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Dear NBER Economics of Digitization Meeting Committee:

I am writing to apply for the 2019 NBER Economics of Digitization meeting. I am currently pursuing a Ph.D. in Management Science and Information Systems in Oklahoma State University, and expect to complete my dissertation by the spring of 2020.

Enclosed with this letter are the following materials:

(1) Curriculum vitae
(2) Coursework and research descriptions

My research centers around cybersecurity. My dissertation focuses on the business value and effectiveness of cybersecurity initiatives as reflected in firm-level announcements and corporate venture capital, as well as state-level legislations. I am also interested in cybersecurity on the individual level, namely the effectiveness of security awareness training in mitigating phishing attacks. With cybersecurity threat being a major challenge for advancement of digitalization, I am eager to develop a deeper understanding of cybersecurity so that I can produce more compelling research in the future.

Please contact me should you have any questions about my application or require further information.

Sincerely,
Tianjian Zhang

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Education

Ph.D. Management Information Systems, Oklahoma State University, 2020 (expected).

M.S. Mathematics, Oklahoma State University, 2015.

B.Sc. Mathematics, Chinese University of Hong Kong, 2010.

Employment

Teaching assistant, Management Information Systems, Oklahoma State University, 2015–Now.
Courses taught: Database Management, Operations Analytics.

Teaching assistant, Mathematics, Oklahoma State University, 2013–2015.
Courses taught: Business Calculus, College Algebra.

Research assistant, Institute of Economics and Finance, Chinese University of Hong Kong, 2010–2012.

Research Paper

Working paper

Havakhor, T., Zhang, T., Hammer, B., Luse, A. "Organizational Impacts of Cybersecurity Initiatives."
Preliminary version presented at 2018 Americas Conference on Information Systems (AMCIS).

Work in Progress

Zhang, T., Havakhor, T., Nasirpouri Shadbad, F. "Risking for Security? Organizational Investment in Cybersecurity Startups."
Presented at 2018 Wharton Innovation Doctoral Symposium (WINDS), University of Pennsylvania.

Zhang, T., Havakhor, T. "Can state legislation in cybersecurity reduce data breach?"

Zhang, T., Biros, D., and Glancy, F. "Knowledge Expiration in Security Awareness Training."
Presented at 2018 Trans-Atlantic Doctoral Conference (TADC), London Business School.

Conference Proceedings

Hammer, B., Zhang, T., Nasirpouri Shadbad, F., Agrawal, R. 2019. "Psychological Contract Violation and Sharing Intention on Facebook," *Hawaii International Conference on System Sciences (HICSS)*, Wailea, HI.

Havakhor, T., Zhang, T., and Hammer, B. 2018. "The Business Value of Engaging in Counter-Breach Initiatives," *Americas Conference on Information Systems (AMCIS)*, New Orleans, LA.

I am a fourth-year Ph.D. student of management information systems at Oklahoma State University with a Bachelor and Master degrees in mathematics. My Ph.D. level seminar courses cover the overview of management information systems (MIS), economics of information systems (IS), privacy and security, and organization theory. In the overview of MIS seminar, we studied the seminal pieces in behavioral studies as well as economics of IS, through which I gradually developed an interest in the latter. In the economics of IS seminar, we studied literature on the business value of IT, resource-based view of IT capability, complementarities, IT spillovers, and business-IT alignment, all of which are helpful in my current firm level studies of cybersecurity. The privacy and security seminar covers relevant behavioral studies, from which I became interested in cybersecurity. The organization theory seminar has taught me various theories such as the behavioral theory of the firm that later became the theoretical foundation to part of my dissertation. In addition to the seminar courses, I also took relevant methodology classes such as econometrics, structural equation modeling, and linear optimization.

Through these coursework and related readings, I have developed an overall interest in cybersecurity. I am mainly interested in the economic and security consequences of cybersecurity investments, as well as the effectiveness of cybersecurity legislations in mitigating cyberattacks on the state level. With cybersecurity being a necessary condition for further advancement of digitalization, my research falls under the main theme of economics of digitalization in this meeting.

I am currently in preparation for the dissertation proposal. My dissertation consists of three studies. The first study examines the business values of broadcasted cybersecurity initiatives (BCIs). Despite the numbing market reaction towards ubiquitous data breaches and the cost nature of cybersecurity investment, there is a general positive value of BCIs through boosted firm legitimacy. Further, value heterogeneity is determined by complementarity with security talent pools and the security level of a firm relative to its industry peers. BCIs create greater values for initiatives accompanied with security talents, and for under-performing firms (breached firms in industries with less frequent breaches) as well as over-performing firms (un-breached firms in industries with more frequent breaches). Through a textual analyses of announcements and annual report emphases on cybersecurity initiatives, I created a matched panel of 3212 firm-year observations spanning from 2005 to 2015. Interestingly, while BCIs without sufficient technical backup cannot significantly reduce subsequent breaches, they still generate business values for under- and over-performing firms. This study points to the socially-relative frame in which the business value of BCIs is interpreted, and market over-reactions towards non-substantive cybersecurity initiatives.

The second study of my dissertation focuses on external cybersecurity investments through corporate venture capital (CVC). With the cost nature of cybersecurity and high uncertainty in investments in startups, the economic impact of CVC investments in cybersecurity is unclear. The study utilizes the real options lens to examine whether organizational investments in cybersecurity startups improve the investing firms' performance. Based on a dataset of 873 firm-year observations from 2009 to 2017, the results suggest an overall significant positive effect of investments in cybersecurity startups on corporate investors' Tobin's q and other accounting measures. The positive effect is more pronounced for IT firms and investments in recent years. The next step of this ongoing study will investigate how (social) media sentiment affect the business value of CVC investments in cybersecurity. This work-in-progress can potentially reveal the implications of external cybersecurity investment through CVCs.

The third study of my dissertation addresses the effectiveness of state legislations in mitigating data breaches. I am currently in the process of collecting data. Difference-in-difference approach will be used to identify the effect. In addition to my dissertation, I have two other projects concerning security and privacy on the individual level. The former is an experimental study about the effectiveness of security awareness training in mitigating phishing attacks. We found that training can reduce phishing succumbing rate by half. The latter study found that when a Facebook user feels violated by another user, the feeling of violation will be irrationally generalized towards the social network site, and consequently discourage content sharing.

With worldwide loss due to data breach to reach $90 trillion in 2030, cybersecurity is perhaps one of the most urgent issues in digitalization. Working in a multi-disciplinal subject, I strive to interact with scholars from various fields. For example, I recently attended the Wharton Innovation Doctoral Symposium, where my presentation and peer discussions have been a valuable experience for my research. As cybersecurity threat has become an unavoidable issue in the age of digitalization, I look forward to adding to the discussion with my research background. In addition to peer discussions, I am certain I could benefit greatly from the guidance of senior scholars in the Economics of Digitization Meeting.