loss of transnational capital caused by relocation may lead to a high risk of research quality reduction. Especially, in a short time after their return, scholars face challenges of reverse culture shock and reintegration, which may have a negative effect on their short-term research performance (Bäker 2015; Fernández-Zubieta et al. 2016). We here propose a new measure--***changes of research quality*** from the pre-return period to the post-return period--to examine returnee scholars' performance in reintegration process. Apparently, a smaller reduction (or no reduction at all) of research quality indicates a more successful reintegration process.

Although a great deal of criticism has been given to the usage of journal impact factors in measuring a scholar's research quality(Adam 2002; Hicks et al. 2015; Seglen 1997), journal impact factors remain as one of the most commonly used tools in China to gauge an individual researcher's research impact(Hvistendahl 2013; Tang et al. 2015). Especially for a returnee scholar, to have papers published in international journals with high impact factors is a direct way of proving his/her research capacity. Therefore, it would be reasonable to use the changes of journal impact factors as a proxy for the changes of research quality. To get each scholar's research quality in each time period, we calculated the average journal impact factors by dividing the total impact factors of journals where papers are published in one period by the total number of papers in this period. Then, we constructed a ***quality ratio*** and a ***ratio dummy*** to measure how returnee scholars change their research quality during and after return migration.

The quality ratio is defined as the ratio of research quality in the first three years of the post-return period to the highest research quality in the pre-return periods. On most occasions, scholars achieve the highest research quality in stay-abroad periods rather than in transition periods. Only a few scholars in our sample are exceptions that they have produced higher impact research in transition periods. Since the majority of publications appearing in high impact journals in transition periods are produced by scholars affiliated with foreign institutions or mixed institutions, we treat these publications as the continuation of high quality research carried out in stay-abroad periods. As a result, we compare the research quality in stay-abroad periods to that in transition periods, and the higher one is used to represent the research quality in pre-return periods. Clearly, if a scholar has a quality ratio larger than one, this scholar appears to have a successful reintegration process, in which their post-return research quality surpasses pre-return research quality. The ratio dummy indicating whether a scholar's quality ratio is larger than one is developed to capture the odds of a successful reintegration process. Furthermore, when a scholar's quality ratio is smaller than one, a larger ratio indicates a smaller reduction of research quality, which also explains a better reintegration process.

Beyond the changes of research quality before and after return, the existence of gap periods is another evidence of reintegration issues. We assume that during a successful reintegration process, returnee scholars are inclined to have a continuous production of international publication while no gap periods are observed. The ***gap period dummy*** is therefore proposed to measure whether returnee scholars have years of zero production right after return. If a returnee scholar is able to have international publications right after return without facing gap periods, then this scholar is found to reintegrate into domestic environment within a short period of time, and thus, (s)he could have a successful reintegration process.

4.2 Defining the amount of transnational capital

Transnational capital, obtained by scholars during the period of overseas studying and working, is the essential reason why returnee scholars have been of greater value in many aspects than local scholars without any overseas experience(Rosen and Zweig 2004; Zweig et al. 2004). The amount of transnational capital is usually determined by the length and quality of overseas experience(Jonkers and Tijssen 2008). In our study, three variables have been proposed to measure the amount of transnational capital which each scholar accumulated during the stay-abroad period.

Firstly, the variable ***TITLE*** is used to describe the highest academic position obtained by scholars during their time abroad. Built on basis of the three categories (established scholars, recent PhD graduates, and postdoctoral fellows) suggested by Chen (2016, pp51), we have distinguished four groups of returnee scholars--PhD returnees, post-doc returnees, junior faculty returnees and senior faculty returnees. Senior faculty returnees refer to established returnee scholars having obtained the highest academic position as at least associate professors or the equivalent during their time abroad. Junior faculty returnees refer to returnee scholars who used to work at foreign universities as junior faculty. Besides, PhD returnees and post-doc returnees refer to scholars who return right after the completion of a foreign PhD and post-doctoral training respectively. Generally speaking, established returnee scholars accumulated more transnational capital than other scholars.

Secondly, we employ the variable ***QUALITY*** to measure the research quality achieved by

scholars when they are abroad. Similarly to the methodology we adopted to calculate the quality ratio, the higher research quality during stay-abroad periods and transition periods is used in this variable. We assume that scholars achieving higher research quality while abroad have accumulated more transnational capital than other scholars.

Lastly, the third variable ***DURATION*** describes the duration of overseas experiences. Instead of CV data, we used publication years of the stay-abroad period to calculate the duration. Sometimes, scholars haven't produced any international publication during their time abroad. Publication years are more appropriate in measuring scholars' pre-return research capacity. Scholars with longer history of international publications while they are abroad are likely to attain more transnational capital(Li et al. 2013).

In addition, we also included the frequency and destination of international mobilities as measures of transnational capital. The ***international mobility*** variable captures the number of foreign institutions where scholars used to study or work during their stay-abroad periods. The ***destination*** measures consist of three dummies determining whether scholars have overseas experiences in the Asia Pacific region, in North America or in Europe respectively.

4.3 Hypotheses

Who will have a more successful reintegration process, whether returnees with more transnational capital or those with less transnational capital? Before embarking on the investigation, we may have contradicting answers to this main question:

On one hand, as most Chinese universities and institutions value transnational capital, returnees having more transnational capital are usually given more resources and support by domestic receiving institutes. Also, these returnees often have greater autonomy in research activities (Chen 2016, pp47), and some of them assume leadership in a research team. Therefore, with more transnational capital, returnees tend to have a better chance of a smooth transition from a foreign country to a home country, and thus go through a more successful reintegration process.

On the other, the amount of transnational capital gained by overseas scholars is largely determined by the length of overseas experiences(Jonkers and Tijssen 2008; Zweig et al. 2004). However, the longer scholars stay abroad, the more unfamiliar with domestic culture and environment scholars become. Accordingly, the risk of the uncertainty lying in the reintegration process increases when a scholar having accumulated more transnational capital through longer years of overseas experience decides to return.

However, we are more inclined to look on the bright sight, and suppose that the amount of transnational capital possessed by returnee scholars before their return has positive impact on a successful reintegration process after their return. According to three measures of transnational capital and three indicators of a successful reintegration process, we proposed nine hypotheses to examine whether larger amounts of transnational capital lead to a successful reintegration process.

In terms of the probability of having a gap period, we proposed that:

H1a. *Established returnee scholars are less likely to have gap periods.*

H1b. *Scholars who achieved higher research quality while abroad are less likely to have gap*

periods.

H1c. *Scholars with longer years of overseas experience are less likely to have gap periods.*

In terms of the probability of having post-return research quality higher than pre-return research quality, we proposed that:

H2a. *Established returnee scholars are more likely to have higher post-return research quality.*

H2b. *Scholars who achieved higher research quality while abroad are more likely to have higher post-return research quality.*

H2c. *Scholars with longer years of overseas experience are more likely to have higher post-return research quality.*

Finally, in terms of the research quality reduction from pre-return to post-return periods, we proposed that:

H3a. *Established returnee scholars have smaller reduction of research quality.*

H3b. *Scholars who achieved higher research quality while abroad have smaller reduction of research quality.*

H3c. *Scholars with longer years of overseas experience have smaller reduction of research quality.*

To test the impact of transnational capital on returnee scholars' performance in reintegration process, we also included a few controlling variables.

Firstly, we introduced a ***transition dummy*** to measure whether a returnee scholar has a transition period. Transition period is a particular period when scholars are affiliated to both domestic institutions and foreign institutions. The existence of transition periods may act as a buffer between pre-return and post-return periods, and get returnees ready for a better reintegration process.

Secondly, we included some institutional factors which may also be relevant in predicting returnee scholars' post-return performance. The ***status*** of domestic hosting institutions is proposed to describe the types of first domestic institutions where scholars returned to work. Three types we identified include the nine original universities sponsored by Project 985 (referred to as C9 universities), non-C9 universities and research institutions. The ***alumni dummy*** is proposed to measure whether a scholar returns to work at his/her Chinese alma maters (the impact of alumni linkage on returnee scholars' research performance is discussed in Li et al. (2015)'s work). We also introduced a ***domestic mobility dummy*** to measure whether a scholar changes his/her affiliation within the first three years of the post-return period.

Thirdly, The interactions between research collaboration, production and impact have been perennial topics in research policy(Lee and Bozeman 2005; Li et al. 2013). When we study on a returnee scholar's post-return performance in academic research, the effects of research collaboration and production cannot be neglected. As a result, we included ***average number of authors per publication*** to measure the average number of collaborators scholars have during the

first three years of the post-return period. Meanwhile, the ***annual production of international publication*** during the first three years of the post-return period is also included as a control variable.

Lastly, both the ***gender*** and ***research fields*** are controlled in our study.

4.4 Descriptive analysis

Table 3 presents the descriptive statistics of each variable. The statistics of dependent variables shows a general picture of how returnee scholars behave in reintegration process. The mean quality ratio is 0.886, smaller than 1, indicating that the majority of returnees suffer a decline in research quality after their return. Evidenced by the ratio dummy, only 40% of returnees (100 out of 249) are reported to have higher research quality in the first three years of post-return periods than in stay-abroad periods. However, only 34% of returnees (84 out of 249) are reported to have gap periods, showing that a large proportion of returnees have not stopped to publish international publication regardless of cross country move.

We have a few independent variables which capture the dynamics of transnational capital. Among 249 returnee scholars, 78 have obtained senior faculty positions in foreign institutions, 21 are junior faculty members, 116 return after overseas post-doctoral training and other 34 return right after the completion of PhD at foreign institutions. The average publication years with foreign affiliations for returnee scholars are 4.4 years. Returnees worked at two different foreign institutions on average, and the average journal impact during the pre-return period comes to 5.9 per publication. The destinations of overseas experiences show that about 23% of returnee scholars have overseas experiences in Asia Pacific region, 54% in North America, and 47% in Europe.

Some other variables are also worth mentioning. 66% of scholars are reported to have transition periods, which is good for experiencing a successful reintegration. About half of scholars return to work at their alma maters, indicating that the relationship between returnees and domestic hosting institutions cannot be simply neglected when considering their post-return performance. Besides, only 10% of scholars are reported to have relocation during the first three years of post-return periods. Also, the uneven distribution of scholars in gender is not surprising. Only 20 scholars in our sample are female.

Table 3. Descriptive statistics

Variable	Description	Obs.	Mean	S.D.	Min	Max
Dependent variables						
Quality ratio	Ratio of the research quality in the first three years of the post-return period to the highest research quality in the pre-return periods.	222	0.886	0.653	0.000	6.002
Ratio dummy	Dummy. 1 if quality ratio larger than 1; 0 otherwise.	249	0.402	0.491	0	1
Gap period	Dummy. 1 if having a gap period; 0 otherwise.	249	0.337	0.474	0	1
Independent variables						
Title	Nominal. Highest title obtained from overseas. 1 if senior faculty; 2 if junior faculty; 3 if post-doc; 4 if PhD.	249	2.426	1.072	1	4
Quality	The maximum value of average journal impacts between stay-abroad periods and transition periods.	222	5.851	5.772	0.445	38.138
Duration	Length of stay-abroad periods.	249	4.386	4.296	0	20
Controlling variables						
International mobility	Number of foreign institutions to which scholars affiliated during stay-abroad periods.	249	2.052	1.212	1	8
Asia Pacific	Dummy. 1 if having overseas experiences in Asia Pacific region; 0 otherwise.	249	0.225	0.418	0	1
North America	Dummy. 1 if having overseas experiences in North America; 0 otherwise.	249	0.538	0.500	0	1
Europe	Dummy. 1 if having overseas experiences in Europe; 0 otherwise.	249	0.474	0.500	0	1
Transition	Dummy. 1 if having a transition period; 0 otherwise.	249	0.663	0.474	0	1
Status	Nominal. 1 if non-C9 universities; 2 if C9 universities; 3 if research institutions.	249	1.731	0.663	1	3
Alumni	Dummy. 1 if returning to work at his/her Chinese alma maters; 0 otherwise.	249	0.506	0.501	0	1
Domestic mobility	Dummy. 1 if changing affiliations within the first three years of the post-return period; 0 otherwise.	249	0.104	0.306	0	1
Authors	Average number of authors per publication during the first three years of post-return periods.	249	5.360	3.280	1	32.5
Production	Annual production of international publication during the first three years of post-return periods.	249	4.344	4.040	0.333	27.333
Male	Dummy. 1 if male; 0 otherwise.	249	0.920	0.272	0	1
Research fields	Nominal. 1 if mathematics; 2 if physics; 3 if earth and environmental sciences; 4 if life sciences.	249	2.550	1.139	1	4

5. Results

5.1 Testing hypotheses

To test the hypotheses developed in the **Section 4.3**, we adopted two sets of regressions to probe the potential factors influencing returnee scholars' performance in reintegration process. First, pooled logistic regressions with robust standard errors are applied to test the impact of transnational capital on gap period and ratio dummy. Second, pooled OLS regressions with robust standard errors are run to assess the impact of transnational capital on the changes of research quality (quality ratio). Along with regression analysis, we also checked the interactions among independent variables and no multicollinearity was detected. For logistic regressions, a few more tests were run and the results indicated no problems with model specification. In short, our models prove to satisfy the basic assumptions of logistic regressions and OLS regressions as well.

Model 1 of **Table 4** presents logistic estimates for different impacting factors on the probability of returnee scholars' having a gap period in between pre-return and post-return periods. The results show that, using established returnee scholars (or senior faculty returnees) as the reference group, junior faculty returnees and post-doc returnees both have smaller probabilities in confronting a gap period than senior faculty returnees. According to the odds ratios, the chance of junior faculty returnees and post-doc returnees having a gap period is only 20.6% and 39.1% of the chance of senior faculty returnees. In other words, established returnee scholars are more likely to have gap periods during the reintegration process. Therefore, **Hypothesis 1a** is rejected. Unfortunately, the impacts of pre-return research quality and duration of overseas experience are both insignificant, leaving **Hypotheses 1b** and **1c** unsupported. Besides, the probability of having a gap period is much smaller for returnee scholars with a transition period than those without. Interestingly, our results also revealed that returnee scholars recruited by different types of domestic institutions exert different effects on the probability of having a gap period. To be specific, working at the C9 universities or research institutions significantly reduces scholars' chances of having a gap period. Especially for those working at research institutions, their probability of having a gap period is 74.3% smaller than that of returnee scholars who work at non-C9 universities.

Model 2 of **Table 4** examines the effect on the ratio dummy--whether the research quality during the first three years of the post-return period is higher than that during the stay-abroad and transition period. Different from **Model 1**, we included three additional post-return factors (*domestic mobility*, *authors* and *production*) in the new logistic model. One unexpected result is that the research quality achieved by scholars while they are abroad has a significant negative impact on the probability of post-return research quality surpassing pre-return research quality, which is the opposite of **Hypothesis 2b**. The odds ratios indicate that each unit increase in the pre-return research quality leads to 26.5% decrease in the odds of post-return research quality surpassing pre-return research quality. When considering the operational definition of research quality adopted in this study, we can come to the conclusion that scholars with experience of publishing in higher impact journals when abroad are more likely to publish in international journals with lower impact factors after their return. Although both post-doc returnees and PhD

returnees appear to have odds ratios larger than 1, indicating that they are more likely to exceed the research quality achieved during pre-return periods than senior faculty returnees, the effects turn out to be insignificant. Meanwhile, the impact of duration of overseas experiences is also insignificant. Clearly, our results cannot provide support for both **Hypotheses 2a** and **2c**. In addition, the only other factor that matters is the average number of authors per publication. More authors in each publication denote more collaborators in research. The result illustrate that returnees with more collaborators in the post-return period tend to have better chance of having higher post-return research quality.

Table 4. Results from logistic regressions on gap period and ration dummy

	Model 1 Dependent variable: gap period		**Model 2** Dependent variable: ratio dummy	
	Odds Ratio	Robust S. E.	Odds Ratio	Robust S. E.
Title				
• Junior Faculty	0.206**	0.163	0.615	0.634
• Post-doc	0.391*	0.201	1.760	0.992
• PhD	0.840	0.537	2.038	1.415
Quality	1.039	0.030	0.735***	0.063
Duration	0.955	0.058	0.992	0.074
Transition	0.115***	0.044	0.835	0.354
International Mobility	1.004	0.204	0.714	0.156
Asia Pacific	0.717	0.392	0.725	0.467
North America	0.671	0.360	0.558	0.303
Europe	1.159	0.560	0.893	0.460
Status				
• C9 universities	0.5244*	0.1938	0.971	0.369
• Research Institutes	0.2567*	0.1798	2.318	1.306
Alumni	0.6970	0.2603	1.035	0.358
Domestic mobility			0.377	0.230
Production			0.983	0.050
Authors			1.489***	0.138
Male	0.5235	0.2335	1.041	0.694
Research fields	1.0120	0.1682	0.785	0.158
Constant	12.3311**	12.1523	1.126	1.239
Observations	222		222	
Pseudo R2	0.1877		0.2552	

Notes: The reference group for title is senior faculty; the reference group for status is non-C9 universities.
*p < 0.1; **p < 0.05; ***p < 0.01.

To test **Hypotheses 3a~3c**, we divided the overall sample into two sub-samples according to the value of ratio dummy, and later two pooled OLS regressions on quality ratio were employed independently. As shown in **Table 5**, **Model 3** targeted at the group of returnees having post-return research quality lower than pre-return research quality (their quality ratios are smaller than 1, or ratio dummies equal 0). Our results accept **Hypothesis 3a** while reject **Hypotheses 3b** and **3c**.

Using senior faculty returnees as the reference group, both post-doc returnees and PhD returnees are reported to have lower quality ratios than senior faculty returnees. Considering that all scholars in this model face decreases in the post-return research quality, established returnee scholars tend to have smaller reductions of research quality than other scholars. However, the impacts of pre-return research quality and duration of overseas experiences on quality ratio tell another story. Returnee scholars having higher pre-return research quality and longer years of overseas experiences appear to suffer greater decreases in post-return research quality. As for other factors, not surprisingly, returnees working at top universities (C9 universities) and research institutes have a smaller decline in research quality than those working at other universities.

When we look at the same regression model employed to the other sub-sample, only the pre-return research quality predicts quality ratio significantly. As presented in **Model 4**, among the group of returnee scholars who have increased research quality after return, junior faculty returnees, post-doc returnees and PhD returnees all have negative but insignificant coefficients, indicating that although established returnee scholars are having more increases in research quality than other scholars, such impact is not statistically significant. Similarly, the coefficient for the duration of overseas experiences is also negative but insignificant. We can only confirm that scholars with higher pre-return research quality tend to have smaller increases in research quality after return.

Table 5. Results from OLS regressions of two sub-samples on quality ratio

	Model 3 Quality ratio<1		**Model 4** Quality ratio>1	
	Coef.	Robust S. E.	Coef.	Robust S. E.
Title				
• Junior Faculty	0.041	0.056	-0.873	0.648
• Post-doc	-0.084*	0.045	-0.172	0.345
• PhD	-0.191**	0.081	0.164	0.431
Quality	-0.027***	0.005	-0.097*	0.049
Duration	-0.011*	0.006	-0.016	0.029
Transition	0.000	0.042	-0.045	0.240
International Mobility	0.006	0.018	-0.175	0.150
Asia Pacific	-0.004	0.050	0.294	0.389
North America	-0.074	0.049	0.567	0.425
Europe	-0.049	0.044	-0.211	0.287
Status				
• C9 universities	0.072**	0.036	0.372	0.249
• Research Institutes	0.181***	0.060	0.189	0.380
Alumni	0.029	0.037	-0.269	0.207
Domestic mobility	-0.010	0.051	-0.074	0.384
Production	0.006	0.005	-0.003	0.018
Authors	0.010	0.011	0.078*	0.043
Male	-0.122*	0.070	0.142	0.166
Research fields	0.028	0.018	0.012	0.098

Constant	0.836***	0.102	1.437**	0.539
Observations	149		73	
Pseudo R2	0.4846		0.3453	

Notes: The reference group for title is senior faculty; the reference group for status is non-C9 universities.

*p < 0.1; **p < 0.05; ***p < 0.01.

5.2 Examining the changing dynamics of research quality

In this section, a repeated-measures ANOVA followed by predicted marginal means is proposed to test the changing dynamics of research quality upon scholars' return. Firstly, we divide the whole post-return period into three successive overlapping 3-year sub-periods. Together with the stay-abroad and transition period, we have included research quality during these five periods as within-subjects factor. Next, to examine how different groups of returnees behave in the changes of research quality over periods, we included returnees' highest titles gained from overseas experiences as between-subjects factor.

Mauchly's test indicated that the assumption of sphericity had been violated for the within-subjects factor, $\chi 2(9)=161.6$, $p<.001$. Therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity. The ANOVA results showed that returnee scholars' research quality was significantly affected by time periods, $F(2.09, 179.33)=4.71$, $p<0.01$. We can, therefore, conclude that there was a significant difference in research quality among the five periods. The between-subjects effect of title is also significant, $F(3, 86)=2.82$, $p<0.05$, indicating that returnee scholars obtaining different titles while abroad have different changes of research quality over periods.

By predicting marginal means, we are allowed to get a straightforward view of how research quality changes over periods and how returnees differ in the changing patterns. As demonstrated in **Figure 1**, all four groups of returnees suffer great decreases in research quality from stay-abroad to transition period. Senior faculty returnees and PhD returnees appear to have similar changing patterns in later periods. Their research quality continues to decline in the first three years of post-return period, and begins to increase during the second-to-fourth years of post-return period. Unfortunately, post-doc returnees don't have pronounced increases in research quality during the whole post-return period. Their research quality reaches steady state after a significant decrease. Junior faculty returnees have the most unique changing pattern. They are the only group to have increasing research quality in the first three years of post-return period. It's also important to note that most groups of returnees reach peak in research quality in the second sub-period after their return. However, only PhD returnees seem to achieve higher research quality during the post-return period than that during the stay-abroad period. Since PhD returnees only have doctoral training experience in other countries, publishing in international journals is not the major task when they are abroad. Therefore, it's reasonable to find that PhD returnees are able to publish in higher impact journals after spending some years doing research at domestic institutions.

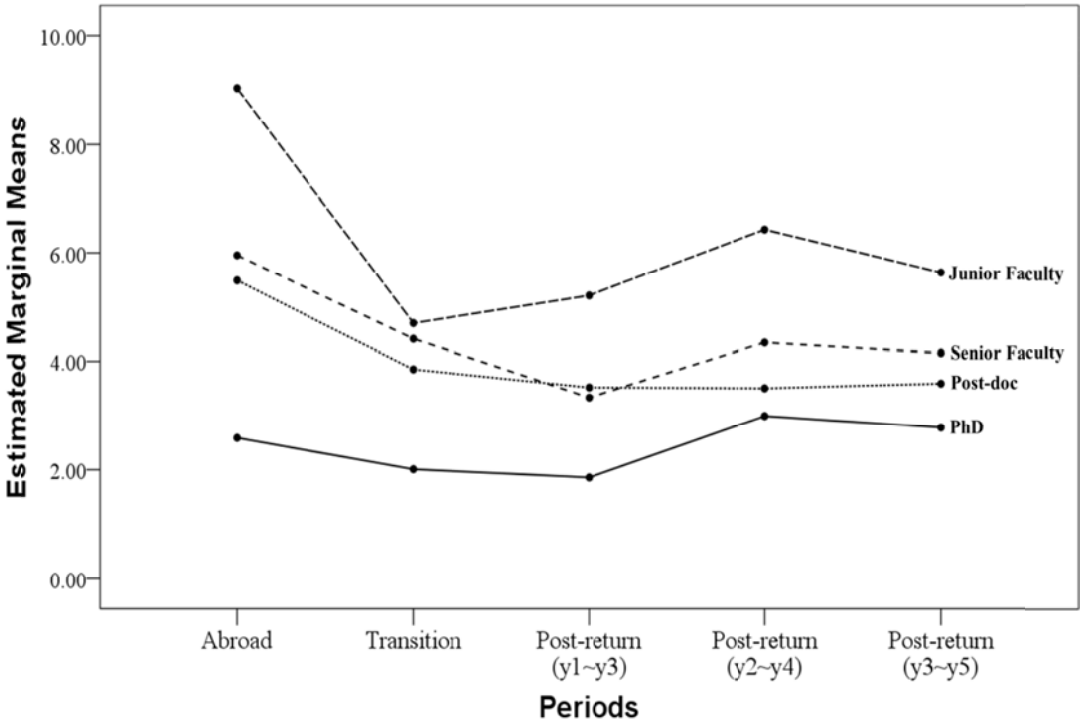

Figure 1. Estimated marginal means of research quality over periods

6. Discussion and conclusion

On knowing the fact that due to reintegration issues, return migration may lead to a short-term decrease in scholars' research performance(Li et al. 2015), our study has further tested how personal characteristics of returnee scholars—measured by the amount of transnational capital accumulated via overseas experiences—impact on returnees' performance in reintegration process. Mixed results have been achieved through several regressions. Established returnee scholars are more likely to have gap periods, and their probability of having higher post-return research quality is smaller than other groups of returnee scholars. On the other side, the only hypothesis supported by our results is that established returnee scholars tend to have smaller research quality reduction after return than other groups. We also find that returnee scholars with higher pre-return research quality or longer years of overseas experiences are less likely to have a successful reintegration process, or sometimes, the impact of pre-return research quality and duration of overseas experience on the performance in reintegration process is insignificant. In this study, we were able to shed some light on the behavior of returnee scholars in reintegration process as well as the personal characteristics impacting the reintegration process.

From a policy standpoint, this study has raised concerns about the post-return performance of established returnee scholars. Established returnee scholars, having received tenure at a foreign institute, are mostly top-notch scholars who Chinese universities are competing for. Upon return, they are given more autonomy and independence in research activities than junior faculty returnees and new graduates (Chen 2016, pp70), and also, they are granted more academic resources (Chen 2016, pp79). However, it seems that Chinese universities' high-input strategy in recruiting established overseas scholars doesn't pay off. The outcomes of return migration appear

more pessimistic for established scholars than for other groups of returnees. Established scholars are reported to have a higher probability of confronting a gap period and reducing the post-return research quality. Apparently, the challenges facing established returnee scholars in reintegration are far more serious than expected. They require an adjustment period to readapt into domestic environment more than other groups of returnee scholars. Therefore, we suggest Chinese universities provide established overseas scholars with more flexible contracts. Instead of asking them to return immediately as full-time faculty, Chinese universities could offer them a buffer period when they could begin at a part-time position and have the freedom of deciding when to have a full-time return. As shown in our results, such buffer period is helpful to reduce the chance of having a gap period.

Another policy implication is to extend the evaluation period for returnee scholars at the beginning years of their return. As far as we know, some Chinese universities have created a dual-track system where returnee scholars are placed into an American-style tenure-track system or PI (principal investigator) system while local trained scholars are placed into regular system(Lu and McInerney 2016; Xu 2009). Although the new tenure-track system allows a probation period of 6 years for junior faculty to get tenured, most Chinese universities are still using annual faculty evaluation combined with regular tenure evaluation. That is to say, most returnee scholars have to be evaluated both every year for annual evaluation and every three years for tenure evaluation. Our study gives inevitable results that returnee scholars suffer great decreases in research quality in the beginning years after return. Most groups of returnees don't have noticeable improvement in research quality until the second-to-fourth years of post-return period. Therefore, we recommend that Chinese universities extend the evaluation period for new returnees to 4~5 years, and also help them relieve the stress of annual evaluation.

However, some limitations should also be acknowledged. Our sample was selected from top-notch scholars recruited by CJS Program. The returning year of each scholar covered a wide range from 1987 to 2013, making it difficult to control the effect of returning years. It will make a better sample if we have gathered scholars who returned close in time. Also, due to the limited sample size and the above-mentioned different returning years, we are not able to track scholars' post-return performance in a longer period. Instead, we were only able to evaluate scholars' short-term performance during the post-return period.

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