Introduction

Although spatial phenomena have been extensively studied in various research fields, such as economic geography (e.g., convergence in per capita income growth rates, inter-regional and intersectorial flows of labor and capital, and regional resource endowments), environmental sciences (e.g., dispersion of air-borne pollutants, soil erosion, and forest growth), environmental criminology (e.g., social organization and processes of informal social control within neighborhoods), geographical epidemiology (e.g., mapping disease areas), and urban economics (e.g., human interaction patterns and spatial behavior), the study of spatial linkages in financial markets has essentially been overlooked. In the 1970s and 1980s, there were some studies of regional banking structures, urban mortgage markets, regional credit availability and regional interest rate differentials; but the studies that appeared hardly added up to a substantial or coherent body of theoretical or empirical research. During the 1990s, however, the relationship between money and space began to attract increasing attention, with a succession of books and papers by economists and geographers (for example, Cohen, 1998; Corbridge et al., 1994; Dow, 1990; Eichengreen and Flandreau, 1996; Laulajainen, 1998; Leyshon and Thrift, 1997; Martin, 1999; O’Brien, 1990, 1992; Porteous, 1995). Ironically, this flurry of publication occurred at the very time that some argue that if geography had once been of relevance for understanding money, it was rapidly becoming irrelevant. O’Brien (1990, 1992) in particular claimed that various processes, especially technological advances in information and communication technologies (ICT), the wave of financial deregulation that had begun in the 1980s in the USA and UK and a new trend of financial innovation, were together facilitating—indeed promoting—accelerating financial integration at a global scale, rendering geography and location of rapidly declining significance for financial firms, financial flows and access to financial products and services. Not only was financial globalization undermining national economic sovereignty (Cohen, 1998), by going global banks were free to locate wherever they chose, and money having become electronic, and so on. In this brave new world of global finance, money had escaped space. On the other hand, geographers on the whole have been much more cautious in pronouncing what O’Brien called the ‘end of geography’ with respect to finance. While they acknowledge that distance may have become irrelevant in financial transactions and operations, they have argued that location and place remain of crucial importance (see Leyshon, 1995, 1997, 1998; Martin, 1994, 1999). The spatial concentration of banks, investment houses and other financial institutions in the major national (and global) financial centers has not dramatically lessened: indeed in many respects it has increased, as has the financial specializations of those centers and the competition between them. The outsourcing and offshoring of certain financial functions and services (such as call centers), themselves developments
facilitated by ICT and related ‘globalization’ processes, have been highly geographical in their locational dynamics and impacts. In short, contrary to what some argued, money remains highly geographical, even in today’s globalized world.

Viviana Fernandez (2011) explores spatial dependency by formulating a spatial version of the capital asset pricing model (S-CAPM). Viviana considers four financial indicators to quantify the distance between neighboring firms: market capitalization (relative to firm size), the market-to-book, the dividend yield and the debt maturity ratios.

Fernández-Avilés et al. (2012) employs spatial techniques to analyze how the relations between stock market returns depend on the (economic) distances between the markets. Hossein Asgharian and Wolfgang Hess and Lu Liu (2013) employ spatial econometrics techniques to investigate to what extent countries’ economic and geographical relations affect their stock market co-movements. They find a strong effect of a unit shock to three regionally dominant countries, namely the US, the UK, and Japan, on other countries through the trade linkage. Hossein Asgharian, etc. investigate eight different measures of distance (geographical proximity, bilateral FDI, the volume of countries’ bilateral trades, the stability of the bilateral exchange rate and so on) while Fernández-Avilés et al. uses two different measures of distance (geographical distance and economic distance measure). Furthermore, Hossein Asgharian, etc. employ a detailed analysis of how shocks to a market’s returns are propagated throughout the spatial system through the dynamic approach while Fernández-Avilés et al. (2012) uses a static approach in his paper. F. Y. Ouyang, B. Zheng, X. F. Jiang (2014) investigate the spatial and temporal structures of four financial markets in Greater China. In particular, they uncover different characteristics of the four markets by analyzing the sector and subsector structures which are detected through the random matrix theory.

II Methodology

The concept of spatial dependence in regression models reflects a situation where the values of the dependent variable at one location depend on the values of the observations at other locations. The most commonly applied spatial regression models are the spatial lag model and the spatial error model.

Formally, the spatial lag model can be expressed as:

\[ y = \rho W y + X \beta + \epsilon \]  

(1)

where \( y \) is a vector of observations on a dependent variable, \( X \) is a matrix of observations on exogenous variables with an associated vector of coefficients \( \beta \), \( \epsilon \) is a vector of idiosyncratic errors, \( W \) is a spatial weights matrix, and \( \rho \) is the SAR parameter. Similarly, the spatial error model can be expressed as:

\[ y = X \beta + v \]  

(2)

where \( v = \lambda W v + \epsilon \), with \( \lambda \) being the SAR parameter.
The key difference between the spatial lag model and the spatial error model lies in the way that shocks are transmitted throughout the spatial system. The spatial lag model framework implies that shocks to both the error term and the explanatory variables at one location are transmitted to all other locations within the spatial system. By contrast, when using a spatial error model, only shocks in the error term but not shocks to the explanatory variables are transmitted to other locations (LeSage and Pace, 2009).

The choice of model specification is thus not ineffectual, and, consequently, a lot of research has been devoted to testing procedures that enable discrimination between the spatial lag model and the spatial error model (see, e.g., Florax et al., 2003, and references therein). However, LeSage and Pace (2009) argue that there is too much emphasis in the spatial econometrics literature on statistical tests to infer the appropriate model specification. They instead recommend the use of the more general spatial Durbin model (SDM), which can be expressed as:

\[ y = \rho \ W \ y + X \beta + W X \theta + \epsilon \]  
(3)

The SDM nests both the spatial lag model given in (1) and the spatial error model given in (2), and will thus produce unbiased coefficient estimates under the data generating processes (1)–(3). By contrast, when the true data generating process is the SDM, both the spatial lag model and the spatial error model will suffer from omitted variable bias, since these models do not include spatially lagged explanatory variables \( W X \).

### III  Why study abroad

The university I’m applying for is University of Michigan-Ann Arbor in America. Firstly, New York is the No.1 financial center all over the world so the finance is well developed. Secondly, the education is high-tech and advanced compared with other countries in the world. As the state's oldest university, University of Michigan has very high research activity. It is a participant in the Committee on Institutional Cooperation (CIC), an academic consortium of the universities in the Big Ten Conference plus former conference member the University of Chicago. Also, it is one of the founding members (1900) of the Association of American Universities. With over 6, 200 faculty members, 73 of whom are members of the National Academy and 471 of whom hold an endowed chair in their discipline, the university manages one of the largest annual collegiate research budgets of any university in the United States. My host supervisor, Dr. Shuming Bao, is a scientist of Institute for Social Research and the director of China Data Center and so on. He is interested in GIS (geographic information system), spatial statistics and spatial econometric models. What’s more, many of his academic papers have been published in the high-level academic journals in recent years.

### IV  Demonstrate the feasibility of accomplishing the research

I have joined in the writing of application of National Natural Science Foundation of China, National Social Science Foundation of China and a Research funded by Ministry of Education with other teachers, discussed the structure and contents, wrote initial literature review and did some correction during 2012 to 2013, which augments my ability to do research. And I have published two academic
papers in 2012. Meanwhile my english is good which facilitates widespread readings of english papers. So I have

confidence in working on several projects related to the “Spatial Finance of China” and finishing at least one research paper during my visit under the guidance of Dr. Bao.

V Expected results and study plan
The purpose of going to University of Michigan-Ann Arbor in America is to learn about the current research of spatial finance and acquire some advanced research skills. Besides, I am very much interested in learning how other countries handle and or study Finance – especially in the United States of America. I am also particularly interested in the education system of USA. Through the visiting experience, I expect to follow Dr. Bao’s guidance to improve my research ability and prepare for the dissertation of Doctor Degree. My study plan is as follows.

1. Study the existing research of spatial finance and economic geography, and summarize the contents and significance of spatial finance.
2. Learn about the latest and advanced methods of spatial econometric models.

1. Participate in some research seminars and workshops at the University of Michigan.
2. Work on several projects related to the “Spatial Finance of China” under Dr. Bao’s guidance.

1. On the base of the research, I’ll try to publish one or two high-quality academic papers.
2. Further the study and lay the root for Doctor Degree’s dissertation.