Journal of Business Venturing Insights 9 (2018) 24–31

Contents lists available at ScienceDirect

Journal of Business Venturing Insights

journal homepage: www.elsevier.com/locate/jbvi

Estimating country-level social network density and supportive surroundings by simulation

Jaehu Shim*, Jiyoung Kim

Australian Centre for Entrepreneurship Research, QUT Business School (Management), Queensland University of Technology, Brisbane, QLD 4000, Australia

ARTICLE INFO

Keywords:
Social network density
Supportive surroundings
Social network properties
Simulation
ABMS
GEM

ABSTRACT

The purpose of this study is to estimate country-level social network properties by reproducing plausible social network structures of each country. For this purpose, we suggest and utilize a novel simulation procedure using Agent-Based Modeling and Simulation (ABMS) method and the Global Entrepreneurship Monitor (GEM) data. Specifically, we estimate two types of country-level social network properties that can be related to entrepreneurial activities, i.e. social network density and supportive surroundings in each country. For the estimation, we use a social network-related question in the GEM questionnaire – "*Do you know someone personally who started a business in the past 2 years?*" As a result, this study provides estimated values of the social network properties for 69 countries. In doing so, this study suggests a simulation procedure for estimating the country-level social network properties, provides estimated values of the properties that can be utilized in future studies, and proposes potential roles of the country-level social network structure as a contextual factor that can affect individuals' entrepreneurial activities.

1. Introduction

The purpose of this study is to estimate and provide country-level social network properties by reproducing plausible social network structures of each county. For this purpose, we suggest a novel procedure of Agent-Based Modeling and Simulation (ABMS) and utilize this procedure using empirical data from the Global Entrepreneurship Monitor (GEM). As a result, we provide estimated values of social network density and supportive surroundings of 69 countries. Advancing scholarly knowledge of the social network structure is important in entrepreneurship research because the impacts of individuals' social networking activities can vary in different macro-level contexts featured with the diverse properties of social network structures. Therefore, understanding diverse social network properties will provide an opportunity to integrate the existing knowledge of individual social networking behaviors and its contexts.

Despite the high volume of literature on the role of social networks in entrepreneurship research (Hoang and Antoncic, 2003; Hoang and Yi, 2015), it is a long-running critique that most attention and emphasis have remained at the micro level focusing on individual and inter-organizational networks (Klyver et al., 2008; Kwon and Arenius, 2010; O'Donnell et al., 2001). Only a few studies have shown how macro-level contextual factors impact individuals' social networking activities, such factors as culture (Klyver and Foley, 2012; Klyver et al., 2008) and trust (Kwon and Arenius, 2010). We consider the social network structure as an important macro-level contextual factor that affects individuals' entrepreneurial activities. Thus, capturing properties of the country-

* Corresponding author.
E-mail addresses: jaehu.shim@qut.edu.au (J. Shim), jiyoungkim1602@gmail.com (J. Kim).

https://doi.org/10.1016/j.jbvi.2017.12.002
Received 18 September 2017; Received in revised form 1 December 2017; Accepted 8 December 2017

level social network structure can further facilitate the integrative understanding of individuals' social networking behaviors in an entrepreneurial context from a multilevel perspective. However, to the best of our knowledge, there has been no such research attempt made to study country-level social network properties in entrepreneurship studies.

To address this research issue, we have found a key social network-related question in the Adult Population Survey (APS) conducted by the GEM and utilized this question to estimate the country-level social network properties. The GEM is the largest global entrepreneurship research on individual-level entrepreneurial behavior and country-level entrepreneurial ecosystem. The key question asks "*Do you know someone personally who started a business in the past 2 years?*" (Hereafter *'knowent'*). Interestingly, according to the GEM data set collected in 2014 (Singer et al., 2015), 42% of the respondents in Finland knew one or more new entrepreneur(s) while Finland had only 1.55% of new entrepreneurs. In contrast, 29% of the respondents in the US knew one or more entrepreneurs while the US had 2.15% of new entrepreneurs, which is more than that of Finland. We infer that this cross-country difference might be associated with different social network properties by countries. However, it is not an appropriate approach to estimate the social network properties only with the responses to the question (*knowent*). This is mainly because the rate of respondents who answered "yes" to the question not only reflects the country's social network density but also reflects the country's number of new entrepreneurs. Thus, despite two countries having a similar "yes" rate of response to the question, the countries' actual social network properties can be different due to the different numbers of new entrepreneurs in the countries.

To tackle this challenging issue, we suggest a novel agent-based simulation procedure by which we reproduce plausible country-level social network structures and estimate the social network properties. The classical usage of ABMS is to understand a macro-level phenomenon by simulating its plausible processes of micro-level individuals' activities (e.g. Shim and Bliemel, 2017; Shim et al., 2017). However, in this study, we present a unique utilization of ABMS, through which we estimate country-level social network properties by simulating plausible social network structures of each country that reproduce the rate of positive responses to the question (*knowent*) obtained by the GEM.

The contribution of this study is threefold. Firstly, we suggest a simulation procedure for reproducing plausible social network structures, which can be a basis of empirically-grounded simulation studies regarding entrepreneurial processes. Secondly, using the simulation procedure and the empirical data, we estimate and provide two types of country-level social network properties, i.e. social network density and supportive surroundings, which can be considered as features of the contextual factor that affect individuals' social networking activities. Finally, we propose potential roles of the country-level social network properties and related research questions that can be answered in future studies.

2. Theoretical background and conceptual definitions

Reproducing plausible social network structures of countries gives information about the social network properties that can be useful in characterizing and comparing the social network structures of the countries. In this study, the term *social network structure* indicates a graph structure formed by social connections of individuals. The term *social network property* refers to the measurable quantity, quality, or attribute describing a social network structure, and generally expressed as a numerical variable such as the number of individuals or the number of links included in a social network (Seidman, 1983). Among diverse social network properties, two important structural properties are 'social network density' and 'social network cluster' (Reagans and McEvily, 2003). Based on these structural properties, this study suggests 'supportive surroundings' and 'connected entrepreneurs', which are contextual properties for entrepreneurship.

2.1. Social network density and supportive surroundings

Social network density refers to the extent to which social connections exist within a given unit (Seidman, 1983; Reagans and McEvily, 2003), and is generally measured by the number of existing links divided by that of all possible links (Otte and Rousseau, 2002; Scott and Carrington, 2011). This study presents each country's level of social network density by showing the count of reproduced social links (acquaintances or friends) per person in the country. In our simulation, we estimate each country's minimum level of social network density that satisfies the country's empirical value of the aforementioned network-related key question (*knowent*) in the GEM.

In entrepreneurial contexts, the social network has been conceptualized as a channel through which individuals access various resources that might support their entrepreneurial activities (Davidsson and Honig, 2003; Elfring and Hulsink, 2003). We conceptualize this social network property as *supportive surroundings* for entrepreneurship, which refer to having established business owners or angel investors within one's social network. Thus, supportive surroundings can be sources of human and financial capital, such as entrepreneurial advice and informal investment. A country's social network density is a basis for estimating the degree of supportive surroundings for entrepreneurial activities in the country.

2.2. Social network cluster and connected entrepreneurs

For estimating social network density of the people in a country, identifying the degree of social network clustering of the entrepreneurs in the country is necessary, because whether an individual's knowing an entrepreneur is affected by the degree of social network clustering of the entrepreneurs. *Social network cluster* indicates a relationship in which two connected individuals have common third-party contacts (Seidman, 1983; Reagans and McEvily, 2003) and clustering coefficient is a measure of the degree to which individuals cluster together (Watts and Strogatz, 1998). Specifically, in entrepreneurship research, there has been a consensus