THE CAREER PATHS OF GRADUATES IN CHINESE INTERPRETING STUDIES: A SCIENTOMETRIC EXPLORATION.

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DOCTORAL DISSERTATION

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Supervised by Dr. Éric Archambault

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I hereby certify that the present study *The career paths of graduates in Chinese Interpreting Studies: A scientometric exploration*, presented by Ziyun Xu for the award of the degree of Doctor, has been carried out under my supervision at the Department of English and German Studies of the Universitat Rovira i Virgili.

The research and the thesis fulfill all the conditions for the award of an INTERNATIONAL DOCTORATE, in accordance with current Spanish legislation.

Éric Archambault

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When I first started my interpreter training back in 2006 it never occurred to me that it would develop into a PhD—deep research and academic writing are not in my blood, and there is no need to recount the struggles I had over papers for graduate school. I am proud—not to mention shocked—to have accomplished this unthinkable mission nine years on: it was a long and tortuous experience, but a gratifying one. None of it could have happened without the support of an amazing network of professors, mentors, family and friends, all of whom gave me the hope and courage to complete the journey.

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Abstract

During the last 30 years the growth of Chinese Interpreting Studies (CIS) has been nothing short of spectacular. Increasing economic and political collaboration between China and the West has driven the demand for interpreters to bridge the linguistic and cultural divide. Since master's and bachelor's degree courses in interpreting and translation were created all over China, hundreds of university graduates have embarked on widely differing career paths. This study begins with an overview of the discipline: its growth trajectory, dominant theoretical and thematic trends, research methodologies and collaborations, and major players. Working from an exhaustive corpus of master's theses, Propensity Score Matching (PSM) and Variable Importance Evaluation (VIE) are used to examine which structural determinants may have a causal impact on the decisions students make about their careers after graduation. The research reveals that writers of empirical theses are much more inclined to enter the academic sphere than those who conduct theoretical studies. Graduation year and geographical location of university also contribute to the choice between one career path and another. Contrary to common expectation, thesis content and the prestige of a student's academic affiliation or thesis advisor have little impact on the decision. As the discipline continues to evolve and mature, the factors affecting graduates' career choices are likely to develop in parallel, becoming ever more complex and diverse.

Resumen

En los últimos 30 años el crecimiento de los Estudios de Interpretación chinos ha sido, como poco, espectacular. La progresiva colaboración económica y política entre China y Occidente ha motivado una demanda de intérpretes para superar las diferencias lingüísticas y culturales. Desde que se crearon grados y máster en traducción e interpretación por toda China cientos de graduados universitarios se han embarcado en diferentes carreras profesionales. Este estudio empieza con un panorama de la disciplina: trayectoria de crecimiento, tendencias temáticas y teóricas dominantes, metodologías de investigación y colaboraciones, y principales figuras. A partir de un corpus exhaustivo de tesis de máster, se usa Pareamiento por Puntaje de Propensión (PPP) y Evaluación de la Importancia de las Variables (EIV) para examinar que determinantes estructurales pueden tener un impacto causal en las decisiones que los estudiantes toman sobre sus carreras tras la graduación. La investigación revela que es más probable que accedan al mundo académico los escritores de tesis empíricas que aquellos que realizan estudios teóricos. Al contrario de lo esperado, el contenido de la tesis y el prestigio de la afiliación académica del estudiante o el director de la tesis tienen poco impacto en la decisión. Según la disciplina se sigue desarrollando y madura, los factores que afectan las decisiones sobre la carrera profesional de los graduados tienden a seguir desarrollándose en paralelo a esta, volviéndola más compleja y diversa.

Resum

Els darrers 30 anys, el creixement dels Estudis d'Interpretació xinesos ha sigut, com a mínim, espectacular. La creixent col·laboració econòmica i política entre la Xina i Occident han motivat la demanda d'intèrprets per a superar les diferències lingüístiques i culturals. Des que es van crear graus i màsters en traducció i interpretació per tota la Xina, centenars d'egressats universitaris s'han embarcat en carreres professionals diverses. Aquest estudi comença amb un panorama de la disciplina: trajectòria de creixement, tendències temàtiques i teòriques dominants, metodologies d'investigació i col·laboracions, i principals figures. Partint d'un corpus exhaustiu de tesis de màster, es fa servir l'Aparellament per Puntuació de Propensió (APP) i l'Avaluació de la Importància de les Variables (EIV) per a examinar quins determinants estructurals poden tenir un impacte causal en les decisions que els estudiants prenen sobre la seva carrera professional després de la graduació. La investigació revela que és més probable que entrin al món acadèmic els escriptors de tesis empíriques que no aquells que van dur a terme recerca teòrica. En contra de les expectatives habituals, el contingut de la tesis i el prestigi de l'afiliació acadèmica de l'estudiant i el director de tesi tenen poc impacte en la decisió. Segons la disciplina continua desenvolupant-se i madura, els factors que afecten les decisions sobre la carrera dels egressats tendeixen a continuar desenvolupant-se en paral·lel a aquesta, tornant-la més complexa i diversa.

Declaration

I, Ziyun Xu, hereby declare that this thesis is entirely my own work, carried out at the Universitat Rovira i Virgili for the degree of Doctor of Philosophy in Translation and Intercultural Studies, and that it has not been submitted as an exercise for a degree at any other university. Where other sources of information have been used, they have been acknowledged. Some parts of this thesis have been published previously in:

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Xu, Ziyun. 2015b. "The past, present and future of Chinese MA theses in Interpreting Studies: A scientometric survey". *Perspectives* 23(2): 284-304.

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Xu, Ziyun and Leonid B. Pekelis. 2015a. "A survey of Chinese Interpreting Studies: Who influences who… and why?" *PeerJ Computer Science* 1(E14): 1-43.

Xu, Ziyun and Leonid B. Pekelis. 2015b. "Chinese Interpreting Studies: A data-driven analysis of a dynamic field of enquiry". *PeerJ* 3(E1249): 1-28.

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List of Abbreviations

ACI	Autonomous Citation Indexing
AICc	Akaike's Information Criterion
AIIC	Association internationale des interprètes de conférence
ARIMA	Autoregressive integrated moving average
ACF	Autocorrelation function
BC	Betweenness centrality
BFSU	Beijing Foreign Studies University
BIC	Bayesian Information Criterion
BISU	Beijing International Studies University
BLCU	Beijing Language and Culture University
BTI	Bachelor's Degree in Translation and Interpreting
BITRA	Bibliography of Interpreting and Translation
CATTI	China Accreditation Test for Translators and Interpreters
CIRIN	Conference Interpreting Research Information Network
CIS	Chinese Interpreting Studies
CNKI	China National Knowledge Infrastructure
CSC	Canonical Scientific Culture
CSSCI	Chinese Social Sciences Citation Index
DC	Degree Centrality
ESIT	École Supérieure d'Interprètes et de Traducteurs
GNNU	Gannan Normal University
GUFS	Guangdong University of Foreign Studies
GXNU	Guangxi Normal University
GLM	Generalised linear model
GSTI	Graduate School of Translation and Interpretation
HITS	Hyperlink-Induced Topic Search
HSC	Human Sciences Culture
IF	Impact Factor
IRR	Inter-rater reliability
IS	Interpreting Studies
ISI	Institute for Scientific Information
JCR	Journal Citation Reports
MASE	Mean absolute scaled error
MLA	Modern Language Association
MTI	Master's Degree in Translation and Interpreting
OA	Open-Access
OUC	Ocean University of China
PACF	Partial autocorrelation function
PRA	PageRank Algorithm
PRC	People's Republic of China
PS	Propensity Score
PSM	Propensity Score Matching
SCI	Science Citation Index
SIAE	Shanghai Interpreter Accreditation Exam
SISU	Shanghai International Studies University
SNA	Social Network Analysis

SQL	Structured Query Language
SSCI	Social Science Citation Index
TIS	Translation and Interpreting Studies
TMLE	Targeted Maximum Likelihood Estimation
TS	Translation Studies
TSB	Translation Studies Bibliography
UIBE	University of International Business and Economics
UK	United Kingdom
UN	United Nations
US	United States
VIE	Variable Importance Evaluation
XU	Xiamen University

Chapter 1. Introduction

1.1. Background

The earliest documentary record of interpreting dates back as far as 3000 BCE—the Ancient Egyptians had a hieroglyph for it (Delisle and Woodsworth 1995)—but it is likely that the first interpreters started work as soon as our distant ancestors realized they could not be sure to make themselves understood by neighbouring tribes using gestures and signs alone. Though interpreting as a means of bridging the communicative divide between peoples of different cultural and linguistic backgrounds has been around for thousands of years, the history of research into the subject is relatively short, indeed less than a hundred years old (Pöchhacker 2015). Jesús Sanz Poch, an education scholar, pioneered the discipline of Interpreting Studies (IS) when he became interested in professionals working at international organizations, presenting his research on the qualities needed to be a good interpreter at a psychology conference in Barcelona in 1930. Since then various Western scholars, among them Henri Barik, Danica Seleskovitch, Daniel Gile, Barbara Moser-Mercer and Robin Setton, have taken diverse approaches to studying the subject from a range of angles, often drawing inspiration from other disciplines such as psychology and linguistics.

Since the Second World War interpreters have been increasingly in demand to facilitate communication wherever the need might arise—war crimes tribunals, peacekeeping operations, high-level international trade negotiations, and low-level sightseeing trips, to name but a few such occasions. Nevertheless, the craft only took on the status of an independent field of academic enquiry in the 1990s, when scholars began consciously to use the term Interpreting Studies (IS), to distinguish it from the original 'parent' Translation Studies (TS).

Chinese research into IS trailed its Western counterpart by several decades. However, since the late 1950s, when papers began to be published sporadically, Chinese Interpreting Studies (CIS) has evolved into a dynamic field of academic enquiry, with more than 3,500 scholars having produced 4,200 publications between 1958 and 2012.

Despite the mystique which, to a certain degree, still surrounds the profession regarding how interpreters can listen and simultaneously translate into a different language, research into the subject increased in volume and the discipline became more professionalised. Some studies have documented the market opportunities available for the language communication industry. DePalma et al. (2015) showed that the global translation services industry is now worth more

than €36 billion; the US is the number one market, followed by the EU and Asia. In 2012 the US Bureau of Labor Statistics predicted that the industry's growth would, in the following decade, be 42% higher than the average for other industries (United States 2014). This is remarkable when one considers that over the past seven years many of the interpreting industry's major clients—the large multinational corporations—have been seriously affected by the global economic downturn.

Aside from large corporations, the government and military are also major users of language services. According to IBIS (2015), despite constant high demand for interpreters, the industry does not offer the same level of job security as in other specialised professions such as software engineering and data science: the industry is far from consolidated; rather, it is characterised by small businesses and individual freelancers scattered all over the US. The majority of service providers are concentrated in the Mid-Atlantic, Southeast and West regions, where demand is the strongest. Most practitioners are court and signed language interpreters, graduates of more than 60 universities across the country. By contrast, conference interpreters, who enjoy the highest pay grade of all language service providers, are all graduates of the Middlebury Institute of International Studies in Monterey and the University of Maryland, both of which offer master's degrees.

In a 2008 paper Liu found that China's translation market was worth €1.5 billion in 2003, and the figure easily surpassed €2.8 billion in 2005, with several hundred conferences, seminars and workshops involving speakers of foreign languages being held in major cities such as Beijing, Shanghai and Guangzhou. As in the West, Chinese conference interpreters are the highest paid of all language-related professionals, but unlike in the West, where the hourly rate difference between interpreting and other professions is often negligible, the Chinese professional's daily is often as much as a regular office worker's monthly salary. The high price of conference interpreting has to some extent been an indicator of the lack of competent professionals in the market and the rigorous training required to master the necessary skills.

The first interpreter training program in mainland China was established at Beijing Foreign Studies University (BFSU) in 1979, eight years after the People's Republic of China regained its seat at the United Nations (UN). Between then and 2003 BFSU produced a total of 103 graduates whose subsequent careers followed predictable paths: most are now deployed at various UN duty stations around the world, while a few serve as teachers at their alma maters (Wang R. 2006). However, since 2003 the need for interpreters of the UN and other international organisations have been largely met, and the career paths of new graduates have become increasingly varied. Thanks to China's increasing trade and investment links with the

rest of the world, many now find gainful employment opportunities as freelance or in-house interpreters, while others opt to remain in academia, conducting research and training the next generation of interpreters.

Owing to the high demand for interpreting services in mainland China, in the short span of eight years since 2007 over 200 schools have joined the interpreter training bandwagon, offering both bachelor's and master's in Translation and Interpreting Studies (TIS). It should be noted here that until three or four years ago specialisation in TIS in China was a reserve of postgraduate education, and that unlike the West, where a mix of conference, legal and medical interpreting courses are offered, all Chinese courses are geared toward conference, in which sector professional openings are severely limited.

Tseng (2005) studied the interpreting industry in Taiwan: she could not conclude that there was a healthy balance between supply and demand for interpreters there, but found strong evidence to suggest that new graduates find it extremely difficult to break into the market.

It should be noted here that much of the existing IS literature is focused on various aspects of training—from Herbet's textbook for conference interpreters (1952), via Seleskovitch's Interpretive Theory of Translation (1968) to Sawyer's work (2004) on curriculum design and assessment—yet few studies shed light on students' professional development after graduation, and there is a dearth of data to determine the factors that influence students' career paths. This is an important issue to explore in IS, because graduates represent the future of this burgeoning discipline and because prospective students are interested in the career trajectories of those who are finished with schooling to determine whether they can and should take the plunge into working with languages. The issue is so important in fact that it is the main focus of this dissertation.

Understanding students' career choices is a particularly relevant issue in CIS which, like China's economy, has experienced tremendous growth to become arguably the world leader in producing texts on IS over the past decade (Gile 2013a). On the surface, studying IS offers excellent career prospects in China: for freelance interpreters the pay is far above average salary for government employees and the work/life balance is good; for those working as trainers in academia there is job security, high social status and flexible working hours to enjoy. This differs from the situation in a mature market such as the US, where interpreters are generally paid little more than other professionals, and in some cases less; few graduates work in academia, most opt instead to work as freelancers. However, as China's economic growth has somewhat tapered off over the past few years, one might wonder whether the growth of CIS has reached its tail end.

A deep understanding of the factors that help to predict the career paths of students can assist aspiring interpreters to embark on rewarding working lives, trainers to provide well-targeted guidance that meets each individual student's professional objectives, and policy-makers to improve the overall quality of interpreting training and research. One method of addressing such questions is provided by scientometrics, by which researchers can scrutinise and analyse raw data to discover hidden trends.

Scientometrics measures and examines scientific and technological enquiry, with a particular emphasis on the use of bibliometric techniques. During the early years of the 20th century numerous studies were conducted which used what would later come to be recognised as scientometric methods, one of the most well-known being Lotka's highly influential 1926 work on the structure of scientific authorship.

Scientometrics truly took on a life of its own when Eugene Garfield established the Institute for Scientific Information, which was later acquired by Thomson Reuters, in the early 1960s. Garfield created the Science Citation Index (SCI), which gave scientists such as Derek de Solla Price a tool for analysing the world of academic writing. Despite having such a brief history—50 or so years, similar to that of CIS—the method has come to be widely used by governments, international organisations, and universities around the world for policy-making based on the prestige of scientific and technological research (see for example Bordons, Fernández and Gómez 2002; Leydesdorff 2004; Debackere and Glänzel 2004). Research and writing on the social sciences and humanities have increasingly been subject to the same scientometric scrutiny as their natural science counterparts, as authors throughout the academic world have felt mounting pressure to publish in prestigious journals, produce highly-cited papers, and maintain high visibility in journals covered by mainstream scholarly publication databases.

1.2. Aim and structure

This dissertation seeks to address the questions left open by the earlier scholars mentioned in Section 1.1. Employing a mixture of data-mining techniques and analytical methods used in biostatistics, computational linguistics, and scientometrics, it aims to explain why students choose to pursue academic or professional careers after graduating.

The dissertation begins with an exposition of the major questions to be pursued and the reasons for doing so. There follows a section devoted to working definitions of the key concepts used, which may assume different meanings in different studies.

In Chapter 2 an in-depth review of the existing literature places the current study in context. The author explores the history, function, and limitations of scientometric research; reviews earlier studies that used citation analysis (one of the cornerstone techniques of scientometrics); and discusses the early adoption of such techniques by Western scholars in TIS, before zeroing in on Chinese studies—ones on TIS in particular—and examining the strengths and weaknesses of these pioneering works. Earlier scientometric studies of post-graduate career choices dealt broadly with the impact of two particular factors: academic affiliations and thesis advisors; the present study goes one step further by examining other potential determining factors, such as thesis topics, research methods, students' research productivity and the geographical environments of their schools.

On the basis of this contextual and theoretical analysis, Chapters 3 and 4 follow a tradition of dissertation-writing in the field of linguistics (see for example Baese-Berk 2010; Fricke 2013) in which empirical chapters can be compared to long journal articles. Each chapter contains its own discrete background, research questions, methods, results and conclusions.

Chapter 3 provides a comprehensive overview of the field of CIS. The landscape is examined from three perspectives (student-, university- and geographically-related), all of which help place in context the factors that determine the career paths students take, which are analysed in greater depth in Chapter 4.

In the student-related section, trends in the discipline over the past two decades are examined, and time-series statistical models developed to forecast how it might develop during the course of the next ten years. Theoretical influences and topics in theses are also studied, and their evolution over time traced. Last but not least, the research methods employed by students and their changes over time are discussed.

Universities are the major drivers of research into CIS. In the section dealing with university-related determinants the most productive among them are ranked using three measurements, to best evaluate how each contributes to the development of the discipline as a whole. Next, the busiest advisors and their thesis supervision practices are profiled to shed light on how the workload for training the next generation of interpreters is distributed. Finally, research interactions between the most productive institutions are put into visual form to illustrate the extent to which schools collaborate with each other on academic research.

Rarely examined by previous TIS researchers, geographical factors are one of the focal points of this study. The reason for this is that unlike in the United States, all the reputable schools in China are public, controlled and regulated by their local governments, which to a very large extent determine the direction and outlook of CIS. The production centres of theses and articles are visually mapped to allow for an examination of geographical patterns: which locations are most productive? do some produce more articles or theses than others? In addition to examining the contributions to research made by individual regions, inter-locational co-authorships are presented in graphic form to highlight the extent to which CIS is a collaborative endeavour. Adams et al. (2007) note that research collaboration has played an increasingly important role worldwide in the quest for advancement in science and technology, because it allows scholars to tap into the state-of-the-art facilities and resources available scattered at various locations. In the case of CIS there is a long way to go in bringing scholars together to share resources and have access to larger study populations for experimental research.

Chapter 4 examines the evidence regarding which student-related, university-related and geographical factors are likely to determine whether students eventually pursue academic careers. Basic statistics are presented on the research productivity of advisors and their students. A Propensity Score Matching (PSM) method is employed to evaluate whether empiricism has a causal effect on students' choosing a certain career path, while taking into consideration influences from key potential confounders. Balance checking and sensitivity tests are conducted to ensure the validity of the PSM analysis. Following on from this, Variable Importance Evaluation (VIE) is used to quantify the individual contribution of each confounding factor to students entering the academic sphere. This chapter reveals that empiricism, university, advisor and geographical factors all have a causal effect on CIS students pursuing academic careers.

Chapter 5 concludes the dissertation, setting its findings within the context of earlier research, acknowledging its limitations, pointing out directions for future research, and highlighting its contribution of the field of TIS research. Beginning with an overall discussion of the present work, the key findings are then presented and compared with those of earlier studies. The chapter addresses how the present study fills gaps in the existing CIS literature and the contributions it makes to the field. It also includes a section on the limitations of the present study, elaborating on the trade-offs that had to be made during the course of the research and the benefits that accrued from them. Potential directions for future research are identified, including questions arising from this study, and suggestions are made of ways in which the ever-changing field of CIS might be further studied and better understood, with particular

reference to students' post-graduate career paths. The dissertation concludes by considering how the scientometric approach to CIS used herein might be applied to other populations within the wider field of TIS.

1.3. Working definitions

The following definitions are of the key terms and concepts used with a specific meaning in the present study, some of which may vary from paper to paper and author to author.

1.3.1. Chinese Interpreting Studies (CIS)

In this dissertation CIS refers to research on Interpreting Studies which has a specific focus on Chinese and English; it may be written in either language. The focus of the present study is not exclusively on work produced in China: any paper dealing with Chinese/English interpreting falls within its scope. Though some authors have published texts on interpreting between Chinese and other languages such as French, Japanese and Russian, these account for only a tiny proportion of all the literature produced on the subject—interpreter training in China is predominantly offered in the combination English/Chinese, so excluding texts–on other combinations does not seriously affect this paper's coverage.

1.3.2. Academic papers

The pioneers of TIS were scholars with educational backgrounds in comparative literature, and professional translators and interpreters with no training in research methodology (Gile 2012). The effects of this have been long-lived: despite increasingly frequent calls for the subject to be approached with the rigour proper to a 'true science', still today the literature falls into three categories: (1) intuitive writings based on personal work experience; (2) work based on Canonical Scientific Culture (CSC); and (3) work based on Human Sciences Culture (HSC) (Gile 2013b). Given that all these types of literature contribute to the development of the discipline, and that there is still a great deal of controversy in TIS regarding what constitute 'research' and 'scientificity', it is beyond the scope of this dissertation to define scientific research or professional work. The shorthand term 'academic papers' is used to refer to any type of document included in the database, be it thesis, dissertation, or journal article. For the

purposes of the present project, journal articles and conference proceedings (many of which are themselves published in journals) are considered as equivalent. If a piece of writing exists in both formats, or in one format in multiple publications, it appears only once in the dataset. Interviews, book reviews, obituaries, reminiscences, discussions of exam questions, and tips for students are all excluded because they represent a different type of data, and therefore fall outside the scope of this project. This is somewhat typical of work in scientometrics, which has traditionally concentrated on the 'article', 'note', and 'review' types of documents indexed in the Thomson's Web of Science (which comprises the Science Citation Index, the Social Sciences Citation Index, and the Arts and Humanities Citation Index).

1.3.3. Research collaboration

Scientific research does not take place in a vacuum (Subramanyam 1983): we undeniably "stand on the shoulders of giants," and even past work with limitations has helped current researchers make significant advances by providing theoretical support. There are various types of research collaboration, ranging from the advisor-student relationship during thesis-writing and co-authorship of a paper, to cooperation between various organisations. Research collaboration is measured in the present work by co-authorship of academic papers. While this strict definition does not capture input and comments from colleagues, editors or peer reviewers, whose assistance does not usually take the form of an actual author credit, co-authorship serves, as Smith pointed out in his 1958 paper, as an effective and direct indicator of collaboration between researchers. Numerous earlier scholars have successfully used co-authorship as a proxy measure for research collaboration (see for example, Price 1963; Clarke 1964; Beaver and Rosen 1979).

Chapter 2. Literature Review

2.1. Introduction

This dissertation employs an interdisciplinary approach to investigate what determines the career choices made by CIS students, touching upon various aspects of Translation and Interpreting Studies (TIS), scientometrics and Social Network Analysis. This chapter provides an overview of earlier research which provided theoretical and methodological underpinnings to the present study. It begins with a review of existing approaches to the study of graduates' career choices in general and in TIS, as groundwork for this area of enquiry is both important and justified. Next it examines scientometrics as a methodological tool, reviewing its evolution and how it has been used to study the field of TIS, as well as assessing indicators of research impact and network analysis. The focus is then turned on China with regard to the latest developments in scientometric research there and how it has been used in the subfield of CIS. It identifies questions that remain unanswered, and anticipates how the present study might fill gaps in our knowledge of the predictors of CIS students' career outcomes.

2.2. Post-graduate career choices

A number of scholars have examined the effects of education on the career paths of students after graduation (see for example, Caplow and McGee 1958; Hargens and Hagstrom 1967; Long et al. 1979; Kirchmeyer 2005). Caplow and McGee argue in their seminal work on the subject (1958) that education should serve as a great social equaliser, opening the same doors to aspiring individuals from all strata of society; unlike other employers who may value seniority over performance, academia is committed to rewarding talented researchers purely on the strength of their individual merits. Yet all the empirical evidence points to the contrary. This 'ideal world' scenario—that rewards in science are distributed equally among all those participating in it—is called into question by the existence of the tenure system, which offers job security and benefits based entirely on a scholar's achievements during a brief period in his or her academic career.

The inherent inequalities of education in the US have long been acknowledged by many scholars: the cream of financial resources and research facilities have always been concentrated

in the hands of a minority of scholars and institutions (Zuckerman 1970). Berelson (1960) was one of the first researchers to explore the 'upward mobility' of American scientists by surveying 92 graduate deans and nearly 2,000 PhD holders. His study revealed that a student's academic affiliation plays a major role in his future career development: over 90% of the surveyed faculty members at the top 20 American universities were alumni of the same, yet those 20 produced only 63% of all PhDs in 1957. Berelson's findings were corroborated by Eisenberg and Wells (2000), who found that 'academic inbreeding' at top American law schools such as Harvard and Yale was substantially more pronounced than at lesser ones. Pjesky and Sutter (2011) noted that top-graduating students from Harvard Law School have long been automatically offered entry-level faculty positions at their alma mater, to the detriment of non-Harvard alumni. Hargens and Hagstrom (1967) surveyed 576 faculty members in natural sciences and concluded that, regardless of their research productivity, there was a strong correlation between the prestige of their alma mater and that of their employers. There are two possible ways of interpreting the findings of these earlier studies: firstly, in the eyes of prospective employers a scholar's graduate school affiliation may carry more weight than his research productivity in determining his eligibility for a particular academic position; and secondly, other prestige-related factors, such as the reputation of a student's thesis advisor, may play a part in whether or not his academic career is a successful one.

However, it should be noted that an individual's academic affiliation has little or no predictive power of his future career options in Western Europe because its academic traditions are radically different from those of the US: German universities, for example, have few openings for professorships, whereas tenure-track positions are typically open to recent PhD graduates in the US (Kosmulski 2014). On the other hand, in Norway and Sweden it is not unusual for individuals to remain with the same institution throughout their working lifetimes, in sharp contrast to their American counterparts, who may have to switch employers several times in their careers (Musselin 2004).

Aside from the prestige of one's graduate school, there is little argument that mentors play an important role in shaping the academic and professional development of their students. There exist two opposing views on why this is so: one argues that mentors can enhance their protégés' performances, thus improving their chances of career advancement (Becker 1975; Hall and Sandler 1983; Wilson and Elman 1990); the other claims that 'the mentor effect' is political in nature: mentors help increase the visibility of their students, who accumulate important contacts through interacting with people within the mentor's circle (Auster 1984; Ragins 1997). Long and McGinnis' study (1985) lent support to the second view: they studied

all male biochemists who received their PhDs between 1957 and 1963, and found that research productivity during their doctoral training had no effect on their post-graduate academic placement; however, collaborating—and sometimes co-authoring—with mentors who were themselves experienced researchers greatly increased their standing in the academic community, and led to their successfully finding placements after graduation. Kirchmeyer (2005) confirmed the second of these ideas by studying 143 early-to-middle career American academics who received their doctorates between 1984 and 1987. Her focus was not on thesis advisors but on senior faculty members taking on the responsibility of helping to develop the careers of their junior colleagues. Nonetheless, the data indicated that mentoring rather than publication counts had a direct bearing on the academic ranking of these junior faculty members.

Most of the empirical studies on this topic have focused exclusively on American PhD students: few have set their sights on other countries, or on master's degree students. Such research may be scarce because of the difficulty of accessing the relevant data. Firstly, as van Leeuwen et al. (2001) and Meneghini and Packer (2007) pointed out, most of the data accessible by the international community is biassed towards the English language. And secondly, information on master's students is held by individual universities: there is no central electronic repository that archives such data.

2.2.1. Career choices in TIS & CIS

The overwhelming majority of IS studies to date have investigated the following aspects of interpreting: the overall process (e.g. Green et al. 1994; Paradis 2000; Gerver 1971); product (e.g. Pöchhacker 1992; Alexieva 1994; Shlesinger 1989); performance (e.g. Jansen 1995; Roy 2000; Wadensjö 1998); history (e.g. Baigorri-Jalón 2000; Gaiba 1998; Wilss 1999); and pedagogy (e.g. Moser-Mercer et al. 2000; Sawyer 2001). Only a handful have focussed on post-graduate career development. Alvar and Tanzella (2011) examined interpreting for European institutions such as the Parliament and Commission, and discussed the in-house and freelance opportunities available to graduates. They also identified the most in-demand language combinations and other qualities and credentials that employers typically seek. Hammacher and Tuccio (2011) created a manual for recent graduates, most of whom are ill-prepared to handle the practical and administrative side of the profession; their study shared tips on how to locate jobs and build up their credentials as interpreters, as well as identifying the professional standards that graduates should follow.

Following China's 2006 National Conference on Interpreting, which took as its theme the professionalisation of the discipline, a number of scholars shared their perspectives on issues related to students' professional development after graduation. Gile (2006) explained why the AIIC model which dominates in the West was not suitable for emerging markets in Asia, and described how training and research would help to enhance the profession's status in China. Feng (2006) pointed out that there is a lack of proper regulation in the Chinese interpreting market, which seriously affects graduates and long-standing professionals alike, and suggested ways of improving market conditions. Wang E. (2006) conducted a survey on market demand for interpreters which revealed that seminars are the most common venue for interpreting, followed by press conferences and interviews, the majority of assignments relating to investment, trade, IT and law.

2.2.2. Approaches to studying career choices

There have been three primary approaches to investigating students' post-graduate careers: theoretical or conceptual discussions (e.g. Gile 2006; Feng 2006; Hammacher and Tuccio 2011); surveys (e.g. Berelson 1960; Hargens and Hagstrom 1967; Wang E. 2006; Alvar and Tanzella 2011); and scientometrics (e.g. Long and McGinnis 1985; Kirchmeyer 2005). The primary focus of the first approach is to offer prescriptive suggestions to students and junior professionals. The second, though grounded in empirical data, faces the challenges of ensuring that its sampled respondents are representative of the wider population, eliciting accurate answers, and of providing evidence of—and establishing—cause and effect. Scientometric research, in the meantime, allows one to perform quantitative, qualitative or computational analyses of large amounts of longitudinal data, making it possible to draw causal inferences and address sample size issues often connected with survey-based studies.

It is for these reasons that this paper, using a mixture of data-mining techniques and computational linguistics, takes a scientometric approach to examining whether certain structural factors, such as research methodologies, thesis supervisors, academic affiliations, and geographical locations can help determine whether graduate students are more likely to pursue academic or professional careers.

2.3. Scientometrics as a methodological tool

2.3.1. An introduction to scientometry and citation analysis

According to Glänzel (2015), the concept of scientometrics was introduced in 1969 by Nalimov and Mulchenko, who defined it as the use of quantitative methods for analysing the flow of information in science (Nalimov and Mulchenko 1969). At almost the same time the term bibliometrics was coined by Pritchard (1969), who used it to describe a statistical approach to analysing communication in books and other scholarly publications. While these two specialties may have had different emphases during the embryonic stage of their development, they are now used interchangeably by scientists around the world. For consistency's sake only the former term is used throughout this dissertation.

Although it was originally used by librarians facing limited shelf space and an ever-widening pool of scientific literature for the purposes of identifying which reference materials should take priority (Archambault and Lariviere 2007), scientometrics has gradually developed into a discipline in its own right. With the burgeoning of scientific research in the latter half of the 20th century, it became increasingly necessary to introduce criteria that could help determine which fields or projects should be funded: scientometrics began to play an influential role in this process of making gains in efficiency (Beck 1978).

The decades that followed the three pioneering works mentioned above witnessed the creation of the dedicated journal *Scientometrics* (1978), the convening of the 1st International Conference on Bibliometrics and Theoretical Aspects of Information Retrieval (1987), and the establishment of the International Society for Scientometrics and Infometrics (1993). As Ivancheva (2008) notes, the science now has many of the defining characteristics of a fully-fledged discipline: well-delineated research subjects, tried and tested methods and techniques, wide-ranging scope, a global body of practitioners, numerous practising institutions, regular dedicated conferences, and its own journal.

Scientometrics provides a set of quantitative methods to identify the trends, influences and gaps in research within a given academic field. Specifically, it can measure the productivity of published authors (Kretschmer 2004; Gupta and Karisiddappa 2005), and the performance of institutions (Lee 2003; Bayers 2005). It can also identify the most productive establishments (Gile 2001) and gauge levels of interdisciplinary collaboration within a field (Schummer 2004; Qiu 1992). Though it was originally used in the natural sciences such as physics (Haitun 1986) and chemistry (Dewitt et al. 1980), it has since been widely adopted by the social and applied sciences such as sociology and economics. For example, Webster (1998) compared the collection of Polish sociological studies in the Social Sciences Citation Index and its local

equivalent, and concluded that while the former is good for assessing the international impact of Polish sociology, the latter offers a more comprehensive and nuanced presentation of the discipline. In 2009 Tol proposed two alternative versions of the traditional H-index, and tested their performances as means of measuring research impact by ranking the publication counts of 100 of the most prolific economists. And Chu (2001) assessed the influence of the world-renowned scientometrician Belver Griffith on scholarly communication between scientists by analysing 377 documents from the Institute for Scientific Information's (ISI) citation database.

Citation analysis is based on the premise that the number of times a work is cited is a measure of its influence in the scientific world. Conducting such analysis is fairly straightforward, entailing a simple tally of the citations made of a given author or work (Meho 2007). According to Weinstock (1971), citations serve fifteen distinct functions in scientific literature. These include backing up claims, tracing the history of an idea, ~~or~~ and giving credit to the originators of a concept.

Several methods are available for carrying out citation analysis but the overall basic concept remains the same. First a set of articles is chosen; next the researcher counts the number of times each article is cited in other works. The citing works can be categorized according to type (conference proceedings, monographs, periodicals, etc.). A weight can be assigned to each citation based on the type of publication, number of authors of the article being cited, a co-author's contribution to a given article, and other factors. Finally a numerical score is calculated for each author, article, research institution, journal, or whatever the researcher is focussing on; these scores can then be ranked to indicate each individual or entity's relative influence (Lowry et al. 2007).

Researchers from fields outside library science have increasingly adopted citation analysis to to map out the historical evolution of a particular area of study, the influence of individual researchers, academic institutions or scientific publications, the extent of collaboration between these, or the impact of certain disciplines on others (Glänzel 2003; Kalaitzidakis et al. 2003). In their general study of the technique, Braun et al. (1985) found that articles cited between five and ten times each year during the period immediately following their publication tend to be assimilated into the relevant discipline's 'universal stock' of knowledge, and that conversely, if articles go uncited over the same period, there is little chance of such assimilation taking place. Citation analysis has been used in well-established disciplines such as linguistics (White 2004), psychology (Carr and Britton 2003; White and White 1977), and information science (White and McCain 1998), but has also been highly

useful in assessing research patterns in fields with much shorter histories, such as TIS (Gile 2005).

As Lawani and Bayer (1983) note, a number of studies attest to the objective nature of citations as a means of assessing the 'quality, influence, significance or impact' of an author or his work. Narin (1976) and Lawani and Bayer (1983) conducted studies which showed that articles, individuals, departments etc. that are frequently cited also tend to be highly regarded by professionals in the given discipline. Similarly, Virgo (1977) found that citation analysis provided a reliable and accurate means of identifying 'important' papers.

Practically speaking, citation analysis is objective in the sense that the data being analysed is concrete and visible to all. As previously mentioned, the existence of a citation generally implies that the article being cited has influenced the current author's work. The same scoring method is applied to all the articles in a given study population, and rankings are assigned accordingly. Because of this relative objectivity, many researchers prefer citation analysis to other methods (institutional surveys, literature reviews, etc.) of assessing the quality of research typically found in theses and dissertations.

It is widely recognized that citation analysis is not without its drawbacks as a scientific method of measurement and evaluation (Glänzel 2003). For instance, Chapman (1989) pointed out no fewer than 25 flaws, biases, weaknesses, and limitations. Just one example is that the outcome of an analysis may vary slightly depending on how weights are assigned to citations. Also, critics have claimed that negative citations—an author cites an article in order to point out its flaws—and self-citations—an author cites his own previous work in an article—may make a given author appear disproportionately influential. However, as Carter (1974) and Meadows (1974) note, researchers very rarely spend time discussing works they perceive to be of poor quality with the result that, as Case and Higgins (2000) point out, the percentage of negative citations in literature is low. As regards self-citations, citing one's own work within reason is considered legitimate practice and is actually quite common; according to Garfield (1979), such citations constitute more than a tenth of the overall total.

To improve the overall quality of academic research by making it easy to locate papers that have discussed or criticised earlier studies, Garfield's ISI produced the first citation index for articles published in scientific journals shortly after it was founded in 1960: this move led directly to an increase in the popularity of citation analysis. A citation index is a database that allows its users to trace how citations of particular research topics or articles are distributed over time by searching archived academic publications that contain those references. In subsequent decades the ISI has produced numerous other indexes concentrating on social

sciences, arts and humanities. The Institute's indexes have grown to encompass more than 40 million records and 8,700 research journals (Meho 2007), and are now accessible online via Thomson Reuters' Web of Science. Although originally designed to facilitate access to information, they are now widely recognised as an important source of empirical data for scientometric research (Ivancheva 2008).

In the 1960s, borrowing largely from the work of Martyn and Gilchrist (1968), Garfield launched the journal impact factor (IF), which has become one of the commoner applications of citation analysis. IF indicates the average number of times that articles appearing in a given journal over a two-year period have been cited in ISI-indexed journals during the year following. For example, among medical journals in 2012, the *New England Journal of Medicine* (NEJM) had the greatest IF score (53.3), whereas *Clinics* ranked 30th, with an IF score of only 2.1 (Thomson Reuters, Journal Citation Report 2012). Put another way, on average each article published in the NEJM in 2010 and 2011 was cited 53.3 times in 2012, while the same figure for *Clinics* was only 2.1. Some scholars have also taken this approach to evaluating individual papers: Franco Aixelá (2013), for example, calculated the IF scores for 51 of the publications most often cited in TIS between 2000 and 2009.

IF is now widely accepted among the several measures of a journal's overall quality: authors increasingly consider it when deciding which journal to submit their manuscripts to for publication, and many research-oriented universities and academic institutions have incorporated it into the assessment metrics they use to determine which professors should be granted tenure (Lowry et al. 2007). The widespread use of the measure is one example of the mainstreaming of citation analysis within the scientific community.

With the evolution of the internet it is becoming more common to publish and access papers which are not indexed by mainstream databases, for example through open-access journals, publishers' websites, and other online platforms. The Web of Science, though still a hugely important resource, may thus have become comparatively less comprehensive than it once was (Meho 2007).

2.3.2. Social Network analysis

As we have seen, citation analysis is a common scientometric technique in which references from scholarly research articles are collected as data and analysed to assess authors, institutions and publications for their impact, quality and influence, but it is important to remember that

scientometrics is a broad field that looks beyond citations to other factors that influence scientific development (Moed 2005). Though Social Network Analysis (SNA) is not commonly used in Translation Studies for studying influences and scholarly interactions, it has been used in numerous other fields to great effect (see for example Otte and Rousseau 2002; Katona, Zubcsek and Sarvary 2011; Frank, Lo and Sun 2014). The concept of the social network was popularised by Gladwell (2000): he argued that when certain social phenomena reach a tipping-point, they spread through society like epidemics. In fact his idea became so popular that its language has become incorporated into everyday English—videos, for example, are often described as 'going viral'. A potential reason for SNA's massive popularity is based on the fact that as only small numbers of people are instrumental in propagating social ideas, products and behaviours to the extent that they become 'the new thing', it follows that if individuals succeed in 'recruiting' the right team of such people to their cause, they potentially wield significant social influence.

Network analysis has been widely applied in the study of social sciences to assess the interaction between different scholars—how ideas are transmitted from one researcher to another (Wasserman and Faust 1994). An important notion in network theory is that of centrality, a quantitative measurement to indicate the importance of each node in a network system. Mathematically speaking, there are numerous ways to calculate a node's centrality. The most straightforward approach is through degree, which is the number of edges attached to each node (Newman 2010). Figure 1 provides an example of a network where the nodes are connected by edges; the direction of an edge is opposite to the direction of its influence. For example, if author A influences author B (B cites a paper written by A), then the edge direction goes from B to A. Yan and Ding (2009) used the approach to study co-authorship networks in library and information science: using data from 16 journals they concluded that centrality measures strongly correlate with citation counts. Their research confirmed the usefulness of centrality measures in examining research impact.

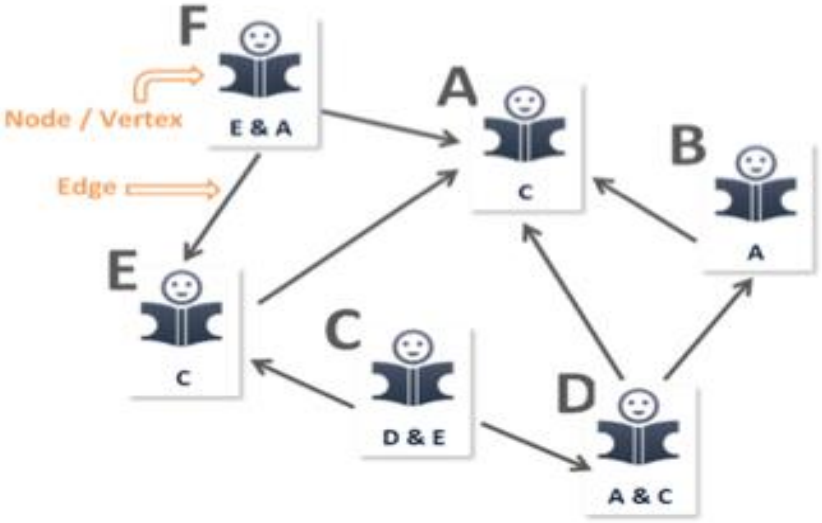

Figure 1. An example of a network with nodes and edges.
Source: Dissertation's author

Centrality-based measures can be divided into two categories: first-order and higher-order. The former is based on the direct interaction of an actor (node) with his neighbours in the same network, whereas the latter is based on his indirect interaction with the entire network, e.g. how he interacts with his neighbour's neighbour. Joseph and Radev (2007), for example, extracted citation data from the Association of Computational Linguistics' digital repository, and used a mixture of first-order and higher-order centrality measures to identify the most influential papers within the discipline's citation network and to examine citation behaviour between its scholars.

In Figure 2 Stella, Raymond, and Bill comprise the first-order zone of the network because each member is linked to everyone else. Ernest, Kathy, Donald, and Gail comprise the second-order zone: all are connected to someone in the first-order zone but they themselves are not central. Jamie comprises the third and final order zone, as he is not directly connected to anyone in the first-order zone and is far removed from the network's centre.

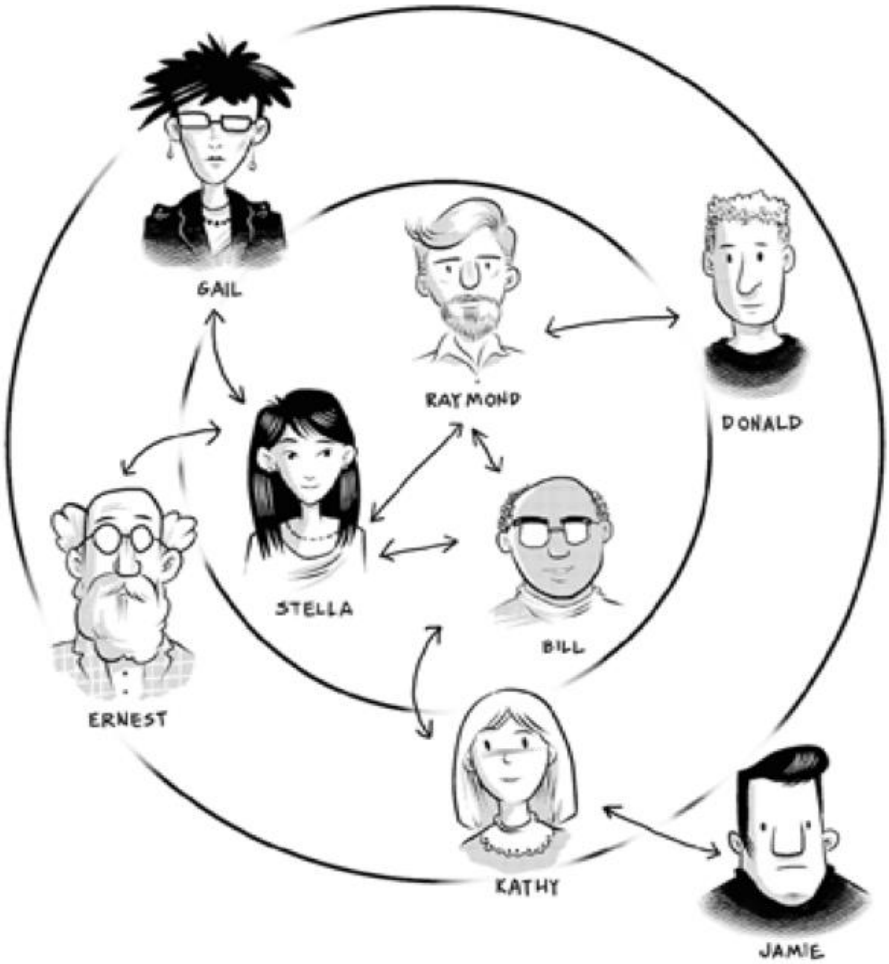

Figure 2. First-, second- and third-order centrality within a social network
Source: Dissertation's author

2.3.2.1. First-order centrality measures in assessing authors' impact on research

A direct method of assessing the research impact of authors is to count the total number of times all the papers they have published are cited, and to rank each author accordingly. The approach can however be problematic because not all citations should be treated equally. For example, a paper cited in a well-regarded book could be said to carry more weight than one cited in a master's thesis which has had little influence on the field. In addition, while a high IF score reflects the high number of citations a journal receives, it is ineffective in comparing the research impacts of journals across disciplines; fields differ in size and may have distinct citation practices, as described by Maslov and Redner in their paper of 2008 where, for instance, they observed that each paper in life sciences receives six citations on average, while in mathematics the figure is only one. *Scientometrics*, a journal which touches on both computer and social sciences, has an IF score of 2.133, much higher than the 0.095 received

by *Interpreting*. This does not mean that the former is necessarily more prestigious than the latter: the discrepancy merely indicates that those scientific communities are far larger than the TIS community. So while the method is useful for determining absolute numbers of incoming citations, other systems of measurement paint a more detailed picture of academic influence.

H- and G-indices are recent attempts to improve upon the straight citation counting method (see for example Maabreh and Alsmadi 2012): they were designed mainly to examine an author's research influence, though Google Scholar also uses H-index to evaluate journals' research impacts. The first uses the number of papers an author has published and the number of times each of those papers has been cited. A scholar is said to have an H-index of *k* if at least *k* of his papers have been cited at least *k* times. An H-index of *k* further implies that no more than *k* papers written by the scholar have been cited at least *k* times. For example, if an author published 10 papers, with two being cited 25 times, six cited 4 times and two never cited, he would have an H-index of 4.

There are many reasons why H-index is not considered a reliable metric for evaluating the research influence of a scholar. Earlier studies argued that the popularity of H-index is mostly due to the absence of an accurate quantitative metric rather than its effectiveness in evaluating a researcher's impact in general (Engqvist and Frommen 2008; Williamson 2009; Kotov 2010). One of the major drawbacks of H-Index is the fact that a new researcher can never have a high score. Even if, for example, his first paper were cited 100 times, his H-Index would still only be 1, given that it was his sole publication. Another shortcoming of H-index is that a scholar can increase his score ranking by way of self-citation. For example, a person who has published ten papers can receive an index value of 9 by citing all his papers in all his own publications even if no one else has cited his work. It should be noted that there is a high correlation between an author's number of published papers and his H-index score, so this additional measure does not add a different dimension to quantifying research impact than simply stating that an author has published *k* papers.

The G-index also uses the numbers of published papers and of citations of each. The basic criteria are the same as for the H-index but it relies more heavily on cited papers and is more difficult to calculate. For a given author to have a G-index of *n*, the *n* most cited papers must have an average of *n* citations per paper. This does not require that each of the *n* papers has individually been cited more than *n* times; rather it only requires that, taken together, the top *n* papers have n^2 total citations between them. Each score's merits and drawbacks are described in the context of a concrete example below.

Grbić and Pöllabauer (2009) studied Daniel Gile's research impact up to 2007 by calculating his H- and G-index scores based on the *Publish or Perish* computer program's analysis of 129 of his publications: his H was 11 and his G 22. The first figure tells us that 11 of his papers received at least 11 citations a piece; the second that his top 22 most cited papers averaged 22 citations each. The disparity can be explained by the difference in the calculation of the two measures. The H-index does not allow for a small number of highly-cited papers to increase the score, as it simply denotes that *h* papers have at least *h* citations. Similarly, the G-index alone would not have revealed that only a small set of his works received a high number of citations.

Using both G-index and H-index, as in this case, affords us a much broader picture of the impact of a scholar's publications. However, both indices are purely dependent on the number of citations a scholar receives, and therefore have some of the same limitations as the straight counting approach: they do not account in any way for the secondary influence of the source paper. A citation in a paper that never receives any citations should not be considered the same as a citation in a groundbreaking, highly-cited work. Furthermore, H- and G-indices are purely quantitative measures of a scholar's research endeavours: they provide little insight into which of his publications have impact and what makes an author influential.

2.3.2.2. Higher-order centrality measures in assessing authors' impact on research

The PageRank algorithm, invented by Google founder Larry Page to rank the influence of web pages, addresses some of the limitations of the G- and H-indices (Maslov and Redner 2008). It was explicitly inspired by citation analysis (Page, Brin, Motwani and Winograd 1998), and awards more value to citations of and by influential papers or researchers. Consequently, professors who are cited frequently in their students' less influential papers but little by their own peers do not rank as highly as those often cited by other influential people in the field.

To visualise how PageRank works let us imagine the following scenario (see Figure 3). A hypothetical random student sits down to read a paper by a particular researcher (Author A). After finishing it, he randomly picks one of Author A's citations and goes on to read work by the cited author (Author B). When he has finished Author B's work, he randomly picks one of B's citations and goes on to read Author C, and so on. In the long term the student is more likely to be reading works by authors who are often cited by others who are themselves often cited. An author's PageRank score represents the long-term probability that the hypothetical student will be reading one of his papers. In mathematical terms the location of the random

student is a Markov chain[1] with transition probabilities given by the citation graph, and the PageRank scores come from the chain's stationary distribution[2]. To put it in more accessible language, an author will receive a high PageRank score when he is much cited by highly-cited authors and cites highly-cited authors himself. The same applies for individual papers too.

Figure 3. Illustration of the PageRank Score

The PageRank score for a paper comprises both the citations included in it (represented by the arrows on the left) and the citations of it (represented by the arrows on the right). The more often a paper cites and is cited by important articles, the higher its PageRank score.

Source: Dissertation's author

In the world of scientometrics the PageRank algorithm has been adopted by various scholars to assess the influence of individual papers and journals. Chen et al. (2007) adapted it

[1] A Markov chain is a stochastic process. Its key property is that the probability of transitioning from one state to another depends only on the current state the system is in, not on prior transitions. This is known as the memoryless property.

[2] In truth the PageRank algorithm is slightly complicated by one other detail: when the student finishes reading, instead of always moving on to a paper by the cited author, there is a 10-15% probability that he might subsequently begin an article chosen entirely at random. This prevents the student from becoming 'stuck' in a cluster of documents that does not connect to the wider community. In a true chain, if a student were reading a paper that had no citation references to any other papers, he would never be able to leave the paper he started with. With the addition of this 'random probability factor' he can jump to a different set rather than staying in the connected set where he started.

to quantify the influence of all papers in *Physical Review* from 1893 to 2003; the approach enabled them to accurately identify influential papers which had only modest numbers of citations, papers which were easily recognisable to physicists but overlooked by the traditional ranking system. Bollen et al. (2006) suggested that in comparison with IF scores the PageRank algorithm is more reliable for objectively measuring a journal's influence.

The PageRank algorithm is effective for assigning a score to an author or paper when he is cited by other influential authors, and when he himself cites other influential authors. However, it is also sometimes useful to have a breakdown of this composite score, to identify which papers are often cited in other frequently cited papers, and in which papers other often-cited papers are cited. This is particularly relevant in citation analysis because, for instance, a quality review paper may contain citations of other frequently cited works, but itself be cited by very few researchers because of its lack of original research content (Newman 2010). Kleinberg (1999) introduced the concept of hub and authority scores, or the Hyperlink-Induced Topic Search (HITS) algorithm, which isolates these two situations that occur in networks: authors receive a high authority score when they are often cited by other often-cited authors and a high hub score when they cite other often-cited papers (see Figure 4). One notable use of the HITS algorithm is by ask.com, a search engine that provides answers to commonly asked questions. In the case of Google, their PageRank team specifically used Kleinberg's concept as one of their theoretical foundations (Page, Brin, Motwani and Winograd 1998). The HITS algorithm sheds more light on the centrality of each node in a network than the previously mentioned methods but, perhaps because of the wide popularity of PageRank, it has seen a somewhat limited application by researchers.

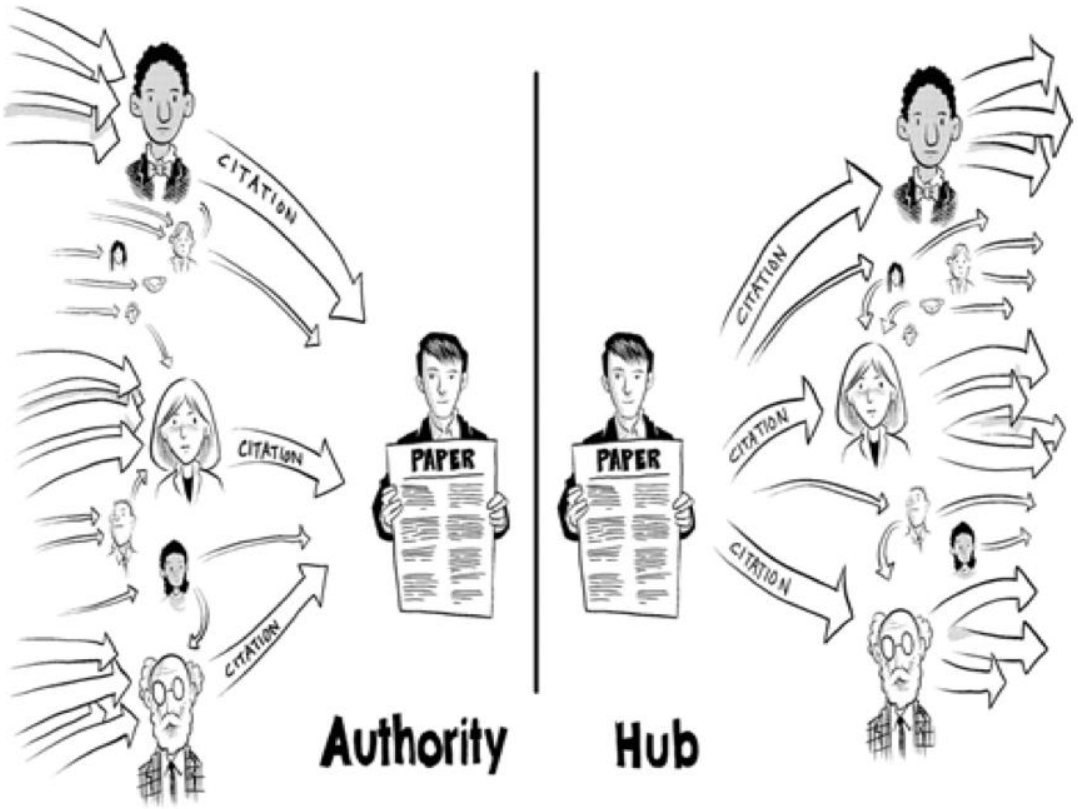

Figure 4. Illustration of the Authority score

The Authority score of a scholar indicates how many other people cite him, thus measuring the authoritativeness of his position in the network. His Hub score measures how effective he is in serving as a centre of information by calculating how many authoritative scholars he refers to in his papers.

Source: Dissertation's author

Another important measure commonly used in Social Network Theory is that of betweenness centrality (BC) (see Figure 5). Introduced by Anthonisse (1971), its purpose is to gauge the extent to which a given node lies on paths between others. To understand the concept, it may help to visualise a network in which items flow from place to place (node to node) along edges (paths). In a social network, for example, messages and items of news or information might pass from one person to another.

For instance, let us initially assume that each person in the network is equally likely to exchange one of these items with another over the same period of time, and that the items always move along the shortest (geodesic) path (if there are several such paths, one is selected at random). If a suitably long period is allowed to elapse, during which multiple items pass through each member (node) of the network on the way to their destinations, the number of items exchanged at a particular node is proportional to the number of geodesic paths which pass through it. This number of geodesic paths is referred to as the BC of that particular node (Newman 2010). Unlike other centrality measures such as degree centrality, betweenness does

not measure a node's degree of connectedness within the network, but how much control it has over the flow of information between other nodes. In other words, removing a node with a high BC score would seriously disrupt the delivery of information from one node to another.

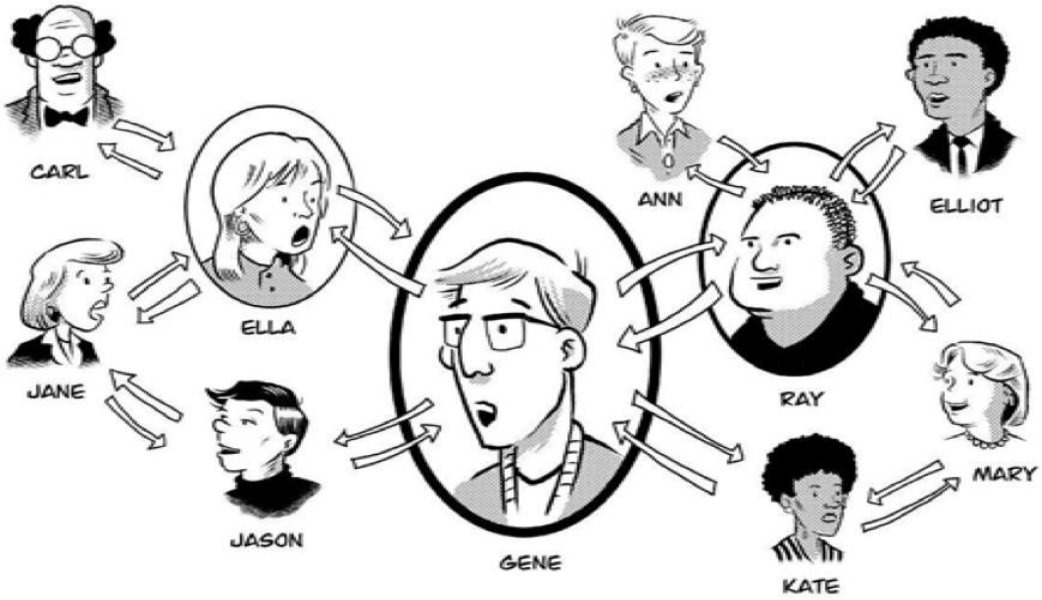

Figure 5. Illustration of the BC score

BC scores for various people within a network: Gene has the highest score, followed by Ray and then Ella. The removal of any of these three people would seriously disrupt the spread of information in this network. Though both Gene and Ray are connected to four people each, Gene has more control over the traffic in the network (without him, the people on the left hand side would not be able to communicate with those on the right), hence his BC score is higher than Ray's.

Source: Dissertation's author

Scholars have applied betweenness centrality to the study of numerous complex networks such as those of wireless sensors (Cuzzocrea, Papadimitriou, Katsaros and Manolopoulos 2012), air transport (Wang, Mo, Wang and Jin 2011) and pollination (González, Dalsgaard and Olesen 2010). The measurement has also been much used in citation analysis. Abbasi et al. (2012) examined research collaboration in the form of co-authorships by investigating the BC scores of various academics; their research found that PhD supervisors and postdoctoral researchers score highly because they typically serve as 'brokers' between new academics and their own existing networks of collaborators. Leydesdorff (2007) studied all 7,379 of the journals archived in the *Journal Citation Reports of the Science Citation Index* and the *Social Sciences Citation Index*, and found that BC scores can serve as a reliable indicator of the level of interdisciplinarity of academic journals: the higher the BC score a journal receives, the more interdisciplinary it is.

To date, higher-order centrality measures have not been actively applied in TIS research—such explorations might shed new light on how influential a certain scholar or publication is perceived to be within a particular community.

2.3.3. Recent scientometric studies in Translation and Interpreting Studies

To facilitate improved communication between researchers in the field of interpreting, in 1990 Daniel Gile set out to create an international network—the Conference Interpreting Research Information Network (CIRIN)—which publishes a biannual *Bulletin*. Since then several other searchable databases have been created for this discipline: the Bibliography of Interpreting and Translation (BITRA), for example, carries over 50,000 entries and is updated on a monthly basis, while the Translation Studies Bibliography (TSB) subscription service has 24,500 entries to date.

Gile spearheaded scientometric research in Interpreting Studies in the early 1990s, when he started using scientometric data in his research. Early on he began exploring the qualitative elements of citation analysis, and indicating the category of each citation (research methods, concepts, terminology, anecdote, etc.). Feeling that citation analysis could offer numerous benefits to students with limited research experience, Gile taught classes in scientometrics and supervised several masters' and PhD students who applied the method in their research projects (Rowbothman 2000; Erwin 2001; Nasr 2010). In 1995 he identified trends in Conference Interpreting Studies through scientometric analysis of the relevant literature. At his suggestion, Pöchhacker wrote an article for *Target* (1995) in which he analysed the productivity of individual authors based on the number and type of their published works.

In the past decade scientometric methods have been increasingly used to study sub-disciplines of TIS. For example, Metzger (2006) expanded the scope of scientometric study to include Signed Language Interpreting, and Pöllabauer (2006) analysed a corpus of literature on Community Interpreting to better understand the methodological and thematic trends of this sub-field. Despite these recent efforts, the technique is as yet relatively under-utilised within the field. Grbić and Pöllabauer (2008) argue that it should be applied more assiduously in order to track the growth of what is, in their eyes, a still-maturing discipline.

In 2005 Gile surveyed citations from 47 papers on translator and interpreter training written by Western academics to determine which theories were most influential, the languages the cited works were most often written in, and whether empirical or non-empirical research

had more influence. The interpreter training material he sampled for the study revealed several interesting points: the model advocated by the Association Internationale des Interprètes de Conférence (AIIC) was the most frequently cited theory for interpreting, while functional theories were dominant in translator training; the majority of the cited literature was written in English; and empirical research played very little part in the papers sampled. In another study (2006) he introduced a qualitative dimension to his analysis by grouping citations into different categories (concepts, methods, findings, etc.), on the assumption that such an approach would provide a more nuanced analysis of each category's impact on the evolution of TIS. The study revealed that scholars were cited on their methods and findings in less than 10% of the articles in the corpus. Adopting the same classification scheme, Nasr (2010) examined a corpus of 542 texts on translator training. Her study produced a similar result, indicating that empirical research was not influential in shaping research into that subject either.

As the field has grown to publish in excess of 110 journals around the world (Rovira-Esteva, Oreroa and Franco Aixelá 2015), more scholars have turned to scientometrics to gain a better understanding of the evolution of TIS. Zanettin et al. (2015) analysed data from Translation Studies Abstracts to describe how scholars' research interests have changed over time, and concluded that literary translation continued to be the dominant research topic in TIS, despite the increase in interest in other areas such as multimedia and legal translation.

Van Doorslaer and Gambier (2015) studied the geographical distribution of TIS research around the world, and examined how certain keywords are more frequently used in certain journals than others. In addition to these studies using empirical data, a number of researchers, such as Gile (2015) and Franco Aixelá and Rovira-Esteva. (2015), have conducted meta-analysis by evaluating methodological issues associated with TIS scientometric research: the former analysed the applicability of scientometrics in TIS research and training, while the latter critically reviewed traditional methods in research evaluation and quality assessment. These studies show that scholars have increasingly recognised the necessity for scientometric work to better appreciate and evaluate the development of TIS, which stands in need of international attention and respect to put it on a par with disciplines that have longer academic traditions.

2.3.4. Chinese scientometric research

The growth of scientometrics in China has trailed developments in the West by about a decade. In an article in *People's Daily* in 1977 Hsue-Shen Tsien, a scientist influential in the

development of missiles and space programs in both China and the United States, argued for the need to establish an independent discipline that focused on the 'science of science'. Hongzhou Zhao is considered the pioneer of scientometric research in the PRC. While interned in a labour camp in Henan Province in 1974 he analysed the *History of Natural Science* published by the *Fudan University Journal* and studied the shifting of research production centres across the world (Liu 1999). In 1985 he and Gouhua Jiang published an article on the demographics of scientists in *Scientometrics*, the first time a Chinese-authored article on the subject received widespread recognition from the international community (Zhao and Jiang 1985). In 1978 the Research Group for the Science of Science became the first academic body in China to study scientometrics (Jiang 2008).

Since then multiple scientometric studies across various academic disciplines have been carried out. For example, Wang et al. (2005) investigated scientific collaboration in China by analysing co-authored works. In another collaborative study published the same year He et al. evaluated research productivity in biochemistry and molecular biology based on data extracted from the Science Citation Index Expanded. Ruan (2012) assessed the quality of medical research in Chinese hospitals by examining indicators such as the number of new drugs and patents. However, scientometric research in the PRC has not been without its problems of methodology, as pointed out by Dong et al. (2013), who noted that a large number of authors of scientometric papers fail to elaborate on their procedures for cleaning and analysing data, thereby calling into question the integrity of the data collected and thus the credibility of the overall work.

China eventually developed its own citation indices, though they appeared much later than in the West and are still not fully comprehensive or standardised. The leading ones include the state-funded Chinese Science Citation Database, created in 1989, and the Chinese Social Sciences Citation Index (CSSCI), established in 1998. Unlike its Western counterpart, the CSSCI collects citation data from monographs, collective volumes and miscellaneous websites in addition to journal articles. However, while the West's SSCI includes articles dating back to 1972, the Chinese version contains articles published only since 1998, seriously limiting the pool that researchers can draw on for analysis. As an example, a search for 'Interpreting' in the CSSCI currently yields only 263 entries; by contrast, the same search of SSCI produces 585 entries. In addition, a large proportion of the citations do not follow the standards outlined in China's official style guide (*Rules for Content, Form and Structure of Bibliographic References*, 2005) and often confuse the first and last names of authors.

2.3.4.1. Scientometric approaches in CIS

A handful of researchers have applied the principles and methods of scientometrics in Chinese Translation and Interpreting Studies. For example, some have attempted to provide a broad overview of trends and developments in the discipline by classifying relevant journal articles according to theme and by giving examples of the leading articles in each category (Hu and Sheng 2000; Liu and Wang 2007; Li X. 2007). Others have gone further by backing up their claims with simple counts of articles published on a given theme (Mu and Wang 2009; Tang 2010). More recently, Wang and Liu's study (2015) examined the landscape of Chinese Interpreting Studies (CIS) by focusing on 597 articles published in premier Chinese journals. These authors investigated publication counts, topics, research methodologies and author productivity. Their research revealed that though CIS is experiencing increased diversity in the themes studied, and the proportion of empirical research is on the rise, there remains a shortage of studies which draw inspiration from other disciplines, and the overview style of research continues to dominate.

Gao B. (2008) and Zhang (2011) published studies of the similarities and differences between translation and interpreting research in China and the West. While Zhang took a broad view, covering the entire subject of interpreting, Gao's interest was in the cognition aspect of Simultaneous Interpreting Studies. The latter's corpus included articles from eight leading Western academic journals and three Chinese. Her analysis suggested that recent Western works were less characterised by debate than was common in the past, and that they frequently drew on findings from contemporary psychology to re-evaluate prior research in the field. Gao noted the strong influence of major Western theories in CIS from the late 20th century, theories such as Gile's Effort Models, cognitive pragmatics and the Interpretive Theory. She found that, compared to their Western counterparts, Chinese researchers were less inclined to interdisciplinarity.

The effectiveness of scientometric studies depends to a great extent on their measurements and data quality. In the past Chinese scholars tended either to assess the CIS landscape descriptively and qualitatively, drawing on their intuition and personal experience, or to present conclusions that were based on very limited data and consequently not representative of Interpreting Studies as a whole. In her 2008 work, for example, Gao Bin employed a database of 197 papers published in three Chinese academic journals between 1994 and 2007. From this she built a secondary database on simultaneous interpreting, selecting a total of 158 citations from just 17 of those papers. Her decision to concentrate on these alone rather than use citations taken at random from all papers on the subject limited her ability to

assess larger trends in the wider population. Zhang Wei's paper (2011) serves as a theoretical analysis of the differences in interpreting research between China and the West, but empirical studies need to be conducted to provide data to support or refute his conclusions that there is little innovation in CIS and that most authors concentrate on practical issues such as interpreter training.

2.4. Problems in scientometric research

The first challenge that researchers typically encounter when conducting citation analysis is the representativeness of the data collected. Incomprehensive data can lead to biassed samples, which can in turn lead to incorrect conclusions. Researchers in other fields have traditionally often relied on information from commercial databases for analysing well-defined small samples of data. Carr and Britton (2003), for instance, relied on citations provided by the Journal Citation Reports (JCR) to assess the academic impact of journals in behavioural psychology. They concluded that the journals in the field could be grouped into two broad types: those of the first were consistently cited more than 1,000 times per year, while those of the second were consistently cited fewer than 1,000 times and as a result had substantially less impact on the research literature. Even in a discipline like information science, which frequently uses citation analysis to measure scientific influence, analysis is typically performed using information retrieved from commercial databases. White and McCain (1998), for example, used data from Scisearch to examine the most frequently cited authors in a dozen premier journals; their findings suggested that scholars were showing an increasing interest in the cognitive aspect of the discipline.

Despite the growth in use of citation indices, the increasing diversification of scientific research and the resulting growth of new disciplines over the past four decades has resulted in numerous high-quality journals being excluded from the 'baskets' used by the leading ones. This is particularly problematic in TIS which, despite having evolved into an area of academic enquiry in its own right, is still regarded by many as a subspecialty of traditional disciplines such as Literature and Linguistics. This can be evidenced by the fact that TIS is under-represented in leading general-purpose academic databases. Grbić and Pöllabauer (2008) observed that of the hundreds of translation journals published worldwide, only four were indexed in the Web of Science. But even some language-oriented databases, such as that of the Modern Language Association (MLA), do not necessarily contain comprehensive information

on TIS, because they employ specific criteria such as citation frequency for selecting which journals to include. Many TIS journal publishers find it difficult to meet these rigid criteria, because the community is small and covers a wide range of issues from the literary, technical, and legal aspects of translation to localisation and signed language interpreting.

Because of the limited availability of comprehensive citation data in commercial databases, scholars have attempted to use computer-generated algorithms such as autonomous citation indexing (ACI) for extracting citations (Goodrum, McCain, Lawrence and Giles 2001). These computer programs can rapidly retrieve a much larger amount of bibliographic information from the Internet than any traditional databases could possibly supply. However, this approach can potentially yield noisy data, with an average error rate of 10%, leading, for example, to named entities other than authors, such as 'Ann Arbor', being credited with outstanding academic impact, despite that being the name of a university city in Michigan (Postellon 2008). So while this method has allowed researchers to automate the entire data-gathering process, it can lead to inaccurate sampling material.

To improve data quality, researchers can opt to collect their citations in person. However, given the time-consuming nature of this work they are seldom able to collect samples of any meaningful size. For example, to assess its library's journal collection, researchers at Delta State University analysed 4,012 citations from 70 dissertations produced by its students, producing a list of the 18 most frequently cited journals. While the study reached its research objective in providing guidance on the journals the library should subscribe to, a sample size of 70 dissertations, all with a common supervisor, would be neither comprehensive nor representative enough for generalising to the population of dissertations. So while in-person data collection can result in high-quality information, those researchers engaged in it must strive to ensure that what they are gathering is representative of the whole population, so as to offset data variation arising from small sample sizes.

Building on the groundwork laid by earlier researchers in scientometrics, this study aims to address the aforementioned problems by creating an all-but-exhaustive database in CIS. The data is sourced from MA theses, doctoral dissertations and journal articles, which are the most productive sources of literature in the field. The comprehensiveness of the collected material should remove the sample size issues faced by earlier CIS studies and allow meaningful conclusions to be drawn about the entire field, as opposed to a partial, potentially unrepresentative sample.

Chapter 3. An overview of research in CIS

This chapter paints a panorama of the CIS landscape and its evolution over the past two decades. It begins by providing the historical context in which interpreter training began in China and reviews some of the earlier scientometric surveys on the discipline. There follows the data analysis for three strands of research questions: student-related (production trends, theoretical influences and research topics), university-related (research productivity of thesis advisors and universities) and geographical factors (regional volumes of research production and inter-locational collaboration). Answers to these questions set the stage for the next chapter, which focuses on evaluating the extent to which these structural determinants influence students' career choices.

3.1. Background

Chinese interpreters came to prominence on the international stage when the People's Republic of China (PRC) regained its seat at the United Nations (UN) in 1971. As a result of China's return, the UN was instrumental in establishing a dedicated training program to meet the demand for conference interpreting services from various of its offices located all over the world (Wang R. 2006). The first research article on Chinese Interpreting Studies (CIS) archived by the China National Knowledge Infrastructure (CNKI) was published in the late 50s (Tang and Zhou 1958); since then the discipline's growth has been explosive: a total of over 3,600 scholars have to date produced nearly 3,000 journal articles and conference proceedings, 1,300 MA theses, and over 30 dissertations on the subject. Given its rapid evolution and ever-heightening academic status it is of great importance to study the structure of this scientific community.

Scholars such as Liu Heping have reviewed the evolution of CIS before. In a 2001 paper she traced the discipline's development by studying the biennial National Conference and International Forum on Interpreting, which held its first session in 1996. As CIS has gained momentum, this event has attracted more participants and featured more diverse themes. Liu called on her colleagues to follow the trends prevalent in Western interpreting research. Following in Liu's footsteps, Liu Shaolong and Wang Liuqi (2007) also studied the landscape of CIS by sampling 161 articles published over the previous decade, and selecting 30 for an in

depth study. They concluded that in comparison with those used in the West, research methods favoured by Chinese scholars were 'subjective and monotonous', and lacked centralised themes. Li Xiangdong (2007) and Tang Fang (2010) took a similar approach but used a larger sample size from articles published in China's premier journals. The conclusion they came to was a different one: they found that not only was the quantity of CIS articles increasing but their quality was improving.

In addition to conference proceedings and journal articles, MA theses are another important source of data that contribute to the advancement of knowledge in CIS. Zhao Nan (2009) employed a dataset comprised of 229 theses to focus on the research methods adopted by Chinese MA students over the previous decade. She found that because of student researchers' lack of relevant training, a large number of theses fell down on methodological issues such as sampling, material selection, testing conditions and quantitative analysis.

Doctoral dissertations are a third important indicator of high-level research activities (Gile 2013). They represent the final destination of an individual's journey through the world of formal education and, as well as demonstrating his or her mastery of the existing literature in a given field, represent original contributions to that sum of knowledge (Kushkowski, Parsons, and Wiese 2003). As a result they constitute an important component in the knowledge-creation process of any given discipline, and should be studied when assessing the evolution of that particular field. Given the academic value of doctoral dissertations in Translation and Interpreting Studies (TIS), a number of scholars have set out to study how they evolve and change over time. In 2013 Daniel Gile carried out a case study of major contributors to research in conference interpreting. His study revealed that over the span of four decades, the École Supérieure d'Interprètes et de Traducteurs (ESIT), a leading TIS school, produced 11 dissertations, Spain 15, Italy one and China seven. Despite ESIT's dominant position in generating the majority of the world's TIS dissertations in the 1970s, it accounted for only 2% of the total between 2000 and 2009. In the last decade doctoral research productivity in Spain and China has been on the rise. Strong leadership at major universities and the requirement for faculty members to have PhDs in order to obtain tenure may be the driving force in Spain. In 2014 Mu, Zou and their doctoral students took a close look at the situation in China, examining 686 doctoral dissertations produced in TIS from 1992 to 2013, of which 39 dealt specifically with Interpreting Studies (IS). They found that most spotlighted interpreting strategies and cognition, and that experiments were the primary research method. They also observed that the topics themselves were focused and well-suited to the authors' capacities, but that few of the dissertations had solid theoretical underpinnings.

While these pioneers have deepened our understanding of CIS by tracing the discipline's evolution, most of these exploratory studies focused on rather limited samples of papers. Another limit of many of the pioneering studies is that they proposed classification systems of research topics which featured overlapping, non-mutually exclusive categories. For example, in Mu and Zou's study (2014) it is difficult to understand why working memory, pedagogy, interpreting competence, interpreter's roles, and interpreting theories were gathered together into one category, thinking process for interpreting, self-correction, and interpreting quality assessment into another, and note-taking, norms, anxiety, communication, information processing and decision-making a third. Elements from each (working memory, thinking process, and information processing) might more profitably have been combined to form a category of their own (e.g. cognitive issues).

This chapter builds upon the work of these earlier scholars (Liu 2005; Liu and Wang 2007; Tang 2010), expands on some of the topics they explored, answers some of the questions they left open, and removes some of the limitations that were present in their work, with the aim of assessing the development of CIS by means of a scientometric analysis of its most productive sources of research—MA theses, journal articles and conference proceedings, and doctoral dissertations. Using an all-but-exhaustive collection of 59,303 citations from 1,289 MA theses, 32 doctoral dissertations and 2,909 journal articles and conference proceedings, we shall examine the growth, themes and theoretical influences of those papers[3] over time, as well as the most productive players and their research collaborations, all of which are essential for a comprehensive understanding of the CIS landscape.

3.2. Organisation of the chapter

This chapter is organised around questions that were devised to describe the context in which CIS students receive training in China. The order in which the questions are presented is the same as for the study of predictors of students' career paths in Chapter 4, and are grouped into three sets:

- Student-related: Questions 1-3 provide an overview of the trends and evolution of CIS literature with a breakdown of its most productive sources: MA theses, doctoral dissertations, journal articles and conference proceedings.

[3] The shorthand term 'papers' will be used to refer to any type of document included in the database, be it thesis, dissertation, or journal article.

- University-related: Questions 4-5 examine in detail the busiest thesis advisors and most productive universities, both of which have played an important role in shaping the development of CIS.
- Geography-related: Questions 6-7 analyse the distribution patterns of CIS production centres and how they interact with one another on collaborative research.

3.2.1. Student-related factors

1. How has CIS progressed over the years and what does its future hold?

Gupta et al. (2002) pointed out that increasing numbers of discoveries and the rapid accumulation of knowledge have been one of the hallmarks of modern science. Publication count is an important indicator of scholarly activities in a given field (Grbić and Pöllabauer 2008); it can also be used with large datasets to analyse the research output of a particular region over a long period (for an example see Blickenstaff and Moravcsik 1982).

Studying the growth of scientific publishing took on a particularly important meaning in 1961 when Price published the first paper on the subject, concluding that the number of journals grew exponentially and that the total would reach 1,000,000 by the year 2000. In a later paper (1975) the same author conceded that reviewing every single academic paper ever published was an impossibility, but argued that simply counting them would contribute to our better understanding of the pursuit of a science as a whole. This eventually led to the development of scientometrics. Numerous scholars (for example Krauskopf et al. 1986; Mabe and Amin 2001; Small 2006) have explored the growth patterns of natural science disciplines, but fewer have examined the social sciences and humanities, and fewer still have tackled CIS.

The translation and interpreting studies (TIS) community is ripe for such studies, having experienced significant growth in both quantitative and qualitative terms over the past two decades, and because hundreds of papers with diverse research methods and themes are produced annually (Franco Aixelá 2013). During this period of significant growth, more empirical studies are needed if we are to fully appreciate the trends prevalent in TIS. The aim of this research question is to gauge the growth of three major sources of CIS literature: articles, MA theses and doctoral dissertations, and to ascertain whether the field as a whole has reached a stage of full maturity. The answers to this question can help in our understanding of why CIS graduates choose academic or professional careers, a subject explored in depth in the succeeding chapter.

2. What are the major theoretical influences in CIS, including the most commonly addressed topics and how has their popularity changed over time?

While publication counts provide a panoramic view of the rapid growth of CIS over the past few decades, they do not reveal its intellectual lineage, i.e. how the ideas and research of preceding scholars have shaped its development. This question explores the theoretical influences and research topics contained in CIS papers. If theoretical influences can be considered the 'input' that inspires researchers to conduct their studies, research topics are the 'output'. Zhang Wei (2009) observed that theoretical and thematic trends in the West have not remained constant over time: in the 1950s scholars focussed on their personal reflections on the best practices in interpreting, but in the 1960s the focus shifted to experimental psychology, and with the advent of the 1970s and 80s interest shifted once again to become completely dominated by deverbalisation and the Interpretive Theory of Translation.

3. What research methods have been employed by CIS scholars in MA theses, doctoral dissertations and articles and what has been the evolution of the propensity to carry out empirical studies over time?

While a number of authors have studied the growth of CIS and investigated the wide range of topics it covers (e.g. Hu and Sheng 2000; Gao B. 2008; Tang 2010), few have looked into the research methodologies employed by its academics. Examining the methodological trends in a given discipline can help improve the ways in which its research is conducted (Liu 2011). Of particular note is empirical research, which can help support or refute theories and hypotheses, a process vital for the robust development of a discipline such as IS in which results and findings display a high degree of variability (Gile 2013).

3.2.2. University-related factors

4. What are the universities with the largest output in the field?

Unlike machine translation and localisation, research in Interpreting Studies is not a lucrative endeavour, so universities are naturally the driving force behind almost all research completed in this field (Gile 2012). Since the creation of the Master's in Translation and Interpreting in 2007, 159 Chinese universities have launched their own training programs for interpreters and translators: all students are required to write theses to be eligible to receive an academic degree. Though tenure is automatically awarded to all teaching staff ~~of~~ at Chinese universities, faculty

members are required to publish their research and pass an annual evaluation. This section examines the number of theses (both MA and PhD) and articles produced at each university.

5. Who are the advisors with the largest production in CIS and how frequently do advisors engage in co-supervision?

In contemporary university education, graduate students are often considered apprentices (Fonseca et al. 1998), developing the skills to master their craft under the supervision of highly experienced advisors, who assume the largest share of the responsibility of developing the next generation of researchers. It is important that each advisor spend enough time with his advisees to ensure a successful outcome to their thesis writing. The question arises as to whether the workload of thesis supervision is evenly divided between all qualified faculty members at Chinese universities, or if a small number of professors supervise a large number of students while the remainder take on only a few.

Research in interpreting often requires technical knowhow from several disciplines (Gile, Dam and Schjoldager 2001). However, few supervisors possess the combined skill sets of practical interpreting and 'professional' research (Gile 2001). This problem can be overcome by co-supervision: advisors with different educational and research backgrounds pool their complementary skills to guide students through the minefield of interpreting research. The arrangement is not, of course, without its flaws: professors may not relish not having full control over the direction a student's research is taking, and may even clash over questions of methodology. This section has been designed to furnish a better understanding of thesis supervision in CIS through the use of descriptive statistics.

6. What is the research output of advisors and their graduate students and what is the propensity to engage in research collaboration?

Since 1930, when Jesús Sanz did the first study of conference interpreters working in Geneva, which has signified the inception of SI, experts from outside disciplines, such as psychologists and linguists, practicing interpreters and those with training in both empirical research methodology and interpreting skills have contributed to the growth of this discipline by publishing their studies in journals and conference proceedings. Across a wide spectrum of disciplines, research productivity has been increasingly regarded as an indicator of a scholar's contribution to the community that he or she works in. With the establishment of CIS as an independent field of academic enquiry, it is worthwhile examining to what extent faculty are

engaged in research activities and whether an MA degree establishes the baseline research skills for graduates to produce papers that pass peer reviews.

According to Long, Allison and Mcginnis (1979), while advisors influence their students in multiple ways, collaborating on the publication of their research articles is the most critical to their career development. Graduate students are unknown quantities in the research world: their works are much less likely to be accepted for publication than those of established academics. This situation is especially true for Chinese academic journals, most of which use the single-blind peer review process, in which the author's identity is visible to the reviewer. When there are numerous papers competing for limited publishing space, both editors and reviewers may feel the need to prioritise and be selective, so it is reasonable to speculate that many papers by lesser-known authors, such as students who have not finished their interpreter training, may go unpublished. As such, the research collaboration between thesis advisors and their students were also explored in this section.

7. What are the patterns of inter-institutional collaboration?

Collaborative research is seen as a sign of the increased professionalisation of a discipline (Beaver and Rosen 1979). It offers an opportunity for institutions to share both their resources and the technical expertise of staff who may otherwise only have the time and energy to produce parts of papers. However, unlike disciplines in natural sciences and engineering, where co-authorship in published articles is standard practice, the level of collaboration among scholars in social sciences and humanities is much lower (Larivière, Gingras and Archambault 2006). In the realm of IS, funding for research is generally provided to a team at the one school, so even when co-authorships do occur it is natural to expect that most are intra-institutional in nature. This section gauges the level of inter-institutional activities in CIS in order to shed light on whether there exists a frequent exchange of ideas between scholars with different academic affiliations.

3.2.3. Geographical factors

8. Which regions of China have emerged as the major production centres for CIS research?

Over the past decade China has been a major global contributor to the advancement of science, as evidenced by its ranking second in terms of the total number of academic publications produced (Zhou and Leydesdorff 2006). One might wonder how the country's 35 administrative areas perform and compare with one another in terms of their contributions to

the overall national scientific 'output'. Zhou et al.'s study of 2009 concluded that in terms of research production and citation impact there existed a great deal of imbalance: the publications from which outgoing citations were primarily taken were concentrated in just a handful of places such as Beijing, Shanghai and Jiangsu. The study covered a dozen major scientific fields, but Interpreting Studies was not among their number. Building on Zhou's foundational work, the present author set out to identify the regions which contribute the most in terms of theses and articles.

9. What are the patterns for inter-locational[4] collaborative research?

With the advent of the internet and other communication technologies, it has become much easier for researchers to collaborate instantaneously, via email and video-conferencing, unhampered by geographical distance. However, it would appear that collaboration across geographical boundaries in the IS community is somewhat limited. Numerous countries that make up the global IS community, such as Denmark and Israel, have only one small production centre in one particular city, with most of the papers being contributed by a small number of researchers there (Gile 2000). China is not like this: it has quickly gone from producing very little in the 70s and 80s to being the world's largest producer of writing on interpreting, with hundreds of researchers having authored papers over the past decade (Gile 2013). This section examines the extent and nature of collaboration between researchers from various regions of China.

3.3. Data Organisation

The dataset used in this chapter comprises 1,289 MA theses, 32 doctoral dissertations and 2,909 journal articles and conference proceedings. For the purpose of this research project, journal articles and conference proceedings (many of which are themselves published in journals) are considered equivalent. A piece of writing appearing in both formats, or in one format in multiple publications, was only collected once for the dataset. Interviews, book reviews, obituaries, reminiscences, discussions of exam questions, and tips for students were all

[4] China is comprised of three types of regional political unit: the capital, the municipalities, and the provinces; all are on a par with each other in terms of administrative power. For the sake of clarity, the term 'inter-locational collaboration' is used to refer to co-authorship between scholars, be they from different provinces, municipalities or the capital.

excluded because they represent a different type of data, and are therefore outside the scope of this project.

To ensure that the dataset was as comprehensive as possible, the majority of these papers were collected from the official Chinese repositories of electronic theses (CNKI, Wanfang, and the National Digital Library of Theses and Dissertations in Taiwan). When theses were only available for review on site, library visits were made. The result was a collection of academic papers representative of the whole CIS community. Each paper was labelled for its author(s), title, academic affiliations, research methods, keywords, and theoretical influences.

3.3.1. Thesis content labelling

Scholars traditionally relied on the keywords supplied by papers' authors to investigate various features of and connections between scholarly works (Yi and Choi 2012; Yoon et al. 2010; Hofer, Smejkal, Bilgin and Wuehrer 2010). However, insufficiencies and inconsistencies in the authors' labelling make it sometimes difficult to identify important features. In addition, there is a danger of generating too many categories which could distract researchers from seeing the bigger picture.

To avoid this kind of pitfall the present study used qualitative data analysis and examined the actual content of each and every thesis rather than relying solely on the authors' keywords. The contents of each thesis were coded in terms of theoretical influences and research themes, which can be thought of as the raw materials and finished products of research.

3.3.2. Definition of theory categories

The first step of the analysis involved examining the literature review section of each thesis (when the full text was available) to identify and code all the theories that were discussed. When certain theories or concepts were only mentioned in passing they were excluded from the analysis. The coding scheme consisted of six categories. For examples of some of the theories identified and how they were subsequently assigned to the various categories see Table 1.

Table 1. Categories of theoretical influences with examples of theories

Categories	**Theory name**	**Representative publication**	**Description**

Cognition	Cowan's Model	Wilson and Cowan, 1972	Describes the interaction between excitatory and inhibitory neurons
	Wechsler Memory Scale	Wechsler, 2009	Describes various categories of human personality
	Five-Factor Personality Theory	Matthews, Deary, and Whiteman, 2009	Describes various dimensions of an individual's personality
Language	Grammatical Metaphor	Halliday, 1994	The use of a different grammatical construction to conjure up a different meaning
	Levelt's Language Acquisition Model	Levelt, Roelofs, and Meyer, 1999	Delineates the stages in acquiring a language
Communication Theory	Lasswell's Model of Communication	Lasswell, 1948	A linear model that describes the communication process
	Noisy Channel Model	Brill and Moore, 2000	A system for finding the right word when a wrong one has been produced
Translation	Function Plus Loyalty	Nord, 2007	A guiding principle for faithful and culturally sensitive translation
Peoples and Cultures	Jauss' Esthetics Of Reception	Rush, 1996	A theory that emphasizes the reader's perception of beauty in the text
Miscellaneous	Family Resemblance Theory	Wittgenstein, 1953	A philosophical idea that argues things are connected by overlapping similarities
	Learning Motivation Theory	Oxford and Shearin, 1994	Explains the hows and whys of motivating learners

Source: Dissertation's author

3.3.3. Definition of research themes

CIS authors investigate a wide array of subjects in their theses. To identify them, the theses were given a first pass in search of a large number of keywords describing the topics addressed in each. These keywords were then grouped into the major themes of CIS employing an adaptation of the classification scheme used by Gile (2000). The adapted scheme was conceptually simple and minimised overlap between categories. The theme categories created are shown in Table 2—examples of selected thesis titles[5] or research questions[6] follow each:

Table 2. Categories of themes

Theme	Examples
Training	What is the present situation of intercultural communication training for English majors in the universities in China? (Feng 2012)

[5] Titles appearing in English are reported here verbatim. When titles only appeared in Chinese, they have been translated by the author of this dissertation.
[6] In cases where there was no specific research question (e.g. meta-analyses, historical overviews), the title was taken to represent the most succinct description of the central theme of the thesis.

	Can training on specific noise-abating techniques and skills effectively improve interpreting quality in terms of fidelity of the output product? (Ma 2009)
Professional	What are the differences between the interpretation users' expectations towards monologic mode and dialogic mode respectively? Why? (Tang 2011)
	An initial investigation of interpreters' work values and job satisfaction in Taiwan (Chen 2008)
Language	Coping with English Accent in English-Chinese Interpreting (Zhao 2012)
	The Exploration and Analysis of the Interpreting Strategies from the Perspective of Meta-discourse Theory (Zhang Q. 2012)
Socio-cultural	A Study on Handling Culturally Loaded Words in Chinese-English Consecutive Interpretation (Jin 2011)
	Redefining the specific role of liaison interpreters (Bao 2009)
Cognitive	An analysis of information storage and retrieval process in consecutive interpretation from the perspective of long term working memory (Zhang 2009)
	Construction of idealized cognitive models in simultaneous interpreting (Li B. 2007)
	The schema theoretic approach to interpretation and interpretation teaching (Gao Y. 2008)
Miscellaneous	The Philosophical and Aesthetic Meanings of Interpretation (Shen 2010)
	An Analysis of Intern Practice in Twenty-Sixth Shenzhen Universiade (Liu 2012)

Source: Dissertation's author

In the example of Zeng and Hong's 2012 paper shown in Figure 6, Levelt's Language Acquisition Model belonged to the Language category and Second Language Acquisition sub-category; both 'self-correction' and 'interpreting performance' belonged to Training issues.

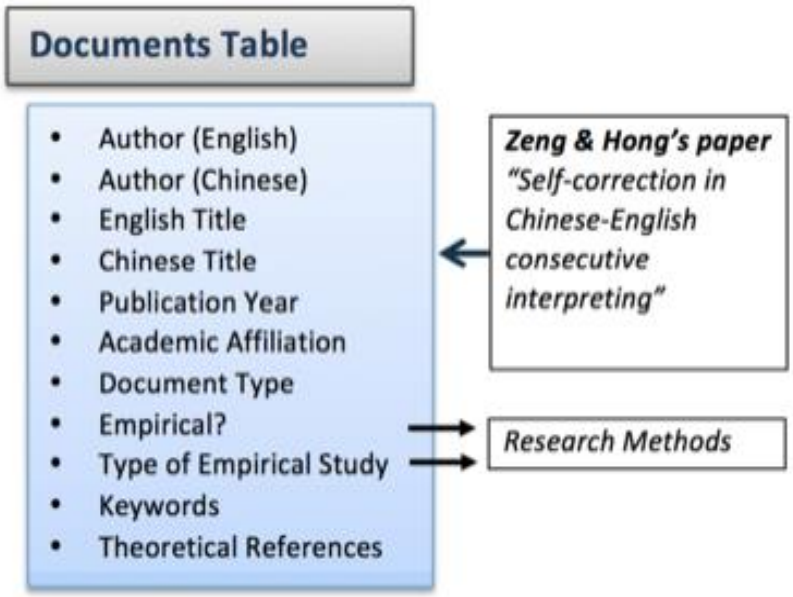

Figure 6. Example of paper labeling method used
Source: Dissertation's author

3.3.4 Inter-rater reliability test

An inter-rater reliability (IRR) test was conducted to judge the suitability of the scheme for coding theories and research themes as a tool for labelling CIS publications. IRR is ideal for ensuring the scientific soundness of a newly developed labelling system. In addition to the present author, another rater was recruited and trained prior to data collection. The recruit having been fully instructed in how the classification scheme worked, both raters came to the task with the same store of knowledge regarding the labelling of theoretical influences and keywords.

After the rater's training, a pilot study was conducted in which both raters did some preliminary labelling. The potential pitfalls and discrepancies were examined and discussed. During this pilot study and the actual IRR assessment procedure, the raters acted entirely independently, to ensure that the results of their assessments were arrived at separately.

The database for this study contains a total of some 450 unique theoretical references and 650 unique keywords. For the purposes of IRR assessment a sample selection from these was made completely at random—each theoretical reference and keyword had an equal chance of being chosen—and then assigned to the raters. Both were presented with the question: Does this reference/keyword belong to one of the six pre-agreed categories? (e.g. "Does the keyword 'ethics' belong to 'Cognitive issues'?")—Answer: Yes/No. Once all the samples had been labelled by both raters the results underwent statistical analysis. The aim of the exercise was to

measure the extent to which the raters' answers matched. A potential drawback to this method resides in the binary nature of the replies, as a result of which matches might occur purely by chance. To illustrate this let us imagine a hypothetical example in which two raters answered 100 individual questions each: their answers are shown in Table 3:

Table 3. Answers given by two raters over 100 questions

Scenarios	Cases	Frequency
1	Questions answered "**Yes**" by both raters	30
2	Questions answered "**No**" by both raters	30
3	Questions answered "**Yes**" by rater 1 & "**No**" by rater 2	15
4	Questions answered "**Yes**" by rater 2 & "**No**" by rater 1	25

Source: Dissertation's author

Rater 1 answered Yes 30+15 times, i.e. 45% of the time; Rater 2 answered Yes 30 + 25 = 55% of the time. Thus the probability that both raters would simultaneously answer Yes at random was 45% × 55% = 24.75%; the same figure for random No was 55% × 45% = 24.75%; therefore the probability that both would randomly give the same answer was 24.75% + 24.75% = 49.5%. This result of chance is known as the probability of random agreement, noted as *Pr(e)*. To measure whether an observed proportionate agreement is higher than the probability of random agreement, *Pr(e)* must be subtracted from the observed proportionate agreement, noted as *Pr(a)*. *Pr(a) - Pr(e)* in our hypothetical case is 30 + 30 = 60% of answers. The results are then normalised: *Pr(a) - Pr(e)* divided by *1 - Pr(e)*. When *Pr(a) = 1* this means that both raters always give the same answer. From this is obtained a quantity between 0 and 1 that measures the true rather than coincidental similarity between raters' answers, known as Cohen's kappa:

$$\kappa = \frac{Pr(a) - Pr(e)}{1 - Pr(e)}$$

In our hypothetical example kappa is equal to 0.21, which is quite low.

Landis and Koch (1977) developed benchmarks, now in wide use, for describing the relative strength of agreement between raters: ranges of κ -values between 0.00 and 0.20 indicate slight, 0.21–0.40 fair, 0.41–0.60 moderate, 0.61–0.80 substantial, and 0.81 to 1.00 near unanimity.

The final results of all these calculations are shown in Tables 4 and 5: the two raters demonstrated a high degree of consensus on how the theoretical references and keywords should be coded; even perfect unanimity was achieved for identifying Language-related keywords, because they were easily distinguishable from thematic categories.

Table 4. Inter-rater reliability scores for grouping references into various theory categories

Group	**Cohen's Kappa**
Cognition	0.954
Language	0.994
Communication Theory	0.914
Translation	0.989
Peoples and Cultures	0.959
Miscellaneous	0.948

Source: Dissertation's author

Table 5. Inter-rater reliability scores for grouping keywords into various thematic categories

Group	**Cohen's Kappa**
Training	0.986
Cognitive issues	0.984
Professional issues	0.895
Miscellaneous	0.956
Language issues	1
Socio-cultural issues	0.972

Source: Dissertation's author

3.4. Research Methodology

3.4.1. Student-related factors

3.4.1.1. How has CIS progressed over the years and what does its future hold?

The journal articles and conference proceedings in the database date from the period 1958-2012, while the MA theses are from 1991-2012. To model and predict the growth of CIS

literature into the future, time series analyses of the data on number of theses and articles per year were conducted. Exploratory analyses were first adopted to examine autocorrelation, trend, and stationarity of the data. Based on these preliminary results, appropriate models were chosen. In order to forecast trends into the future, models were compared to find which produced the most accurate forecasts, and the most accurate was selected as the final model. In this analysis the mean absolute scaled error (MASE) was used (Hyndman and Koehler 2006) as the criterion for model comparison, because it is applicable to non-stationary series. MASE is defined as:

$$MASE = \frac{1}{n}\sum_{t=1}^{n}|y_t - f_t|/u$$

where f_t denotes a forecast of observed series y_t, and u is a stable measure of the scale of the time series y_t. For non-seasonal data[7], u can be estimated as

$$u = \frac{1}{n-1}\sum_{t=2}^{n}|y_t - y_{t-1}|$$

Three methods for prediction were considered: an autoregressive integrated moving average (ARIMA) model, exponential smoothing, and an extended generalised linear model. The $ARIMA\ (p, d, q)$ model is generally given by

$$\left(1 - \sum_{i=1}^{p}\phi_i L^i\right)(1-L)^d y_t = \left(1 - \sum_{i=1}^{q}\theta_i L^i\right)\epsilon_t$$

with p being the order of the autoregressive model, d the degree of differencing, q the order of the moving-average model, L the lag operator, ϕ_i the parameters of the autoregressive part of the model, θ_i the parameters of the moving average part, and ϵ_t the error process.

Considering the observed trend, Holt's linear trend method, which is an extension of simple exponential smoothing, is given by:

$$y_t = l_{t-1} + b_{t-1} + \epsilon_t$$

$$l_t = l_{t-1} + b_{t-1} + a\epsilon_t$$
$$b_t = b_{t-1} + \alpha\beta^*\epsilon_t$$

[7] For time series data a seasonal pattern exists when a series is influenced by seasonal factors (e.g. quarter of the year, month, or day of the week). Seasonality is always of a fixed and known period. Non-seasonal data means that the data does not exhibit any seasonal patterns.

where l_t denotes an estimate of the level of the series at time t, b_t an estimate of the trend (slope) of the series at time t, α the smoothing parameter for the level, $0 < \alpha < 1$, and β^* the smoothing parameter for the trend, $0 < \beta^* < 1$.

Extending the generalised linear model (GLM) for count time series is detailed by Fahrmeir and Tutz (2001, Chapter 6) and Kedem and Fokianos (2002, Chapters 1-4), among others. Let F_t be the history of a joint process $\{Y_t, \lambda_t, X_{t+1}: t \in N\}$, with $E(Y_T|\mathcal{F}_{t-1}) = \lambda_t$, and X_t be the time varying covariate, the general form of the extended GLM is to model the conditional mean by a latent mean process,

$$g(\lambda_t) = \beta_0 + \sum_{k=1}^{p} \beta_k \tilde{g}(Y_{t-i_k}) + \sum_{l=1}^{q} \alpha_l g(\lambda_{t-j_l}) + \eta^T X_t$$

That is, the model considered lagged observation Y_{t-i_k} , and lagged latent means λ_{t-j_l}. For this method, the maximum likelihood algorithm can be applied directly.

The R package FORECAST was used for data analysis. By default, the corrected Akaike's Information Criterion (AICc) is the one used for model selection of ARIMA (auto.arima function in R) and exponential smoothing (ets function in R). For the GLM model the Bayesian Information Criterion (BIC) was adopted for model selection. In essence AICc can be derived in the same Bayesian framework as BIC, merely by using a different prior. For time series in this study, AICc and BIC were tested on the available data: the results revealed that they selected the same model.

The observed data were split into a training set and a validation set. With MASE as the criterion, the above models were compared using the validation set to evaluate their predictive accuracy: the model which gave the best performance was selected for out-sample prediction.

One limit of these models is that they cannot predict the level at which a limit to growth becomes observable, nor when it is likely to appear. No system has unbounded growth, and exponential growth can be followed by linear growth, levelling of growth, and even decline. All the aforementioned models are based on the parsimonious hypothesis that no change in growth pattern is likely to be observed in the forecast period.

3.4.1.2. What are the major theoretical influences in CIS, including the most commonly addressed topics and how has their popularity changed over time?

Each document was assigned multiple labels for theoretical influences and research themes, depending on the theories and topics that it touched on, but no two categories completely

overlapped in which papers they applied to. To investigate the evolution of theoretical influences and themes in CIS papers, the total numbers of theories and themes per thesis were counted and divided by the total number of theses. This approach ensured that all papers were weighted equitably, regardless of their length: for instance, those with more theory tags tended to have more input from different theoretical influences. It would not be reasonable to attribute the same weight to a 100-page thesis with input from ten theories as to one of 20 pages with two theoretical influences.

3.4.1.3. What research methods have been employed by CIS scholars in MA theses, doctoral dissertations and articles and what has been the evolution of the propensity to carry out empirical studies over time?

Broadly speaking there are two types of research: empirical and theoretical. An empirical study is one based principally on data collected from observations or experiments rather than one which analyses theories. It should be noted that such data need not be quantitative, but can be qualitative in nature. Theoretical studies, by contrast, are based on an existing literature of ideas and theories: they may expand on them, apply them in new ways, or even seek to refute them. Because of the special nature of research in Interpreting Studies (e.g. the difficulties of observing mental processes at work during interpreting and of replicating interpreters' performances), working definitions were created for the different types of empirical study one typically encounters in CIS:

Experimental: The experimenter controls the environment and sets a specific task for participants to perform.

Observational: Involves the observation of phenomena or behaviours without control or manipulation of the environment, with the aim of drawing conclusions from the effects under study.

Questionnaire-based: Relies on the collection of data by means of a set of questions or prompts given to study participants.

Interview-based: Data is gathered by means of conversations with subjects.

Ethnological: Data is collected in a social group by means of observation and interviews.

The proportions of each type of research method were calculated. A smoothing spline was used to trace the growth of empirical studies over the past few years. This technique automatically trades off trend-detection and natural variability in data.

3.4.2. University-related factors

3.4.2.1. What are the universities with the largest output in the field?

While tallying up the number of theses produced by each university is quite straightforward, assessing the number of articles they produce is more problematic: papers may be authored by individuals or by multiple people, making it difficult to apportion credit to authors and their respective universities in an objective manner. Three approaches were adopted to assess the research productivity of universities in China:

1. Full-paper or straight count: Each author and his academic affiliation received one count for each article published. This is one of scientometrics' most frequently used counting methods for apportioning authorial credit (see for example Lowry et al. 2007 and Dean et al. 2011).
2. Fractional or weighted count: Each author of a particular paper was given an equal credit for their contribution, the total credits adding up to 1. For instance, for a three-author paper, each author and his academic affiliation received a ⅓ credit: ⅓ + ⅓ + ⅓ = 1.
3. First-listed author count: First-listing is highly valued in the Chinese academic community, because it alone is used for rank promotion[8]. In this case only the first author and his academic affiliation received a credit for each paper published (see for example Chua et al. 2003; Jackson and Nath 1989). This method can only be used in specific contexts as author ordering changes widely according to disciplines and countries. For example, in some fields, ordering is purely alphabetical, in others the most senior author appears last.

3.4.2.2. Who are the advisors with the largest production in CIS and how frequently do advisors engage in co-supervision?

Given that numerous professors have advised CIS students on their theses, the cut-off point for inclusion in the list of the most productive was set at a minimum of ten advisorships. The same cut-off for co-supervisors was set at five. Though this approach may appear somewhat crude,

[8] In China's liberal arts academic community an author needs to be listed first for the work to count towards meeting his school's research target, and for him to be considered for promotion to an associate professorship. However, associate and full professors can be listed as other than first authors to fulfil their research quotas (Shanghai International Studies University 2007).

it provides descriptive statistics that are useful for understanding how the training of CIS graduate students is divided up between advisors.

3.4.2.3. What is the research output of advisors and their graduate students and what is the propensity to engage in research collaboration?

Descriptive statistics was presented in tables, detailing in ascending order the publication counts associated with faculty and their students. The total number of students who engaged in co-authorships with their advisors was also provided. These summary data allows for intuitive understanding of the research activities in CIS and whether advisors and their students are among the biggest contributors to the advancement of the field.

3.4.2.4. What are the patterns of inter-institutional collaboration?

To examine collaboration between authors from various universities, firstly articles with more than one author were collected; their authors' universities were identified; and finally all the various pairings were listed. An intra-institutional relationship is one in which both (or all) authors come from the same university (e.g. 'three authors from BFSU[9]' = one intra-locational pairing); whereas in an inter-institutional pairing the authors come from different universities (e.g. 'three authors, one each from BFSU, SISU and BISU' = three inter-institutional pairings: BFSU-SISU, SISU-BISU, and BFSU-BISU).

3.4.3. Geographical factors

3.4.3.1. Which regions of China have emerged as the major production centres for CIS research?

For this section the data for MA theses and academic articles were examined to ascertain whether research clusters have developed for CIS research collaboration. After the authors' academic affiliations had been grouped according to place of origin, they were then plotted on a map of China. The map was generated using CartoDB, a cloud computing platform for data

[9] BFSU = Beijing Foreign Studies University, SISU = Shanghai International Studies University; BISU = Beijing International Studies University.

visualisation in web browsers (CartoDB 2015); HTML5 was used to set the general page layout; and OpenStreetMap was adopted to create the basic map layer with GeoJSON outlining the boundaries of the Chinese locations that have produced academic papers. Next, CSS3 was applied to generate the colour distribution across the entire map, and JavaScript to create the hover effects, making it possible to explore the map interactively. Once paper counts per location were obtained, CartoDB allowed for their straightforward graphical representation—the darker the shade, the higher the number of papers.

3.4.3.2. What are the patterns for inter-locational collaborative research?

Each university was tagged with the province/capital/municipality it belongs to. The same approach used in 4.2.3 was applied to calculate inter-locational pairings. An intra-locational relationship is one in which all the authors are from the same province, municipality or the capital, whereas authors from different locations constitute inter-locational pairings: for example, three authors, one each from Beijing, Tianjin and Liaoning = three inter-locational pairings: Beijing-Tianjin, Tianjin-Liaoning, Liaoning-Beijing.

3.5. Results and discussions

3.5.1. Student-related factors

3.5.1.1. How has CIS progressed over the years and what does its future hold?

Figure 7 shows the autocorrelation (ACF) and partial autocorrelation functions (PACF) among the observed number of journal articles and proceedings. Obvious exponential decay exists in the autocorrelations. The PACF spike on the first lag suggests an autoregressive process.

As can be seen from the residual plots (see Figure 8), the original data cannot be fit well with either ARIMA, ETS, or GLM. Expected normality of residuals was not achieved based on the QQ plot. The residual vs. observed values plot suggests that the variance was not stationary, i.e. the variances of residuals are proportional to corresponding observed values. A residual analysis based on models fitting original data indicating variance stabilisation is required. A power transformation was used in accordance with the Box Cox method. An estimated power of $\lambda = 0.22$ was used to transform the observed data. Further analysis indicated that the 0 observed in 1981 was an outlier (Figure 9). After excluding this the models fit the data

reasonably well, with diagnostics shown in Figure 10. There was no outstanding autocorrelation between the residuals (middle panel of Figure 10), and Ljung-Box tests all confirmed the null hypothesis, i.e. the model yielded a good fit.

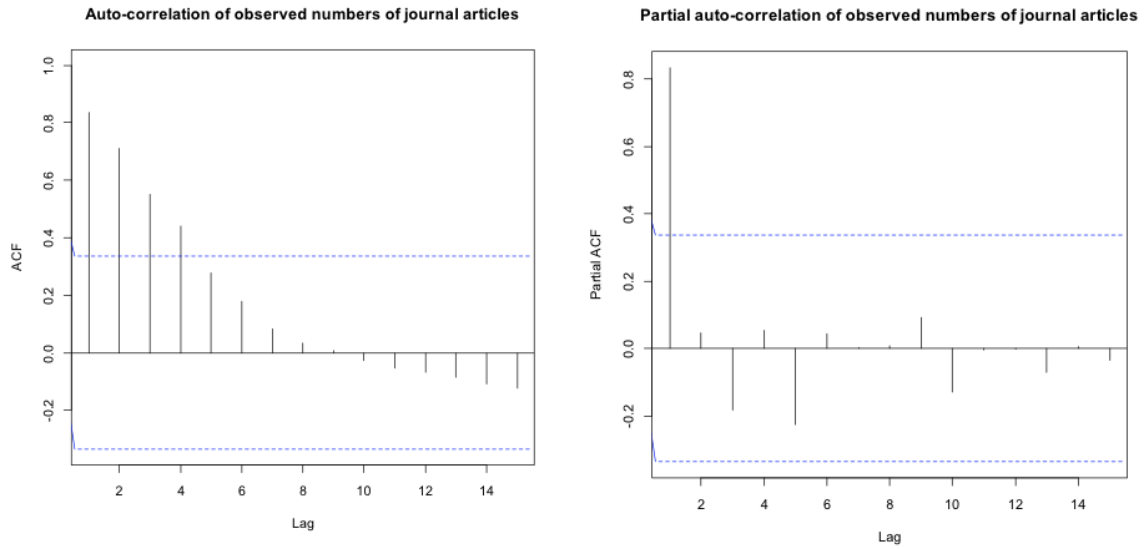

Figure 7. Autocorrelation functions of number of journal articles and proceedings.
Source: Dissertation's author

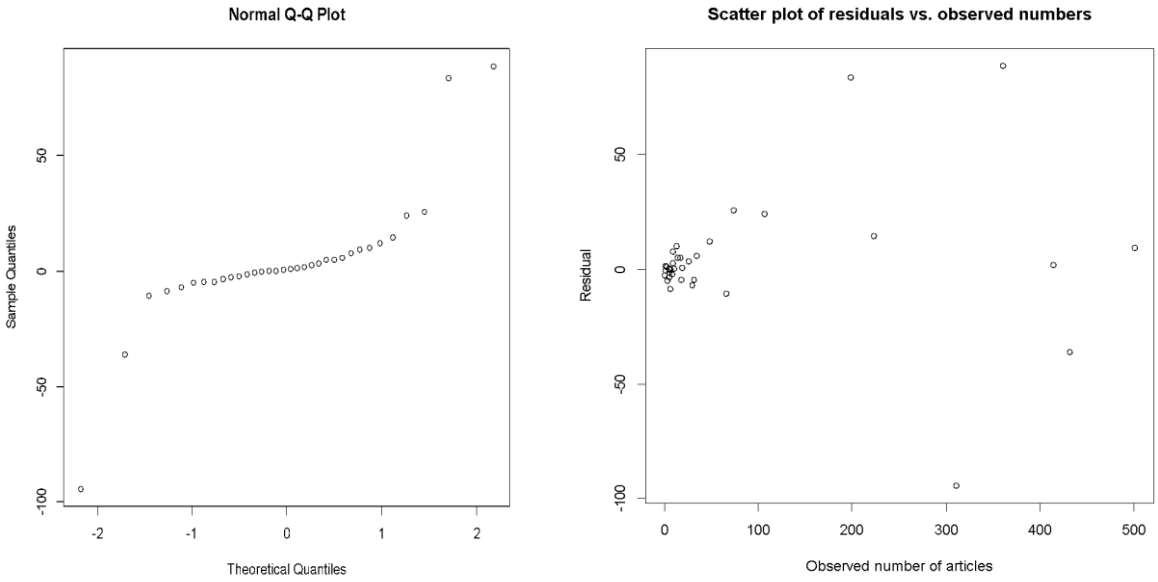

Figure 8. Plots of residuals from exponential smoothing.
Source: Dissertation's author

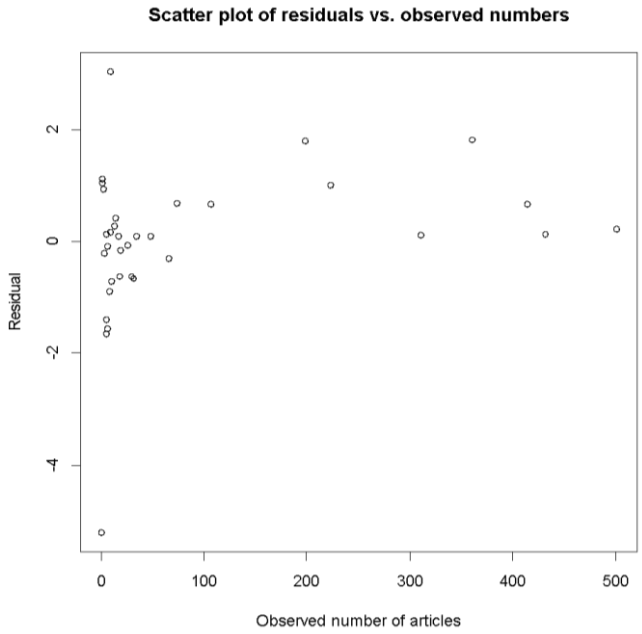

Figure 9. A large residual less than -5 is observed in fitting transformed data.
Source: Dissertation's author

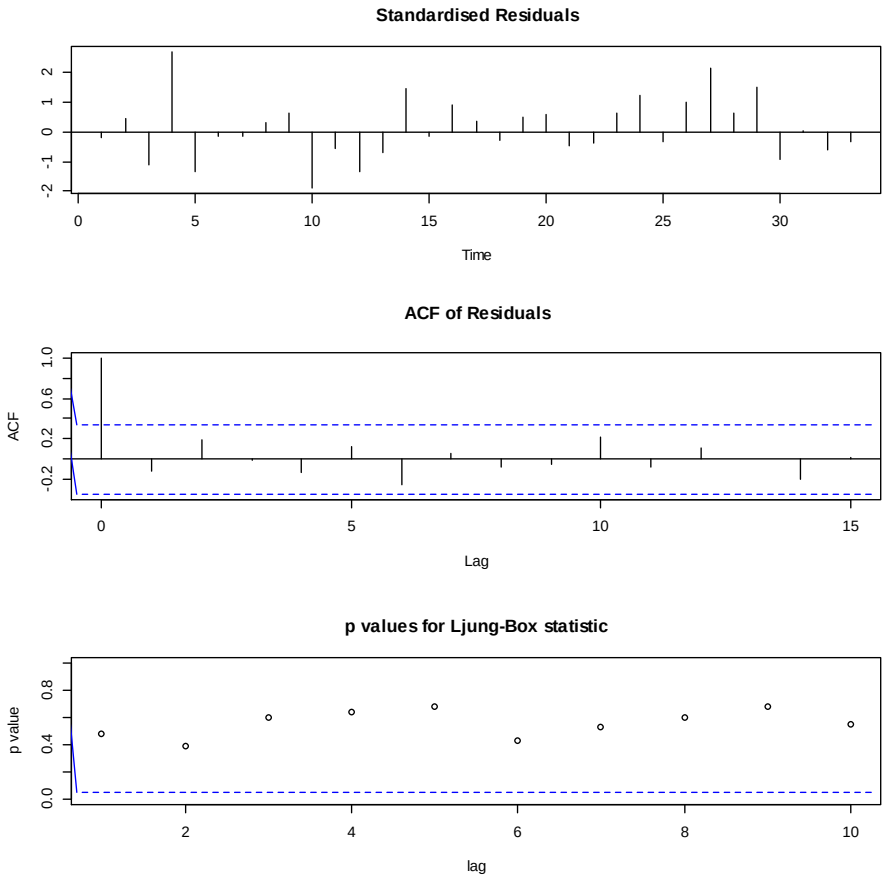

Figure 10. Diagnostic plots of exponential smoothing model fit to transformed data without the outlier
Source: Dissertation's author

Using MASE as the criterion, their performances were compared for predictive accuracy. The training set included data points from the first 28 years. The data starting from the 29th year were used for sequential validation. Predicted values based on transformed data were back-transformed, and MASE was then calculated. Figure 10 shows the performances of the four prediction methods. None consistently yielded the smallest MASE when predicting five years ahead. If predicting five years into the future is expected, the ARIMA model performs well.

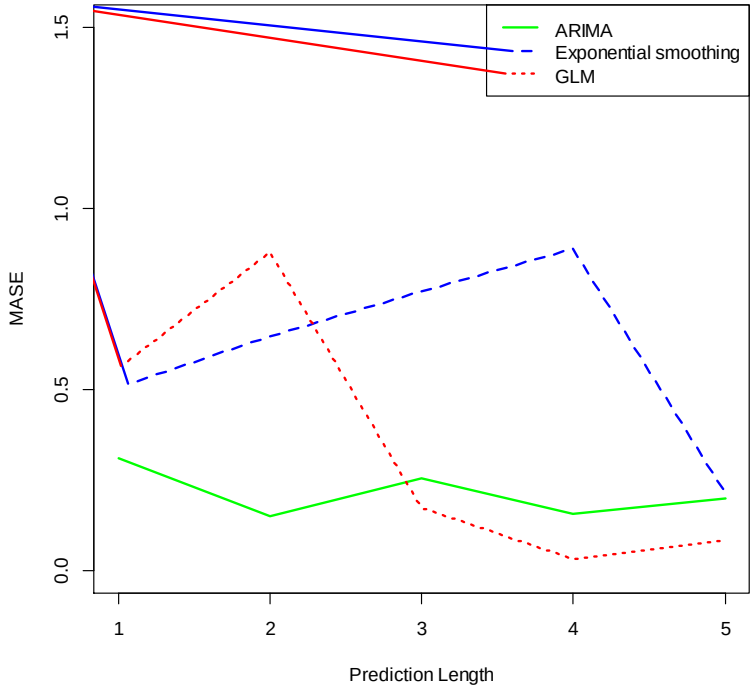

Figure 11. Predictive accuracy of three models
Source: Dissertation's author

Table 6. ARIMA prediction of number of articles for the five years 2013-17 inclusive

Year	Predicted mean	80% CI		95% CI	
2013	532	409	682	353	774
2014	593	443	782	376	898
2015	653	462	900	380	1058
2016	720	494	1020	399	1214
2017	791	526	1151	417	1387

Source: Dissertation's author

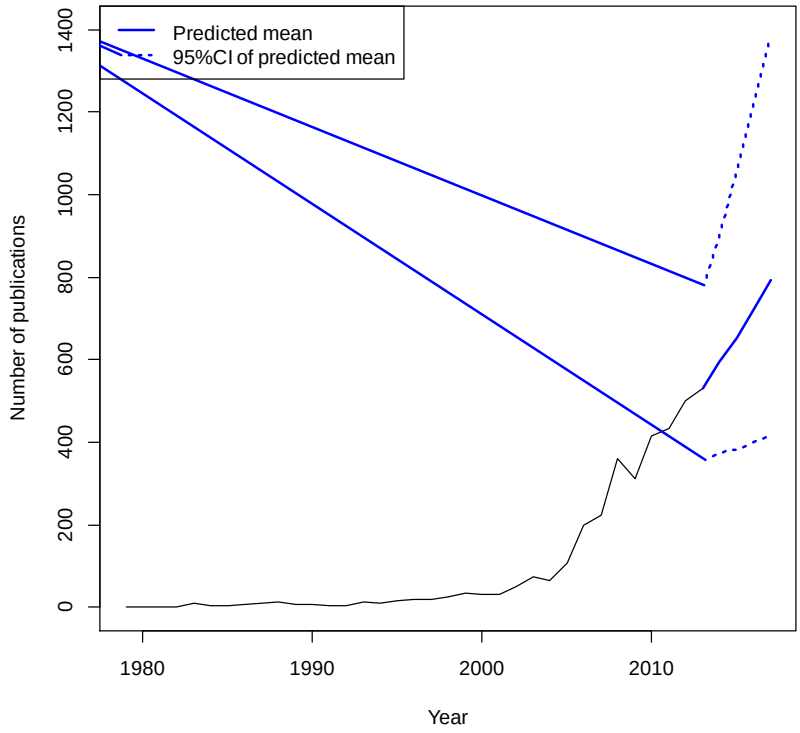

Figure 12. ARIMA prediction with 95% confidence interval
Source: Dissertation's author

The number of articles published annually in CIS has grown steadily since the early 1990s. Though the rate of growth dipped briefly around 2006, the ARIMA model shows no sign of its slowing down for the five years through to 2017 (Table 6, Figure 12). This sustained growth is attributable to the expansion of CIS itself. A very high number of Chinese educational establishments now offer degrees in translation and interpreting: at the time of writing (May 2015) the total stands at 106 for BA and 216 for MA; to these can be added numerous community colleges that now hold courses in business interpreting. Not only do the burgeoning numbers of scholars attracted to these programs produce large quantities of research for journals, but the teachers who staff them, despite not being obliged to publish in order to gain tenure (unlike their Western colleagues), are nonetheless required to do so once they have assumed their duties.

For annual numbers of MA theses, exponential decay in the autocorrelation between years is obvious based on the ACF plot (Figure 13). An autoregressive process is also suggested by the PACF function (Figure 13).

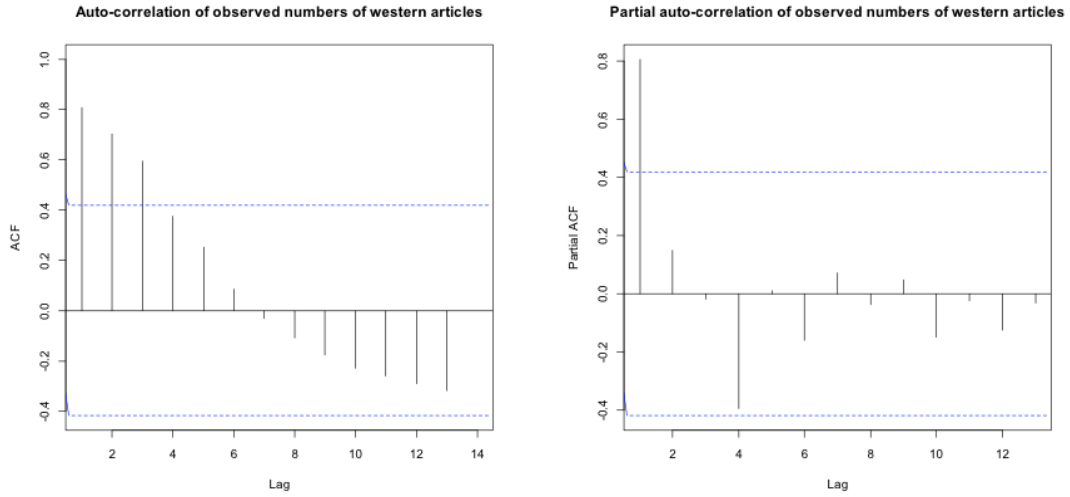

Figure 13. ACF and PACF plots of numbers of MA theses
Source: Dissertation's author

Residual analysis indicates that fitting the original observed numbers of MA thesis data with either exponential smoothing or the ARIMA model would result in poor model fits. The normal QQ plot and the scatter plot of residual vs. observed numbers (Figure 14) demonstrate that both the normality assumption and stationary variance of residuals were violated. As a consequence of this, a power transformation was thus adopted, with an estimated power of $\lambda = 0.41$.

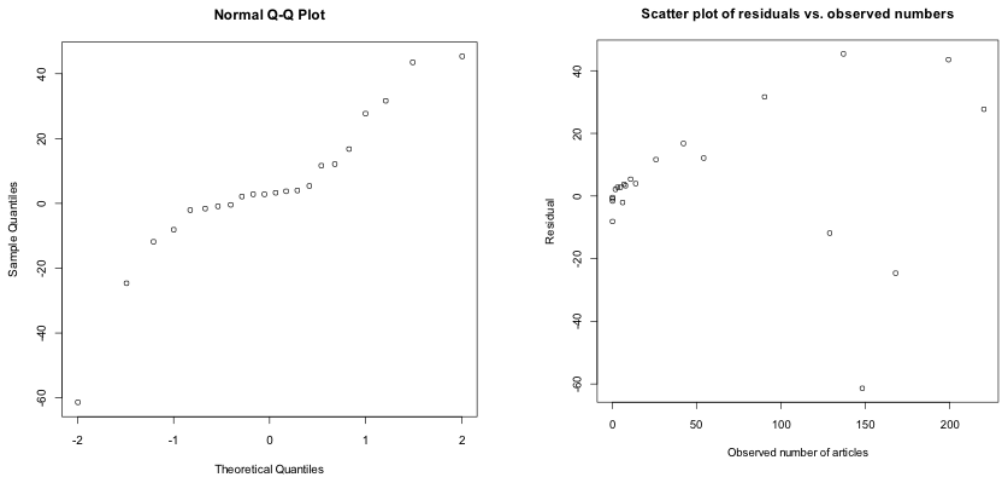

Figure 14. QQ plot of residuals from exponential smoothing model fitting
Original numbers of MA theses and residual-observed values scatter plot
Source: Dissertation's author

Diagnostics of exponential smoothing fit to the transformed data was plotted in Figure 15. Standardised residuals were all in the reasonable range (-2, 2), and Ljung-Box tests suggested that a good fit had been achieved. Using the first 15 years of observed data as the training set, ARIMA, exponential smoothing, and cubic spline were compared. The exponential model yielded the best performance according to MASE (Figure 16).

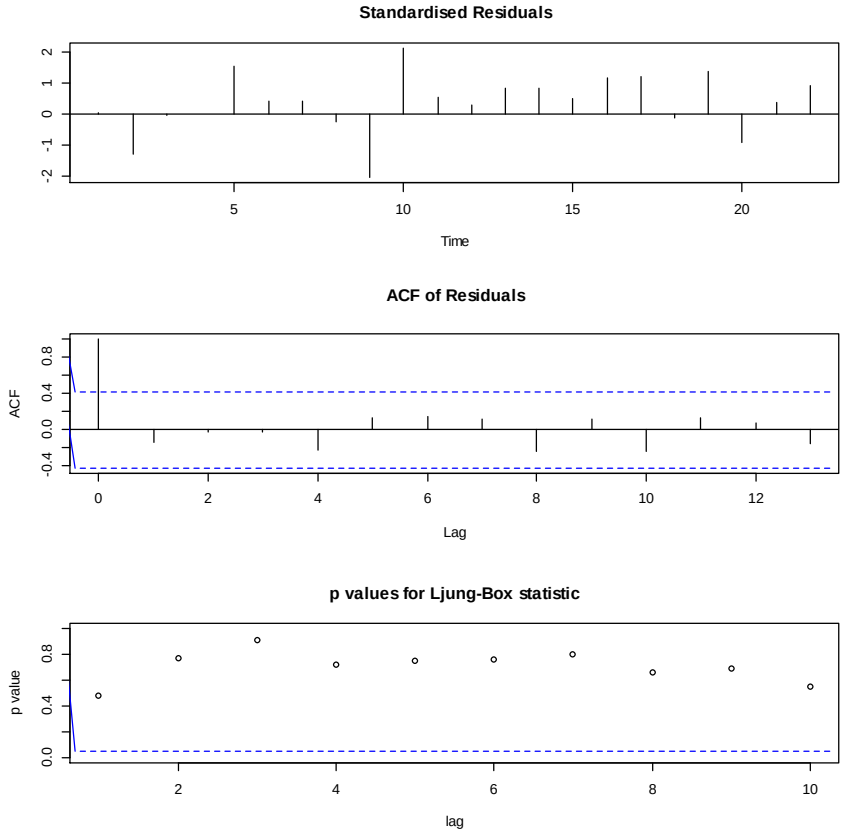

Figure 15. Diagnostics of exponential smoothing fitting to the power transformed number of MA thesis
Source: Dissertation's author

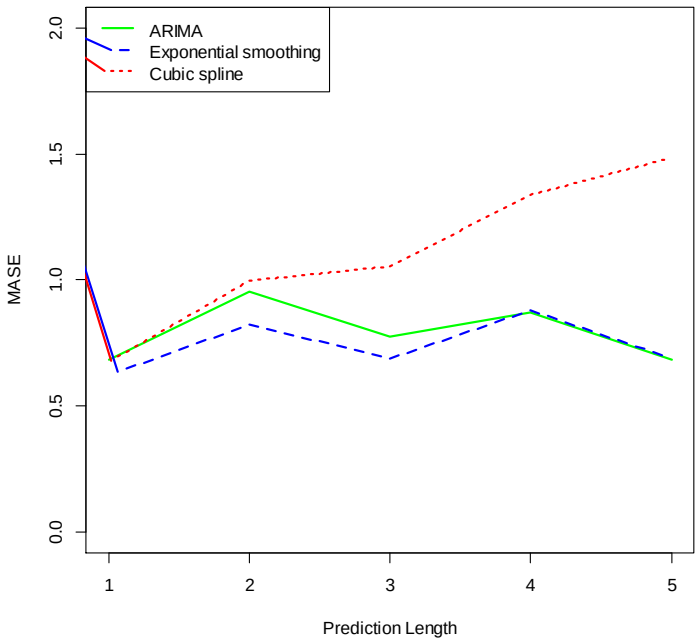

Figure 16. Comparison of performance of prediction models
Source: Dissertation's author

Predictions of the number of MA theses in the years 2013-17 (inclusive) are listed in Table 7 and plotted in Figure 17. They suggest that the mean number of MA theses will not change greatly, but the prediction interval also indicates a large amount of variation in the possible values for these years.

Table 7. Prediction of number of MA theses in the years 2013-17 (inclusive)

Year	Predicted mean	80% CI		95% CI	
2013	218	149	303	118	356
2014	218	126	341	89	420
2015	218	110	372	69	475
2016	218	97	400	55	524
2017	218	87	426	44	570

Source: Dissertation's author

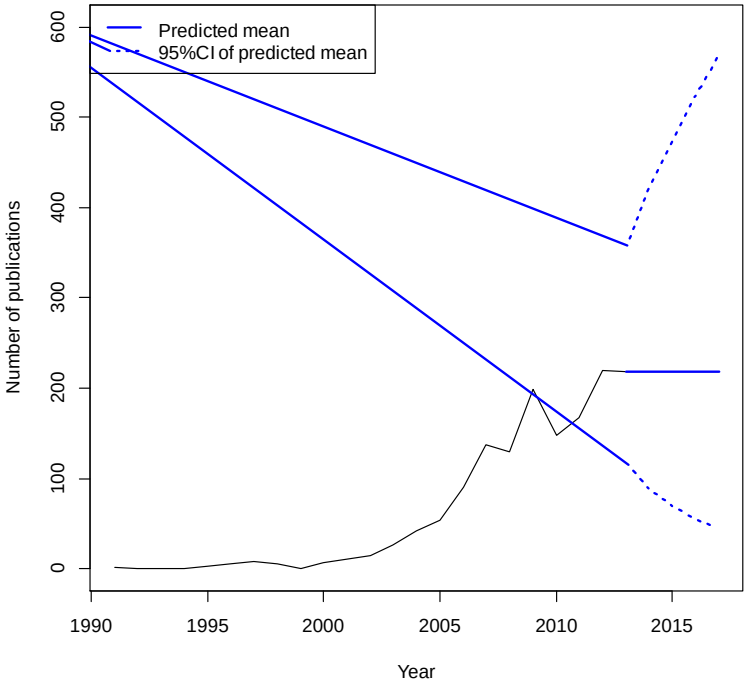

Figure 17. Prediction of MA thesis for five years 2013-17 inclusive
Source: Dissertation's author

The first MA theses in mainland China were written in 1995 by the first class to graduate from the newly restructured GSTI at BFSU. That school continued to dominate until 2001 in terms of number of theses produced, though its productions were limited to non-empirical studies of the basic techniques of consecutive and simultaneous interpreting. Since 2002, as new training programs have been set up all over the country in response to ever-increasing interest from aspiring interpreters, BFSU's dominance has diminished. The overall number of theses has grown significantly, with a few newcomers such as Xiamen and Guangdong Universities standing out from the crowd of competitors as major new research centres.

From the late 1990s to around 2006 the number of Chinese MA theses experienced a period of tremendous growth. Since then growth has declined slightly, but 2012 again saw a surge in the number of publications; the exponential smoothing model projects that the-number of MA thesis would maintain the 2012 level in the five years following. China's growing connectedness with the rest of the world and the prospects of highly remunerative interpreting opportunities are perhaps accounting for the higher number of graduate students on interpreting courses. Despite the high regard in which SISU's and UIBE's non-degree two-year training programs are held in interpreting circles (Bao 2015), the data suggest that large numbers of students are inclined toward courses that offer master's degrees.

3.5.1.2. What are the major theoretical influences in CIS, including the most commonly addressed topics and how has their popularity changed over time?

3.5.1.2.1. Theoretical influences in MA theses: The existing theories most referred to in MA theses are as follows: the Translation category leads with 35.4% of the total, followed by Cognition (28.5%), Language (15.6%), Communication Theory (9.3%), and Peoples and Cultures (7.6%); Miscellaneous brings up the rear with 3.5%. It is only natural that influences from the translation field should emerge on top since translation and interpreting are in essence both about rendering one language into another, and Interpreting Studies is generally considered a specialty within the field of Translation Studies.

As the faculty members of most Chinese universities' interpreter training programs—themselves often offshoots from language and literature courses—come from backgrounds in those disciplines (Zhang 2011), one might reasonably expect instructors to direct students' theses on subjects which fall within their areas of expertise. Yet it is interesting to note that the influence from Cognition outweighs that from Language-related fields such as linguistics and second language acquisition. A possible explanation for this counter-intuitive finding is that the boom in interdisciplinary studies in the West is starting to spread to the CIS community: the majority of citations in Cognition-related theses are from Western articles, and it would appear that familiarity with this corner of the literature is driving this trend. An example of how Chinese MA authors apply Western cognition theories in their theses is Zhang Yanyan's thesis from 2009, in which she drew inspiration from the long-term working memory theory proposed by Ericsson and Kintsch (1995) to explain how consecutive interpreters can hold information of a few minutes' duration in their memories.

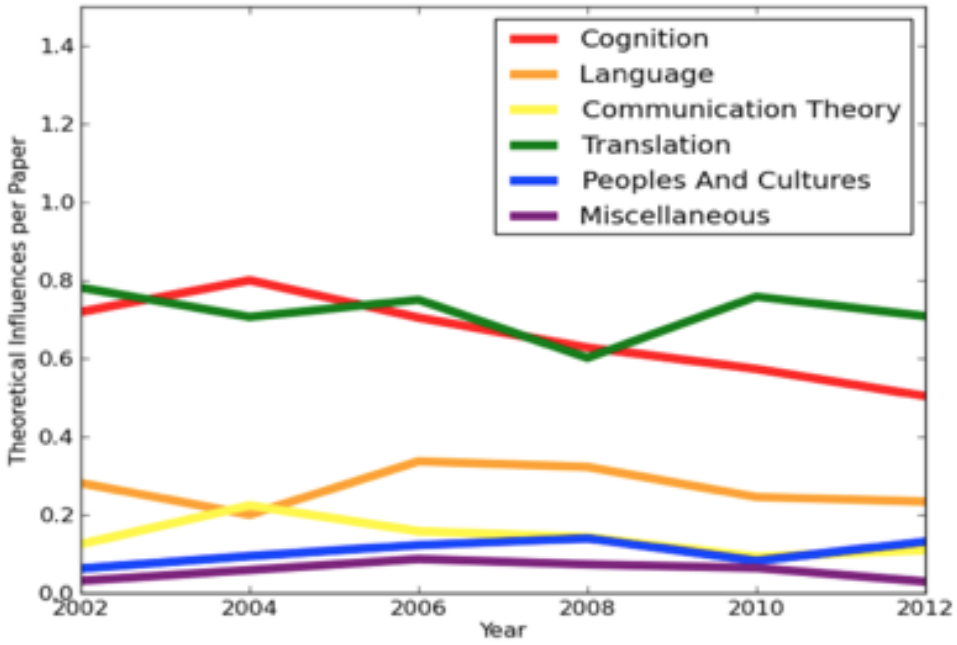

Figure 18. Theoretical influences on CIS over time
Source: Dissertation's author

It is evident from Figure 18 that there have been no major changes in theoretical influences on CIS over time: this may corroborate Zhang's view (2008) that the discipline's academic tradition is self-replicating and conservative. Unlike those of their counterparts in the West, where they tend to change by the decade (please refer to section 2.1 for more detailed discussion), the dominant intellectual influences on Chinese authors have remained relatively stable. A possible explanation for this is that CIS scholars have a fairly homogenous educational background: most have degrees in English language and literature, and few are active interpreters or come from other disciplines. Western researchers, by contrast, come from diverse backgrounds (psychology, linguistics, professional interpreting, translation, and pedagogy) and as a result often hold clashing views on the subject. Given that most Chinese universities provide limited—if any—access to Western journals and books specialising in IS, CIS students generally have very little exposure to the latest developments in interpreting research from other countries. Perhaps with the increasing popularity of open-access journals, the theoretical trends in CIS may start to change over time.

3.5.1.2.2. Research themes in MA theses: The data revealed that Training was the most popular theme in MA theses with 43% of the total, followed by Language (18%) and Cognitive issues (16%). Socio-cultural (11%), Miscellaneous (9%) and Professional (3%) matters made up the rest. Interestingly, nearly half of all students were attracted to Training-related issues. Gile

(2000) points out that in the West, where the interpreting community is comprised mostly of instructors, making the subject of training understandably popular, writings tend to be didactic and based on personal experience. By contrast, Chinese students, who generally lack that experience, often produce in their writings empirical data which serves to back up their Western colleagues' work. For example, Liu Hui (2004), Zhu Ling (2010), Lin Yingjun (2011) and 23 other students have conducted experimental or observational studies to investigate the use of deverbalisation—a popular Western approach in interpreter training first introduced by French researcher Danica Seleskovitch—as a strategy in interpreting.

It is understandable that Language was the second most popular theme given the importance of mastering a second language for success in interpreting. Further, Chinese students are more likely to be preoccupied with language-related matters as they face far greater challenges in that regard than their Western colleagues: the English they bring with them to university is often in serious need of improvement, and they are required to work in both directions.

Cognitive and Socio-cultural issues were the other two moderately popular research themes. Firstly, students rightly realise that cognition is highly relevant to interpreting research (Gile 2000). Secondly, Chinese students in particular face an undoubted problem with—and are understandably interested in—social and cultural matters: they are acutely aware that prolonged immersion in the life of a foreign country plays a crucial role in improving understanding of the socio-cultural issues that might arise during interpreting (Lantolf and Thorne 2006), yet very few can afford to spend more than a month or two overseas (Setton and Guo 2009).

Professional matters received the least attention, probably because students have yet to experience first-hand some of the issues that interpreters routinely encounter in real-life situations. Indeed some Chinese programs, such as the Conference Interpreting course at the Shanghai International Studies University (SISU), even prohibit students from taking interpreting assignments during the course for fear that they may reinforce bad habits (or tarnish the university's reputation) before they are ready to enter the professional market. It is also interesting to note that the program at SISU offers no courses or class hours on professional ethics (AIIC 2012). This stringent training regime would undoubtedly make it difficult for students to carry out research on this topic.

To find out how the themes evolved over time, the average number of each theme category per thesis was plotted against publication year. Since so few theses were produced

before 2002, averages before then are statistically unreliable, so Figure 19 shows data only from the years since.

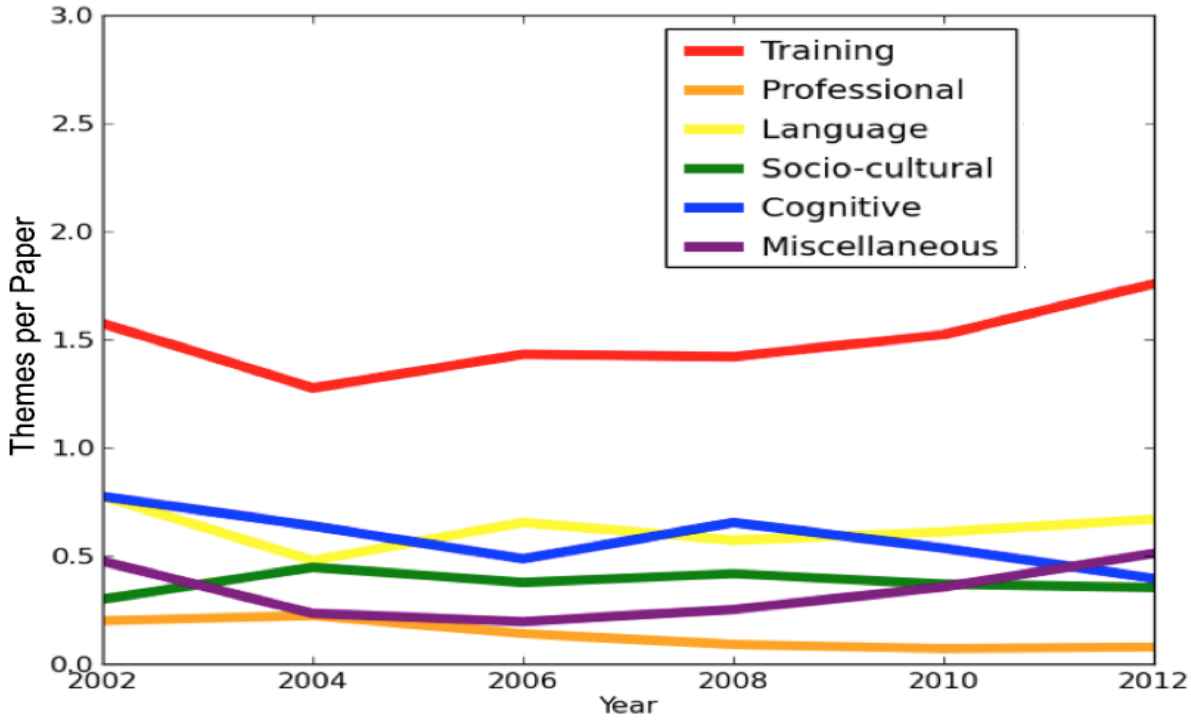

Figure 19. Average number of themes of each type per paper over time
Source: Dissertation's author

None of the themes became particularly more or less popular over the period, a finding which is significant for the following reasons. Firstly, it illustrates that academics in CIS have been broadly convergent on its most important themes over the last ten years.

Secondly, the constancy of the figures over time may also reflect a sustained preference among students for particular topics that most capture their interest or that they can easily relate to. For instance, it is no surprise to see that Training tops the chart—a great number of MA students are given the opportunity to teach various interpreting courses organised by their schools, which are aimed at helping lower-level students to pass various certification exams, such as the China Accreditation Test for Translators and Interpreters (CATTI) and the Shanghai Interpreter Accreditation Exam (SIAE). Through their teaching these graduate students often acquire a significant amount of training experience, so they are very likely comfortable exploring various themes on the subject. Another possible explanation for this constancy is that, since it is the primary aim of all MA students (except those who intend to go on to pursue doctorates) to acquire practical interpreting skills, they may feel the need to minimise the

amount of time spent on research for their graduation theses and so choose subjects that allow for the most convenient access to materials and test subjects.

3.5.1.2.3. Theoretical influences in doctoral dissertations: In this section we examine the theoretical influences which served as foundations for each CIS doctoral research project, to discover their underlying trends. Cognition was the dominant influence with a share of 36.8%, followed by Language-related disciplines (28.9%) and Translation (22.4%). Communication Theory (6.6%), Peoples and Cultures (2.6%), and Miscellaneous (2.6%) made up the remainder (see Figure 20). Given that Interpreting and Translation Studies are closely related, it is interesting to observe that rather than Translation theories, Cognition claimed the top spot. A possible explanation for its popularity is that over recent years there has been an increasingly vocal call for interdisciplinary research in the international IS community (Baker and Saldanha eds. 1998), and within CIS itself scholars are encouraged to conduct research using methodologies from other disciplines (Cai 2001; Zhang W. 2012).

Of the 32 authors, 17 recruited participants for their research, and employed Cognition-related theories such as Effort Models (Gile 1995), Baddeley's working memory model (Baddeley 1992) and the Probability-predict model (Chernov 2004), to help them explain why interpreters behave in particular ways. However, similarly to the author's earlier finding with regard to CIS research papers (Xu 2014), there were only very limited influences on doctoral papers from the Communication Theory and Peoples and Cultures categories, as can be seen from their low rankings, a finding which serves to highlight that those two categories are under-researched in CIS. A quick survey revealed that nearly all PhDs in CIS are either offered through a university's foreign language department, as in the case of Sichuan University, or granted directly by the Graduate School of Translation and Interpreting, as is the case at the Shanghai International Studies University (SISU); none are offered by departments of Communication or Intercultural Studies. This may explain why the aforementioned categories are unable to gain traction.

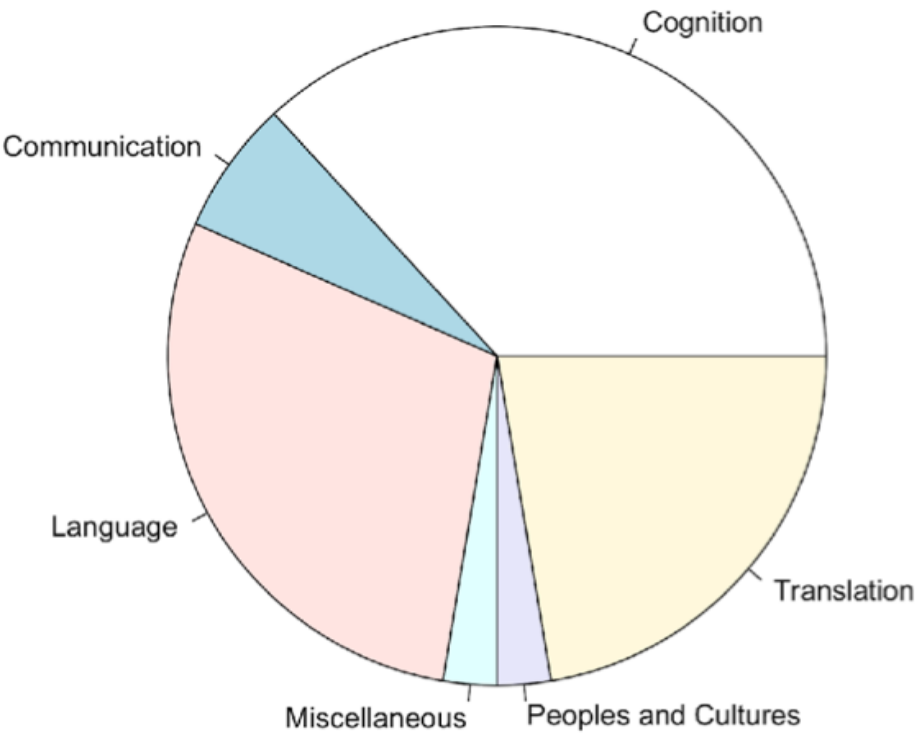

Figure 20. Proportions of theoretical influences in doctoral dissertations
Source: Dissertation's author

3.5.1.2.4. Research themes in doctoral dissertations: It was observed that Training was the most studied among PhD students, with an enormous 47.2% of the total, far outstripping all the others. According to Mu and Zou (2014), the majority of Chinese doctoral students are interpreter trainers, so may find Training issues convenient to tackle and relevant to their jobs. Cognitive (19.1%) and Language-related (16.9%) issues received a moderate amount of attention, while Socio-cultural (12.4%) and Professional (4.5%) issues were the least favoured (see Figure 21). Owing to the limited number of doctoral dissertations produced in CIS, no time-series analysis was conducted for the evolution of theoretical influences and research themes.

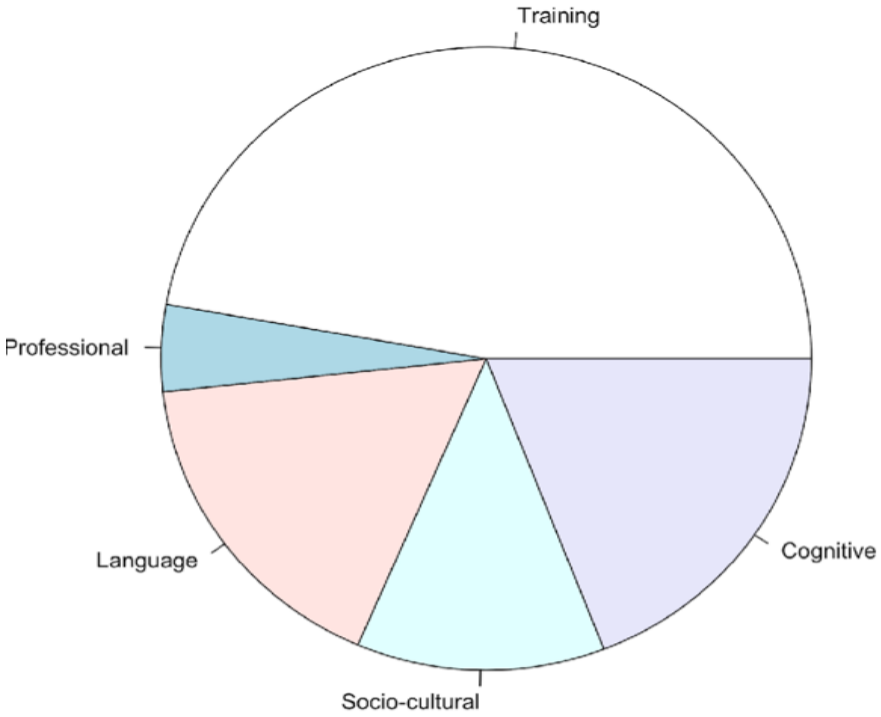

Figure 21. Themes in doctoral dissertations
Source: Dissertation's author

3.5.1.2.5. Theoretical influences in journal articles and conference proceedings: Theories relating to Cognition were the most popular among academics with a share of 30.4%, followed by Language (21.1%) and Translation-related fields (19.1%). One might have expected Translation Studies to be more dominant given the close relation between translation and interpreting, but the broad CIS community seems more inspired by Cognition and Language-related fields. Meanwhile, Communication Theory came in last place (6.6%), behind the Miscellaneous (10.5%) and Peoples and Cultures (12.3%) categories.

A time series analysis of theoretical influences on CIS for the period 2003-12 was conducted (see Figure 22). This time frame was selected because few articles (2.86% of the total) were published before then and the theoretical influences recorded in them accounted for only 5.98% of the overall total. In addition, 1,161 of the 2,909 articles (almost 40%) in the dataset lacked identifiable theoretical influences. This led to the low proportions for each category, which in turn led to the trend lines being more prone to fluctuation. There are two possible explanations for the paucity of theoretical influences in CIS papers: 1) article authors do not have the necessary space to flesh out the theories that inspired their work; 2) the trend for drawing on existing theories did not really begin until 2003: before then papers were more likely to take the form of descriptive studies of datasets.

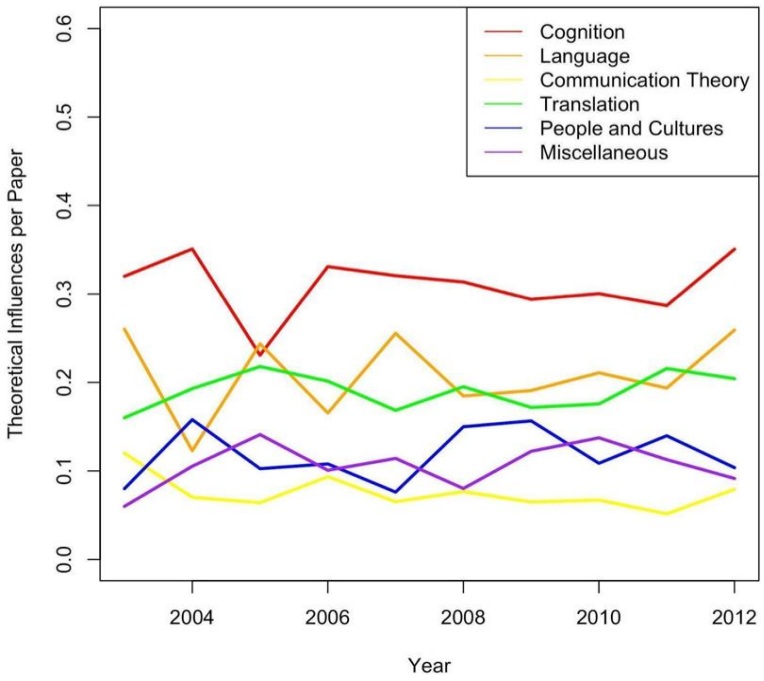

Figure 22. Average number of theoretical influences of each type per paper over time
Source: Dissertation's author

Despite the variation in the data, figure 13 seems to suggest that influences from different theories have remained stable over time, with Cognition-related disciplines being the most prominent while Communication Theory and the Peoples and Cultures categories remain rather flat and low. To determine whether these proportions truly stayed constant over the displayed time period, a multinomial logistic regression model was fit using the publication year as a predictor.

After fitting the multinomial logistic regression model, analysis of deviance was used to test the model that uses only each theoretical influence's mean proportion over all year versus the model that uses year to predict proportions in each of the theoretical influences. The analysis of deviance p-value was .9367 (see Table 8), indicating that the model using only the means is sufficient. This suggests that there was no discernible effect of year on the proportions of theoretical influences, which is to say that it can be reasonably concluded that theoretical influences have not changed substantially over the years.

Table 8. Deviance table for multinomial logistic regression of theoretical influence proportions

	LR Chisq	Df	Pr (>Chisq)
Year	1.81	6	0.9367

Source: Dissertation's author

A possible explanation for this is that all interpreting courses in China are offered by departments of translation or foreign languages, as opposed to faculties of intercultural studies or communication—indeed, China's Ministry of Education lists Translation Studies as a branch of Foreign Languages and Literature in its classification of disciplines. This institutional ethos inevitably limits students' exposure to cross-cultural and communication studies.

3.5.1.2.6. Research themes in journal articles and conference proceedings: Training was by far the most popular theme in Chinese research articles, with 51.2% of the total. Memes such as Cognitive (15.8%), Language (12%) and Socio-cultural issues (10.7%) enjoyed modest levels of popularity. Only a small proportion of authors addressed Miscellaneous (5.1%) and Professional (4.9%) issues. It should be stressed that the majority of the article authors are academics who hold teaching positions at universities; most have not served as advisors to graduate students. The fact that a large number of authors wrote about Training could be due to a number of factors such as personal interest, familiarity with the topic, or convenience;however, it may be for the simple reason that finding the most effective ways of turning the students on all China's newly created BTI and MTI programs into qualified interpreting professionals is of paramount importance and urgency. More research needs to be done to specifically identify what motivates scholars to write more about Training than any other subject.

It was rather surprising to see that Professional issues received scant attention in journal articles. Its relative unpopularity can perhaps be ascribed to the fact that most Chinese article authors do not work actively as interpreters; by contrast, these issues received a great deal of attention in Western publications, the majority of *their* authors being working professionals (Gile 2000).

None of the themes in research articles grew appreciably in popularity over time (see Figure 23). To analyse how theme usage changed over time, simple linear regression was used to model the mean number of themes using the year of publication as the sole predictor.

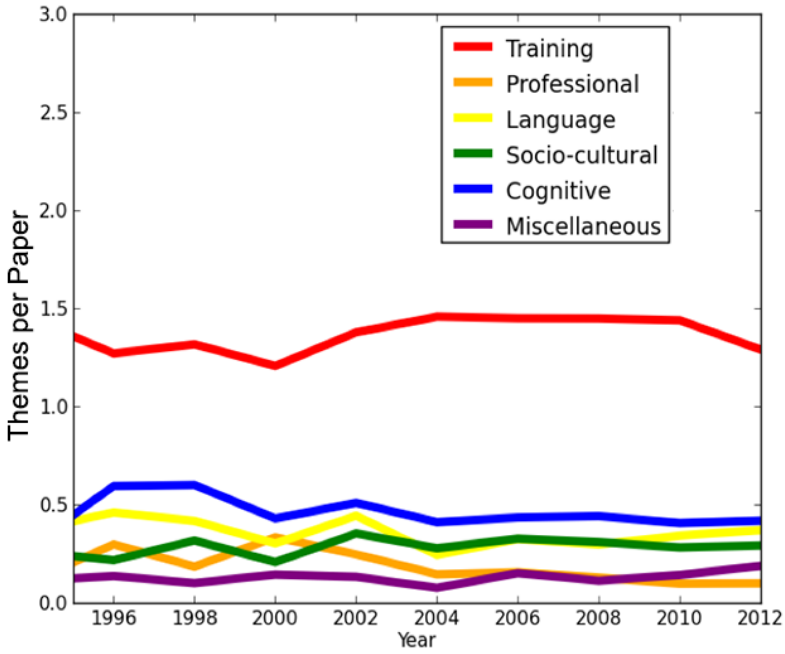

Figure 23. Average number of themes of each type per paper over time
Source: Dissertation's author

As can be seen in Table 9, 95% confidence intervals were provided for the slope of year in each of the theme categories. The analysis revealed that both Training and Cognitive theme slope coefficients were not significantly different from zero (which follows from the fact that the confidence intervals contained zero), which suggests that over time publication year had no effect on the mean number of Training and Cognitive themes per paper. Conversely, it was observed that Professional, Language, Socio-cultural and Miscellaneous themes all had slope coefficients significantly different from zero. Specifically, the slopes for the Professional and Language themes were negative, suggesting that theme usage in these two categories decreased. The slopes for Socio-cultural and Miscellaneous themes were significantly larger than zero, suggesting that theme usage increased for both those categories. However, it is important to consider the magnitude of these slopes. For instance, the largest possible (in magnitude) slope would be -.01172 for Professional themes. This regression line suggests that over the course of the decade the mean number of themes per paper decreased by -.1172. All this is to say that even the most significant slopes were practically zero. It is therefore reasonable to conclude that theme usage has, in general, remained unchanged over the time period under study. This consistency indicates that over the last ten years CIS has come of age, its scholars having broadly converged on its most important themes.

Table 9. Slope coefficient confidence intervals for mean theme count per paper in each category

95% CI for β		DF	Meme
-0.00817	0.00609	2903	Training
-0.01172	-0.00605	2903	Professional
-0.00889	-0.00126	2903	Language
0.00021	0.00686	2903	Socio-cultural
-0.00928	0.00038	2903	Cognitive
0.00011	0.00381	2903	Miscellaneous

Source: Dissertation's author

3.5.1.3. What research methods have been employed by CIS scholars in MA theses, doctoral dissertations and articles and what has been the evolution of the propensity to carry out empirical studies over time?

3.5.1.3.1. Research methods in MA theses: A closer examination of empirical studies reveals that 599 of the 1,290 theses, or 46%, were empirical. A further 97 (8%) were internship reports. Of the empirical total, 295 (49%) included an experiment, 230 (38%) featured an observational study, 103 (17%) involved questionnaires and 68 (11%) interviews.[10] A mere 7 (1%) were ethnological in nature.

It is natural that students should favor observational studies above all others. Firstly, the research methodology involved is quite straightforward: with access to a constant flow of televised press conference interpreting, students have little difficulty observing and recording spontaneous behaviour, unlike in experimental conditions which, unless managed with a great deal of care and skill, can tend to affect the subjects' performances and so produce skewed results. While interpreters may not behave completely naturally in observational studies, the method's ecological validity is likely to far excel that to be derived from experimental studies. Secondly, conducting such work typically does not involve making a large financial commitment: the materials involved (paper, cassettes, etc.) cost little, and no specialised equipment is required (Gile 1994a). Of the 240 theses labelled as observational, in 61 the authors scrutinised the interpreting performances of professionals during the Chinese Premier's annual press conferences. Given that even the most seasoned researchers do not take lightly the difficulties involved in setting up experiments, it is encouraging to see so many students tackling experimental studies: the total (297) exceeds the combined total of interview- (71) and

[10] As some theses used multiple research methodologies, the total proportions add up to more than 100%.

questionnaire-based (113) ones. A note of caution should be sounded, however: Tang's analysis (2010) uncovered a host of methodological problems with students' experiments, so the results should be interpreted with a degree of circumspection.

It has come to be felt by the CIS community that the amount of empirical research carried out in China needs to be increased, given the important role it plays in validating or refuting instructors' ideas, and the much-needed rigour it brings to the development of Interpreting Studies as a scientific discipline (Zhang W. 2012). To examine whether the amount has indeed begun to increase, Figure 24 was created: in it are plotted with a solid line the proportion of theses that were empirical each year in the nearby plot from 2002 onward—there were fewer than 20 empirical theses prior to that year, making the earlier averages less statistically reliable. In addition, a smoothing spline was used to project the growth of empirical studies in the near future, illustrated with a dotted line on the graph. The smoothing spline technique automatically trades off trend-detection and natural variability in data: in this case it did not detect nonlinearity for the data, hence the curve was a straight line. This line should be understood as the best first-order approximation to the true trend of the proportion of empirical theses over the time shown. The negative trend in the proportion of empirical theses during this time was only very slight, and might not necessarily continue in the future.

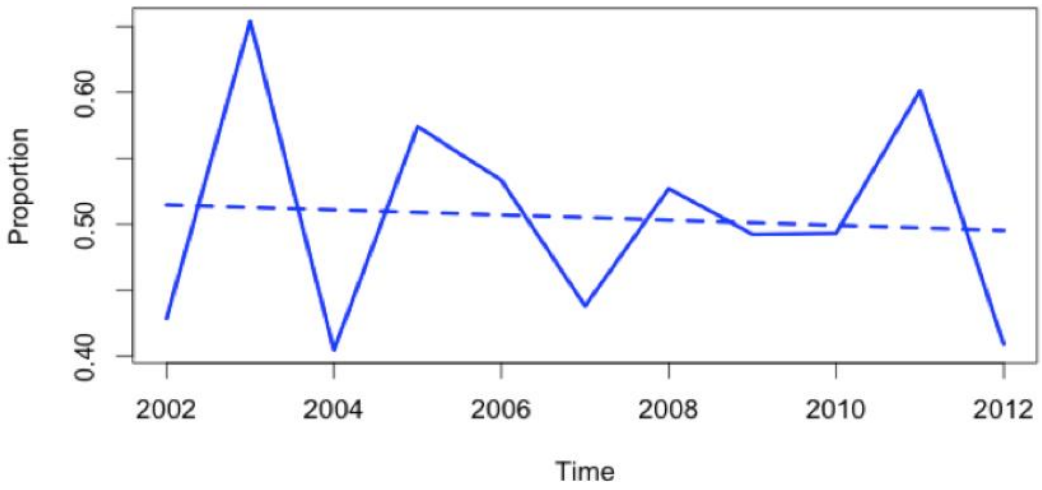

Figure 24. Proportion of empirical theses over time (solid line), and trend (broken line)
Source: Dissertation's author

The mean proportion of empirical theses is around the 50% mark, ending with a sharp decline in 2012, the sharpest since 2003/4; this is remarkable given that the total number of theses has risen so sharply, from just 42 in 2004 to 220 in 2012. Though a gradual increase in the proportion of empirical MA theses had been expected, Figure 15 clearly shows that it is most likely not increasing. Of the 658 non-empirical theses, 97 took the form of internship

reports, a trend set in motion by the creation of the MTI. There is a growing consensus in Chinese academia that the MTI should be profession-oriented, just as are MBAs from business schools. It seems, from a review of T&I curricula at various schools in China (Wang 2009), that graduate students receive no preparation in thesis-writing, hence the allowing of internship reports in lieu of theses.

3.5.1.3.2. Research methods in doctoral dissertations:

Empirical research can help support or refute theories and hypotheses, a process vital for the robust development of a discipline such as IS in which results and findings display a high degree of variability (Gile 2013). The data for the present study revealed that 26 of the 32 dissertations (81.3%) were empirical in nature, in comparison with the dataset for MA theses, where the proportion was just under 50% (see section 3.5.1.3.1). This finding suggests that doctoral researchers are perhaps more inclined or have more time to use a data-driven approach to finding answers to their research questions. It is clear from Figure 4 that experiments were the primary research method for empirical studies: 17 took that form, followed by observational (9), questionnaire-based (7) and interview-based (5) studies (see Figure 25). (It should be noted that some studies employed a number of research methods, so the total does not add up to 26.)

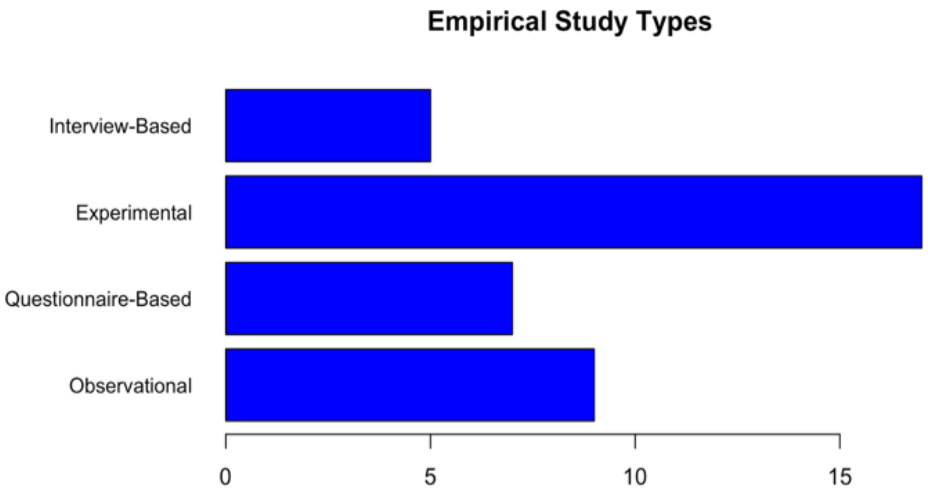

Figure 25. Frequency of different types of empirical research methods used in PhD dissertations
Source: Dissertation's author

Gile (1994) points out that in comparison with other disciplines in behavioural sciences, experiments in IS face fewer technical difficulties such as the creation of test environments similar to those of actual working conditions. Simultaneous interpreters work in booths much like those found in language labs, and consecutive interpreters typically sit at the conference

room table or stand at the podium; both can easily be simulated in a regular classroom. The relative ease of replicating ecologically valid conditions may help to explain why so many doctoral researchers favour experiments. However, none of the researchers conducted multiple experiments in their studies. This may have limited their ability to draw valid conclusions that were representative of the overall population under scrutiny. The variability of test subjects is a notable feature of Interpreting Studies (Gile 1994a). Even the same individual cannot produce identical interpretations when asked to render the same material twice, not to mention the significant differences between participants in terms of language proficiency, training and experience. Multiple experiments with different participants and under various working conditions are required before generalisations can be made.

3.5.1.3.3. Research methods in journal articles and conference proceedings: Of the 2,909 articles in the dataset, 533 (18%) used empirical methodologies; of these, 286 used observation, 151 questionnaires, 148 experiments, and 53 interviews. None dealt with questions of ethnology. A possible reason for the low proportion of empirical studies is that few authors can afford to spend a great deal of time collecting data for the sole purpose of publishing a single article. Also worth noting is that questionnaires were more commonly used by professors than by students, often with a completion rate of more than 95%—no doubt teachers find it easier than students to persuade large numbers of people to complete surveys!

Prior to 1994, with the exception of nine articles, all the Chinese authors explored interpreting techniques and competence from the perspective of their personal experience. However, things have moved on from those days: the proportion of empirical research has been growing steadily despite the fluctuations in the late 1990s, which were likely caused by the limited number of articles published at that time. It is obvious from Figure 26[11] below that the sharply rising proportion of empirical papers—up to 30% in 2012 from virtually zero in 1994—has gone hand in hand with a progressive rise in the use of all four research methods. In particular, the growth of observational and experimental studies has been impressive. The first type saw consistent growth after 1998, and increased to 15% of the empirical total in 2012. Experimental papers, on the other hand, only began to be written in 2000, and have since grown to be more than 5% of the total. With the expansion of MTI and BTI education in China, it has

[11] A cumulative plot was created because it clearly shows how both the overall trend (the proportion of empirical articles) and the components of that trend (the proportions of the four different empirical research types) fluctuate at the same time. In other words, it allows us to compare subcategories over time and to see how each contributes to the growing proportion of all empirical papers over the same period.

become easier for authors to recruit student participants for their observational and experimental studies, but it would be interesting to see how the results from those studies might be extrapolated to the interpreter population at large.

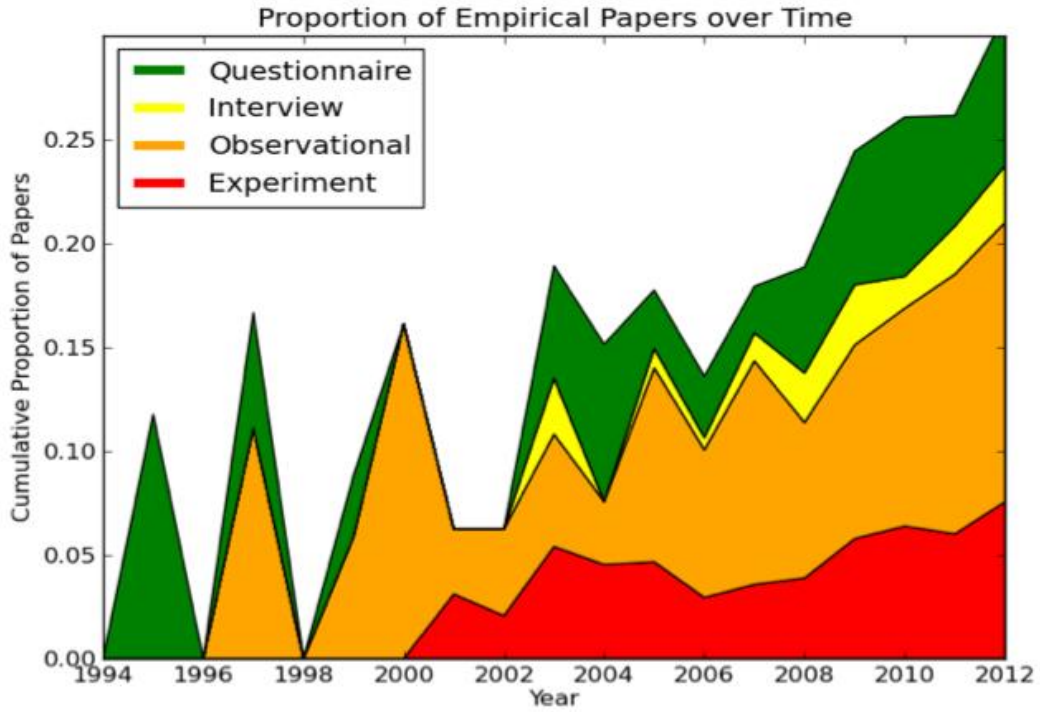

Figure 26. Cumulative proportions for different categories of empirical research over time
Source: Dissertation's author

3.5.2. University-related factors

3.5.2.1. What are the universities with the largest output in the field?

While numerous universities are represented in the data, most of the theses issue from only a few. Just five account for 62% of the total:

1. SISU - 23%
2. BFSU - 18%
3. XU (Xiamen University) - 11%
4. GUFS (Guangdong University of Foreign Studies) - 7%
5. OUC (Ocean University of China) - 3%.

By comparison, the next five universities—Central South, Sichuan International Studies, Suzhou, National Taiwan Normal, and Guangxi—together account for only 10% of the total. It should be noted here that the large contribution of theses from the top five universities is a result of their high student numbers and the fact that *all* their MA students are required to complete a thesis upon graduation. One surprising finding from this analysis is that

OUC, a university that specialises in marine sciences, is ranked among the top five producers of Interpreting Studies theses. Though it has the shortest track record in interpreter training of the top five, its College of Foreign Languages has actively forged close links with front-runners such as SISU and GUFS by recruiting some of their faculty to serve as visiting professors, with the result that it has produced a significant number of graduates in interpreting.

In comparison with MA theses, of which 62% come from only five schools, the universities' presence in journal publications is far less concentrated. Figure 27 shows those which generated at least 25 papers. Notice that the top five on the list account for only 10% of papers, and the top ten only 15%. In fact the top 100 universities published less than half of the overall total (49%). On the one hand this may indicate that large numbers of Chinese faculty members view interpreting as a down-to-earth profession rather than a subject of intellectual inquiry, and are more focused on imparting practical hands-on skills to their students. On the other, it is worth remembering that a large percentage of current CIS faculty members have not carried out advanced research for PhDs, which may account for the sparsity of output at the top MA thesis-producing universities.

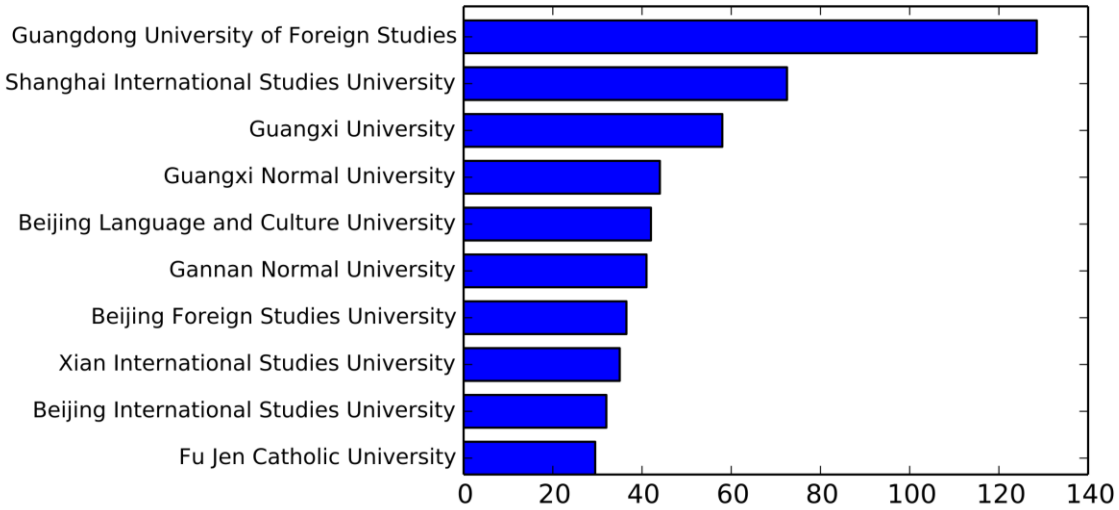

Figure 27. Most productive Chinese universities with at least 25 papers (straight count)
Source: Dissertation's author

Six of the top ten thesis-producing universities (GUFS, SISU, GXU, BFSU, XU and Sichuan ISU) are also major contributors to article publication, but at the same time universities such as Beijing Language and Culture (BLCU), Guangxi Normal (GXNU) and Gannan Normal (GNNU) have emerged as high-rankers in the production of research papers. As a matter of fact, only two of the top five thesis-producing universities also feature among the top five by

straight count. That universities which produce no theses do produce research papers indicates that participation in CIS research is widespread among Chinese academic institutions.

The results for the weighted and first-author rankings are given in the bar charts below (Figures 28 and 29).

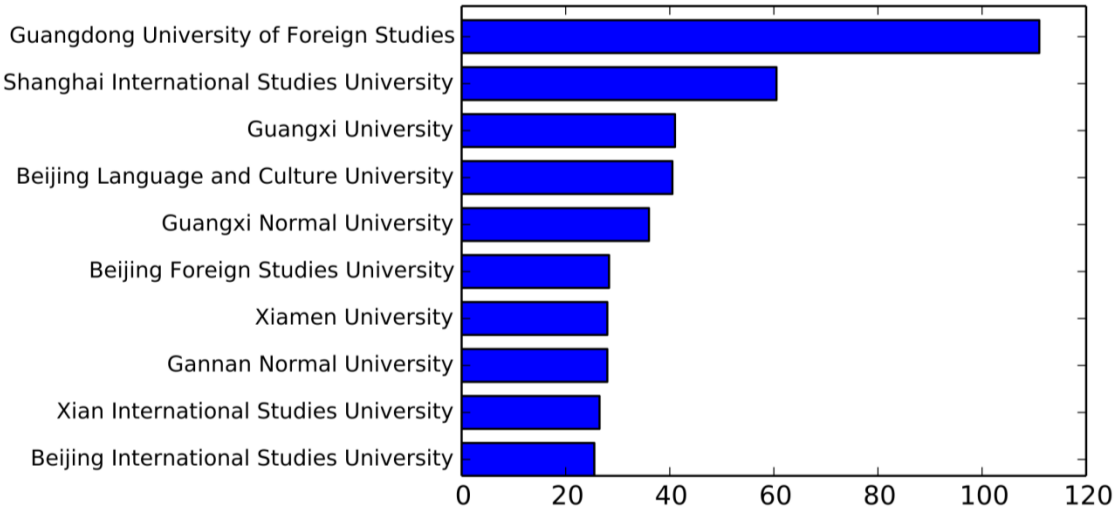

Figure 28. Chinese universities - weighted count
Source: Dissertation's author

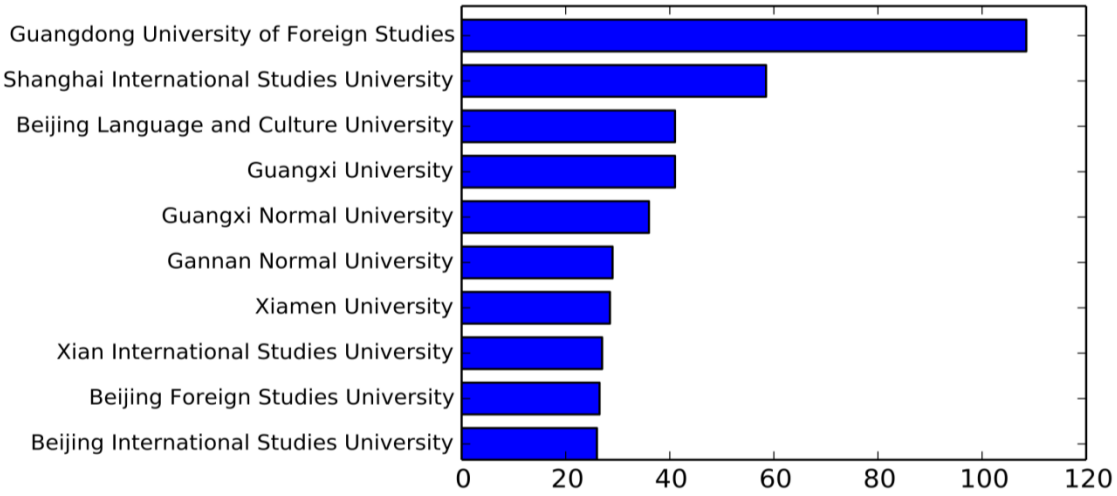

Figure 29. Chinese universities - first-listed author count
Source: Dissertation's author

Despite some minor differences in the listings, GUFS, SISU, XISU, BFSU, GXNU and GXU appear in the top ten across all three ranking methods, indicating that their faculty members are highly motivated to publish and that these six schools are among the institutions with the greatest research paper output. Most notably, GUFS and SISU consistently ranked as the top two on every count method, indicating that their researchers are not only actively

involved in CIS, but act as principal investigators on the projects they participate in. However, the following universities should also be noted for appearing among the top ten in two of the three ranking schemes: BLCU, GNNU, XU and Beijing International Studies (BISU).

3.5.2.2. Who are the advisors with the largest production in CIS and how frequently do advisors engage in co-supervision?

Figure 30 shows those advisors who have supervised at least ten MA theses. Interestingly, six of the top ten, at the time of their advising, were serving or had previously served as dean or associate dean of their universities' schools of foreign languages and T&I. This runs counter to the situation in the West, where deans are mainly responsible for fundraising and administration. Of our top ten, two were working actively as interpreters and nine had an educational background in linguistics.

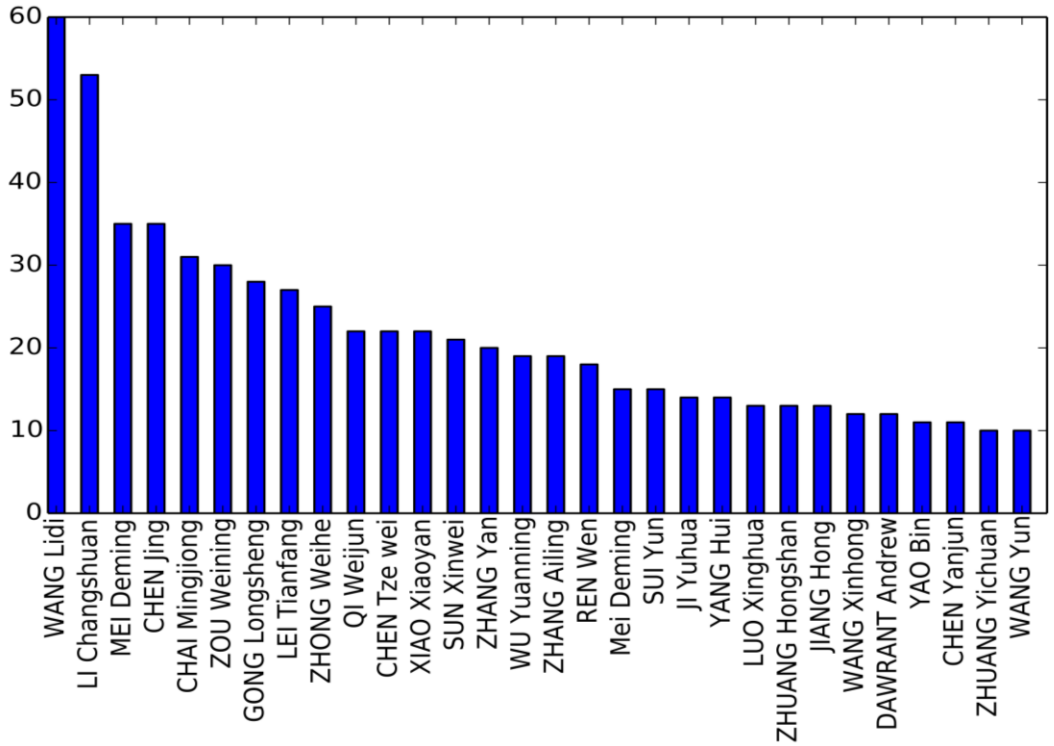

Figure 30. Busiest Chinese advisors
Source: Dissertation's author

The number of theses supervised by individuals, especially ones with extensive administrative duties, was worthy of interest: one might wonder how they make time enough away from their other duties to provide effective supervision of students' theses. A partial answer to this puzzle lies in the fact that it is not unusual for them to co-supervise. Figure 31

lists all those who have co-supervised at least five times, with the number of times they have done so:

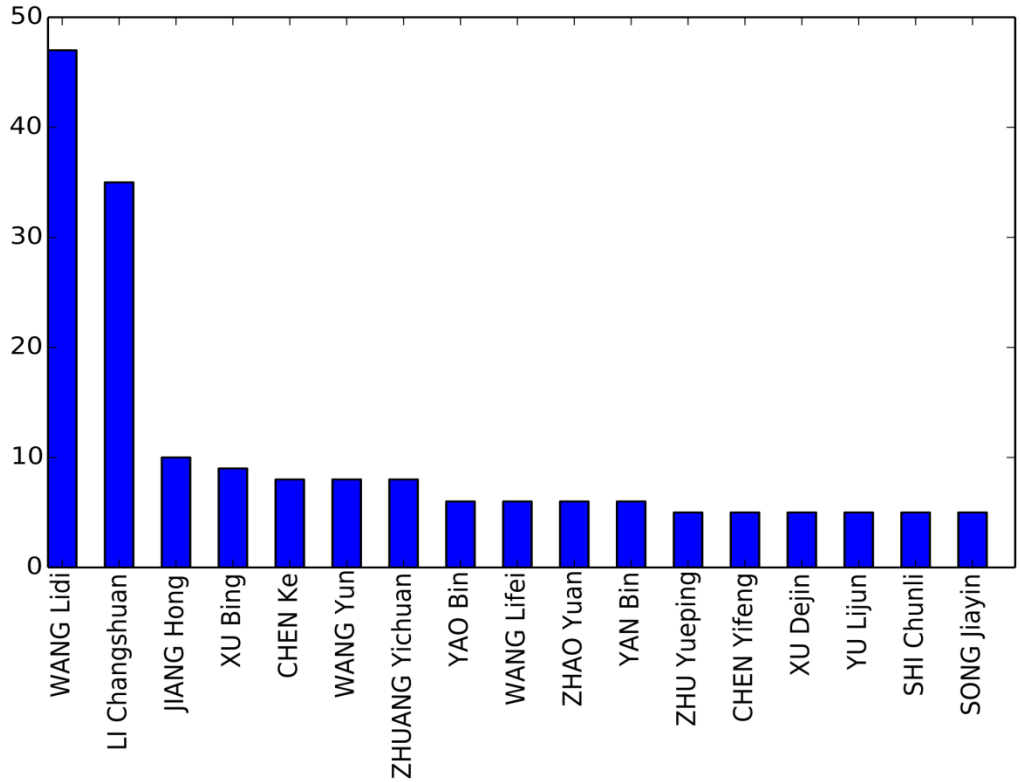

Figure 31. Number of Chinese advisors who have co-supervised at least five times
Source: Dissertation's author

Closer examination of the data revealed that few co-supervisions took place between advisors of equal academic standing. The majority of co-supervision teams were composed of one senior and one junior faculty member. It is possible that during the process the junior colleague observes his superior to learn the art of serving as a mentor; only later does he move on to advise students independently himself. This is exemplified by the case of Jiang Hong from BFSU who started her thesis supervision by working with more senior scholars in the late 1990s, such as Zhang Yichuan in 1996 and 1998, and Xia Zukui in 1997. By 2000 she had started independently advising MA students, her mentorship of junior colleagues beginning the following year when she and Xiong Lixia co-advised two MA students. Given that interpreting is a young discipline with a rather brief history in China, it can be somewhat difficult to find an adequate number of advisors sufficiently competent to provide quality research support to students. This type of collaboration between senior and junior colleagues is a potential way of accelerating the professional development of young scholars and can work to the great advantage of T&I schools, which struggle to meet the shortage of CIS advisors in the face of an ever-increasing number of students.

Wang Lidi and Li Changshuan, the top two Chinese advisors who co-supervised the most theses, also happen to be the top two most active thesis advisors over all (see Figure 31)—co-supervision explains how they have each managed to supervise over 50 theses. However, it does not explain how the other top three busiest advisors, who are absent from Figure 31, dealt with such large numbers of advisees without the assistance of co-advisors. To examine this question, a plot was produced with the five busiest advisors' work over time to find out their average number of advisees per year.

All these supervisors took on as many as seven students per year on average (see Figure 32). This indicates that the significant quantities of theses they supervised were completed within a short span of seven years on average, rather than being the result of very long-term supervision[12]. A piece of data worth noting is that Mei Deming had the highest ever number of advisees in his career while serving as the dean of SISU's College of English from 2004 to 2009, the decline in their total coinciding with his departure from the post in 2009, although he continues to advise MA and PhD students there. This leaves one wondering whether students in China typically seek out high-status supervisors, as opposed to merely competent and available ones.

To answer this question, the number of theses supervised by all advisors at the top universities in China was examined. Table 10 lists these along with the number of advisors advising between 1 and 3, between 4 and 10, between 11 and 20, and over 21 students.

[12] There was some fluctuation in the number of students the six advised per year: since each advised only a handful annually, there was bound to be natural variation as a result of the small-sample sizes. Indeed, if an advisor supervised a Poisson number of students each year, with a mean of five students, one might expect to see data that looked like this: 2 5 1 2 12 4 7 2 6 3 (sampled data).

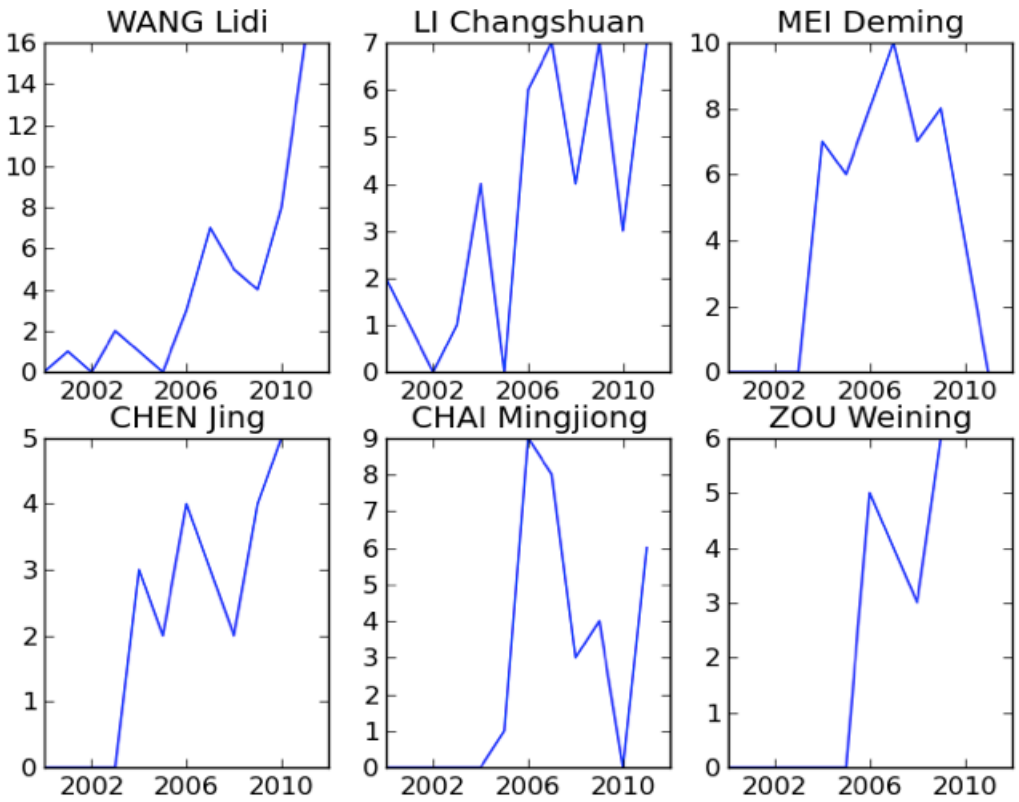

Figure 32. Number of theses advised over time by the six busiest supervisors in China
Source: Dissertation's author

Table 10. Number of theses supervised by advisors at the top universities in China

	1 – 3	**4 – 10**	**11 – 20**	**21+**
SISU	15	4	4	5
BFSU	29	16	2	2
XU	5	1	2	3
GFSU	19	4	0	1
OUC	4	0	0	1

Source: Dissertation's author

Some noteworthy facts arose from the garnered data: nearly all MA students from the Ocean University of China were advised by Zou Weining, though the university has four other faculty members who have advised students on interpreting. Zou serves as the chief interpreter for the Translation Division at the International Office of his university, and as a professor in the English department; to judge from the biographical material available on him and his OUC colleagues, he has the most extensive experience as a practising professional interpreter, but is not the highest-ranking professor of the five.

The load appears to be different at the other top universities where there are typically one or two advisors with many students, (e.g. Mei Deming, Li Changshuan), a handful with around ten students (Jiang Hong, Yao Bin, Ji Yuhua, etc.), and then numerous advisors with just one or a small number of students. One exception to this is SISU, where a goodly number of advisors have more than ten students. Generally speaking, in China only faculty members at or above the associate professorship grade are allowed to supervise the theses of graduate students[13]. The establishment of an advisorship is a mutual selection process: interpreting students can indicate their preference for certain professors (up to three in the case of SISU), but it is ultimately the professors who select the students they would like to work with from the pool of candidates, even without having seen any research proposals.

3.5.2.3. What is the research output of advisors and their graduate students and what is the propensity to engage in research collaboration?

Of the total number of thesis supervisors (405), only 67 have published peer-reviewed research articles on interpreting (see Table 11). This is somewhat surprising in many academic fields, but in CIS it is not unexpected considering that, as mentioned previously, many supervisors have not completed a doctoral degree, and also given the fact that publications are not the sole contributions that can be made to an academic community (Gile 2000). Mei Deming, for instance, though one of CIS' busiest supervisors, does not work as a professional interpreter and has yet to publish a single-author research article on the subject. He is, however, the author of *An Advanced Course in Interpreting* (1996), China's most popular related textbook. By contrast, in more mature fields such as linguistics and computer science, supervisors choose to guide student projects which accord most closely with their own professional experience and research expertise (Gile 2013). This problem is not unique to China: as pointed out by Gile in the same article, throughout the world the majority of doctoral dissertations are completed under the supervision of faculty members who have not gone through the same rigorous training in research methodology as their advisees. Because CIS (interpreting studies generally, in fact) is such a young discipline, supervisors themselves are only now starting to build up publishing histories.

Table 11. Number of MA advisors who have published research papers

[13] Certain universities do make exceptions to this rule. At GFSU, for instance, Zhang Cheng independently advised students when he was an assistant professor, while Wang Dan and Zhang Lihua served as co-advisors to graduate students when at the same grade.

Times published in research papers and proceedings	No. of advisors
0	368
1	35
2	13
3	8
4	4
5	2
6	2
8	2
15	1

Source: Dissertation's author

Moving on to examine the most published authors of MA theses, it was found that from the total of 1,290, only 139 have published work appearing in the journal databases. Their numbers break down as follows (see Table 12):

Table 12. Number of MA students who have published research papers

Times published in research papers and proceedings	No. of students
0	1,144
1	104
2	22
3	9
4	2
6	1
7	1

Source: Dissertation's author

The statistics in Table 12 reveal that the results of MA students' research are not widely propagated. While a large number of universities in mainland China have taken the initiative of sharing their MA theses via a common platform (CNKI), BFSU's theses can only be accessed in their own reading-room. This low level of diffusion can also be explained by the timespan and difficulties involved in the publication of peer-reviewed papers. The peer review process can take up to a year to complete, and sometimes authors may have to submit their papers to several journals before they are accepted for publication. As indicated in section 4.2.1

in Chapter 4, nearly 80% of MA students choose not to pursue an academic career upon graduation. With a large number of students regarding a master's as the end point of their education, some may lack the motivation or patience to seek publication for their research. That said, this problem is not unique to Chinese universities: BITRA, one of the largest bibliographic repositories of Translation and Interpreting Studies in the world, specifically excludes MA theses for the very reason that they are nearly impossible to locate (Franco Aixelá 2014).

Co-publishing is often a mutually beneficial process: students' papers are more likely to make it to print when their supervisors are listed as co-authors; at the same time supervisors, who are often associate or full professors, can put the titles towards meeting their institutions' research targets. The present analysis reveals that only 33 papers in the dataset were co-published by students and their supervisors. There are explanations for this limited number. Firstly, unlike in natural science and engineering disciplines, co-authorship is comparatively rare in the humanities as a whole (Larivière et al. 2006). Also, though various forms of informal collaboration exist between scholars, such as participating in conferences and workshops and co-editing textbooks, these seldom assume the form of co-published papers.

3.5.2.4. What are the patterns of inter-institutional collaboration?

Given that numerous universities have co-authorship pairings, it was decided to present only the top 20 in Figure 33[14]. Each of the 20 has four or more inter-institutional pairings, as well as pairings with a further 14 universities outside the top 20, making a total of 34 institutions shown in this Figure.

[14] For a more dynamic visual effect, readers can visit the permanent link hosted on the author's website: http://interpretrainer.com/Chinese_universities_chord.html. Hovering the cursor over the edge of the circle or the key highlights each region's co-authorships. The peak for each region represents intra-locational collaborations, while the linking chords represent inter-locational ones. The width of each peak and chord corresponds to the number of pairings hosted at the following link: http://www.interpretrainer.com/journal_regions_chord.html.

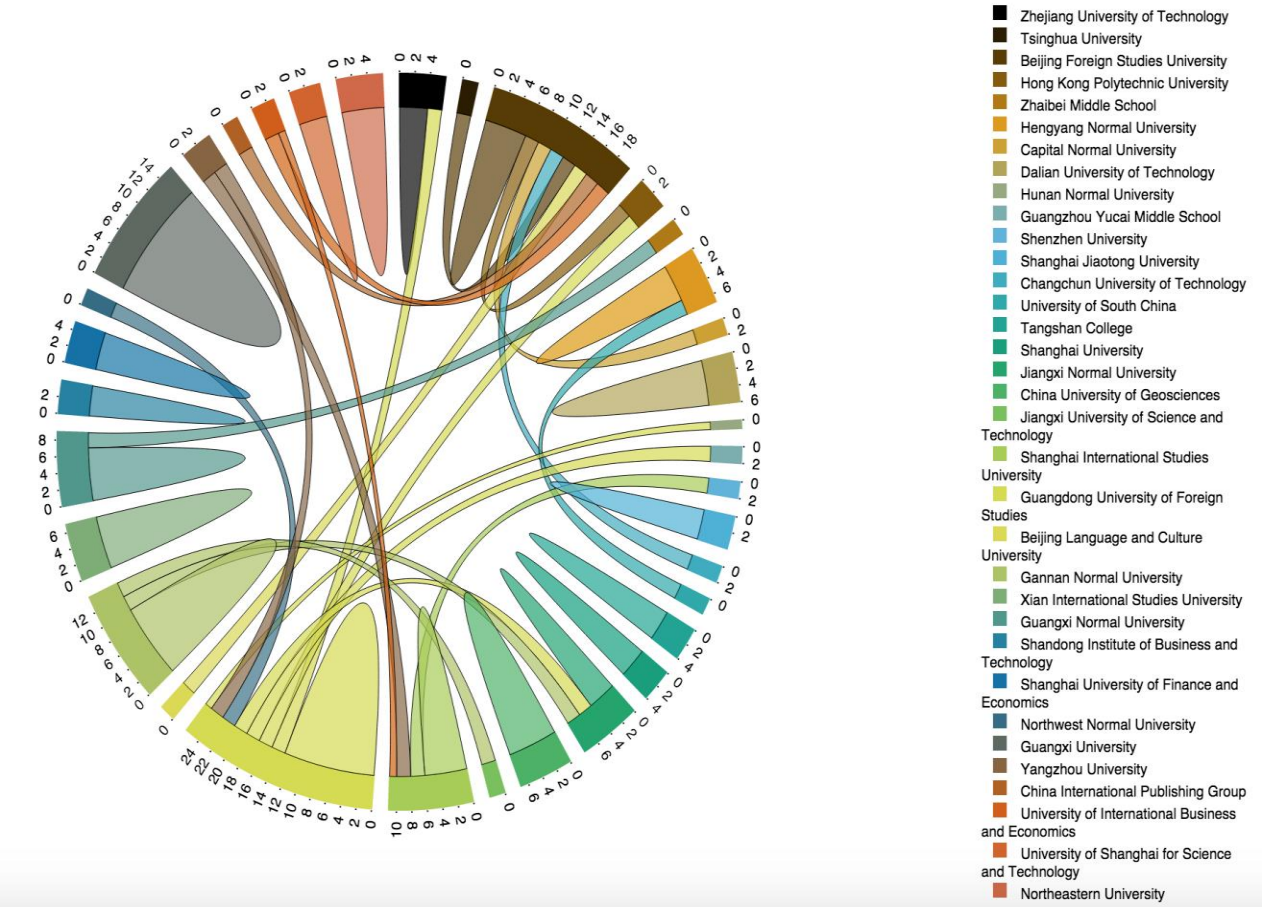

Figure 33. Co-authorship for articles and proceedings between and within Chinese universities
Source: Dissertation's author

The data revealed a total of 588 intra-institutional pairings, among which Guangxi University (16 pairings), GUFS (13) and Gannan Normal University (10) are the top three. Researchers from these universities work well together and have co-published the most articles. At the same time Figure 20 indicates that there is a low degree of inter-institutional collaboration, as evidenced by the relatively low figure of 194 such pairings. Even the top-ranking schools by such measurement—SISU (16), BFSU (9) and GUFS (9)—have fewer than 20 pairings each. These three are among the most well-respected in CIS, so it is likely that scholars there find it easy to locate research collaborators from other universities, which may explain the high level of their inter-institutional activities. Of course it is also possible that graduates from these three schools who find employment at other universities continue to collaborate with their former classmates or thesis advisors in publishing papers.

Approaching the matter of institutional collaboration from a different angle, it was found that of the 2,909 papers in the dataset, 176 were authored by scholars from multiple universities; of these 167 papers had authors from two universities, and 9 from three. The

somewhat low rate of co-authorship among paper authors (570 in total, or 30.9%) seems to indicate that it is the norm in CIS to conduct research independently rather than tapping into colleagues' resources and working on joint projects. This practice, common in the humanities, is distinctly different from that in the natural science and engineering communities, where nearly all the published research is collaborative in nature (Larivière, Gingras, and Archambault 2006). In addition, some 37% of co-authored papers were between universities, indicating that a rather low percentage of authors chose to venture out and work with colleagues from other establishments. CIS authors may prefer to collaborate with those they are in frequent physical contact with; also, it is reasonable to speculate that authors from the same institution find it much easier to apply and be approved for funding from higher authorities.

3.5.3. Geographical factors

3.5.3.1. Which regions of China have emerged as the major production centres for CIS research?

The map in Figure 34 shows the number of theses produced per province[15]. Research revealed that most theses were produced in localities in central and southeastern China and in the capital: Beijing (323 theses), Shanghai (283), Fujian (120), Guangdong (74) and Taiwan (69). These places have a high concentration of universities with established interpreter training programs (BFSU and UIBE in Beijing, and SISU in Shanghai, for example), hence the high numbers of theses produced there. In addition they have all enjoyed close economic ties with the rest of the world since the late 1970s, and their geographically strategic positions have made it easy for them to attract large numbers of students. At the other end of the scale, northern China is much less well-represented—Liaoning (16), Jilin (14), Shaanxi (12) and Inner Mongolia (1)—despite there being no shortage of first-tier universities in those areas: the universities of Jilin, Liaoning and Xi'an Jiaotong are considered among the best in China. Given the boom in popularity of interpreter education all over China, these areas might be expected to have huge potential for growth in producing MA theses in future.

[15] For a more dynamic visual effect, readers can visit the permanent link hosted on the author's website: http://interpretrainer.com/maps/geo-ma.html

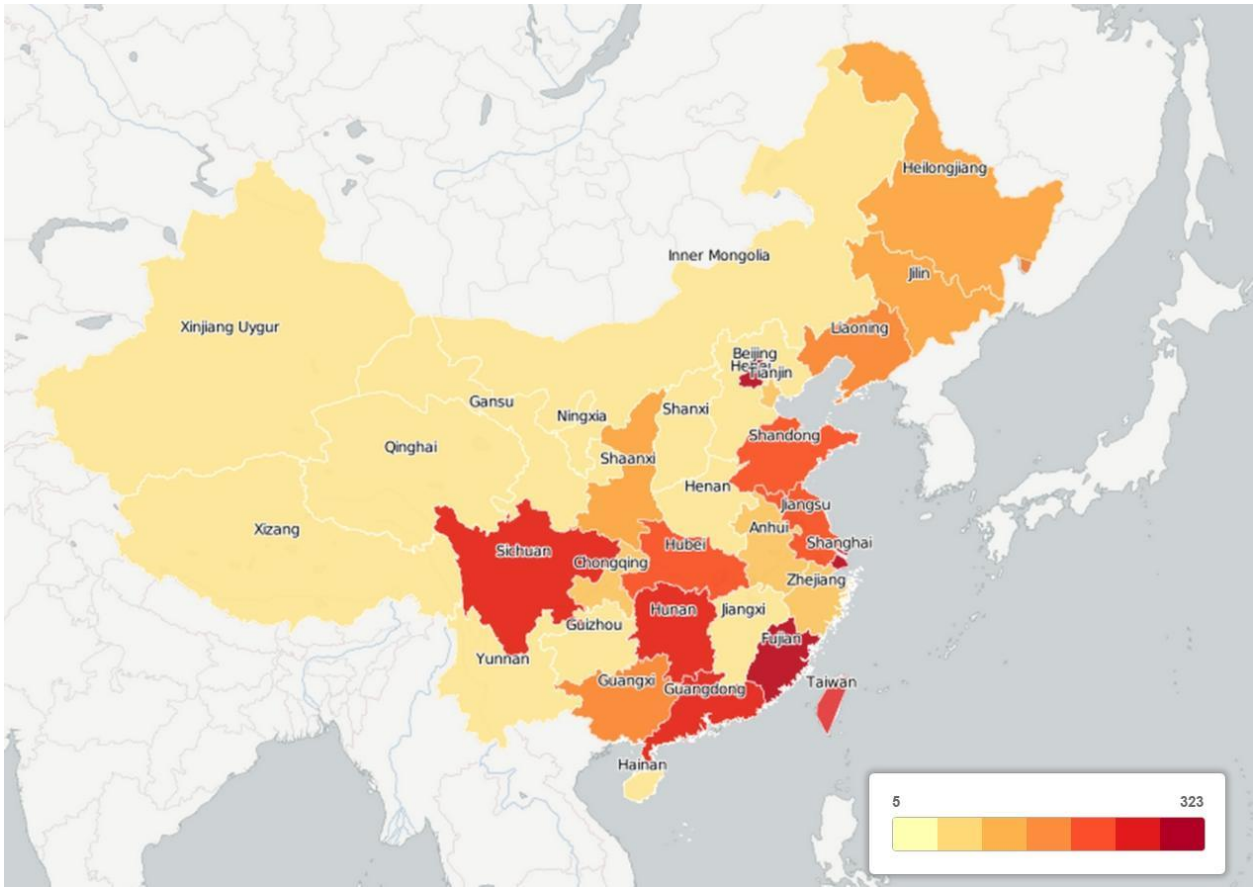

Figure 34. Distribution of MA theses across China
Source: Dissertation's author

From Figure 35[16] it is plain to see that most research was concentrated in Southeastern and Central China, the locations with the greatest output being Guangdong (311 papers), Beijing (309), Jiangsu (265), Hubei (211) and Shanghai (207). The country's coastal regions enjoy high levels of economic productivity and are engaged in intensive industrial and commercial activities, which have no doubt led to more international contacts and a higher demand for business interpreters. A case in point is Guangdong province where the total number of papers published far exceeded that of Beijing which, despite its strategic and political importance as the capital of China, not to mention its high concentration of first-tier universities, is landlocked and not a trading hub. The Yangtze River Delta, another important focus for foreign trade, comprises three more major contributing locations to CIS research: Shanghai (207 mentions), Jiangsu (265) and Zhejiang (198). At the other end of the scale, economically less-developed regions such as Xinjiang (17), Inner Mongolia (14) and Yunnan

[16] The dynamic version of this Figure is displayed here: http://interpretrainer.com/maps/geo-articles.html

(17) contributed very little, despite the existence of multi-lingual cultures and ethnicities in these regions.

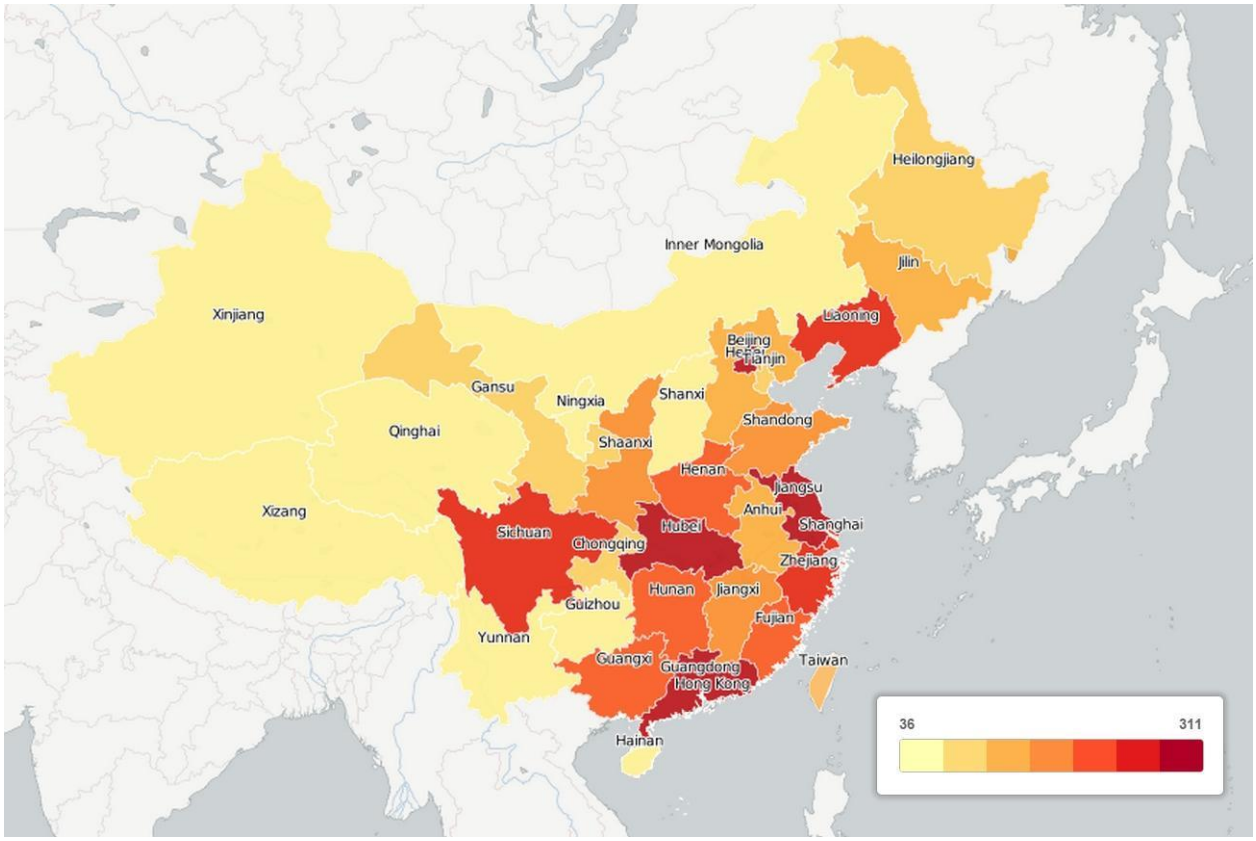

Figure 35. Research paper distribution across China
Source: Dissertation's author

Research into interpreting, which is often funded by institutions, is not a lucrative endeavour. Furthermore, Chinese researchers typically have to pay an article processing charge when their works are accepted by academic journals; these range from a few hundred to several thousand dollars, depending on the journal's ranking. Both these factors may deter scholars in financially disadvantaged areas from actively carrying out and publishing research, the funding they receive from their schools being insufficient to cover the two expenses.

3.5.3.2. What are the patterns for inter-locational collaborative research?

The data revealed 632 co-authorship pairings between provinces (and countries)[17]. Beijing and Shanghai led the way with 74 collaborations apiece, followed by Guangdong with 59. Of the first total, 43 were between Beijing authors ('intra-city') and 31 with authors from other regions

[17] Because co-authorship between Chinese and foreign scholars is rather limited in CIS, both national and international collaborations are presented in the same figure.

('inter-locational') (see Figure 36). The same figures for Shanghai were 39 and 35, and for Guangdong 34 and 25. The level of inter-provincial collaboration across China was generally rather low. It can be surmised that a significant majority of authors prefer to work face-to-face with colleagues from similar academic backgrounds (fellow alumni, for example) with whom they have been able to build relationships of confidence and trust over time. The vast majority of collaborations were between Chinese authors, a mere four having been co-authored with overseas colleagues (UK - 2, Australia - 1, Germany - 1).

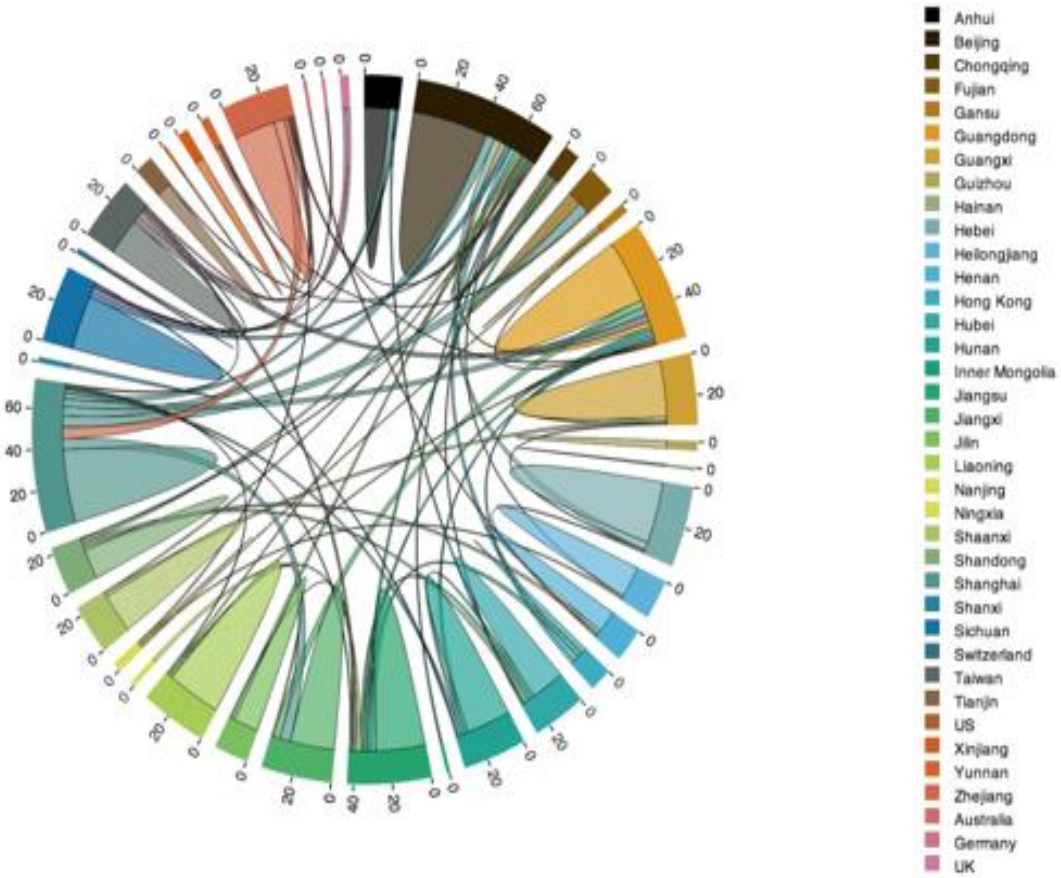

Figure 36. Co-authorship for articles and proceedings between and within regions
Source: Dissertation's author

Gile (2013) points out that international collaboration is particularly beneficial to research because not all countries share the same resources and areas of expertise. In addition, researchers from different countries can conduct experiments using a single piece of source material (one in English, for example), having it interpreted into different languages using the same research methodology. This international approach can help address the problem of language specificity and provide much-needed data in various languages. With China's ongoing biennial conferences on interpreting studies attracting scholars from all over the world, an increased level of research across regions and countries seems a likely prospect.

3.6. Conclusion

In parallel with its economic and trade liberalisation, China has rapidly emerged as a large-scale producer of MA theses and research articles on interpreting studies, and the discipline's growth remains strong even after a decade of massive expansion. The general 'culture' of CIS has changed little, none of its theoretical influences or research themes having gained significantly in popularity in MA theses or journal articles. Cognition remains the dominant theoretical influence, followed by language- and translation-related theories and ideas. Training remains the most studied topic, its popularity perhaps being driven by the creation of numerous MTI and BTI programs throughout the country. Despite this consistency, CIS research has changed in some unforeseen ways, most notable among them being that the proportion of empirical MA theses seems to be declining.

Of the 111 universities producing theses, a mere five have been responsible for the overwhelming majority, but the production of journal publications is far less concentrated, spread among some 900 academic institutions with the top five accounting for only a tenth of the total. There appears to be a significant imbalance in the workload of thesis-advising at the top Chinese universities, with just a couple of professors assuming most of the responsibilities at each. Because they also have onerous administrative duties, many resort to co-supervision in order to share the labour, which probably helps to groom a new generation of advisors. Though universities are producing a wealth of CIS research papers, one cannot help but notice the dearth of collaboration between them. Unlike disciplines in the natural sciences where a high percentage of papers involve co-authors from multiple institutions, CIS scholars have yet to form the habit of sharing resources and expertise on joint research projects with colleagues from other schools.

China's capital and coastal cities, which have close commercial ties with the rest of the world and are well endowed with economic resources, stands out as powerhouses in producing theses and journal articles on interpreting, whereas inland locations in the northwest have contributed only minimally to the literature. Single-author research is the norm in CIS: the limited number of collaborative research articles are produced in discrete areas of the country—few are inter-regional, still fewer international.

As CIS research becomes ever more interdisciplinary, it will require experts with different skill-sets from various fields to work together on joint projects. It is likely that with the aid of modern technologies, remote collaboration between universities and regions will

become increasingly attainable, thus leading to more studies that use samples more representative of the overall interpreter population. No doubt changes in certain academic policies, such as recognizing the research contributions of second or third authors in article publication, will help accelerate this trend.

Chapter 4. Career Choices

4.1. Background

The expansion of the European Union (EU) and the increasing integration of the world economy have, over the past two decades, given rise to a growing demand for interpreting services and contributed to the creation of numerous interpreter training programs worldwide. At the turn of the millennium more than 230 schools in over 60 countries offered different levels of training, with EU nations taking the lead, accounting for more than half of the total (Niska 2005).

In the 21st century the landscape has changed significantly, with China rising to prominence as a major global power, more closely linked with the rest of the world than ever before. This expanding political and economic interaction has led to an increase in demand for interpreters, to help break down the linguistic and cultural barriers that for so long hindered communication and cooperation between China and the 'outside world'. As a consequence, the interpreting industry of the People's Republic has attained for itself a significant position in the world market for professional training: as of early 2013 there were Master's programs in Translation and Interpreting at 159 Chinese universities (Chai 2012), compared with a single university just 20 years earlier.

Whereas formal training in interpreting is still a relatively new phenomenon in China, in the West it has a much longer history, allowing it time to develop into a mature academic discipline (Moser-Mercer 2011). The first Western school for interpreter training was established in 1941 at the University of Geneva (Moser-Mercer 2005), almost four decades before its Chinese counterpart. By 2013 a total of 69 programs worldwide met the Association Internationale des Interprètes de Conférence's (AIIC) standards for interpreter training, but only one of these was in China.

Western research into the subject has gone through several phases since its inception in the 1950s, and is increasingly characterised by empirical research and an interdisciplinary approach. Early Western interpreter training courses focussed heavily on practice (Moser-Mercer 2005), but today their curricula commonly feature elements of research and theory. While interpreter education in China is still practice-driven, all students, unlike their

predecessors, are now required to produce theses before they can be awarded their master's, resulting in a new trend toward academic research.

There is general agreement among academics that graduate students in any discipline should master two types of knowledge in their training (Becher 1989): they must know their subject matter, but they need also to learn the code and culture of their chosen discipline. Becher observed that this second stream of knowledge acquisition, the ultimate aim of which is to produce professionals who know how to conduct themselves appropriately in their work, begins as early as the undergraduate level and continues through post-graduate education. The culmination of this dual-track process is the thesis, which marks a student's training completion and readiness to work as a fully-qualified professional (Kushkowski, Parsons and Wiese 2003).

This description of graduate education as a process of knowledge accumulation and professional socialisation undoubtedly applies in the case of interpreter training. However, certain unique features set interpreting apart from other disciplines. Unlike neighbouring areas of academic enquiry such as linguistics or psychology, a PhD in interpreting studies is not a prerequisite for becoming a professional practitioner or a faculty member teaching or engaged in research, and indeed a master's is often the highest qualification a student obtains before venturing out into the world of paid work. Indeed, the fact that a PhD is less critical in IS may have given rise to some cultural and professional norms that differ from more 'traditional' academic fields. For example, IS faculty members often act more like 'consulting professors' whose industry experience is valued over their research productivity; and the majority of IS schools have no structured syllabus or textbooks to follow for teaching interpreting skills, typically relying on ad hoc materials provided by faculty members from their own work experience.

In the field of Chinese Interpreting Studies (CIS), the first master's thesis was produced in 1994, when the conference interpreter training program at Beijing Foreign Studies University (BFSU) was upgraded and granted its own formal graduate school (Wang R. 2006). In this new incarnation it began to offer theoretical instruction in addition to practical training. Since then, as part of the requirements for graduation laid down by the Chinese National Degree Commission, all MA students throughout China must complete a thesis in addition to passing performance-based exams in interpreting before they can be awarded a master's degree. As of 2015, a large number of teachers and academics in CIS—and 12 of the 20 most active MA advisors—do not have PhDs. It should be pointed out that CIS theses may be written in either Chinese or English.

Moser-Mercer (2011) argues that interpreting studies now stands at the beginning of what Shneider (2009) describes as the third stage of a discipline's evolution, that in which most of its 'stock' of knowledge is produced and understanding of the subject deepened, largely thanks to new research. The progress of a discipline cannot be separated from the research contributions of its scholars. New graduates in interpreting who take up careers in academia represent the future of the field, so understanding the factors that contribute to their choice of an academic or a professional career would help institutions and those who frame educational policy make informed decisions on how to better shape the development of the field, for example by allocating funds in the direction of research topics that ought to promise that more students will enter the academic sphere.

The primary focus of this chapter is to examine whether certain factors associated with students, such as their academic affiliations or particular features of their theses, can serve to predict the type of career they are likely to pursue after graduating. The emphasis is on factors that may be termed 'structural' (school location, city population, research productivity, etc.) rather than 'social' (students' economic background, gender, etc.), though the two can sometimes be difficult to disentangle.

4.2. Research questions

This chapter approaches students' career choices from three perspectives: student, university, and regional factors, which are the most critical sources of influence affecting students' professional development. The rationale for investigating each of these factors is outlined below.

4.2.1. Student-related factors

4.2.1.1. To what extent does an emphasis on empirical compared to non-empirical thesis work help predict the course of a student's subsequent career?

Numerous scholars from the international interpreting community (e.g. Lambert 1994; Gile 1994b; and Pöchhacker and Shlesinger 2002) have recognised the value of empirical research, and there has been an increasing call within the CIS community in particular (e.g. Tang 2010; Zhang 2011) for scholars to conduct more data-driven studies. Empirical research generates evidence-based knowledge that can then be shared with other scholars and with professionals

seeking to improve their skillsets. The empirical approach is especially valuable in interpreting studies, which was started by practising interpreters who relied on intuition and ratiocination to develop theories. As Lambert (1994) observed, the interpreting process is a complex one, making it difficult to design studies for which enough willing and competent participants can be mustered and, above all, which are as close to empirically robust and statistically reliable as it is possible to be. Against this background it can be hypothesised that students whose theses employ the empirical approach must be highly motivated in that direction and that consequently they are more likely to pursue academic careers than their non-empirical colleagues: while theories can be mastered by a thorough review of existing literature, the essential components of conducting empirical research such as sampling, hypothesis testing, power size calculation and data analysis, require specialised training, which cannot be completed in a short period and is not part of the curriculum for MTI students.

4.2.1.2. Do research topics and theoretical underpinnings have an influence on students' subsequent career choices?

Selecting the right research topic is the essential first step when it comes to writing a successful MA thesis. Students should not, however, overlook the fact that their decision may influence their long-term interests as professional researchers in the field, as well as their career prospects as academics or otherwise. An on-trend mainstream topic may provide them with a wide choice of thesis advisors and open the doors to a well-established community of researchers; it may even make it easier to secure funding. Conversely, those who opt for paths less trodden may subsequently have difficulty in finding a PhD advisor willing to pursue the same line of research; should they set their sights on faculty positions, an esoteric choice of MA topic may fail to pique the interest of—and may even actively prejudice—potential employers. Though creativity and originality are frequently rewarded in the world of scientific thinking, this is much less the case in the IS community, where leading researchers such as Gile (1998) strongly encourage the replication of pioneering studies. It can therefore be hypothesised that students who produce theses that deal with mainstream research topics, and which are based on prevailing theories, are more likely to pursue academic careers.

4.2.1.3. Does a student's year of graduation have any impact on his selected career path?

There is little doubt that the expansion of the Chinese professoriate has been profoundly influenced by the country's rapid economic growth and urbanisation, and the need for high-

speed scientific development. In the case of CIS, while competent interpreting instructors are still highly sought after in universities all over China, the top-flight schools have already secured enough trained teaching staff to fill all their vacancies. For example, when Shanghai International Studies University started its Conference Interpreting program in 2003, it had only two full-time faculty members who were experienced interpreters with master's degrees, but at the time of writing (August 2015) it boasts 14 faculty members to share the teaching load, and now only recruits those who hold PhDs in interpreting. The competition for jobs is therefore understandably becoming fiercer with each passing year, as ever more graduates vie for the limited number of available academic openings. Against this background it is hypothesised that the more recent the graduate, the more likely he is to have opted for a career in the private market.

4.2.1.4. To what extent does a student's publication record have an effect on his later career path?

Larivière's study (2011) points out that there is a positive relationship between graduate students' publishing and their subsequent careers in research. Publication is the first opportunity for senior colleagues in the field to get to know students, and an important step in their forging of important contacts in the academic world which may prove useful in advancing their future careers. At the same time employers may favour candidates with proven publishing records over those with similar educational credentials but no publication history, because the funding agencies on which universities rely so heavily factor in faculties' publication records when deciding where to allocate resources. Admittedly it is not common that MA students in CIS publish their research—some 130 of the almost 1,300 students in this study's dataset had published work. The number is probably so low because of the heavy workload they face, not only completing theses but having to pass periodic performance-oriented interpreting tests. Undoubtedly those 10% were, by virtue of having overcome these difficulties, the most highly motivated to conduct research, and therefore more likely to pursue academic careers than their colleagues with no published work. It is hypothesised in this study that published graduate students are more likely to become academics than their unpublished peers.

4.2.2. University-related factors

4.2.2.1. How does attending a top-ranking university influence a student's likelihood of taking up an academic career?

Despite the scientific community's desire to be wholly meritocratic, a scholar's career prospects can nonetheless be adversely affected by the university he or she attended (Long and Fox 1995). Furthermore, numerous studies have shown a strong correlation between the academic reputation of a scholar's doctoral program and his or her first academic position (Caplow and McGee 1958; Cole and Cole 1973).

Given that in interpreting studies, as in other academic disciplines, not all schools or training programs are created equal, one is justified in asking if students from some establishments might find it easier to secure academic posts than others. To answer this question the present study examines the effect of CIS students' academic affiliations on their career prospects immediately after qualifying, and asks if graduates from top-flight universities are more likely to pursue academic careers than their colleagues from lower-ranking ones.

4.2.2.2. Can a student's career path be predicted from his choice of thesis advisor?

To investigate this, four lines of enquiry will be followed: 1) Does the number of his advisor's past charges affect a student's success in securing an academic post? 2) Does the number of papers published by his advisor contribute to a student's academic placement? 3) Are advisors who had co-authors from other universities better at placing their students than those who did not? 4) Could an advisor's academic influence, as measured by his PageRank and Degree centrality scores, have any effect on helping his students to enter the academic world?

Thesis advisors are without doubt one of the most important sources of influence over students' academic and professional careers. They share technical knowledge of the subject matter and provide a first line of quality assurance before a thesis is presented to review committee for final approval (Cone and Foster 1993). Also, though an MA student generally has to provide the labour, as the thesis progresses and his research skills evolve and mature so does the advisor's input frequently increase, sometimes to the point where the collaboration develops into a full-blown co-authorship (Long and McGinnis 1985). Consequently when the thesis is completed, the advisor's name is listed alongside that of the author, making it doubly important that the work be of the best possible standard. Another important role that they play is to act as sponsors, inducting students into the social network of a scientific community (Brown 1967; Merton 1973). Advisors—in particular those with a well-established reputation to maintain—

do not take their role lightly: they seek to ensure that they introduce to the élite academic club of scholars only individuals who are able to contribute to the discipline's fund of knowledge and be accepted as credible new members. Finally, as suggested in Long and McGinnis's study of biochemists (1985), advisors' own academic performances have a positive effect on the placement of their student collaborators, though this effect does not exist for sole-authorship students.

The present study examines these various aspects of 'the advisor effect' on students' career paths, and hypothesises that highly influential well-published advisors who have co-authors from other universities are the most likely to influence students in their choice of whether or not to pursue an academic career.

4.2.3. Geographical factors

4.2.3.1. To what extent does 'the capital factor' influence students' academic placements?

Scientometric researchers have been analysing the impact of geographical factors on scholars' professional development for the past five decades. Hargens' study of 1969 demonstrated that, contrary to the traditional belief that highly educated professionals enjoy complete geographical mobility in their employment opportunities, they are far more likely to move within regions than between them. It is reasonable to assume that geography may play an even greater role in the placement of academics in China than in the West: both mainland China and Taiwan have in place a registration system—the *hukou*—whereby citizens are restricted to living in their home locality, the aim being to control population growth in particular areas and ease social unrest. When students are admitted to universities outside their home provinces, their *hukou* is transferred accordingly; it is much easier for employers to take on new recruits who are already registered to live locally. Numerous studies have demonstrated that Chinese internal migrants face multiple problems securing jobs outside their native provinces owing to the constraints caused by the *hukou* system (Chan and Buckingham 2008; Friedman and Lee 2010): each institution or university in Beijing is allotted a limited quota of *hukou*, so priority is naturally given to those with highly specialised skills. There is no doubting that Beijing is the most highly sought after destination among college graduates thanks to its status as the political and economic centre of China. Against this background, the present study examines whether this capital factor has any bearing on students' academic placement.

4.2.3.2. How does coastal vs. inland location of a student's university affect her chances of becoming an academic?

Renard (2002: 23) pointed out that in the context of China the matter of inland vs. coastal is an important structural determinant because, relative to their inland counterparts, coastal areas enjoy a much higher degree of investment and trade openness, benefiting, for example, from more flexible currency conversion rates, the creation of special economic zones, and preferential tax treatment. In an earlier study (Xu 2014) the present author identified this phenomenon as an important factor in the development of CIS, a large proportion of thesis-producing universities being located along China's coast. As an extension of the earlier study, this dissertation examines whether a university's location can be predictive of its graduates' career outcomes.

4.2.3.3. In what way does the population of the city in which the student's university is located influence his academic placement after graduation?

By creating a host of master's and bachelor's programs in Translation and Interpreting universities are seeking to remain socially relevant by offering vocational courses in subjects for which there is real demand. The recruitment of faculty members naturally depends on the exact level of demand for such courses. Megacities such as Shanghai, Beijing and Guangzhou, each with a population of over ten million people, are the stage for more interaction between speakers of different languages than smaller inland cities, leading to greater demand for interpreting work and more academic study of the subject. Indeed these megacities boast hundreds of universities between them, many of which have recently started to offer instruction in interpreting, and are consequently in need of competent faculty members. It is therefore reasonable to hypothesise that the populations of students' university cities affect their academic placement.

4.3. Methods

4.3.1. Data collection and organisation

4.3.1.1. Data collection

Considerable efforts were made to procure, analyse and investigate a broad range of CIS theses produced at universities in both mainland China and Taiwan, as it was felt that a large and representative sample of data was necessary to draw robust and meaningful conclusions. The comprehensive—near-exhaustive—size of the collection removed from the present work a data-based limitation that was to be found in previous exploratory studies such as Zhao's (2009). A corpus of close to 1,300 MA papers was examined, the texts having been obtained through the official Chinese repositories of electronic theses (the China Knowledge Resource Integrated Database—CNKI, Wanfang, and the National Digital Library of Theses and Dissertations in Taiwan). In certain cases library visits were made when theses were only available for review at the universities themselves. Of the 1,289 theses in the dataset, 70 were available only as abstracts; 22 were embargoed, i.e. only their titles were available; and one was collected through citation analysis.

It should be noted that a small number of schools in China, such as the Shanghai International Studies University (SISU) and the University of International Business and Economics (UIBE), offer two-year graduate-level training courses, which lead to a certificate (not a degree) in interpreting and which do not require students to write theses. Also, some universities, such as the Middlebury Institute of International Studies at Monterey and those in the United Kingdom, do not insist on their students writing theses as a condition for graduation. The combined student population of the aforementioned non-thesis-writing schools is rather small—SISU and UIBE, for example, produce fewer than ten graduates per year—so excluding their data from the present analysis did not affect the extent to which the conclusions reached could be applied to the CIS student population as a whole.

Given the paucity of coverage of CIS citation data in existing academic databases, for the present study a further near-comprehensive database of 59,303 citations was built from scratch, working from the 1,289 MA theses, 32 doctoral dissertations and 2,909 research papers available to the author. These three bodies of literature were chosen because they best represent the overall state of CIS. Collecting such information can help calculate the academic influence of each scholar as measured by their total paper count, PageRank and Degree Centrality scores.

4.3.1.1.1. Student profiling: To find out what types of student enter the ranks of academics after earning their MAs an initial manual search was performed on the Internet and on the CNKI academic database to identify the post-graduation career paths of the authors in the dataset, each student being labelled according to his or her subsequent choice of career: scholar, practicing interpreter, both, or unknown. The results show that 20% of the students were found to have pursued an academic career. In addition, each student's academic affiliation and thesis advisors were identified.

4.3.1.1.2. Thesis content labelling: To facilitate the isolation of meaningful trends from such a tremendous amount of information, once all the data had been collected, the theoretical influences were grouped into the following six categories:

1. Cognition
2. Language
3. Communication Theory
4. Translation
5. Peoples and Cultures
6. Miscellaneous

A coding scheme originally developed by Gile (2000) was adapted with the aim of consolidating the keywords; by this means they could be divided into the following theme categories:

1. Training
2. Professional
3. Language
4. Socio-cultural
5. Cognitive
6. Miscellaneous issues.

For more detailed information regarding tagging papers into theoretical and thematic categories, please refer to Chapter 3 section 3.3.3.

In addition, all the theses were grouped into two broad categories based on the nature of their research methodologies: empirical and theoretical. The former arrives at conclusions based on data collected from experiments or observations, while the latter discusses ideas or theories from existing literature with the aim of expanding, confirming or refuting them (Xu 2015b).

4.3.1.2. Data organization

Once collected, the document information (author names, title, publication year, academic affiliation, document type and keywords) and their references were manually entered into Excel Spreadsheets, using the idea behind Structured Query Language (SQL) to manage data. SQL typically employs multiple interactive and cross-referenced tables to link pieces of data at multiple levels; in the present case there are three such: Documents, Authors, and Citations. For these tables to interact with one another it is important to have unique 'keys' or elements that allow each row to be identified: a unique, consistent author key, for example, will show us whether a particular person in the Authors table is the same as one found in a row of the Documents table.

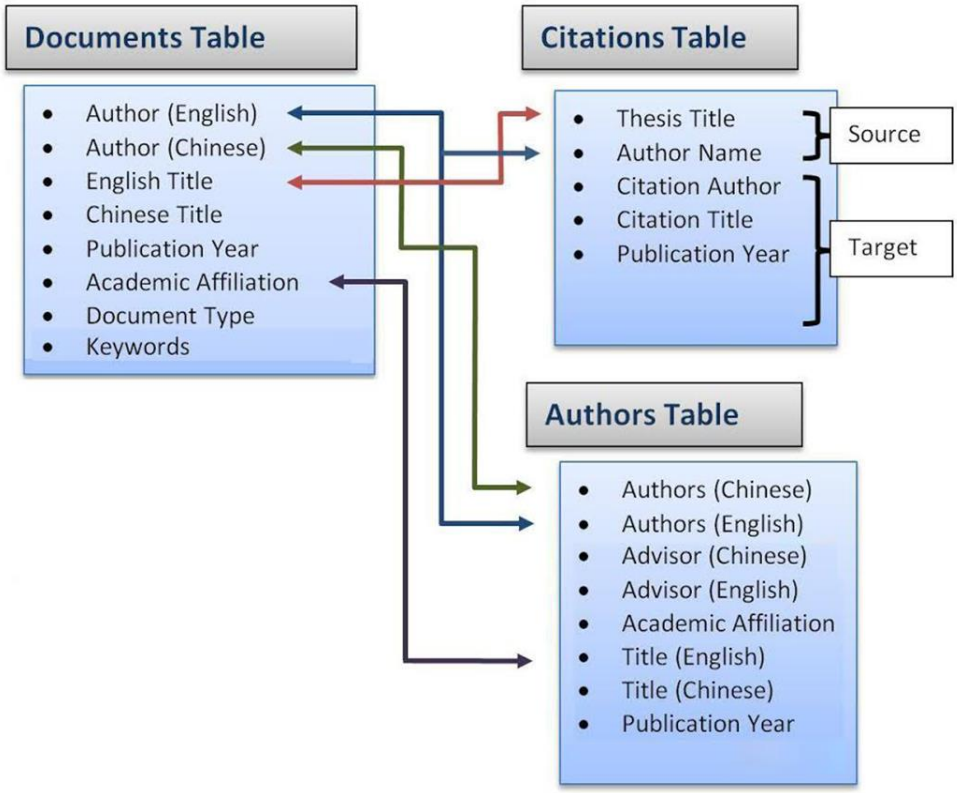

Figure 37. Relational data structure
Source: Dissertation's author

The key concept behind the present analysis is that of the citation network: the documents are nodes in this network, with arrows interconnecting them when authors cite their predecessors (see Figure 37). Nodes are labelled with various attributes such as 'author', 'publication year', and 'keywords'. The number of nodes associated with an author is the number of documents he or she has produced. Authors share a node when they have co-authored a document. Arrows are in the direction of the citation, so the cited work is at the

receiving end of the arrow. When arrows are used to indicate the presence of a citation between documents, there can be at most one arrow between each pair of nodes; when they are used to indicate a type of citation, there can be multiple arrows, as one document may cite another multiple times. A total of ten Excel Spreadsheets were compiled:

- three documents tables for CIS doctoral dissertations, MA theses and academic papers;
- six citation tables—CIS doctoral dissertations (English and Chinese citations), MA theses (English and Chinese citations), and academic papers (English and Chinese citations);
- and one author table.

4.3.2. Measurement of academic influence using PageRank

PageRank Algorithm (PRA) scores were calculated for all the CIS thesis advisors appearing in the citation data in order to quantify their academic influence. The main idea behind PRA is quite simple, but it has strong mathematical foundations with the theoretical motivation coming from Graph Theory, Markov Chain, and Linear Algebra.

Let us consider a simple case where the PageRank scores of four authors are calculated. The problem can be modelled as a graph with four nodes. each representing an author and numbered 1-4, as shown in Figure 29. Edges between authors denote that two authors have cited one another in their respective articles. Directed edges provide additional information about the relationship, so for example, Author 1 has three outgoing edges towards Authors 2, 3 and 4, meaning that he has cited the works of those three authors. These works can be considered important insofar as they are cited by other authors.

Graph theory provides a natural mathematical structure not only to model this data, but to easily visualise and comprehend the complex relationships between authors. Once this data is modeled as a graph, the process of estimating whether an article will be cited is simulated using a Markov Chain where moving from one state to another in this graph mimics the citation of another article. The more often an author is cited, the more important he can be considered: this high level of recognition for his work earns him a high PRA score. It is this algorithm's recursive quality which makes it a good performer: the ranking of a node depends on the importance of its immediate neighbours, not their mere numbers. For example, to calculate the PRA of Author 1, the PRA scores of authors 2, 3 and 4 would be required, which in turn would call for the calculation of *their* respective neighbours' scores, and so on ad infinitum. The algorithm assigns each node with an initial PRA score of 1, then tries to find an equilibrium by

iteratively calculating the PRA score of every node. This leads to a system of linear equations which can be mathematically solved using linear algebra. The procedure for calculating the PRA score of each author is as follows:

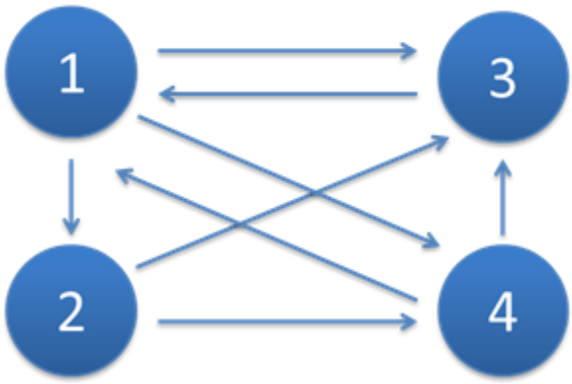

Figure 38. Schematic illustration of a simple citation network
Source: Dissertation's author

1. Each author is treated as a node on the author citation graph. An edge between two authors is created when they cite one another. For example (see Figure 38), Author 1 cites the works of Authors 2, 3, and 4, so the arrows are facing away from Author 1 to the other three.

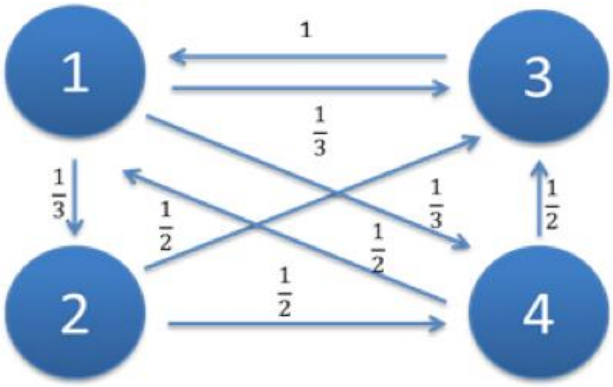

Figure 39. Weights for each author
Source: Dissertation's author

2. Now let us suppose that all nodes have equal weights. This means that the probability of Author 1 citing papers by Authors 2, 3 and 4 is the same, Pr(1→2)=Pr(1→3)=Pr(1→4)=⅓; and the probability of Author 4 citing 1 or 3 can be given by Pr(4→1)=Pr(4→3)=½; and so on (see Figure 39).

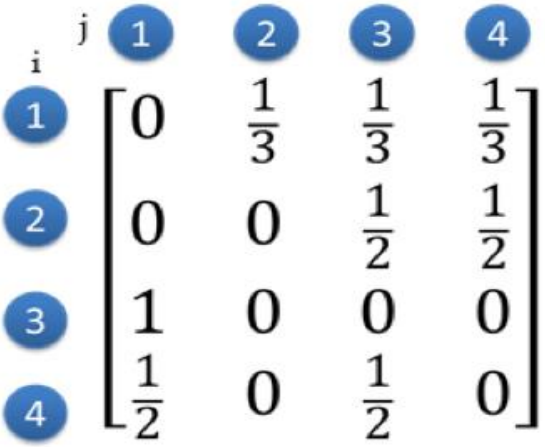

Figure 40. Transition matrix A
Source: Dissertation's author

3. These probabilities form a transition matrix *A*, where each entry *(i, j)* represents the probability of authors in the *i* columns citing authors in the *j* rows (see Figure 40).

4. We then have to find the stationary state *r*, which are the PageRank scores for each author. To obtain this the following linear equation must be solved:

$$r = \frac{1-d}{N} I + d\,Ar,$$

where N is a number of nodes, $d \in (0,1)$ is a damping factor[18], and I is a matrix of ones.

The damping factor represents the probability that an author will randomly choose a new author to cite whom he has not cited before. With every iteration of the algorithm, the PageRank scores of the nodes change until an equilibrium state is reached: this gives us the final scores of nodes present in the network.

A number of graph and network analysis software applications, such as the iGraph Package with R Statistical Language and Tulip Graph Analysis and Visualization Library, can generate PRA scores. The standard implementations scale very well with large graphs: all these applications can easily calculate PageRank scores for graphs with over a million edges. For the present study Tulip was chosen to generate the PRA scores of all the thesis advisors.

[18] The damping factor in this study was set at 0.85, the same as that used by Page et al. (1998). The percentage (85%) represents the chances that an author will cite another author he has previously cited; there is a 15% (1-0.85) chance that he will cite someone he has never cited before.

4.3.3. Statistical modelling

4.3.3.1. Propensity Score Matching for empiricism

The present analysis focuses on whether a student's opting for the empirical research method affects his choice to become an academic. Other observed parameters such as University and Advisor may influence the parameter Empirical and the target variable Academic: University X may be associated with producing empirical theses, and graduates from this university may often become academics, so it is difficult to conclude a priori that Empirical is a cause of Academic. Consequently all possible observed parameters need to be taken into account.

When computing the treatment effect, researchers have traditionally implemented the following design: a student producing an empirical paper is matched with another producing a theoretical one, all other factors being the same (same university, same advisor, etc.). By this method it is possible to make a reliable estimate of the intrinsic effect of empiricism on the probability of an individual's becoming an academic. In reality, however, the approach is impractical because it is often impossible to perform matching on every confounding variable.

To address the limitations of variable-wise matching, Paul Rosenbaum and Donald Rubin (1983) developed a technique called Propensity Score (PS) matching by means of which all confounding effects can be synthesised into one variable; this was adopted for the present study. Logistic regression was used with confounding variables as independent variables and the variable Empirical as the response. Participants were matched on the logit of their propensity scores using the optimal matching algorithm, and the treatment effect was estimated using the matched data.

This type of logistic regression allows us to obtain an estimated probability of writing an empirical thesis for each student. The propensity score of each individual is the logit of this probability. Two individuals were considered similar if their propensity scores were of the same order of magnitude. In short, two students with the same PS were equally likely to have conducted an empirical study. So if in reality one had written an empirical MA thesis and the other a theoretical one, it would be entirely due to chance and not to confounding variables. Two comparable groups of students—empirical vs. non-empirical—could be constructed in this way; the populations were matched according to their propensity scores using an optimal matching algorithm: for each empirical student a theoretical one with the closest logit of PS was selected. Once the matching was complete, a standardised bias was calculated to ensure that the differences between the A and B students were minimised.

One objective of the propensity score method is to recover the idea applied in experimental study. Let us take as an example a simply designed experiment on the effects of drugs on participants. To ensure a fair comparison between two randomly divided groups of participants, the experimenter allows only one condition to vary between them while all others remain the same. By this design, differences between measured outcomes can be attributed to the varied condition. Unfortunately, it is impossible to randomise subjects in an observational study. Controlling any relevant condition (i.e. covariate) is also impractical in observational studies, such that potential confounding from covariates becomes a major concern when analyzing data from observational studies. Though covariate adjustment via regression has long been a major analytical tool, it regrettably does not allow the researcher to establish a causal connection between a factor and a response.

The counterfactual framework is a very good tool for facilitating the discussion of propensity score methods (Neyman 1923; Rubin 1974 and 1978). Within this framework a causal effect is ascertained by comparing potential outcomes observed from the same unit (Guo and Fraser 2009). For example, to calculate the causal effect of empirical research on Student A's becoming an academic scholar, an observer ideally has to observe the outcome 'becoming an academic scholar' under two conditions at once: one in which A did empirical research, and another in which he did not. If it were possible to observe both of these two situations (that is, all potential outcomes), this would be the perfect scenario for calculating the desired causal effect, since all A's other covariates are comparable. Of course, in the real world it is impossible to observe both outcomes simultaneously. The fact that one of the potential outcomes is missing is the problem that lies at the very heart of causal inference.

When data is complete, the propensity score for subject $(i = 1, \dots, n)$ is defined as the conditional probability of assignment to a particular 'treatment' $(T_i = 1)$ vs. control $(T_i = 0)$ gives a vector of observed covariates, x_i:

$$e(x_i) = pr(T_i = 1 | X_i = x_i)$$

Where it is assumed that, given the X, the T_i is independent:

$$pr(T_1 = t_1, \dots, T_n = t_n | X_1 = x_1, \dots, X_n = x_n) = \prod_{i=1}^{n} e(x_i)^{t_i} \{1 - e(x_i)\}^{1-t_i} .$$

As the 'coarsest function' of the covariates, the propensity score operates as a balancing score. Rosenbaum and Rubin (1983) define a balancing score, denoted by $b(X)$, as 'a function of the

observed covariates X such that the conditional distribution of X given $b(X)$ is the same for treated $(T = 1)$ and control $(T = 0)$ units'. For any specific PS value, the difference, denote by τ, in means from all units with that PS value between the treated and controls is an unbiased estimate of the average treatment effect (ATE) at that PS value, if, given observed covariates, the treatment assignment is strongly ignorable, that is,

$$\tau = E(Y_1|T = 1) - E(Y_0|T = 0)$$

Thus, PS matching, and other methods using the PS such as stratification or inverse probability weighting, produces unbiased estimates of the treatment effects when treatment assignment is strongly ignorable. Treatment assignment is considered strongly ignorable if the treatment assignment T, and the response Y, are known to be conditionally independent given the covariates, X, that is, when $Y_1, Y_0 \perp T|X$. Rosenbaum and Rubin showed that if potential outcomes are independent of treatment conditional on covariates X, they are also independent of treatment conditional on a balancing score $b(X)$.

Given that the conditional independent assumption holds and assuming additionally that there is overlap between both groups (this is known as the common support condition, and was also called strong ignorability by Rosenbaum and Rubin (1983)), the PS estimator can generally be written as:

$$\tau_{PS} = E_{e(X)|T=1}\{E[Y_1|D = 1, e(X)] - E[Y_0|D = 0, e(X)]\}$$

To put the above into words, the PS estimator is simply the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of participants.

4.3.3.1.1. Choice of the confounders for Propensity Score matching

The following variables were included in the logit model used to estimate the PS score of each empirical student:

1. Six research themes: Training, Professional, Language, Socio-cultural, Cognitive, and Miscellaneous
2. Six theory categories: Cognition, Translation, Communication, Peoples and Cultures, Language, and Miscellaneous
3. Publication year
4. Whether the student had a top ten advisor
5. Whether the student was enrolled at a top ten university
6. Number of papers published by each student
7. Number of advisor's past students
8. Annual number of papers published by each advisor
9. Total number of papers published by each advisor

10. Whether the advisor had co-authors from other universities
11. Advisor's academic influence, as measured by PageRank
12. Advisor's academic influence, as measured by annual Degree Centrality score
13. Capital factor: whether the university is in Beijing
14. City population
15. Whether the university is in a coastal or inland city

The listed confounding variables had to be taken into consideration when it came to evaluating the effect of having written an empirical MA thesis. It was possible, though, that some confounding variables would have little or no impact on the probability of writing empirical theses. A logit model, referred to herein as the treatment model, was trained with all possible confounding variables and Empirical as the outcome variable, and coefficients were attributed to each confounder. Each coefficient was associated with a *p*-value to determine whether this variable needed to be included in the model assessment. All the variables with a *p*-value higher than 0.05 were removed from the model. It should be noted that confounders which had a small effect on Empirical but a significant effect on Academic were kept in the model. To evaluate whether a confounder had a large impact on Academic, a similar logit model, referred to herein as the outcome model, was developed: all the confounders were considered with Academic as the outcome variable. Those variables which had *p*-values lower than 0.05 in this outcome model but which were not significant in the treatment model were also included in the analysis of the PS model. Including outcome predictors in a PS model can decrease the variance of estimated treatment effect (Brookhart et al. 2006). Once all the confounding variables had been selected, a PS for Empirical was attributed to each student.

4.3.3.2. Variable importance evaluation

While section 4.3.3.1 presented a viable approach to addressing the main question of whether empiricism has a causal effect on students pursuing academic careers, it remains to be seen how other covariates contribute to this outcome. There are two primary methods that have been traditionally applied in this scenario. The first of these are regression methods. To specify a correction regression model, it is important to know each variable's correct function form and the appropriate terms of interaction to be used, but unfortunately neither is available in this study. The frequent result of this is models in which only the main effects are included, and whose performances are very limited. More sophisticated non-parametric models then need to be considered: these would lead, thanks to the curse of dimensionality, to an overfitted model, i.e. one which fits perfectly to the available data but fails to predict the response to any new

data. The second set of methods, sieve covariates, select a subset from all possible covariates. Methods which accomplish this include penalised regression and machine learning. Applying these can produce low-dimensional models (only selected covariates are included in the final model), which are rooted in a sensible trade-off between bias and variance of all candidate predictors. However, the resulting fit may prove disappointing to many researchers for two reasons. Firstly, in most applications the true regression is a function of almost all variables, with many variables giving very small contributions to the regression. And secondly, a measure of importance for each variable is generally desirable, but such low dimensionality reflects zero importance for all the variables not present in the obtained fit. In sum, neither of the traditional approaches would yield statistically efficient and convincing answers to the question under investigation in this section.

While the PS method for empiricism can be applied to evaluate the impact of each and every variable on the likelihood of students becoming academics, repeating so many variables would not be the most efficient approach to statistical analysis. Furthermore, there is always a bias-variance trade-off in building models for PS, which involves model selection. When applying the PS method for each variable, there is no way of comparing all the different fits (which may have completely different bias-variance trade-offs) that is both simple and guaranteed to yield statistically efficient information. Van der Laan (2006) proposed an approach—variable importance evaluation (VIE)—which uses causal inference to measure the independent contribution of each variable to the target variable, allowing for an efficient and robust marginal estimator to be obtained using the estimating equation methodology (Van der Laan and Robins 2003). This approach was adopted for the present study to quantify the individual impact of all variables **(**with the exception of Empirical**)** on students becoming academics.

For our purposes an attributable risk is defined as the difference in the probability of a particular outcome occurring between those exposed to a certain variable and those not. For example, an attributable risk for the Capital factor is the difference in the likelihood of becoming academics of those living in Beijing and those living elsewhere.

The attributable risk for each variable was calculated by using the doubly-robust inverse-probability-of-censoring-weighted (DRIPCW) estimator formulated by Hubbard and van der Laan (2008), which is defined as

$$\hat{\phi} = \frac{1}{n}\sum_{i=1}^{n}\left[\left(\frac{I_{T_i=0}}{P(T_i=0|W_i)}-1\right)Y_i - \left(\frac{I_{T_i=0}}{P(T_i=0|W_i)}-1\right)E(Y_i|T_i=0,W_i)\right]$$

where Y denoted the outcome, T the treatment variable, W the covariates, and $W_i$the observed covariates. $I_{T=0}$ was the indicator, whose value was 1 when $T_i = 0$ and 0 when $T_i = 1$. $P(T_i = 0|W_i)$ was the propensity score for those students not subjected to the treatment, and $E(Y_i|T_i, W_i)$ was the probability of a student given the treatment T_i becoming an academic.

A variable was set as the 'treatment' variable in order to estimate its attributable risk to the outcome, while all other variables were considered covariates. This process was applied to each variable that was considered as a confounding factor. Bootstrapping was applied to obtain the variance estimation of attributable risks. These steps were repeated for each covariate. Those whose attributable risks were close to zero were considered unimportant. Hypothesis testing was subsequently conducted to determine whether or not the risks were statistically significant. Given that multiple hypothesis testing was involved, the Bonferroni-Holm correction method was implemented to control the familywise error rate.

As the current approach for importance analysis is still limited to categorical variables, continuous variables were dichotomised for this study. Given that more recent years contribute more theses, publication years after 2008 were each coded a value of 1, previous years 0. The median was used as a cut-off for dichotomising population (14602202.45), PageRank (0.00021673) and Degree Centrality (11); values greater than that median were coded as 1, and those lower 0.

4.4. Results and discussions

4.4.1. Propensity score matching

As mentioned in the Research Methodology section, the purpose of PS matching was to generate two comparable groups of students—empirical and theoretical; a pair of students from each was considered comparable if they had similar propensity scores. Figure 41 shows a high level of overlap in estimated propensity scores between the two treatment groups, indicating a good match between them. The scores of authors who did not use empirical research methods had a slightly heavier tail close to zero, while those of empirical authors were slightly right-skewed.

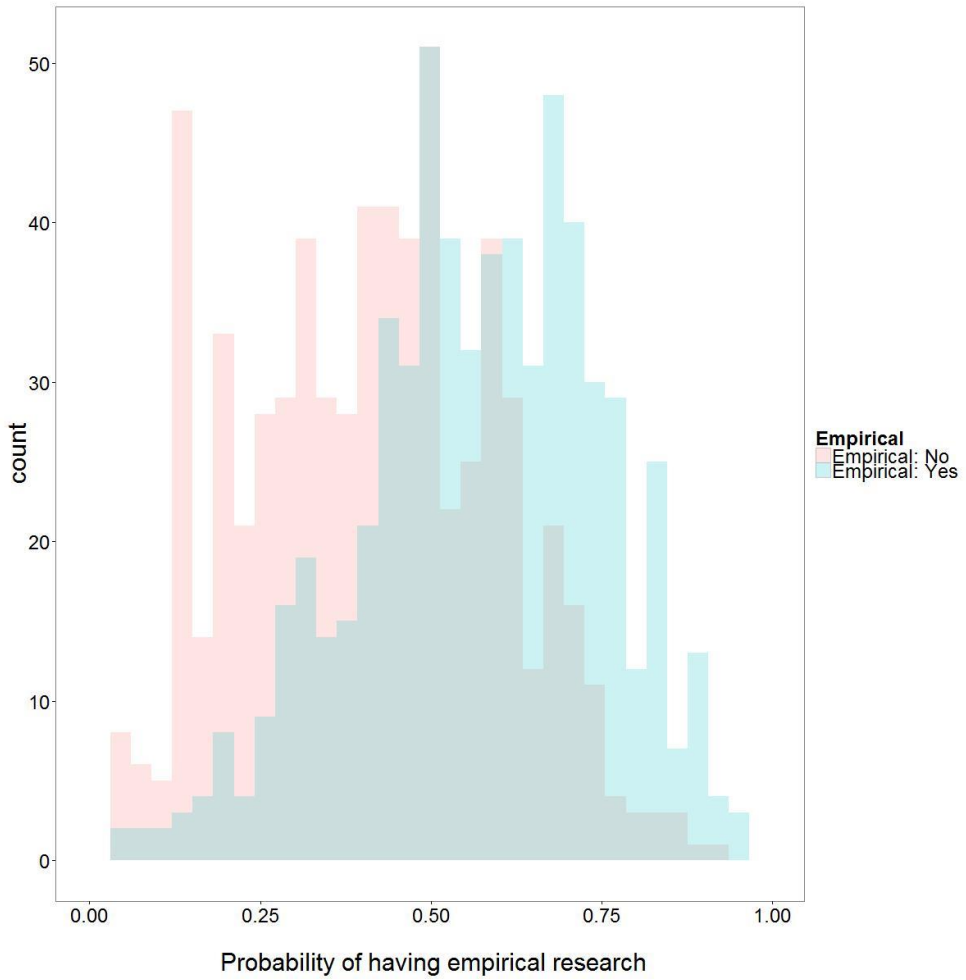

Figure 41. Distribution of propensity scores

The distribution of propensity scores is similar in the theoretical and empirical groups. This overlapping is a required property of the PS method, based as it is on the distance between the two values of propensity scores, and in which the idea is to match two individuals—one empirical, one theoretical—whose PS scores are closest. A distance of 0 denotes a perfect match. If there is no observable overlap between the two treatment groups, it means that large differences in propensity scores exist between them, making close matching difficult.

Source: Dissertation's author

4.4.2. Balance checking

As described in the Research Methodology section, two students (one empirical, one theoretical) with similar propensity scores were matched with one another. To verify whether each pair had similar confounding variables, it was necessary to analyse the distribution of each confounder.

Standardised differences between all the matched pairs were calculated. For categorical predictors such as a research theme (a binary indicator), use was made of the standardised differences in proportions of each level of the predictor within each treatment group. Therefore if, for example, the percentage of empirical students writing on the Training theme was P, and

in the theoretical group Q, the difference would be |P-Q|. This was then divided by $\sqrt{(P(1-P)}$ (i.e. the standard deviation in the empirical group) to obtain a standardised difference. The reason for favouring standardised difference measures over non-standardised ones is as follows: let us imagine a scenario where P = 50% and Q = 45%. The difference between these two proportions (without standardisation) is 5%, which is quite small. However, another scenario in which P = 10% and Q = 5% would yield the same difference in proportions (5%), but 10% is twice as much as 5%. Standardised difference takes this issue into account.

For a continuous variable such as city population the difference would be, in each matched pair, the population of the empirical student's city minus that of the theoretical's. The standardised difference would be the mean of the calculated difference divided by its standardised deviation. The smaller the standardised difference, the better the balance achieved.

A covariate is considered balanced if the standardised bias is less than 0.25 (Ho et al. 2007)—this is a rule of thumb rather than a strict cut-off (Rubin 2001). When possible, a stricter cut-off, e.g. less than 0.10, is preferable in propensity score analyses. Table 13 shows the balance status of all the covariates. Except for Language issues (a research theme), all the other variables were less than 0.25, suggesting that a good balance was achieved.

4.4.3. Estimating the treatment effect

A mixed effect logistic model was adopted to obtain the treatment effect. In this model each matched pair was treated as a unique subject with repeated measurements of the outcome. Table 13 indicates that an empirical author would be 1.45 (95% CI: 1.05 – 2.003) times more likely than a theoretical to secure an academic position.

Table 13. Estimated treatment effect

Method	**Odds ratio**	**95% confidence interval**
Propensity matching	1.45	1.05, 2.00
Propensity stratification	1.48	1.10, 2.00
TMLE	1.58	1.19, 2.09

Source: Dissertation's author

At this point in the study two further statistical methods were called upon: stratification of propensity scores, and Targeted Maximum Likelihood Estimation (TMLE). These were used

as sensitivity analysis to compare how they performed against the PS method, with the aim of evaluating how accurate the latter was in estimating the treatment effect. Stratification relies on the PS method: After estimating all the students' propensity scores and matching them into pairs, the data was broken down into ten groups so that the within-propensity score was more or less constant, in order to compare empirical students with theoretical students in each group. The stratification method retained some imbalance in the lowest and highest strata. Applying it resulted in the formation of ten strata; the Mantel Haenszel estimate was then calculated. Meanwhile TMLE is a variant of the propensity score method, developed fairly recently (Gruber and Van der Laan 2009). Given the set of covariates, TMLE estimated the treatment effect as slightly higher than those of the matching and stratification methods. That said, both methods supported the hypothesis that the writing of an empirical thesis has a causal effect on an individual's choice of an academic career.

Empirical studies are essential for the healthy development of research in interpreting, given that they can help generate data needed to further develop and test theories in the field (Gile 2013). This is not to say that there is little or no value to conceptual studies, which to date have been influential to many fields in the humanities and social sciences, including Interpreting Studies. Here they have led to the creation of numerous models and theories, among them Effort Models and the Interpretive Theory of Translation, both of which are regarded as cornerstones in the development of the discipline. There is, however, no requirement for conceptualists to verify their ideas through data analysis. Empiricism is a more procedurally exacting methodology: Gagnon (1982) described the difficulties it involves, including the time it takes to recruit participants for experiments, the problems of accessing and collecting data, and learning the skills required for data analysis. Empirical studies are not undertaken lightly—and not completed without considerable effort. Since MA students in CIS are required to complete both their interpreter training and thesis-writing in just two years, and since research methodology classes are not part of their core curriculum (Wang and Mu 2009), it is not unreasonable to argue that only those who are truly dedicated to research will write empirical theses. This may explain why there is a causal link between a student's choosing the empirical research method and her taking up a career in academia.

4.4.4. Sensitivity to hidden bias

In this study all the possible covariates which may be confounders have been taken into account in order to evaluate the real impact of Empirical on Academic. However, it is also likely that other variables (such as the age of students and their social background) which are impossible to obtain may interact with Empirical and Academic. If such variables exist and interact with Empirical, it is important to understand to what extent they may impact on the results. The change in probability of Empirical caused by hidden variables was measured by an odds ratio. In essence, for observed covariates X and unobserved variable u, we have

$$logit(P(Empirical = 1)) = \beta X + \gamma u$$

Then $\Gamma = exp(\gamma)$ which is the odds ratio measuring the sensitivity of the model. If u had no effect on the response Empirical, then $\gamma = 0 \rightarrow \Gamma = 1$, and two subjects with the same observed values on covariates X would have the same probability of conducting empirical research. However, if a small change in u leads to different responses in Empirical, then our inference will be sensitive to the unobserved variable u.

Since u is unobserved, estimating $\gamma$is difficult. In practice an option would be to choose a set of Γ values to see how the inference changes the chosen Γ values. Next we examine the sensitivity of a treatment's significance level. Under Rosenbaum theory a significance level's pair of bounds can be computed for each Γ value. If a small change in Γ value quickly leads to a loss of significance, that is, if a *p*-value > 0.05, then the treatment effect is sensitive to an unobserved confounding factor. It should be noted that a large Gamma may or may not affect the conclusions of the present study: the real impact of hidden variables on the conclusions will depend on some intrinsic features of the study, such as sample size and the proportion of students who become academics.

Table 14 shows the impact of Gamma values on the results of the present study. Generally speaking, Gamma has to be as high as 5 or 6 in order to reach the 0.05 level. Such a high number means hidden variables must have had a big impact on the Empirical variable in order for the current results (i.e. the measured influence of Empirical on Academic using PSM) to be called into question. In our case, the 0.05 level was reached while Gamma was still small, namely 1.1. To be more precise, the upper bound of the confidence interval of the *p*-value was ~0.05 for Gamma = 1.1, meaning that the *p*-value was likely to be slightly smaller than 0.05. This indicates that the results of the present study were sensitive to 'hidden' bias. Simply put, if some hidden biases had been found, they would have affected the conclusions drawn here, and a new analysis—one which took these additional covariates into consideration—would be necessary.

Table 14. Balance status after propensity score matching

Variable	Standardized bias
Publication year	-0.024
Population	0.023
PageRank	-0.065
Degree Centrality	-0.036
Population: Socio-cultural issues (research theme)	0.006
PageRank: Socio-cultural issues (research theme)	-0.056
Co-author (Y/N)	0.144
Miscellaneous (research theme)	0.051
Socio-cultural issues (research theme)	0.188
Professional issues (research theme)	0.029
Language issues (research theme)	0.260
Peoples and cultures (theoretical theme)	0.159
Language (theoretical theme)	0.016
Miscellaneous (theoretical theme)	0.015
CHEN Jing	0.048
LEI Tianfang	0.063
Guangdong Univ. of Foreign Study (GUFS)	0.150
Univ. of International Business and Economics	0.240
BFSU: Language (theoretical theme)	0.127
No. of Advisor Papers: Miscellaneous (theory category)	0.025
Co-author*GUFS	0.132
Lei Tianfang: Professional issues (research theme)	0.040
Peoples and cultures: Language (theoretical theme)	0.083
Language issues: Socio-cultural issues (research theme)	0.022
BFSU: Socio-cultural issues (research theme)	0.073
Socio-cultural issues (research theme): Language (theoretical theme)	0.096
Chen Jing : Miscellaneous (research theme)	0.000

Note: A standardized bias lower than 0.25 indicates that there was a good balance between the two treatment groups, that the pairing of participants from each group was well made, and that the use of the PSM method was appropriate.

Source: Dissertation's author

4.4.5. Evaluation of other variables for students' career outcomes

Table 15 lists the importance estimates for all the variables (barring Empirical) that may have an effect on students' career choices. After performing the Bonferroni-Holm correction for multiple hypothesis testing, the results indicated that of the top ten universities, students attending the Ocean University of China were the most likely to become academics. Other significant causes of students becoming academics included whether they studied in Beijing or in inland cities, and the population sizes of their places of study. Each of these variables and their implications are discussed in depth in the following sections.

Table 15. Variable importance estimates (statistically significant covariates are in bold)

Variable	Attributable Risk	SE	T	P value	Adjusted P value
Shanghai International Studies University	0.0314	0.0174	1.8073	0.0707	1
Beijing Foreign Studies University	0.0468	0.026	1.8012	0.0717	1
Xiamen University	0.0291	0.0108	2.683	0.0073	0.2481

University of Int'l Business and Economics	0.0119	0.0077	1.5358	0.1246	1
Guangdong University of Foreign Studies	-0.0036	0.0047	0.7714	0.4405	1
Ocean University of China	**0.0081**	**0.0022**	**3.7485**	**0.0002**	**0.006**
Central South University	-0.0043	0.0042	1.0279	0.304	1
Sichuan International Studies University	-0.0001	0.0022	0.0686	0.9453	1
Suzhou University	-0.0007	0.0019	0.3848	0.7004	1
National Taiwan Normal University	0.0022	0.0035	0.6201	0.5352	1
CHEN Jing	0.0023	0.0016	1.3909	0.1642	1
MEI Deming	-0.0074	0.0028	2.6747	0.0075	0.2543
CHAI Mingjiong	-0.0008	1.70E+04	0	1	1
ZOU Weining	-0.001	0.0017	0.5807	0.5614	1
GONG Longsheng	**0.0037**	**0.001**	**3.5764**	**0.0003**	**0.0118**
LEI Tianfang	0.0005	8.10E+12	0	1	1
QI Weijun	-0.0001	0.0018	0.0368	0.9706	1
XIAO Xiaoyan	-0.0008	0.0016	0.5144	0.607	1
ZHONG Weihe	0.0009	0.0017	0.5313	0.5952	1
SUN Xinwei	-0.0013	0.0016	0.8371	0.4025	1
Training (theme)	0.0106	0.036	0.2942	0.7686	1
Language issues (theme)	-0.003	0.0097	0.3114	0.7555	1
Cognitive issues (theme)	-0.0101	0.0088	1.1551	0.2481	1
Socio-cultural issues (theme)	-0.0113	0.0092	1.2201	0.2224	1
Miscellaneous (theme)	0.0107	0.0056	1.9058	0.0567	1
Professional_issues (theme)	0.0041	0.0037	1.1185	0.2634	1
Miscellaneous (theory)	0.0033	0.0035	0.9443	0.345	1
Cognition (theory)	0.0044	0.0202	0.2203	0.8257	1
Translation (theory)	0.0003	0.0158	0.0189	0.9849	1
Communication theory (theory)	0.0054	0.0057	0.9426	0.3459	1
Peoples and cultures (theory)	-0.0034	0.0042	0.8112	0.4172	1
Language (theory)	-0.007	0.0066	1.0606	0.2889	1
Beijing	**0.0198**	**0.0045**	**4.3584**	**0**	**0.0004**
Inland	**0.0363**	**0.0097**	**3.7396**	**0.0002**	**0.0063**
Publication Year	**0.0467**	**0.0173**	**2.6947**	**0.007**	**0.0282**
Population	**0.0991**	**0.0087**	**11.44**	**0**	**0**
PageRank	**-0.0494**	**0.0129**	**3.8294**	**0.0001**	**0.0005**
Degree Centrality	0.0191	0.0205	0.9353	0.3496	1

Source: Dissertation's author

4.4.5.1 Effects of research topics and theoretical underpinnings

The VIE analysis did not yield any statistically significant topics or theory categories that contributed to students pursuing academic careers. This finding is at odds with the results of an earlier paper by the present author and colleague (Xu and Archambault 2015), which analysed the effects of academic affiliation, thesis advisor, research methodology and thesis content on students' career choices. In that paper the Training theme was identified as having a causal effect on students entering the academic sphere. Only limited confounding factors were taken into consideration, unlike in the present analysis which added more covariates, which are considered to be potential confounders; this led to more convincing results. The discrepancies between the previous and present studies also suggest that TMLE, which was employed in the previous study, though claimed to be doubly robust (Rose and van der Laan

2011; Schnitzer et al. 2012), is still prone to biases when models are misspecified owing to confounders going unobserved.

Despite all this, the present results are surprising because, in the West at least, a novice academic's expertise needs to be in line with the research direction of the team he seeks to join before his more senior colleagues will accept him and he can receive funding. Additionally, TIS scholars working at the same institution tend to subscribe to the same schools of thought. For example, nearly all the faculty members and teaching assistants on the University of Geneva's doctoral program for interpreting studies are former students of Barbara Moser-Mercer. Another case in point is ESIT where the majority of faculty members in the interpreting department are disciples of Danica Seleskovitch and adherents of her Interpretive Theory of Translation.

A possible explanation for thesis topics and theoretical underpinnings not being effective predictors of CIS students' career paths is that Chinese universities attach more importance to recruiting students with the potential to conduct sophisticated research rather than amassing those who share the same theoretical backgrounds or areas of expertise. This is evidenced by the fact that empiricism is a likely cause of Chinese students opting for academic careers (see section 4.2) and that interdisciplinary research is strongly encouraged by senior members of the CIS community (see for example Liu 2012).

4.4.5.2. Effects of graduation year

Contrary to the common expectation that with each passing year new graduates are less likely to choose a career in academia, Table 14 shows that the rate among those who graduated later than 2008 is nearly 5% higher than among those who graduated earlier. Two factors may explain this unusual phenomenon: first, the Ministry of Education has been significantly increasing the number of accredited schools which can offer bachelor's and master's degrees in TIS. From only 15 certified schools in 2007 the number has grown steadily year on year, to 206 at the time of writing (September 2015). The creation of these new programs inevitably leads to an increase in the availability of academic positions open to new graduates—unlike in the West, where researchers move freely from one place to another until they obtain tenure, in China it is usually those fresh graduates who compete for these new openings. Second, though high-end Chinese interpreting jobs are quite lucrative, it is difficult for newcomers with no experience to break into that corner of the market, and lower end jobs such as tour guide interpreting pay very little. In comparison with the past when few graduates worked as freelancers, recent ones may find it more difficult to secure enough assignments to make ends

meet, with the result that many set their sights on academia, where they would still have enough free time to take interpreting jobs on the side.

4.4.5.3. Effects of students' publication record

The present statistical analysis does not suggest that a student's publication record has any statistically significant impact on her future academic career—it did not even meet criteria for inclusion as a covariate in the VIE model. This finding is somewhat surprising but at the same time paints a unique side of CIS which sets it apart from other established disciplines that put a high value on scholars' research productivity. The primary goal of the MTI is to train individuals who can handle international conferences with complex subject matters, who can, in short, acquit themselves in the real world of professional interpreting. This emphasis on practice, which naturally operates somewhat to the detriment of the separate skill-set of scholarly research, makes it unlikely that employers in academia would place the same significance on the publishing histories of potential new faculty members as is the case in more purely academic disciplines.

4.4.5.4. Effects of students' academic affiliations

Of the top ten universities, only attendance at the Ocean University of China makes students more likely than those from non-top-ten schools to enter the academic sphere. The rate of its students who become academics is nearly 1% higher than for those who went to schools outside the top ten—the difference in attributable risk between these two groups is very small. The first possible reason for this is that Chinese schools have a tendency to recruit only from among their own graduates; therefore, given that schools within the top ten produce more graduates than those without, it follows that the those in the top flight stand a lower numerical chance of securing academic posts. Second, their privileged educational background may make it easier for them to gain a foothold in the interpreting market than for their colleagues from less prestigious schools, so it is fair to say that, should they fail to secure academic positions with their alma maters, they will more readily find work in the professional market, rather than having to cast around for employment opportunities with other schools. This result regarding the effects of students' university affiliations should be of particular interest to those who plan to become academics—they should by no means imagine that admission to one of the top ten universities will provide them with an automatic entrée to the world of academia.

4.4.5.5. Effects of a student's thesis advisor

Of the top ten busiest advisors, only Gong Longsheng was better at placing his advisees in academic positions than his non-top-ten colleagues: the proportion of his students who became academics is half a percent higher than those who studied under advisors outside the top ten. In a nutshell, the most highly sought-after advisors in CIS are no better at securing academic posts for their students than their colleagues. This finding is intriguing because these busiest advisors are well-known scholars in CIS, and one might have thought that their advisees would find it easier than their peers to become academics. One possible explanation is that though the advisors are well-connected and have access to an abundance of resources, they have so many students to take care of and are so burdened besides with teaching and administrative responsibilities that they have difficulty giving students effective help with their professional development. It is typical in CIS for students to seek highly visible advisors in the hope that they can assist in launching their future careers successfully. The result of this analysis should be sobering to them: less visible advisors with fewer students may be able to expend more time and attention on them, and may therefore be in a better position to help their advisees embark on academic careers.

The present study also examined whether an advisor's academic influence as measured by his or her total number of publications, Degree Centrality (DC) and PageRank (PR) scores, are predictive of his students' career outcomes. Though the results of neither of the first two analyses was promising—the publication count was not even considered a confounding factor by model selection— the PR score did yield statistically significant results: the proportion of students whose advisors had PR scores higher than the median who became academics was half a percentage point lower than for those studying under one with a score lower than 0.00021673, a result in line with the finding from the previous paragraph that eminent professors are no better at securing academic placements for their students. Aside from the "a little jam, thinly spread" explanation elaborated above, it is also possible that these prestige professors have forceful personalities and strongly-held views which occasionally put them at odds with their peers, which may limit their ability to help their protégés take up academic careers.

To obtain a comprehensive understanding of the effects of thesis advisors on their graduate students, an analysis was also conducted on whether those with co-authors from other universities would be better at launching their students' academic careers. Unfortunately, the effect from this variable on students' career outcome proved so insignificant that it was not

even considered a confounding variable by the VIE. Collaboration on a research article would certainly suggest a good professional relationship between individuals. A possible reason for this variable not being a good predictor in CIS is that co-authorship is the exception to the norm in the field: unlike their counterparts in the natural and social sciences, CIS scholars—even those in the wider Interpreting Studies community—do not readily engage in collaborations. Of the 2,909 articles and proceedings in the dataset, no fewer than 2,345 (80%) were written by a single author (Xu 2014).

4.4.5.6. Effects of the 'Capital Factor'

The analysis revealed that the academic placement rate of students who study at a Beijing university is nearly 2% higher than those who study outside the capital. As of 2015 there are 91 universities in Beijing offering bachelor's and/or graduate degrees, and 24 community colleges awarding associate degrees, easily surpassing the total number of universities in any other Chinese city. Most of these schools offer interpreting courses (BTI or MTI) which provide numerous employment opportunities to graduates. Beijing students have at least two distinct geographical advantages over their peers from other regions when it comes to competing for these openings. Firstly, they can easily attend as many on-site job interviews as they wish, whereas out-of-towners might have trouble lining up their study and travel schedules, not to mention covering the expense of multiple journeys. Secondly, students from Beijing schools have no need to transfer their *hukou* when they find employment at a local establishment, while their colleagues from other localities may be forced to seek work in places that have no *hukou* quota restrictions.

4.4.5.7. Effects of a coastal vs. an inland location

The data also revealed that the academic placement rate for students in inland locations is nearly 4% higher than for those on the coast. As discussed in Chapter 3 of this dissertation, coastal regions boast many more schools offering MTIs than inland areas of China, so it might have been expected that studying in a coastal locality would have a causal effect on students' career paths. However, it should not be forgotten that the coastal regions, with their close economic ties with foreign countries, are far more abundant in interpreting opportunities than inland China, where contacts with the outside world are somewhat limited and there is thus a lower demand for interpreting services. Given that two or three days' work as a conference interpreter pay the equivalent of the monthly salary of a faculty member at the average university, it makes much more economic sense that coastal students should work as freelance

interpreters rather than remain in academia; conversely, it is understandable that students from the interior, deprived as they are of readily accessible interpreting jobs, should be more inclined to enter the academic sphere.

4.4.5.8. Effects of population

The last geographical factor to be analysed was the population size of the city where a student's university is located. The data suggest that this has a statistically significant causal effect on whether or not students take up an academic career: the rate of uptake for those studying in cities with populations of over 14 million—so-called megacities[19]—is nearly 10% higher than for those from smaller urban centres. This result is worthy of note because the population covariate has the highest attributable risk of all the confounding factors analysed (the rest have risks lower than 5%). Bugliarello (1999) observed that megacities have high concentrations of educational establishments and are typically regarded as barometers of a country's socio-economic development, attracting those who wish to seek better living conditions and education. It is therefore little wonder that they provide more academic opportunities to CIS graduates than cities of a smaller size. All other conditions being equal, aspiring future academics would do well to study in one of the megacities to maximise their chances of securing academic positions.

4.5. Conclusion

As CIS continues to grow and mature, the factors that govern the choice students make between an academic and a professional career are becoming ever more complex. The data analysis in this chapter reveals the variables that have a causal effect on that choice. The CIS community seems to have taken to heart the calls made by pioneering researchers such as Liu Heping for an increase in empirical research; this may be reflected in the fact that students whose theses were empirical in nature were far more likely to secure academic positions than those whose work was primarily conceptual or theoretical. At the same time, the topics covered by CIS scholars are diverse, and various schools of thought compete with one another (Zhang W. 2012): this rather fragmentary nature is reflected in the fact that no particular topic or

[19] One internationally recognized definition of a megacity is one with a population of over 10 million (Pearce 2006).

theoretical underpinning would appear to make graduates more likely to take up academic careers.

Unlike the results of an earlier paper by the present author and colleague (Xu and Archambault 2015), and unlike the situation in other maturing disciplines where the number of graduates that universities produce gradually comes to outstrip the quantity of academic posts available, CIS students are now more likely than their 1990s predecessors to take up academic careers. The newer student seems more attracted by the flexible working hours and job security offered by academia than by high-paying but unpredictable freelance conference assignments.

While students are increasingly motivated to enter the academic sphere, it should be noted that their research productivity has yet to become a determinant of securing an academic position. The majority of master's students have not published peer-reviewed papers or sought publication of their theses, but as academic standards continue to rise this situation may change and publication history may become an important factor for schools to consider when making their hiring decisions.

It is natural that students should seek eminent professors as their thesis directors. This study examined various indicators associated with high academic prestige and social standing, including the number of past advisees, publication counts, PageRank and Degree Centrality scores. Contrary to expectation, the data suggested that the most actively engaged advisors or those with high publication counts or DC scores were no more instrumental in influencing the academic placements secured by their students than their colleagues who took on fewer advisorships; those with a high PR score even had a negative impact on the placement of their students. Advisors assume multiple and often subtle roles, influencing the professional development of their protégés. Those students who choose advisors on the basis of their eminence in the hope that it will afford them a better chance of embarking on an academic career may have to re-evaluate their advisor selection criteria.

However, in this regard and indeed throughout this investigation, two important factors need to be taken into account. Firstly, the field of CIS is still at a relatively early stage in its development, as can be seen from the fact that numerous eminent professors do not have doctoral degrees. This situation is likely to change in the future: an increasing number of advisors will have obtained doctoral degrees and will therefore take a greater interest in pure research rather than concentrating solely on producing skilled professional interpreters.

The other important factor to be remembered is that working as an interpreter is a far more lucrative enterprise than teaching, so the professional market will always lure new graduates away from academia. For this reason it came as little surprise to learn that graduates

from the majority of CIS' most prestigious schools were no better at securing academic posts than those from outside the top ten thesis-producing universities.

It is worth emphasising that no attempt was made in this study to assess the *quality* of the research contained in the theses that make up the dataset: an entirely separate and altogether different study would be required to explore the connection—if there be any— between students' work and career outcomes.

This study also ventures into previously neglected territories of TIS scientometric research, using geographical data for detailed scientometric explorations of the discipline. As the development of an academic discipline does not take place in a vacuum immune from geographical factors, an examination was made of the effects of the 'capital factor', inland vs. coastal locations, and city population on CIS students' career outcomes. All these turned out to have a statistically significant causal impact on graduates pursuing academic careers, with population as the biggest influencer of all the confounding factors. Students who study in Beijing or inland megacities were more likely to become academics than those in provincial and coastal locations.

Traditional statistics are concerned with identifying correlations, and this is typically the route most scientometric researchers have taken to determine the factors that influence students' career choices (e.g. Long and McGinnis 1985; Pinheiro et al. 2014; Van der Weijden et al. 2015). Given all the possible variables that can have a bearing on career outcome and the correlations that potentially exist between them, it is very difficult to identify accurately which variable has a direct impact and to what extent it does so. This study provides new avenues for research in this area by introducing PSM and VIE, powerful statistical techniques which apply multiple models to pinpoint the causal effect of every relevant factor on the response variable.

The purpose of this study was to examine an assortment of factors—structural determinants—which influence the choice made by master's students to take up academic careers after completing their courses. That structural factors alone were scrutinised is not to say that social factors are not without their importance—in fact they may even be more important (see for instance Bourdieu 1989). Clearly more research is needed to gauge the relative importance of different types of factors on students' career choices. Such a study would be particularly interesting—not to mention ground-breaking—in the case of China, given its unique socio-economic system.

Chapter 5. Conclusion

5.1. Discussions

For many decades Interpreting Studies was considered a speciality of linguistics and, unlike other applied academic disciplines, was only offered at selected schools in the countries where it was available at all. However, thanks to a growing interest—from both within and without—in understanding the craft of interpreting, professional interpreters and researchers from other disciplines have begun to produce a significant number of publications in a wide variety of formats: journal articles, conference proceedings, dictionaries, encyclopedias, MA theses and doctoral dissertations. The growth of these publications over the past decade or so has been nothing short of spectacular: as of May 2015 no fewer than 10,000 papers on IS have been published worldwide. It is also worth noting that despite a common focus on the subject of interpreting, these studies have used wide-ranging research methodologies, many of which are from other fields such as cognitive science and linguistics, making interpreting an established discipline in its own right (Moser-Mercer 2011).

Chinese Interpreting Studies deserves special attention because it boasts the largest population of researchers in the world (over 3,500 in comparison to just a handful in many European countries), having produced over 4,200 publications (Xu and Pekelis 2015). Section 3.5.1.1 in this dissertation demonstrated that the growth of CIS papers has shown no signs of slowing down; rather, it is expected to sustain its momentum into the foreseeable future. CIS' substantial research activities are no doubt boosted by China's rapid economic development and trade liberalisation, and its increasingly close ties with the rest of the world in the spheres of investment and politics.

As China's economy has overtaken that of Germany (in 2009) and Japan (in 2010) to become the second largest in the world, it has found itself playing host to thousands of international conferences, exhibitions and events every year. This has created a huge demand for professional interpreters to help businessmen, technology professionals, and politicians alike transcend language barriers. Over 100 bachelor's and 200 master's programs specialising in interpreter training have been created throughout China, but the production of theses is unevenly distributed among them. It was found in section 3.5.2.1 that of the 100 or so universities in the dataset, a mere five accounted for over 60% of the theses produced, while the next five generated just 10%. These top five schools have a long-running tradition in

interpreter training, so may be better equipped with resources to handle the student demand than some newly accredited programs. However, as an increasing number of students opt to enter the academic world with the passage of time (see Chapter 4 for more detailed information), it is expected that this situation will change significantly.

In addition to these imbalances between universities, the production of theses and academic papers is also unevenly distributed in geographical terms. As the findings from this dissertation show (see section 3.5.3.1 for more detailed information), most theses are produced in Southeastern China, where most cities are situated on the coast. The most notable exception to this 'coastal rule' is the capital Beijing, which despite being landlocked, is the political, cultural and educational centre of the nation, and home to not only hundreds of universities but the local or regional headquarters of numerous multi-national corporations. It should be noted here that research productivity in theses coincides with that of academic papers, there being little activity in northern and inland areas of China.

Notwithstanding the impressive growth and extent of the production of literature in CIS, section 3.5.1.2 indicated that no particular theoretical influence or research theme has gained in popularity over time. This consistency seems to suggest that the discipline has reached a period of stabilisation in its development, though this might be characterised by some as 'a rut'. Despite the increasing call for interdisciplinary research and collaboration, some leading scholars in Interpreting Studies are reluctant to embrace new methodologies or approaches from other disciplines, which may partially explain the lack of change. Another factor that may have hindered the spread of new ideas and perspectives is the homogeneity of CIS scholars' educational backgrounds: few have received any training in data-driven disciplines such as psychology, education or statistics, making it difficult to adapt and incorporate the latest methodological approaches developed in those fields.

Gile outlined his hopes for the training of the next generation of interpreters in a 2001 paper in which he suggested that students be co-supervised by an interpreting scholar and a subject-matter expert such as a psychologist or linguist. Unfortunately this model has yet to become a reality in the supervision of Chinese theses (see section 3.5.2.2 for more detailed information): all the co-supervised theses in the dataset were completed under the direction of interpreting scholars, typically a senior scholar working with a less experienced one being groomed to take on more thesis-advising responsibilities in the future.

There are obvious administrative and academic hindrances to the adoption of Gile's interdisciplinary approach. Firstly, co-supervisors from other institutions are not routinely compensated for the time they spend advising outside students. Even in Europe, which leads

the rest of the world in TIS research and where thesis co-supervision is much more common, external supervisors are rarely offered any financial assistance. A case in point is the Intercultural Studies Group at the Universitat Rovira i Virgili, which has arguably the largest number of external advisors in the entire field of Translation Studies. Though many of these assume sole responsibility for advising students, without input from URV's internal faculty, they do so purely out of good will and for the pleasure of inducting new members into the élite club of academic scholars. Unlike disciplines in the natural and social sciences, where government funding is substantial and each professor has his or her own 'pool' of cash to fund research projects and graduate students, faculty members in IS typically cannot secure adequate financial resources even to support their own internal students, let alone external ones.

The second major hindrance to widespread adoption of Gile's model is the difficulty of finding two scholars from different educational backgrounds who are in sufficient agreement on how to jointly supervise one student. Gile (1994 and 1999) observed that professional interpreters are hostile toward 'outside' scientists on the grounds that they do not know enough about the underlying principles of interpreting or the particular challenges faced by its practitioners.

The most important contribution of this dissertation no doubt is it answer to the Gile's challenge. Not only does it use scientometrics to inquire into the field of IS, but it also used uniquely advanced statistical methods to examine causal determinants of career choices in IS. Unlike earlier TIS scientometric studies that exclusively used either descriptive statistics or classic methods that rely heavily on inferential statistics, the present dissertation provides a balanced presentation of both, offering an intuitive interpretation of summary data and inferring relations between a host of variables.

For the present research project, an extensive academic database was built from scratch which comprises almost all the CIS literature published in theses, dissertations and articles. The comprehensiveness of the collection meant that any biases caused by limited data could were removed, thus making it possible to make meaningful deductions that could be applied to the entire CIS population. Heeding the call for the free movement of information, the raw data used in this study has been made publicly available at GitHub, a leading repository for source codes: this should save future researchers from having to go back to square one to collect their data and allow them to investigate other interesting features of CIS not covered by this study.

Drawing inspiration from biostatistics, the author used PSM and VIE to establish causalities between empiricism, advisor, university, location, graduation year, city population and students' career outcomes. Earlier TIS scholars were primarily concerned with establishing

correlations between various variables (e.g. Timarová 2012; Olivera Tovar-Espada 2014), but none applied causal inferences, which can be particularly useful in studying whether certain factors, attributes or exercises lead directly to improved interpreting performance.

Both PSM and VIE can be particularly useful in TIS empirical research, where typical research participants differ widely in terms of language proficiency, work experience, age and level of interpreting performance. When establishing causalities, homogeneity between participants is desirable for computing treatment effect: it is only when the characteristics (as above) of a participant in the treatment group are the same as or very close to those of the control group that differences in outcome between subject and control can be attributed to the treatment itself. A great deal of experimental research in TIS uses variable-wise matching, but this approach is only valid when the number of variables is small, which is not the case with subjects in TIS. This issue has been effectively addressed by dimension reduction theory (Fodor 2002), the purpose of which is to summarise all the information contained by a large number of variables into one or a very few variables. Fodor (op. cit.) presents a detailed overview of the popular techniques in this specialty, including Principal Component Analysis (PCA) and Factor Analysis (FA). PSM is essentially the same technique used in PCA minus the logit transformation. In addition to synthesising all the confounding effects into one or a handful of variables, instead of dropping any of them, PSM allows observations to be used multiple times. This is particularly useful in TIS research, where scholars are often faced with recruiting enough willing and qualified participants to meet the minimum sample size required by power analysis.

In addition to bringing causal analysis to bear on TIS and shedding light on the CIS landscape and the post-graduate career trajectories of its students, this paper has also introduced Social Network Analysis into the field. Assessing academic influence was traditionally performed with first-order centrality measures in TIS, such as straight counting or calculation of Impact Factors, but both these forms of analysis proceed on the assumption that all citations are created equal—that one from a student's thesis would carry the same weight as one from a peer-reviewed paper penned by a highly respected scholar. Furthermore, all scholars' research contributions ought to be evaluated on their own merits by weighing the citations they receive from highly influential colleagues in the field, rather than relying on their academic affiliations, i.e. whether or not they belong to a prestigious school.

The PageRank measure used in this dissertation effectively addressed these issues, providing an objective means of quantifying the influence of scholars in the field. PR measures might serve as a spur to scholars to focus on producing high-quality papers, rather than

generating opinion pieces for lower-tier journals. It should be noted that this higher centrality measure approach has already gained some traction in the field: the ranking of CIS universities according to academic influence using this same methodology, which the present author proposed in another paper (Xu 2015), has received recognition from the Beijing Language and Culture University, one of the premier providers of T&I training in China. The practice of SNA, whose roots can be traced back to the early 1900s, has become one of the prime methodologies for modelling human behaviour and network dynamics in contemporary sociology, can help us understand how the discipline's scholars interact with one another and identify the major sources of influence in TIS, often perceived to be a somewhat fragmented field of academic enquiry with numerous schools of thoughts competing for recognition.

Aside from the low level of collaboration among thesis supervisors, it was also found in Chapter 3 that jointly published research between scholars of different academic affiliations and geographical locations is rare. This situation is similar to that of many disciplines in the humanities, where single authorship is the norm (Larivière et al. 2006). Yet IS scholars often find themselves dealing with phenomena or ideas which straddle various disciplines that may have distinctly different research methods. As Shlesinger observed (n.d.), it is difficult to become an 'interdisciplinarian' with expertise in both IS and other disciplines, so co-authorship between scholars with different skill-sets would be the more natural choice of model for addressing many of the complex research issues involved in IS. However, the low level of co-authorship even between CIS scholars indicates that there is a long way to go before the discipline becomes a fully mature field of scientific enquiry.

Despite the aforementioned challenges that CIS faces, this would seem to be something of a 'golden age' for the discipline. Gile summarised the reasons for this observation in a 2010 paper:

1. The establishment of MTI degrees in China indicates that the field has been officially recognised as a discrete academic discipline, and that it receives strong government support. By contrast, in most European countries TIS is still regarded as an extension of traditional disciplines such as foreign languages, literature or linguistics, most related research being considered at best marginal by academic authorities.
2. Interpreter training in China has a much shorter history and is thus more of a 'blank slate' than in the West, which is plagued by issues of precedent'; also, tensions run high in the West between professional interpreters who do not conduct research and researchers who are not active practitioners. Since all master's students in China are required to produce a thesis

and command a certain level of familiarity with research and theories, future professionals tend to be less hostile towards academic research.

IS is similar to other applied branches of science in that its graduates have the option of choosing to work for industry or in academia, both of which offer excellent prospects for professional development. Yet as described in Chapter 4, the bar for working as academics is currently lower for CIS students than in most established disciplines—a PhD is not necessary to secure a faculty position in IS because interpreting is a practice-oriented discipline and an instructor's interpreting competence is as important as—if not more important than—his research skills. However, unlike in other applied studies, where schools recruiting new faculty members clearly state the areas of expertise they are looking for, the situation in IS is somewhat murky. For example, an advertisement for a post teaching computer science might clearly state that the school would give preference to candidates specialising in cloud computing, big data or security issues, whereas one for an interpreter trainer might list degree requirements and language combination but be hazy on the subject of what skill-sets or specialties would best align with the program's research agenda. Passing juried interpreting exams at a reputable school establishes the baseline for a graduate's competence in interpreting skills, but to date there is very little information available as to how students can maximise their chances of finding gainful employment in interpreting studies. This is a very relevant issue because as the various schools carry on producing new graduates, the available teaching positions will become increasingly difficult to secure. In addition, the tuition fees for IS in China are arguably the highest of all the disciplines: the majority of the leading schools charge as much as €13,960 for two years' worth of education, in contrast to €2,800 for four years in other disciplines. The average GDP per capita in China is around €6,700, so it is all the more critical for interpreting students to understand how they can stand out from the crowd when it comes to seeking academic posts with universities.

Chapter 4 approaches this issue from three perspectives: student, university and regional factors. Statistical analyses were conducted to determine how each factor influenced students' career choices. Those who conducted empirical research, be it experimental, observational, questionnaire-based, interview-based or ethnological in nature, were 1.45 times more likely to enter the academic sphere than those who wrote theoretical theses. Moser-Mercer (1994) observed that the interpreting research community can be divided into two loose groupings: those who prefer the type of general theorising most often used in the liberal arts, and those more interested in the data-driven approaches typically found in the natural sciences. The findings of the present study suggest that as CIS continues to evolve, those who lean in the

direction of empiricism are more marketable in academia. There have to date been a slew of competing theories on and models of interpreting, few of which have been subjected to sufficient empirical testing to verify their validity.

With the recruitment of an increasing number of empirical scholars into the ranks of academia, it ought to be possible to adapt and refine existing theories so as to guide students in their practice and help them acquire the specific skills they will need. Thanks to the development of better training methods and the introduction of deliberate practice (Ericsson et al 1993), instruction in many another discipline has improved dramatically over the years. Take the example of musical performance, a discipline that shares various characteristics with interpreting (Olivera Tovar-Espada 2014). Tchaikovsky's Violin Concerto, which was deemed unplayable by the most accomplished violinist of the 19th century, can now be played by any graduate of the Juilliard School (Colvin 2008). By comparison, even performances by the most experienced interpreters are fallible and vulnerable to errors and omissions (Pearl 1999). The increase in empirical research might serve to narrow the gap between interpreting theory and practice.

However, of all the other student-related factors (research topics, theoretical influences, graduation year, publication record, etc.), only graduation year yielded a statistically significant result, indicating that recent graduates are more likely to enter academia than those who completed their studies prior to 2008. China's interpreting market is diverse, ranging from escort/tourist interpreting to business negotiations, and from in-house projects to international conferences. It employs a large number of people, many of whom have received no formal training and have low proficiency in English: but still they work because their services are needed. However, not all Chinese interpreters are paid equally well: only those lucky enough to secure conference work are well remunerated; tour guides—who are far greater in number—languish at the bottom of the payroll. It is every graduate's dream to break into the conference interpreting market, but the reality is that only a small circle of well-established practitioners control this particular niche, and it takes time, effort and sometimes the right connections to break in to it. Unlike in the West, where the majority of opportunities lie in conference and community interpreting, the Chinese market is dominated by business interpreting (Gile 2010), a sphere in which remuneration is decidedly mediocre, and where the availability of work is unpredictable, subject as it is to the vagaries of the prevailing economic climate. These sobering facts have probably made graduates more realistic and pragmatic about their job prospects, hence the observation from the data that with each passing year an increasing number are more motivated to enter academia.

The fact that no particular research direction made a student more likely to become an academic highlights the all-inclusiveness of CIS. In the natural and social sciences, since most funding is tied to national priorities (e.g. the development of green energies), most schools are very particular about the specific skill-sets candidates require to join their research teams; this currently appears not to be an important consideration by CIS schools when hiring new faculty members. This may partially be down to the massive array of topics covered by IS, from directionality, pauses, accuracy and quality to pupillometry, all of which lead to a better understanding of the interpreting process.

Though a student's publication record has no statistically significant effect on his career path, this situation will likely change in the near future. As more scholars with backgrounds in research seek to join interpreting faculties, their research productivity will undoubtedly become an important factor to be considered in the hiring process. That few students' theses make it to print is not due to poor quality or a lack of suitable and amenable 'venues' for publication. Rather, the peer review process can take a long time to complete, and this is particularly true for specialised journals in TIS. For example, the review time for top-tier journals such as *Babel* is approximately 15 months, and that for *Target* is over 12 months. Since students generally start preparing their theses in the second year of their training, they rarely see their work published until around the time they graduate. Also, having work published in China is a costly affair, many academic journals charging processing fees ranging from a few hundred dollars up to several thousands. In the case of faculty members publishing, they can allocate a portion of the grants they receive towards such expenses, but students are generally not supported by any type of funding, so the high cost of publishing may serve as an active deterrent to them.

The movement toward Open-Access (OA) journals may be a solution to this issue: to date it has moved the goalposts in publishing in numerous other disciplines such as computer science and biomedicine. OA journals charge no subscription fees to individual readers or institutions, and most offer authors a rapid peer review process in which highly prestigious scholars in the field serve as academic editors to ensure publication quality. The practice ensures that knowledge is disseminated rapidly and authors can quickly gain academic influence by allowing anyone to view papers that are of interest to them free of charge. Leading journals such as *PLOS ONE* and *PeerJ* have already received Impact Factors as high as 3.2 and 2.1, whereas the top journal in IS, Interpreting, received a score of only 0.579—numerous other T&I journals register no IF score at all. Some organisations have taken the initiative to spearhead OA publishing in T&I studies: all past issues of the University of Western Sydney's *Translation & Interpreting* are now available free online.

Some traditional academic publishers in the field have also recognised the innovation in publishing brought about by OA journals, and have tried to head off challenges from these new ventures by offering Green and Gold options. Green allows authors to self-archive pre-prints (and post-prints) at institutional repositories such as arXiv in the field of physics. Many T&I scholars have begun posting their research at academia.edu and researchgate.com, which allow registered researchers to connect with and follow colleagues with similar research topics. It should be noted here, however, that unlike in other disciplines, most TIS scholars are cautious about posting pre-prints in the fear that a great number of changes will most likely have to be made before their manuscripts are finalised for print—that they would prefer to present an image of 'perfect' research to potential readers. That said, some pioneers have started posting drafts of their work online: Anthony Pym, for example[20], has thus engaged the entire community in active discussion of particular translation issues and used the feedback to further improve the quality of his papers. Gold refers to papers that are freely available to the general public in subscription-based or open-access journals. It should be noted that the Gold OA option offered by most T&I publishers is very costly—the Taylor & Francis Group, which publishes various of the premier T&I journals such as *Perspectives: Studies in Translatology* and *Translation Studies*, charge over €2,000 plus 20% tax for publishing a single Gold OA article. Obviously only faculty members with institutional funding can afford sharing their research via this option.

As for university-related factors, only one top-ranking university and one of the busiest advisors had a positive impact on the choice of students to become academics: the overwhelming majority had no statistically significant effect. An even more surprising finding was that an advisor's academic influence, as measured by PageRank, had a *negative* impact on students' choice to pursue an academic career. As mentioned at the beginning of this chapter, tuition fees for IS in China are five to ten times higher than for the bulk of other majors. In the US and Europe, however, fees for IS degrees are no higher than for any other, and often attract far fewer students than majors relating to Science, Technology, Engineering and Mathematics (STEM) subjects, which professions offer higher starting salaries, better job security and brighter prospects for career advancement. The university-related findings should serve as a wake-up call to students wishing to maximise their chances of securing a position in academia: selecting a top school or advisor will not necessarily benefit them. Education is a heavy

[20] A case in point is Pym's paper *West enters East: A strange case of unequal equivalences in basic translation theory* at academia.edu: https://www.academia.edu/s/0405e58386#comment_94903

financial investment on the part of Chinese students and their families and should not be entered into lightly. Those wishing to continue down the academic path of IS should consider taking electives in research methodology and statistics, which are essential for conducting empirical research.

Examining geographical factors revealed that the capital factor, the coastal/inland factor, and population had a bearing on students' career choices. In particular, the attributable risks of inland vs. coastal and population were much higher than those for advisors and universities, meaning that students who chose to study in an inland populous city were far more likely to enter the academic sphere. The findings of this study suggest that thanks to the Chinese state's policy of development for the western, inland provinces, including heavy investment in the region's education sector, that part of the country now has more academic openings than the coastal regions where, by contrast, the market has reached saturation point, though there are better prospects here for language professionals, thus making students more attracted to full-time freelance interpreting.

In the West the academic sector employs a large number of PhD holders—40% of the total workforce—as adjunct faculty members. Their job is far from glamorous: they receive below average remuneration and none of the benefits (healthcare, etc.) enjoyed by their full-time colleagues, and have to deal with the job insecurity inherent to contract work. In China, by contrast, working in academia—and especially in CIS—comes with a trio of attractive benefits: automatic tenureship with each academic appointment—there is no such thing as an adjunct professor in the Chinese system; flexible working hours and the ability to supplement one's income with interpreting assignments on the side—the vast majority of Chinese universities do not have any restrictions on the number of hours faculty members may spend on consultancy work per semester; and a high level of prestige which may further boost their chances when it comes to competing against full-time freelance interpreters for assignments.

It was striking, then, to find that a geographical factor appears to have a greater influence on students' likelihood of pursuing academic careers than academic variables such as choice of supervisor and number of papers published.

The present study has filled some of the gaps in the literature on CIS students' professional development by identifying a number of predictors that have a causal effect on whether or not students opt to pursue academic careers. Given the ever-increasing number of CIS graduates seeking to enter the academic sphere, the findings made here should prove useful to students in planning their careers.

5.2. Limitations

Additional work needs to be carried out in future to address issues that fell outside the original scope of this project. The present work's limitations include the methodological (such as the dichotomisation of continuous variables as seen in Section 5.2.1, and the sensitivity of PSM and VIE to unmeasured confounders as seen in Sections 5.2.2 and 5.2.3), and issues linked with the types of variables considered (as seen in Section 4.3.3.1.1).

It was beyond the scope of this dissertation to examine certain possible predictors of students' career choices, such as gender, motivation, interpreting skills, educational background and work experience, all of which were excluded from the analysis. The author's limited resources prevented him from examining all possible variables, collecting many of which would have required years of work by a dedicated team.

It was also beyond the the author's powers to review and evaluate literature in sociology, which would have complemented the scientometric analysis. For example, sociologists such as Pierre Bourdieu (1989) did excellent work examining the social determinants of entry to France's grandes écoles. A potentially worthwhile future line of enquiry would be to combine a sociological-critical approach to with scientometric and statistical methods to investigate the factors that contribute to students' choices to pursue one career over another.

5.2.1. Dichotomising variables

In this study several variables were collected using continuous scales, including publication year, PageRank, Degree Centrality and population size. It is generally acknowledged that maintaining the continuous nature of these variables in data analysis can yield better results in linear regression (Cohen 1983; Fitzsimons 2008; Humphreys 1978; Humphreys and Fleishman 1974; MacCallum et al. 2002; Maxwell and Delaney 1993; Maxwell, Delaney and Dill 1984). However, whether the high level of performance afforded by linear regression carries over to VIE is worth further discussion. The standard method for VIE, whereby potential causal importance can be quantified, only allows dichotomous treatment variables to be included in the model. In order to evaluate the potential importance of each variable, continuous treatment variables are dichotomised, so that no variable will be left behind.

One feature which distinguishes the two approaches is that the analytic procedures differ between general regression methods and causal analysis. Unlike general regression methods in which variables are placed in a model for direct adjustment, a causal analysis with

PSM needs at least two models: one for obtaining a propensity score, and another for evaluating the effect of a treatment. The objective of modelling propensity scores is to ensure that as many confounding variables as possible are controlled for. Obviously, such a specific procedure achieves results that general regression methods can never approach. Because the models have important differences, it may not be warranted to conclude that all assumptions about regression models - including the danger of dichotomization - also apply to causal inference models. Further investigation is warranted to determine whether the problems of dichotomising a continuous treatment variable in regression are truly comparable to VIE. One possible solution would be to apply the generalised propensity score method to a continuous treatment, as proposed by Hirano and Imbens (2004). Whether such a method extension can be used in VIE analysis invites further theoretical investigation.

Furthermore, some researchers (Iacobucci et al. 2015) suggest that there is no reason to reject outright the dichotomisation of a variable in general regression. Almost all previous studies which showed that dichotomisation leads to weaker and potentially misleading statistical tests via mathematical proofs and Monte Carlo simulations were based on the assumption that the variable being dichotomised has a naturally continuous normal distribution (e.g., Cohen 1983; MacCallum et al. 2002; Maxwell and Delaney 1993). This leaves the unanswered question of what happens when variables that have irregular distributions are dichotomised. As Iacobucci et al. (2015) noted, previous findings on dichotomisation leading to an increased risk of Type I error (incorrectly rejecting a true null hypothesis) were based on highly contrived data, i.e. a very small sample size and closely correlated covariates (Maxwell and Delaney 1993). It is theoretically possible that there are some specific types of distributions in which dichotomisation provides better representations of the underlying constructs than the observed continuous indicators. DeCoster et al. (2009) demonstrated that in some situations dichotomised indicators perform as well as or better than the original continuous indicators. Such situations include variables whose underlying latent distributions are categorical and whose latent variables are skewed. These results suggest that the cautions against using dichotomisation need to be updated.

For a field in which dichotomising a continuous variable is necessary for, *inter alia*, (1) avoiding the linearity assumption implicit in common statistical models for continuous covariates, (2) modelling a previously suspected or assumed threshold effect, and (3) making data summarisation more efficient, the standard procedure is to find an optimal cut-off point for a dichotomisation. This point is defined as that threshold value of the continuous covariate distribution which, using statistical criteria, best separates low and high risk subjects with

respect to some outcome. Numerous past researchers used median split as their cut-off. For example, in several articles recently published in the Journal of the American Statistical Association, median splits were applied to examine teenagers' driving behaviour (Kim et al 2013), the effects of age on prostate cancer outcomes (Farewell, Tom, and Royston 2004), and markers to determine the symptoms necessary to establish a new classification of 'complicated grief' (Wang et al. 2013). However, it is acknowledged that the median split is arbitrary. The minimum P-value method has been explored in biomedical research (Mazumdar and Glassman 2000), while the likelihood-based approach for determining optimal cut-off point has statistical advantages and more flexibility (Brent et al. 2006).

Dichotomising a treatment variable is a common approach when dealing with treatments which are either categorical with more than two possible values, or continuous. Some examples of this in a causal inference setting include Brotman et al. (2008), Bryan et al. (2004), Joffe et al. (2004), and Tager et al. (2004). Stitelman et al. (2010) examined the effect of dichotomising a treatment variable and the traditional assumptions used in the causal inference framework, namely that: (1) the treatment mechanism observed in the data resides within a specified level; (2) the implied treatment mechanism is equal to the intended treatment mechanism (this is called the mechanism equivalence assumption); and (3) the expected outcome is the same across all sub-levels (the effect equivalence assumption). If neither the mechanism equivalence assumption nor effect equivalence assumption is violated, an estimator for the parameter of interest after dichotomisation will remain consistent under the intended treatment mechanism.

In summary, dichotomising a continuous variable does not necessarily lead to an incorrect analysis result. From a practical point of view, binary covariates may be preferred because: (1) they offer a simple risk classification into 'high' versus 'low'; (2) they establish eligibility criteria for prospective studies; (3) they assist in making 'treatment' recommendations; and (4) they impose an assumed threshold.

5.2.2. PSM

Multivariable analytical methods other than the propensity score approach were considered for the present study. Although the penalized logistic model can be useful for dealing with a large number of covariates, it does not necessarily work very well in cases where the model selects many covariates for a dataset with comparatively few observations per variable. As suggested by simulation studies, when there are at least eight events per variable, a multivariable model

may perform well in comparison with the PS method. But when the number of covariates is so large that the number of events per variable is smaller than eight, PSM will outperform all other multivariable methods—that is, PS-based methods can provide less biased, more robust, and more precise results (Biondi-Zoccai et al. 2011). Considering the large number of potential confounders in the present study, that method of analysis was considered the optimal choice.

The downside of applying PSM is the increased level of complexity it results in the statistical analysis. Unlike general multivariable models which may reach a result with one model, two models need to be built in to the propensity score method. One is to model the conditional probability of receiving an exposure, i.e. the PS model, which in this case is that of 'having experience of empirical research'; the other is used to obtain the treatment effect. Extra effort is required to build a PS model, which is critical to ensuring that the best possible balance between the treated (or exposed) and control (or unexposed) groups be achieved.

As proposed by Austin et al. (2007), including not only variables relating to the treatment variable but those relating to the outcome(s) of interest can minimise the impact of residual confounding. Avoiding misspecification of a PS model is problematic since no knowledge can ever be had of the true model. This is not to be taken lightly, given that misspecification has an impact on effect estimation (Smith and Todd 2001), but fortunately that the impact is no greater than that misspecification in a general regression model (Drake 1993).

It is also a challenge to determine how best to exploit propensity scores and incorporate them into the analysis. Some evidence in support of the superiority of the matching approach over stratification and regression strategies is provided by Rubin and Thomas (2000) and Austin (2008). When the matching method is applied, balance assessment of matched data is required. The result of balance assessment can also be applied to PSM. In cases where the expected balance is not achieved, another technique such as machine learning methods (e.g. boosted classification and regression trees) might be the best options for defining propensity scores (Lee et al. 2010).

Following the above steps, a well-grounded analytical model can be adopted to obtain the treatment effect. Indeed, whenever matched data is employed, standard methods for non-clustered data are inappropriate as they fail to take into account the matched structure of the data. More sophisticated statistical approaches need to be applied if many-to-one matching is used (Austin 2010; Sekhon 2011).

One assumption in propensity score analyses is that there is no unmeasured confounding, i.e. no unobserved variable exists which can affect the outcome and is distributed

differently between the treated and control groups. In observational studies this assumption, known as strong ignorability, cannot be verified since it depends on our knowledge and techniques available for detecting a confounding effect. To reduce the possibility of missing a confounder, a comprehensive literature review is necessary to identify all potential confounders at the study design stage. In the present instance a large number of variables were collected in an effort to avoid residual confounding. However, the sensitivity analysis that was performed using the method described by Rosenbaum (1995) still suggested that the estimated treatment effect was sensitive to possible unmeasured confounding. One possible explanation for this is that limited resources available in a doctoral-level research project such as the present one made it impossible to collect information such as social networking between scholars, which data might well have a major bearing on the causal link between conducting empirical research and becoming an academic scholar.

5.2.3. VIE analysis

VIE is used for quantifying the contributions of variables which are considered confounding factors. The method can complement PSM, especially in approaches such as matching and stratification, which supply no further information on the extent to which each covariate drives the causal relationship. Since the measure of variable importance is inspired by its analogue in causal inference, the assumptions of causal inference are inherited. Specifically, each variable is assumed to be chronologically ordered, i.e. for an event to be a cause, it needs to occur before an outcome; consistent missing data structure as counterfactual framework is assumed; and no unmeasured confounding is assumed (van der Laan 2006). Under these assumptions, measures from the importance analysis are marginal or adjusted causal effects, i.e. adjusting for all other variables used to predict the outcome, they measure the importance of a variable. However, investigators should bear in mind that assumptions like unmeasured confounding are difficult to verify.

Unlike the importance measures generated by the random forest algorithm (Breiman et al. 1984), which can be used for variable selection in regression tree analysis, the connection between the importance measure of adjusted causal effect and model selection warrant further investigation. It is also unclear how measurement error and model misspecification affect marginal importance measures. Furthermore, marginal importance measures are not intended to be a replacement for formal investigation of causal effect, by which the true causal effect of

a variable can be estimated, provided the study has been sufficiently well designed to ensure adequate statistical power.

5.3. Directions for future research

This dissertation is an original contribution that uses scientometrics and advanced statistical techniques to study the determinants of career choices in IS. The focus of this dissertation being very specifically Chinese Interpreting Studies, no attempt was made to explore the career paths taken by majors in Translation Studies. Given that in China TS has a longer history and far more participants than IS, a comparative study of the differences in career choices between students of the two disciplines would be an interesting future line of enquiry, providing a balanced view of how the whole discipline of Chinese Translation and Interpreting Studies has developed and continues to evolve.

With more and more schools worldwide engaged in digitising their theses, it is becoming increasingly straightforward to explore how Eastern vs. Western students differ in the career choices they make, and to examine the factors that contribute to those divergent outcomes. Unlike in other parts of the world, in the UK a master's program in Conference Interpreting lasts only one year as opposed to the standard two. Though the US typically conforms to the two-year model, there has been a recent trend toward condensing MA courses to a single year in a lot of applied disciplines such as data science, international education management, electrical engineering and biotechnology. Ascertaining whether shorter courses would make T&I students more or less likely to choose a professional career over a research-oriented academic life would make for an interesting study, which might provide valuable information to school authorities for designing their future course offerings.

The principles of scientometrics could be employed to examine in detail how the research influence of individual scholars has changed—or not changed—over the past twenty years. Were the most influential researchers in the 1990s able to maintain their rankings into the 21st century, or did any of their lights begin to dim? What might account for the continuing or waning of their popularity? Does the heavy workload of supervising students' theses interfere with their research productivity? Earlier studies of academic influence in CIS such as Xu (2015) and Xu and Pekelis (2015), as well as the present dissertation, took a synchronic approach when it came to calculating citation data, but did not take into consideration the dynamic nature of citation networks. While this worked well for addressing the research

questions posed in those studies, it should be acknowledged that the influence scholars exert may change over time: as new models and theories based on empirical testing are developed, existing ones derived from personal reflection may lose their appeal.

Future studies could use this temporal information to build a dynamic graph in which nodes and edges are all time-stamped. These time stamps could be used to study what is known as 'ageing' i.e. the effective lifespan of a publication. It would be an interesting line of work to take into consideration ageing which can be associated with publications and authors as a new approach to studying citation networks. The ageing effect is not to be disregarded because when using the synchronic approach earlier papers have a higher probability of being cited by others and thereby creating a bias towards older publications being cited. This newly proposed methodology would not replace the synchronic approach used in earlier studies but rather complement it by adding a new dimension to tracing the evolution of the CIS citation network. Future researchers might explore these citation networks by assigning temporal decay to reduce the ageing factor, as a result of which earlier publications would not have the added advantage of being cited more than recently published works. This would be helpful in understanding the changes at work in CIS academic influence over time and in predicting future citation trends in interpreting studies.

Another popular way of quantifying academic influence is to examine the role a node plays in a connected network (Paul et al. 2004). It has been demonstrated that networks typically have only a small set of influential nodes that are responsible for keeping all the others connected (Kempe 2005). If these influential nodes were removed, the entire network would fragment into smaller connected components (Holme et al. 2002; Albert et al. 2000). This approach to studying the connectivity of a network by removing nodes iteratively is referred to as network robustness study (Dou et al. 2010; Callaway et al. 2000). Typical networks demonstrate an exponential decline in connectivity after a certain number of important nodes are removed, as opposed to a linear decline when they are removed randomly (Latif et al. 2013). This is extremely useful for understanding how influential nodes play the role of messengers in spreading information throughout the whole network (Kempe et al. 2003). In the context of TIS, identifying these influential scholars would add a new dimension to our understanding of the entire field and in particular how they keep the discipline moving forward by serving as conduits for the propagation of new ideas, innovations and pioneering research methods.

Though the use of scientometric research in TIS can be traced back to the early 1990s, it is only recently that it has been systematically and rigorously applied in the field. Most of the pioneering papers (e.g. Pöchhacker 1995; Gile 1995 and 2005; Gao 2008) focused on rather

limited corpora that were unrepresentative of the overall TIS landscape, and only computed counts and proportions in their analysis. The first of these shortcomings might be ascribed to a dearth of comprehensive databases bringing together various sources of TIS literature, most of which was at the time only available in hard copy or through subscription; and the authors' incomplete knowledge of machine learning may have meant the labour-intensive nature of citation mining deterred them in their quests for comprehensive data collections.

Interpreting is a profession in which the actions of its practitioners can have real-world consequences in diplomatic, military, commercial, and judicial fields, among many others. For this reason alone the ideas and theories currently in use need to be tested, adjusted and improved in the real world so that aspiring interpreters may hone their skills with the maximum of efficiency and efficacy. The findings of this study have demonstrated that Chinese Interpreting Studies has come a long way since its infancy. While much more work undoubtedly needs to be done to improve the overall quality of CIS research, it was reassuring learn that scholars in the field have begun to appreciate the importance of empiricism and that as a result the general trend of the discipline is moving in the right direction.

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