Pennsylvania State University

The Graduate School

TIME-SPACE COMPRESSION REVISITED: EXAMINING THE EFFECT OF INTERNET USE ON COSMOPOLITANISM, INTERNATIONAL ONLINE COMMUNICATION AND TRADE

A Dissertation in

Mass Communications

by

Yang Bai

Submitted in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

August 2019

The dissertation of Yang Bai was reviewed and approved* by the following:

Krishna P. Jayakar
Professor
Donald P. Bellisario College of Communications
Dissertation Advisor
Chair of Committee

Patrick R. Parsons
Professor
Donald P. Bellisario College of Communications

Anne Hoag
Associate Professor
Donald P. Bellisario College of Communications

Johannes W. Fedderke
Professor
School of International Affairs

Matthew McAllister
Professor
Director of Graduate Programs
Donald P. Bellisario College of Communications

*Signatures are on file in the Graduate School

ABSTRACT

The role of communication technologies as an agent of globalization has long been recognized. With the wide adoption of the Internet around the globe, increasing attention has been given to the new technology as a force which could shrink the world into a global village. This dissertation joins the discussion on the distance-compressing effect of the Internet. First, the common narratives regarding the role of the Internet in the compression of physical distance are revisited. Specifically, the distance-compression is often described as a dramatic increase in cross-border communication, which, in turn, fosters a cosmopolitan worldview that all humans belong to the same community. Two studies are conducted to examine whether these potentials of the Internet, which are widely believed to be the reality but in fact have never been empirically tested, are indeed realized. In general, a positive effect of the Internet is found. Nevertheless, only after the diffusion of the Internet reaches a critical level will the increase in its adoption lead to a rise of the cosmopolitan worldview, and the positive effect of the Internet on cross-border online communication is found to be stronger in high-income countries. Second, the Internet's effect on the compression of physical distance is examined by analyzing data on U.S. exports. Although the Internet could significantly increase the exports of the U.S. to its partner countries, there is little evidence suggesting that the Internet achieves this effect through mitigating the challenges imposed by the physical distance.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

Writing a dissertation is not an easy task, and I'm proud that I made it. Meanwhile, there are many people to whom I must express my deepest gratitude. Without their help and support, I wouldn't have finished the dissertation or the Ph.D program.

First of all, I want to thank my committee members, Dr. Jayakar, Dr. Parsons, Dr. Hoag and Dr. Fedderke for their unreserved support and help. They not only inspired me on this dissertation but also showed me how to be a good scholar. It was a great pleasure and privilege working with them.

Also, I'd like to thank my dear wife, Amanda. She gave up the sunshine of California and moved all the way to State College. The Ph.D life can be harsh and boring. But with her beside me, my life in the past four years have been so sweet and happy.

Last, I'd like to thank all the professors who have instructed me and all my peers who I have worked with during the last four years. They all helped me become a better researcher, and I truly cherish my friendship with them.

Chapter 1 INTRODUCTION

Among all the significant social changes that have taken place in human history, the increasing level of globalization since the 1500s is perhaps one of the most studied events (Bentley, 1996). As a loaded term, globalization has been defined by scholars of various fields. Economists define it as the integration of national economies in the direction of an international trade-based economy (Bhagwati, 2004). Some international relation scholars define it as the "increasing consciousness of the world as a whole" (Robertson, 1992, p.8). McLuhan (1962), a prominent media scholar, described it as the shrinking of the world into a global village. Although these definitions emphasize different aspects of globalization, they all point to a common theme, which is well summarized by Giddens (1990), that globalization can be understood as "the intensification of worldwide social relations which link distant localities in such a way that local happenings are shaped by events occurring many miles away and vice versa" (p. 64).

The driving forces of the intensification of worldwide social relations are manifold, but the development of technologies has long been recognized as a critical factor (Moak, 2017). First, modern transportation technologies greatly reduce the time needed for long-distance movement of people and goods. Second and increasingly important, the advancement in communication technologies greatly reduces the cost and increases the speed of information exchange over a long distance. Harvey (1990) succinctly summarized the role of transportation and communication technologies in facilitating the globalization process: goods and information can now transfer across a great distance in much less or even in no time, as if space and distance are "compressed"

by the speed of the technologies (1990, p. 241). Thus, at the most fundamental level, the role that technologies and particularly, communication technologies play in the globalization process is that they overcome the challenges imposed by geographic distance, which has long been an obstacle in human history separating people and limiting the expansion of social relations (Warf, 2008).

This dissertation joins the discussion on the compression of space and distance and elaborates on the role of the Internet, the most recent fundamental breakthrough in communication technologies. Under this broad theme, three studies are conducted as an attempt to answer some very critical yet largely untouched questions.

As suggested by the existing body of literature, which is reviewed in the next section of this chapter, the distance-compressing effect of the Internet is often described as follows. First, the Internet could greatly facilitate and boost international communication (Rauch, 1999; Borcuch, Piłat-Borcuch & Świerczyńska-Kaczor, 2014). Second, the use of the Internet could lead to the rise of a cosmopolitan worldview that all human beings, regardless of their nationalities, belong to the same community (Appiah, 2006). Although widely believed to reflect the reality and generally treated as common sense (the effect of the Internet on cosmopolitanism to a lesser degree), neither of the two effects of the Internet is in fact examined and verified by rigorous empirical tests. To fill this gap, two studies are conducted which examine the effect of Internet use on international online communication and on the formation of the cosmopolitan worldview.

Besides the untested conventional wisdom, the nature of the distance-compressing effect of the Internet is also worth further exploring. Physical distance has long been recognized as a major barrier to cross-country movement of people and goods. For

example, geographic distance is found to be one of the most persistent barriers to international trade. On average, a 1% increase in the distance between two countries would decrease the trade volume between them by 0.9% (Disdier & Head, 2008). Does the Internet help overcome the challenge by making it a lesser barrier to trade, i.e., making the size of the effect smaller? Or does the Internet simply boost international trade through other channels without mitigating the negative effect of distance per se? The third study focuses directly on this dyad or dichotomy in the distance-compressing effect of the Internet by investigating whether the Internet has weakened the effect of physical distance as manifested in U.S. exports.

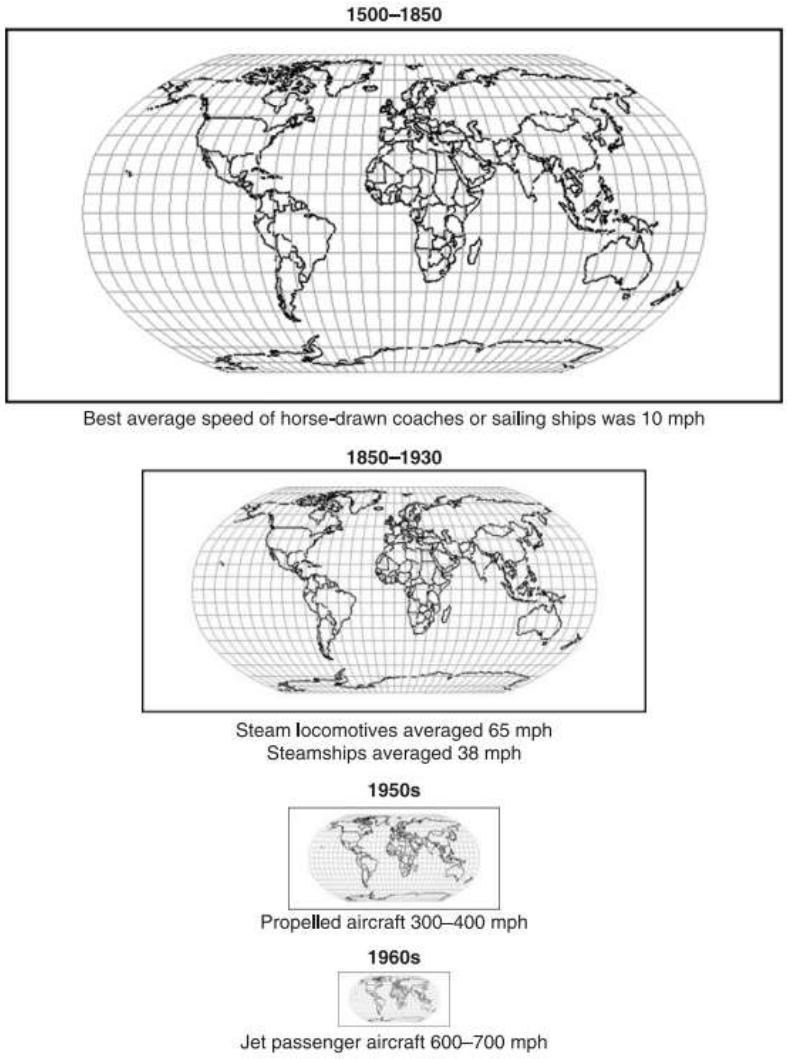
In the remaining parts of the introductory chapter, the related literature on the concept of time-space compression and the role of communication technologies in such compression, at the conceptual level, is reviewed. The chapter ends with an overview of the structure of the dissertation.

The Compression of Time and Space

The idea of time-space compression, or the compression of distance by time, loosely defined as a set of processes that lead to shrinking of the relative distance between places (Warf, 2008), is not new at all. Keen on analyzing the spatial components of social phenomena (Dunbar, 1977), social geographers were among the first scholars to pay attention to the compression of distance by time. The isochronic map drew by Schjerning (1903) which shows the time needed to travel from Berlin to various places in Germany typifies the long-term recognition that with the help of technologies, the geographic distance can be overcome. Perhaps more famous is the isochronic map drawn

by McHale (1969) which shows how the world is in effect becoming smaller with the advent of modern transportation technologies (see Figure 1).

Figure 1. Transportation Technologies and the Shrinking of the World



The map is originally compiled by McHale (1969). The picture is extracted from the *Global Shift* (Dicken, 2007)

While social geographers treat the compression of space mainly as the result of reduced travel time caused by advances in transportation, many other scholars pay close attention to the role of communication technologies. In this line of inquiry, many follow a hardcore technological determinist approach: the most prominent feature of the

technology will force the society to follow suit (Fischer, 1992), and a direct, unidirectional causality from the technology to social change is often assumed (Neuman, 2010). Therefore, because the Internet can link people in different places in no time, all aspects of social life would adjust accordingly, and then the world would shrink into a global village (Ogburn, 1922). Some scholars, although in general following the determinist approach, elaborated on the relationship by adding some intermediating factors. For example, Abler and Falk (1981) discussed the way intercommunication services led to the rise of connected information-based societies and economies. According to Abler and Falk, the power of the intercommunication service lies in enabling effective and instantaneous coordination among agencies in different locations. However, some infrastructure and personnel for such coordination must be in place in order for the Internet to generate any tangible impact. Other scholars, however, adopt what Neuman called the co-evolutionary approach in analyzing the relationship between communication technologies and time-space compression. One typical example is the work by Carey (1988). In *Technology and Society*, he provided a detailed example of how various advancements in communication technologies and changes in social institutions such as railroads, telegraph and stock markets synergized to lead to the compression of time and space.

Another school of scholars, although still recognizing the importance of technologies, view the time-space compression as a manifestation of the fundamental logic of capitalism. In *Grundrisse*, Karl Marx made the famous thesis that influenced many sociologists afterward. “While capital must strive to tear down every barrier ... to exchange and conquer the whole earth for its markets, it strives on the other side to

annihilate this space with time." (1971, p. 538-539) The concept that space is annihilated by time is adopted and further elaborated in the work by David Harvey. Heavily influenced by Karl Marx, Harvey proposed the influential concept of time-space compression. With the acceleration of the accumulation, transportation, and transaction of capital, all aspects of social life will speed up. Consequently, the time needed for everything is shortened, and physical distance, which is a counter-force to the speeding-up momentum, will be compressed to the degree of irrelevance.

Not all sociologists describe the phenomenon observed by Marx, Harvey and social geographers as the compression or annihilation of space by time. In the *Consequences of Modernity*, Giddens (1990) explained the shrinking of the world as the distanciation of time from space and vice versa. In a traditional society, time and space are always bounded, and space is almost always embedded with local happenings. This coupling of time and space is broken by a number of factors, one of which Giddens pays special attention to is wide use of mechanical clocks. Time, once perceived in conjunction with space, becomes an independent and abstract concept in modern societies. The conception of space is also changed by the Western explorers' *discovery* of remote lands devoid of any local social interactions and relations. According to Giddens, the shrinking of the world is, therefore, the process where social relations and interactions and more importantly, the perception and planning of them are stretched to the emptied times and spaces or time-space slots, without the limitation imposed by the *here* and *now*. With time-space distanciation, interactions with people who are absent in space or time become possible (Johnston, Gregory, Pratt & Watts, 2000). Although Harvey (1990) and Giddens (1990) explained the shrinking of the world with different terms, the concepts

they propose have a common ground: the challenges imposed by geographic distance become a lesser obstacle not only because of technological changes but also because of the change in how people perceive time and space.

The Role of Communication Technologies

The relationship between communication technologies and social changes have been the focus of sociological and communication studies for a long time. Fischer (1992) provided a critical summary of the frameworks used the studies of the social impacts of communication technologies. Two of the frameworks summarized by Fischer, the deterministic approach and the user-heuristic approach, are particularly useful to answer the research questions of this dissertation.

The Deterministic Approach

Internet use and international communication. While the compression of distance by time is often associated with the advancement in transportation technologies, communication technologies also play an important role as they enable fast and costless exchange of information over a long distance (Moak, 2017). The increased international communication is perhaps the least doubted effect of the Internet and is widely believed to derive directly from the intrinsic characteristics of the technology (Borcuch, Piłat-Borcuch & Świerczyńska-Kaczor, 2012). This emphasis on the effect of the technology's characteristics and their impact on the society is the most distinctive feature of the technological deterministic approach.

The central thesis of technology determinism is that the most prominent properties of a technology significantly impact one or several elements of a society, and changes in one or a few parts further alter other social elements, at last leading to

fundamental changes of the entire society (Fischer, 1992). Under this framework, an increase in long-distance communication is a predestined outcome because arguably, the most prominent feature of the Internet is its "anti-spatial" nature (Mitchell, 1995, p.8).

The mechanism of the change caused by the use of the Internet can be explained by the cultural-lag model proposed by Ogburn (1922). According to Ogburn, social change is a process of multiple stages. First, inventions are created. Some are immediately abandoned and never enter the diffusion process, but some are successful and are adopted first by some parts of the society, for example, certain social groups or some industries. While some parts of a society are quicker in their adoption or adjustment to the new technologies, others lag behind. Central to Ogburn's model of social change is the concept of cultural lag. All elements of the society do not change at the same speed, and the rapid change in one part requires readjustment in other elements. Social changes can be then conceptualized as the process through which the lagged-behind parts of the society adjust themselves to be compatible with the parts which already adjusted. Using Ogburn's model, the effect of the Internet can be summarized as a process through which all parts of the society adjust themselves to the parts which pioneered in the adoption of the Internet and used it for long-distance communication, such as researchers and large businesses (Leiner, Cerf & Clark, 2009).

Although Ogburn's model is self-consistent, it has one serious limitation: it cannot explain why certain groups used the Internet for long-distance communication in the first place. In hindsight, this issue seems pointless, since the early adopters, researchers and large businesses, did use the technology for long-distance communication. However, as Conole and Dyke (2004) critiqued, scholars who emphasize

the impact of the characteristics of a technology on users and society often take the observed usage of the technology as its most prominent feature, whereas the observed use of the technology could be a completely unintended consequence. To fully explain why the use of the Internet would lead to an increase in international communication, a different approach is necessary where the idiosyncracies not of the technology but of its users are treated as the determining force.

Although not the focus of Innis' research, the bias of communications theory developed by him provides a compelling explanation as to why advanced communication technologies are associated with an increase in international communication. Innis grouped all types of communication media into two types. Time-biased media are heavy and durable. As a result, such media restrain the expansion over territory but foster a culture that emphasizes eternity and local consolidation. By contrast, space-biased media are light and ephemeral. Thus, such media facilitate territorial expansion and foster a culture of dynamic changes. The bias of the dominant communication medium of a society determines the distinctive features of a society. More importantly, the dominant medium empowers certain classes or social groups. For example, the oral tradition empowered the old, and parchment empowered the clergy. These empowered groups become the dominant classes, and their unique characteristics often leave a mark on the society.

Innis passed away long before the advent of the Internet. Nevertheless, I believe he would agree to categorize the Internet as a space-biased medium. It can transmit information to any place in the world almost immediately. Creating or changing the content on the Internet is easy, compared to the same activities on time-biased media

such as clay and stone. If the Internet is a space-biased medium, then the critical question is: which social classes or groups does it empower? Nowadays the Internet has been used by a variety of groups. However, the early users of the technology are predominantly researchers who longed for national or international collaboration and large businesses which needed to coordinate their business operations around the country and the world (Bolaño & Vieira, 2015). Based on this observation, a tentative conclusion can be made that the Internet first empowers the social groups which have an intrinsic tendency to connect with distant people and places. Therefore, it might not be appropriate to say that the Internet *leads* to the increase in international communication. Instead, it simply empowers the social groups who are already deeply involved in international communication. With the diffusion of the Internet around the globe, this particular social group in all parts of the world are empowered, which further drives up the volume of international communication at the global level.

Internet use and cosmopolitanism. Except for Karl Marx, most of the scholars discussing the compression of time and space agree on one thing: time-space compression is not merely a physical, mechanical and objective process. More fundamentally, it is a way in which people perceive time and space and their relationship (Warf, 2008). Indeed, distance is never really dead. What matters is that in people's perception, it no longer exists. Consequently, what used to happen only locally, such as interpersonal communication and business transactions, is stretched over long distance (Giddens, 1990). Therefore, no matter what roles the Internet has played in the compression of distance by time, the process, or at least a critical part of it must have something to do with how it changes the way people perceive space and distance.

Focusing on the perceptual aspect of the effect of the Internet suggests a very powerful yet underutilized tool to analyze the time-space compression – the media ecology theory. Media ecology is the study of media as environments (Scolari, 2012). It investigates how media influence human perception, understanding, feeling and value, and how our interaction with media influences our perception of the world and existence as humans (Postman, n.d.). Under this framework, the critical question to ask is: how does the Internet change the way we perceive the world?

The key to understanding how the Internet changes people's perception of the world lies in the unprecedented speed of information transmission it enables. Since the Internet transmits information at the speed of electric waves or even light, the time needed for information to travel over the globe is reduced to milliseconds *as if* people in the other end of the world are right beside the users. As Salwen, Garrison and Driscoll (2004) described, when people browse the web, they are in the same online community no matter how far they are from each other in reality. Spence (2001) characterized online communication, which is devoid of nationalities, geographies and many of the traditional identity cues, as "the communication of disembodied minds" (p. 1). This communication of disembodied minds would further promote a perception that all humans are equal "with respect to moral worth on the sole basis of human capacity" (p.2). This perception that all humans are on an equal basis irrespective of their nationalities is the foundation of the cosmopolitan worldview that all human beings belong to the same community (Appiah, 2006), or using the famous quote of McLuhan (1962), that all human beings are in the same global village. Therefore, the more important aspect of the Internet's effect is not that it technically makes communication with people far away easier but that it makes

long-distance communication *resemble* local communication and makes users *feel* that distant people are in the same locality. Indeed, the local social interactions and relations are stretched to distant space (Giddens, 1990) because technologies allow us to do so. However, what is more important is that we never feel the "stretch": the interactions and relations are felt just like local happenings.

Of course, there are counter-arguments which suggest that communication technologies and the Internet in particular, are not a bonding force but a separating force. Instead of promoting a cosmopolitan worldview, the Internet is equally capable of reinforcing the nationality or geographically bounded identities (e.g., Lu & Yu, 2018; see more detailed discussion in Chapter 3). Therefore, the convoluted effect of the Internet on how people perceive the world is worth further exploration.

The User-Heuristic Approach

Contrary to the deterministic approach, the user-heuristic approach does not assume any predestined outcome or impose any prominent characteristic of the technology on its users or the society. As an agnostic method of inquiry, this approach demands that researchers pay attention to the detailed histories and empirical evidence on how people actually use the technology in the real world. At first sight, the user-heuristic approach might not be as powerful as the deterministic models introduced earlier since it does not clearly indicate what the effects of communication technologies are. However, as Fischer (1992) acutely critiqued, very often, deterministic studies either simply take it for granted that a technology leads to certain outcomes based on what has happened or focus only on the examples compatible with the predictions of the model while ignoring the cases that are not. Fischer's critique is well taken, and finding the empirical evidence

for the social and economic effects of the Internet lies at the heart of this dissertation. However, as Neumann (2010) pointed out, technologies might not determine a society, but they do influence it a lot. Ignoring the characteristics of the technology is as shortsighted as taking a deterministic view. Therefore, although it is problematic to take it for granted that Internet use will lead to increased international communication and the emergence of the cosmopolitan worldview, these two propositions derived from deterministic models could be subjected to empirical tests. Moreover, the fundamental thesis that the Internet would compress the physical distance by time should also be subject to empirical analysis.

The Structure of the Dissertation

Chapter 2 discusses the common methodological challenges faced by the three studies and introduces the general empirical strategy employed. In Chapter 3, the relationship between Internet use and cosmopolitanism is examined. Chapter 4 focuses on the effect of Internet use on the volume of international online communication. In Chapter 5, whether the Internet achieves the distance-compression effect through mitigating the distance effect is examined by examining the role Internet use in international trade. Since each of the three studies looks into one aspect of the roles the Internet plays in the compression of space by time, each chapter has its own introduction section where the background of each specific topic is discussed, a literature review section where prior studies directly related to the specific research question are reviewed and a method section introducing the data sources and the specific empirical strategies employed. Also, each of the three chapters ends with a conclusion and discussion section where a thorough summary and discussion of the findings of are provided. In Chapter 6,

the main findings of each study are overviewed and synopsized to shed some new light on the role of the Internet in the compression of physical distance.

Chapter 2 Methodology

Although each of the three studies focuses on different samples and time periods, methodologically, they share some common challenges. Most significantly, as many researchers (Czernich, Falck, Kretschmer & Woessmann, 2011; Shadish, Cook & Campbell, 2011; Kolko, 2012) have pointed out, Internet penetration should almost always be treated as an endogenous variable in non-experimental research either because of its correlation with unobserved heterogeneity in the observation units or reverse causality. For example, in the analysis of the relationship between Internet use and cosmopolitanism, although it is assumed that it is the use of the Internet that leads to the rise of the cosmopolitan worldview, the causality is just as likely to be from the dependent variable to the Internet, i.e., those who are more cosmopolitan are more likely to adopt the Internet in the first place. Also, in the analysis of the effect of the Internet on trade, both Internet use and the trade volume could be caused by some unobserved factors in the error term. An endogenous variable is correlated with the error term, making the coefficient estimates biased and inconsistent (Woodridge, 2016).

To tackle the endogeneity issue, for each study, a panel dataset is constructed, which allows for a variety of methods to address the endogeneity in Internet use. One of the most commonly used panel data methods is the fixed effect estimation (FE), which addresses the endogeneity by the within-transformation that removes all the time-invariant heterogeneity correlated with the independent variable. Although the FE method is a commonly used panel data method, it has a serious limitation: along with the within-transformation, all the time-invariant independent variables in the model will be differenced out. Given that certain time-invariable variables, such as the distance

between two countries and the remoteness of countries, are the key independent variables in some of the studies, an alternative method, the random effect estimation (RE) could be a better option. Random effect estimation is valid if the unobserved heterogeneity is uncorrelated with the independent variables, which might not hold in many cases. In two of the studies, the results of both the FE and RE estimations are reported, and the Hausman test is conducted to determine which method is more appropriate.

Besides the inability to estimate the effect of any time-invariant variable, the fixed effect model also suffers from some other weaknesses. First, it only removes the time-invariant unobserved heterogeneity in the observation units while leaving the time-variant heterogeneity unaddressed. Second, it cannot address the endogeneity caused by the reverse or simultaneous causality, which is particularly pertinent to the research questions I seek to answer. Given the inadequacy in the power of the fixed effect estimation, many studies (Czernich et al., 2011; Kolko, 2012) utilize the two-stage instrumental variable (2SLS IV) estimation.

As the most commonly used method to address the issue of endogeneity, the 2SLS IV estimation first estimates the endogenous regressor by a set of instrumental variables and then uses the estimated values of the endogenous regressor in place of its original values in the model estimation. The key to the validity of this method is that the IVs must be 1) strongly correlated with the endogenous variables after the effects of other exogenous variables are controlled for and 2) uncorrelated with the error term, also known as the exclusion restriction (Woodridge, 2016). However, finding the valid instrumental variables for Internet use could be challenging. A common strategy

employed in prior studies (Czernich et al., 2011; Kolko, 2012; Biswas & Kennedy, 2016) is to use the adoption of similar technologies, such as telephone and cable TV as the IVs for Internet use. Since the adoption of these technologies and the use of the Internet could both be caused by the same unobserved factors, it is a common practice to use the adoption of the earlier technologies prior to the first year of observations in the sample as the IV. In two of the studies, the 2SLS IV approach is used to analyze the effect of Internet use. However, it is worth emphasizing the limitations of this method. First, if only one external IV[1] is available, then there is no way to test whether the overidentification condition is satisfied. Second, as shown in the later chapters, besides Internet use, many other variables in the models, such as the GDP per capita and the level of government censorship, could also suffer from endogeneity. Given the difficulty of finding good IVs even for one endogenous variable, the existence of multiple endogenous variables makes it impractical, if not impossible to use estimation based on external IVs.

Given the difficulty of finding valid external IVs, this study addresses the endogeneity issue in Internet use with a third method: the generalized methods of moments (GMM) estimation. First developed by Arrellano and Bond (1991), the GMM estimation addresses the endogeneity issue by using the internal IVs, i.e., the time-lagged endogenous variable. In conventional difference-GMM estimation, the differenced equation (where all variables are first-difference transformed) is estimated with the endogenous variables instrumented by the lagged levels of the endogenous variables (Arrellano & Bond, 1991). However, later studies show that the difference-GMM estimation often suffers from weak instrument issues when the dependent variable is

[1] The exogenous variables in the model can also be used as the IV for the endogenous variables. External IVs refer to the ones that are not included in the original estimation model.

highly persistent (Stock, Wright & Yogo, 2002). Therefore, the two-step system GMM proposed by Blundell and Bond (1998) is used. In addition to the estimation of the differenced equation, the two-step system GMM also estimates a level equation (where all variables are in their original forms) where the endogenous variables are instrumented by the lagged endogenous variables in their differenced forms[2].

Besides the reliance on internal IVs, the GMM method also offers some other advantages. First, it can correct for the bias and inconsistency in the estimates of panel data with a large number of cross-sectional units but a small number of time periods (Nickell, 1981), which is exactly the case for the data used in all of the three studies. Second, GMM estimation is a suitable method for the estimation of dynamic processes. As Hall (2005) pointed out, many phenomena in social sciences have a dynamic nature, i.e., the current value of the dependent variable is influenced by its past values. The effects of the Internet examined in the studies, the cosmopolitan tendency of countries, the volume of international online communication and the volume of international trade, are all likely to have a dynamic nature. Therefore, the Woodridge test for autocorrelation is run in each of the studies. If the current value of the dependent variable is significantly impacted by its past values, its one-year lag is included in the model as a RHS variable. In spite of all the advantages discussed, the GMM estimation does have a serious limitation: the number of IVs cannot be greater than that of the observation unit (for the three studies in this dissertation, countries). Therefore, a tradeoff must be made. On the one hand, having too many IVs (e.g., using deeper lags of the endogenous variables)

[2] In the differenced equation, $D.\ y_{it} = c + \beta_1\ D.\ x_{it} + \beta_2\ D.\ z_{it} + v_{it}$ where x_{it} is the endogenous variable, the lagged endogenous variable, such as x_{it-1} and x_{it-2}, are used as the IVs for $D.\ x_{it}$. In the level equation, $y_{it} = c + \beta_1 x_{it} + \beta_2\ z_{it} + v_{it}$, the lagged endogenous variables in difference, such as $D.\ x_{it-1}$ and $D.\ x_{it-2}$ are used as the IVs for x_{it}. The depth of lags used can be adjusted dependent on the number of available time period.

would make the results of the validity tests invalid. On the other hand, having too few IVs will leave the endogeneity insufficiently addressed (Roodman, 2009). To balance the reduction of bias and the accuracy of the validity test results, a limit is set for the number of lags used in the IVs, and the collapse function in STATA is applied to further reduce the number of IVs.

Chapter 3 INTERNET USE AND COSMOPOLITANISM

Introduction

The role of the Internet in national identity building has long been discussed. On whether the Internet is an agent of cosmopolitanism – the worldview that all humans belong to the same community irrespective of nationalities (Merton, 1964), two camps with conflicting arguments have formed. On the one hand, the de-territorial nature of the Internet is believed to make national borders and identities less relevant (Lu & Yu, 2018), and the constant exposure to other cultures and frequent interactions with people from different countries and cultural backgrounds would foster a cosmopolitan worldview. On the other hand, another group of scholars argues that the destruction of the meanings of locales, peoples and groups by the Internet has in fact strengthened the internal need of human beings for stability, certainty and commonality. Therefore, the shared identity based on geography and nationalities is reaffirmed in the age of the Internet (Castells, 1996).

Although there are many conceptual and theoretical discussions on this topic, there is little empirical analysis of the relationship between Internet use and cosmopolitanism. Using the European Values Study data, this study applies several panel model estimation strategies to test the influence of Internet use, and its potential non-linear impact on cosmopolitan orientation at the country level. The main contribution of this study is threefold. First, in the few studies which empirically test the relationship between Internet and cosmopolitanism at the national level (Norris, 2000; Verboord, 2017), the endogeneity of Internet use is not properly addressed. Using the system GMM method, the result of this study could provide a more reliable estimate of the effect of

Internet use. Second, by extending the factors found to be strong predictors for cosmopolitanism at the individual level to a national level analysis, this study tests the applicability of these individual-level factors in the prediction of national cosmopolitan tendency. Also, by adding new factors pertinent to the characteristics of the countries, this study makes an exploratory effort to the building of a model of national cosmopolitan tendency. Third, the study makes a significant theoretical contribution by providing a potential reconciliation to the two conflicting theses regarding the role the Internet plays in fostering cosmopolitanism. By showing the non-linearity in the effect of Internet adoption, the study suggests that the two conflicting theses, in fact, point to the Internet's effects at different phases of the technology's diffusion.

The rest of the paper is structured as follows. In the next section, related studies on defining and operationalizing cosmopolitanism, and on the effect of the Internet on cosmopolitanism and national identity are reviewed. The third section describes the data and empirical methods used in the study, followed by the analyses and empirical results. The last section provides a summary of the main findings and implications of the study. The limitation of this study is also discussed in this section.

Literature Review

The Definition of Cosmopolitanism

It is believed that the Cynics in the 4th Century BC first developed the notion of cosmopolitanism, "citizens of the cosmos" (Appiah, 2006, xiv). The concept was first used to explain the relationship between individuals and state or kinship-based communities. A cosmopolitan believes that loyalty may not be solely given to the state polis or kinship but also to a universal shared identity (Nussbaum, 1997). Later, this

notion was further developed by the Stoics, who proposed that the identity of a man is not based on one's immediate physical environment such as cities or states, but a holistic human community bonded by reason and irrespective of local identities (Badger, 2014). An influential thinker on cosmopolitanism, Immanuel Kant, in *Perpetual Peace*, emphasized that such a holistic human community means there exists universal rights of all humans or universal humanitarian laws shared by all human beings (Taylor, 2010). As Kwame Appiah (2006), one of the most widely cited contemporary scholars of cosmopolitanism, summarized, cosmopolitanism is a forming condition and an ideal of a global community based on shared morality, economic interaction and inclusive political structure that transcends different nation-states and promotes mutual respect.

As Pichler (2009) pointed out, cosmopolitanism is a complicated, multifaceted concept. According to Vertovec and Cohen (2002), there are at least four aspects of cosmopolitanism. First, it is a condition or reality that is shaped by the ever-tightening links among countries around the globe and people in different places. Second, it is a worldview that all human beings are citizens of the world. Third, it refers to the efforts to build a cosmopolitan world. Forth, it is manifested as a set of attitudes, such as being open to other cultures, tolerant or fond of cultural pluralities and hospitable to immigrants and foreigners. Despite the complexity of the concept, it is generally agreed that the essence and central message of cosmopolitanism is that all humans belong to one community (Merton, 1964).

Operationalization of Cosmopolitanism

Although there is an abundant discussion on the definitions and scope of cosmopolitanism, concrete and feasible operationalization is needed to evaluate the status

of cosmopolitanism and its consequences. Broadly speaking, the measurements of cosmopolitanism can be grouped into three categories. The most commonly used method is the "identity approach" (Pichler, 2009, p.709). This approach operationalizes cosmopolitanism as the degree of attachment to one's immediate locality, such as city, region, and country versus his or her attachment to the world as a whole. One widely cited metric using the identity approach is developed by Roudometof (2005), who used a four-question survey to gauge the degree to which a person is attached to his or her locality or state. From the answers, the level of localism, which is the opposite of cosmopolitanism, can be evaluated. The identity approach is also adopted in many large-scale social surveys such as the World Value Survey, European Values Study and Eurobarometer. Using the World Values Survey and European Values Study data for 1990-1991 and 1995-1997, Norris (2000) evaluated the status of cosmopolitanism, and found that 47% of the respondents could be classified as localism, as they first and foremost identified with the localities or the regions (states, counties, provinces) they resided in, whereas only 2% of them were pure cosmopolitans who first saw themselves as citizens of the world.

Some scholars criticize that such a one-dimensional measurement omits much of the complexity in the concept and propose an attitude-based approach of measurement. For example, Olofsson and Öhman (2007) extended the one-dimensional, localism-cosmopolitanism metric proposed by Roudometof (2005) with an additional protectionism – openness continuum. Using the International Social Survey Programme data, their analysis shows that people with cosmopolitan orientation could also possess protectionist attitudes, and localists could also be open to foreign cultures and people.

Although the attitudes-oriented approach can effectively capture the nuance in the concept of cosmopolitanism, there is no consensus on what attitudes should be measured as the manifestation of cosmopolitanism.

The third type of metrics, which measure cosmopolitan behaviors, resonates with the third dimension in Vertovec and Cohen's model (2002), which summarizes cosmopolitanism a set of efforts to build a cosmopolitan world. For example, Dimitrovic, Vida and Reardon (2009) analyzed the purchasing behaviors of 1954 residents of seven Balkan countries and developed a scale that measures consumer cosmopolitanism. At one end is consumer ethnocentrism, and at the other is consumer worldliness. A negative relationship is detected between cosmopolitan orientation and consumer ethnocentrism. Various other behavior-based measurements have been developed which evaluate the level of involvement in local activities as compared to those that involve foreign culture (Dye, 1963) and interest in information about international events (Jain & Etgar, 1977). However, as Riefler and Diamantopoulos (2009) critiqued, these various expressions and behaviors are indeed part of cosmopolitanism, but their comprehensiveness and ability to fully capture the construct remains questionable. Also, from an analytical perspective, these behaviors and expressions are the causes as well as consequences of cosmopolitanism. Therefore, using these measurements would make any empirical analysis prone to the simultaneous causality issue.

Although the identity approach of operationalization may be oversimplified, its direct relation to the central thesis of cosmopolitanism, the ease of implementation and its wide use in large-scale social surveys make it an ideal cosmopolitanism indicator for cross-country analysis. Therefore, this study follows the identity tradition and

operationalizes cosmopolitanism as the degree to which people believe that they are citizens of the world.

Internet and Cosmopolitanism

The acceleration of globalization in the past few decades has spurred a new round of studies which examine and critique the effect of the increasing transnational flows of people, goods, services and information on perceptions of nation states and identities (Beck, 2002; Badger, 2014). Among all these emerging phenomena, the rise of new media, particularly the Internet, has attracted much attention. Several distinct features of the Internet make it an ideal agent of cosmopolitanism. For example, as Salwen, Garrison and Driscoll (2004) described, when users browse the web, they are constantly directed to content produced by people from other cultures or countries, and search engines do not discriminate the content by the country of origin when a keyword is searched. Thus, the Internet provides its users an unlimited and unprecedented opportunity to embrace and familiarize themselves with events in other countries and foreign cultures, cultivating interest in and identification with people and cultures outside ones' own immediate environment (Jeffres, Atkin & Bracken, 2004).

In *Cosmopolitanism: Ethics in a World of Strangers*, Appiah (2006) summarized the role of the World Wide Web as a means by which we can learn about life everywhere and also affect life everywhere. Because "each person you know about and can affect is someone to whom you have responsibilities (xxiii)", the Internet becomes a tool that lays the basis for a cosmopolitan morality. Not all scholars attribute the cosmopolitanism-promoting potential of the Internet to its facilitation of the learning and appreciation of foreign cultures. For example, Spence (2001) argued that the Internet makes traditional

factors that determine people's identities much less irrelevant, and communication on the web becomes the "communication of disembodied minds" (p.1). This communication of disembodied minds promotes a perception that all humans are equal "with respect to moral worth on the sole basis of human capacity" (p.2).

Scholars in media studies and technology diffusion often conceptualize cosmopolitanism as a motive that leads to the adoption of new media. In one of the earliest studies which touches on the relationship between new media adoption and cosmopolitanism, Neuendorf, Atkin and Jeffres (1998) applied the uses and gratification theory to explain the adoption of audio information services and fax, and found that interest in people, events and ideas outsides one's own environment, a basic element of a cosmopolitan worldview, to be a strong predictor of the new media adoption. Defining cosmopolitanism as the "degree to which an individual is oriented outside a social system" (p.290), Rogers (2003) observed that the social ties cosmopolitans establish outside their own societies, and their familiarity and possibly deeper identification with other social systems, would lead to a social distance from the particular tendencies and norms of the cosmopolitan's own societies. This social distance frees the cosmopolitan from the local constraints and allows the person to try out innovation.

Based on the review of prior studies, there is clearly a simultaneous causality in the relationship between Internet usage and cosmopolitanism. On the one hand, the use of new communication technologies could nurture cosmopolitanism among the users. On the other hand, the adopters of the new technology, particularly the early adopters, are more likely to be well-educated, high-income, urban residents who are cosmopolitan in the first place (Rössel & Schroedter, 2015; Lunn & Suman, 2008). Therefore, to argue

that the Internet is an agent of cosmopolitanism requires empirical studies and particularly the analysis which properly addresses the endogeneity in Internet usage. However, to the best knowledge of the author, such studies are very limited. The study by Norris and Inglehart (2009) is one of the few attempts to empirically test the relationship between the Internet and cosmopolitanism. Based on data for over 50 countries, the authors found that after controlling for factors such as the traditional media use patterns and socioeconomic and demographic factors, using the Internet for news consumption has a strong correlation with higher interest in and tolerance of other cultures. However, as the authors themselves pointed out, the main purpose of their study is to establish correlation rather than causality. Therefore, only limited efforts were made to correct for the reverse causality issue. Also, a critical element of the Cosmopolitanism Index the authors constructed is the Globalization Index calculated by the KOF Swiss Economic Institute, which itself measures several factors such as the existence of free trade promotion policies, the participation in international organizations and the telephone subscription rate (Gygli, Haelg, Potrafke & Sturm, 2019). Arguably, many of these factors in this measurement could also be the cause of cosmopolitanism. Thus, the positive correlation between Internet use and cosmopolitanism Norris and Inglehart found could be very misleading.

The study by Verboord (2017) is the closest to the current research. Using the Eurobarometer data, the author analyzed the effects of the frequency and intensity of several online activities, such as downloading free movies and purchasing cultural products online, on the users' interest in foreign cultures and cosmopolitan orientation. The multilevel analyses show that using interactive online functions such as chat rooms

and IP telephony has a positive effect on interest in foreign cultures and cosmopolitan orientation, whereas purchasing cultural products online predicts that the users are interested in foreign cultures. The author did control for several potential confounding factors such as education, income and the user's existing overseas social ties and international experience and therefore, addressed the endogeneity issue to some degree. However, several other variables in the model, e.g., educational attainment and income, are potentially endogenous as well. Since endogenous variables bias the estimates not only for themselves but also for other variables (Woodridge, 2016), failure to address the endogeneity in these control variables could make the estimated effect of Internet usage misleading.

Internet and Nationalism

Although many studies have suggested that the Internet could foster a cosmopolitan worldview, many other scholars argue that the use of the Internet, in fact, strengthens the role of national identities and promotes nationalistic mentality and behaviors. Putting aside the debate on whether nationalists put the interests of their own countries in the first place, nationalism, as compared to cosmopolitanism, maintains that individuals' identities are always and should be bound by geography and nationalities (Voronkova, 2010). It might not be appropriate to say that nationalism is the direct opposite of cosmopolitanism since many studies have suggested (Bowden, 2003; Olofsson & Öhman, 2007; Boyne, 2011) that people with cosmopolitan orientation could also have some nationalistic attitudes. Nevertheless, there is little doubt that they represent distinctively different and competing worldviews. Therefore, the studies about

Internet usage and nationalism could also help us better understand the role the Internet plays in fostering cosmopolitanism.

In his discussion about the relationship between the Internet and self-identity, Castells (1996) argued that the Internet results in the destruction of the meanings of locales, peoples and groups and the restructuration of those meanings in the logic of the network. The reaction to the destruction and restructuration often takes the form of affirming the most basic cultural, historical, geographical and biological commonalities as the state of existence. Therefore, national identity is strengthened rather than weakened. Similarly, Flanagin and Metzger (2001) commented that the outcome of Internet development is, at best, a case of information overload with rumors and misinformation, disrupting the social orders based on stability and certainty. Facing this high level of instability and uncertainty, not all people would embrace it. Instead, some might seek out the stability and certainty provided by a strong national identity (Lu & Yu, 2018).

Taking a social constructionist approach in their studies, scholars in this camp often critique that the technological potential of the Internet to greatly facilitate cross-border communication and foster mutual understanding does not necessarily mean people *will* use it for that purpose. In many cases, the Internet is used as an enabler or catalyst of ethnocentrism and nationalism (Ericksen, 2007). Numerous examples, such as the online anti-Japan nationalistic movement in China (Hyun, Kim & Sun, 2014) and the large number of websites created by Dutch-Iranians to maintain connections to the immigrants' cultural motherland (Eriksen, 2007), illustrate that, just as the Internet can be used to promote a cosmopolitan orientation, it can also be used no less effectively to strengthen

national identity and nationalism . As Lotz (2007) summarized, the Internet not only exposes people to foreign cultures, it also ensures that all citizens who are on the web stay tuned to domestic and national cultures. More importantly, the awareness facilitated by the interactive nature of the Internet that many other compatriots are also consuming the same media content at the same time could foster a strong national identification among all users (Anderson, 2006)

Given the complexity of the relationship between the Internet and national or world citizen identity formation, it is likely that the effect of Internet use on cosmopolitanism is a non-uniform and possibly, a non-linear one. However, as Lu and Yu (2018) pointed out, the "cosmopolitan-effect" and "nationalist-effect" camps follow two distinct approaches. There is little effort to reconcile the two conflicting theses. This study proposes and tests a possible explanation that could make the two contradictory theses compatible: once the diffusion of the Internet exceeds a certain level, its effect on nationalism/cosmopolitanism will shift.

Data and Method

The Dependent Variable

To evaluate cosmopolitan orientation, this study uses the European Value Study (EVS), a large-scale, international social survey project administered by the European Value Systems Study Group, as the main source of data. Since 1981, the survey has been conducted every 10 years in European countries. A random, representative sample of approximately 1000 respondents aged 18 or older are selected for each participant country, and the respondents are surveyed in face-to-face interviews (EVS, *n.d.*). With a wide range of questions regarding family, work, life, society, religion and politics, the

EVS is one of the most widely used sources in research about popular culture and attitudes, including the cosmopolitan orientation (Norris, 2000; Sinnott, 2006; Pichler, 2009).

Specifically, Question 69 of the survey, which asks people to rank their feelings of belonging to various geographic units from the immediate locality (i.e., cities, towns, etc.), region, country, continent to the world as a whole, is used as the main instrument. The wording of the question reads "*Which of these geographical groups would you say you belong to first of all? And second? And which do you belong to least of all?"* Therefore, a higher ranking given to "the world as a whole" indicates that the person has a higher cosmopolitan orientation. Given the wide range of geographic options, those who first identified themselves as a world citizen or European citizen were both considered to have a cosmopolitan worldview. For each country, a continuous variable, *Cosmopolitanism*, is created by calculating the percentage of respondents with cosmopolitan orientation in all the participants of the country. Three waves of EVS data (1990, 1999 and 2008) are used for this study. The 1990 survey was conducted in 27 countries, all of which were included in the 1999 and 2008 surveys. Thus, a 3-year panel for 27 countries is constructed. Appendix A provides a list of participant countries.

Admittedly, the dependent variable falls short of a comprehensive measurement of the complex concept of cosmopolitanism. It predominantly focuses on the identity aspect of the concept while leaving other dimensions, particularly the one regarding the attitudes toward foreign people and cultures, inadequately addressed. Several questions in the EVS do touch upon some of the attitudinal aspects of cosmopolitanism. Nevertheless, as Vertovec and Cohen (2002) argued, cosmopolitanism can only be captured by a set of

attitudes rather than any single attitudinal dimension alone. Therefore, a valid metric for cosmopolitanism would require a scale composed of multiple items measuring several attitudinal items. Such a scale is not possible, given the use of country rather than individual as the unit of analysis and the percentage of cosmopolitan citizens as the dependent variable[3]. Therefore, the result of the analysis should be interpreted as the effect of the Internet on only one aspect of cosmopolitanism.

It should be noted that although the EVS data are at the individual level, the unit of analysis of this study is countries, and the calculated percentage of the population with cosmopolitan orientation is used as an indicator of the country's general cosmopolitan tendency. Accordingly, the effect of Internet use at the national level is examined.

Internet Use

The main independent variable of interest is the percentage of Internet users for each country, obtained from the World Bank Open Data website. Since the data are based on individuals who have used the Internet in the last 3 months on all kinds of devices and in all kinds of venues. Arguably, countries with many occasional users who access the Internet in public computer centers or mainly through dial-up services would be reported to have the same level of Internet use as countries with many fixed broadband users—this might be a problem. However, other sources of data, for example, the OECD ICT Statistics and the ITU World Telecommunications Indicators database, either fail to cover all the three years or only provide the broadband subscription rate. Since this study focuses on the effect of Internet use, which includes both the subscription-based, intensive use and occasional and casual use, the World Bank Data are still the best option

[3] For instance, if a country has 20% of its population having one aspect of cosmopolitan attitudes and 30% having another, it makes no sense to conclude that 25% of the population are cosmopolitans.

available for this study despite the aforementioned issue. It is critical to emphasize that the data shows the extent or breadth of Internet usage in a country rather than the intensity of usage. Based on the review of the literature, it is possible that the effect of Internet use on cosmopolitanism is nonlinear. Thus, the quadratic form of the variable $Internet^2$, is included in the model in order to capture the potential non-linear effect of Internet use on cosmopolitan orientation. The inclusion of the quadratic form of the Internet variable is also strongly supported by the data, as the preliminary test using only the linear form of the variable indicates that Internet use has no impact at all on cosmopolitanism. The insignificance of the effect suggests that having only the linear form of the variable is inadequate to capture either of the effects of Internet discussed in the literature (Castells, 1996; Appiah, 2006; Lu & Yu, 2018), let alone reconciliating them.

Control Variables

According to prior studies, a number of socioeconomic, demographic and cultural factors are believed to have a certain impact on cosmopolitanism. First, many studies suggest that younger people, the better educated, people with higher income and urban residents are more likely to be open-minded and global-oriented (Szerszynski & Urry, 2002; Pichler, 2008; Rössel & Schroedter, 2015). To control for the effects of these factors, data on the percentage of the population aged 65 or older, the tertiary education enrollment rate, GDP per capita and percentage of the rural population are downloaded from the World Bank Open Data for each country.

Second, several studies have shown that the lack of social trust is a strong predictor of xenophobic or nationalistic mentality or behaviors (Steenkamp, 2009;

Sharipova, Burkhanov & Alpeissova, 2017). Thus, this study also includes social trust as a potential determinant of cosmopolitanism and explores its effect. Question 7 of the EVS, which asks "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" is used as the main measurement. The percentage of respondents who chose most people can be trusted is calculated for each country. However, the effect of social trust on cosmopolitanism could be more complicated. A society where most people trust each other might indicate that the society has a high level of solidarity. This is supported by the strong correlation (Pearson's $r = 0.79$, $p < 0.01$) between the level of social trust and the country solidarity index among the 26 European states in the sample, obtained from the EUROSTAT database. As Hechter (1987) pointed out, nationalism often involves within-group solidarity. Instead of contributing to cosmopolitanism, an exceptionally high level of social trust could also be associated with nationalism. Hence, the effect of social trust on cosmopolitanism could also be a non-linear one, which is also supported by the scatter plot (see Appendix B). In order to test for the possible non-linearity in the effect of social trust, a quadratic form of the variable is also included in the model.

Third, the political institutions of a country could greatly influence its citizens' attitudes toward the world and foreigners. Non-democratic regimes which suppress personal freedom are more likely to promote populist nationalism or xenophobia in order to legitimize and consolidate authoritarian governance (Catterall, 2011). In this study, the Empowerment Index computed by the CIRI Human Rights Project is employed to control for the effect of government types on citizens' worldviews. The index measures the level of government interference with the freedom of speech, assembly, association and

demonstration, self-determination and domestic/international movement. A higher score indicates a higher degree of authoritarian governance.

Not only the political institutions of a country can influence the worldview of its citizens but also the political stance of the citizens can determine the general level of cosmopolitanism of a country. On the one hand, as Calhoun pointed out (2012), cosmopolitanism is often associated with liberalism, and in many political discussions, cosmopolitanism is referred to as the liberal cosmopolitanism. Liberals, who emphasize the sacredness and universality of human rights, would be more likely to downplay the differences among nations and believe that at least some values should be treasured and enjoyed by all human beings. On the other hand, not all scholars believe that liberalism leads to cosmopolitanism. As it is summarized in Brock (2002), the essence of cosmopolitanism is that all human beings are of equal moral values, and the differences among humans, including the ones rooted in the differences among nations, must be acknowledged and treasured. Therefore, the respect of, if not emphasis on national identity is not an impediment but a prerequisite for a truly cosmopolitan world. To capture the controversial effect of the liberal political stance on cosmopolitanism, the answers to Question 57 of the EVS, which asks the respondents to self-evaluate their political position on a liberal-conservative scale, are coded to show the percentage of population having a liberal political stance in a country.

Last, the share of trade (export and import) in a country's GDP, *Openness*, is included to control for the effect of economic globalization. While many scholars have argued that the rise of international trade has created an increasingly homogenous world of convergent tastes and morality and therefore, weakens the relevance of national

identities (Lan & Li, 2014), many others have found that the homogenizing power of international trade, which erodes national borders, indigenous cultures, and national identities, has backfired and led to a resurgence of nationalistic or even xenophobic mentalities (Colantone & Stanig, 2018). Therefore, the squared *Openness* is also included in the model to allow for the potential non-linear effect of this factor.

The summary of the data used for this study is presented in Table 1. Note that some economic and demographic data for 1990 are not available for the former Soviet Union or Yugoslavian countries. In this case, the observations were proxied with the earliest available data after they gained independence.

Table 1 Data Summary

Variable	**Definition**	**N**	**Mean**	**SD**	**Min**	**Max**
Cosmopolitanism	% of population with a cosmopolitan worldview	78	10.17	5.03	0.00	28.64
Internet	% of population using the Internet	78	26.55	29.96	0.00	91.00
Older	% of population aged 65 or above	78	14.53	2.46	9.95	20.07
College	Tertiary education enrollment rate	78	45.95	19.78	8.41	94.69
GDPpc	GDP per capita (current $)	78	26094.17	11491.03	5828.92	47134.30
Rural	% of population living rural areas	78	29.84	13.88	2.45	59.54
Trust	% of population who generally trust others	78	31.74	14.85	9.86	74.98
Suppression	The degree of human rights violation	78	11.23	3.12	1.00	14.00
Liberal	% of population with a liberal political stance	78	21.53	8.48	3.31	37.40
Openness	% of trade in GDP	78	88.99	45.82	32.34	297.20

*****Data on *Cosmopolitanism* and *Trust* were calculated based on EVS results. Data on *Internet*, *Older*, *College*, *GDPpc*, *Rural* and *Openness* were obtained from World Bank Open Data. Data on *Suppression* is from the CIRI Human Rights Project database. One country is removed because of the lack of Internet adoption data. All data are available for 1990, 1999 and 2008.

The Model and Estimation Strategy

Severe multicollinearity could cause inflated estimates of the standard error (Woodridge, 2010) and therefore, must be removed from the estimation model. Based on the VIF test, two variables, *College* (VIF = 13.49) and *GDPpc* (VIF = 21.24), could potentially cause severe multicollinearity problems. Nevertheless, they are still included in the model to avoid omitted variable bias. As a result, a more lenient standard of statistical significance, i.e., a higher p-value (p = 0.1), is used in the testing. The data were also screened for outliers and non-normality, and no observations needed to be deleted or variables transformed. The model for estimation is constructed as follows:

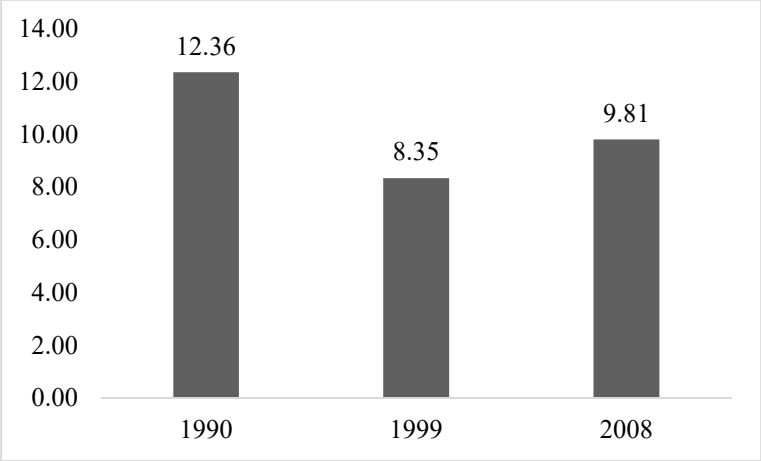
$$Cosmopolitanism_{it} = constant + \beta_1 Internet_{it} + \beta_2 Internet^2_{it} + \beta_3 Older_{it} + \beta_4 College_{it} + \beta_5 Rural_{it} + \beta_6 Trust_{it} + \beta_7 Trust^2_{it} + \beta_8 Supression_{it} + \beta_9 Liberal_{it} + \beta_{10} GDPpc_{it} + \beta_{11} Openness_{it} + \beta_{12} Openness^2_{it} + \beta_{13} T + v_{it},$$ where t = 1990,1999 and 2008, T is the year dummies and v_{it} is the error term.

Several panel data estimation approaches to address the endogeneity in Internet use are employed, including fixed effect estimation (FE), random effect estimation (RE), two-stage least square instrumental variable estimation (2SLS IV) and system generalized methods of moments (system GMM). All the data preparation, transformation and analysis were conducted on STATA 15.

Analyses and Results

As Figure 3 shows, in 1990, approximately 12% of the population surveyed had a cosmopolitan orientation. The number dropped to about 9% in 1999 and then increased slightly to about 10% in 2008.

Figure 2. The Percentage of Population with Cosmopolitan Orientation



The ANOVA test indicates a significant drop in the percentage of the population with cosmopolitan orientation in the surveyed countries during the periods under study ($F = 4.64$, $p < 0.05$) despite a dramatic increase in the percentage of the population using the Internet from 0.07% in 1990 to 64% in 2008.

The remarkably higher percentage of people possessing cosmopolitan worldview in 1990 is an observation worth careful examination. Given that some European countries, particularly the former Yugoslavian, Soviet Union states and Eastern Europe States, had just gone through or were in the process of major political changes in 1990, the high level of cosmopolitanism observed could be the result of the short-term shocks of the political events, for instance, the breakup of the socialist regimes. Therefore, although the study has a relatively small sample size of 26 countries, it is still necessary to conduct some robustness check to see whether the effect of Internet use differs when the former Yugoslavia countries (including Croatia and Slovenia in the sample) and former Soviet Union states (Estonia, Lithuania and Latvia in the sample) are excluded.

The Regression Analyses

The baseline results obtained from the FE and RE estimation are reported in Table 2. As shown in the table, both estimations indicate the existence of a non-linear relationship between Internet use and cosmopolitanism, where the increase in the percentage of Internet users in the total population first drove down the percentage of population with cosmopolitan worldview and then, when the diffusion of the technology reached a certain level, it began to generate positive impact.

Table 2. Fixed and Random Effects Estimators

	FE	**RE**
Internet	-0.09 [0.05] $^{+}$	-0.10 [0.06] $^{+}$
Internet^2	0.001 [0.0005] *	0.001 [0.0001] **
Older	-0.11 [0.43]	0.20 [0.25]
College	-0.03 [0.06]	-0.04 [0.04]
Rural	0.05 [0.17]	-0.01 [0.07]
Trust	0.66 [0.25] *	0.54 [0.16] **
Trust^2	-0.005 [0.003] $^{+}$	-0.006 [0.002] **
Suppression	-0.19 [0.17]	-0.24 [0.18]
Liberal	0.06 [0.10]	0.14 [0.08] $^{+}$
GDPpc	0.0002 [0.0002]	-0.0001 [0.0001]
Openness	-0.04 [0.04]	-0.05 [0.03] $^{+}$
Openness^2	0.0002 [0.0001] $^{+}$	0.0001 [0.0001] $^{+}$
Constant	0.31 [7.84]	3.80 [6.53]
F/Wald Chi^2	F (14,25) = 5.88	Wald Chi^2(14) = 141.35
R^2	0.21	0.37

Note: Year dummies are included in the model. Unstandardized coefficients and heteroscedasticity-robust standard errors are reported. **p < 0.01, * p < 0.05, $^{+}$ p < 0.1

Although in most cases, the fixed effect model is preferred, since the unobserved, time-invariant heterogeneity can be completely removed, random effect model gives more efficient estimates if the unobserved heterogeneity is uncorrelated with independent variables (Woodridge, 2010). To decide which model is better, the Hausman test was

conducted. The result indicates that the random effect model would be more appropriate, Chi^2 (9) = 7.06, p = 0.79.

The 2SLS IV Result

In light of prior studies (Czernich et al., 2011; Kolko, 2012), three variables, the telephone subscription rate, cable TV subscription rate and the population density are selected as the potential IV candidates. Since the adoption of telephones and cable TV could be influenced by the same factors that lead to the use of the Internet, using the telephone and cable subscriptions in the same years as the Internet use is observed could violate the exogeneity condition of the IVs. As a result, prior studies using the IV method often select the adoption of similar technologies long before the first year of observation as the IV (Czernich et al., 2011; Biswas & Kennedy, 2016). To ensure that data are available for all the countries, the cable TV and telephone subscription rate in 1985 are used in this study. As Table 3 shows, only the telephone subscription rate is strongly correlated with the percentage of the population using the Internet rate after controlling for the effects of other independent variables.

Table 3. First Stage Random Effect Estimators

Dependent Variable: *Internet*	**Coefficient**	**Std. E**	**R^2**
IV: *Telesubs*	0.21***	0.08	0.95
IV: *Cablesubs*	0.11	0.1	0.94
IV: *Density*	0.07^{+}	0.04	0.94

Note: The endogenous variable, *Internet*, is regressed on the potential IVs and other independent variables. The estimated values of *Internet* replace the original values of *Internet* in the second-stage regression. *** $p < 0.001$, $^{+}$ $p < 0.1$

Based on the first-stage result, the telephone subscription rate in 1985, *Telesubs* is selected as the IV for Internet usage. The result of the second-stage regression is reported in Table 4.

Table 4. 2SLS IV Random Effect Result (Second Stage)

Dependent Variable: *Cosmopolitanism*	**Coefficients**	**Std. E**
Internet	-0.43	0.36
Internet^2	0.0001	0.003
Older	-0.21	0.47
College	-0.07	0.16
Rural	0.07	0.11
Trust	0.64	0.25 *
Trust^2	-0.005	0.003 $^+$
Suppression	-0.10	0.33
Liberal	0.06	0.12
GDPpc	-0.0001	0.0002
Openness	-0.04	0.03$^+$
Openness^2	0.0001	0.0001
Constant	4.26	11.44
Wald Chi^2(14)	72.68	
R^2	0.14	

According to the result, after Internet use is instrumented by the telephone subscription rate in 1985, it is no longer a significant predictor for cosmopolitanism. However, this result could be misleading for two reasons. First, since only one excluded instrument is used, the Sargan test cannot be run. Thus, it is not clear whether the overidentification restriction of the IVs is valid. Second, it is reasonable to doubt the exogeneity of other explanatory variables as well. For example, it is likely that the respondents first developed a cosmopolitan worldview. As a result, they tended to trust people. Also, it is possible that countries with a larger cosmopolitan population tend to more actively participate in international trade. This reverse causality would mean that these two variables are also correlated with the error term, and therefore, endogenous. Since the existence of endogeneity biases not only the coefficient estimate of the endogenous variable but of all other explanatory variables (Woodridge, 2016), all the endogenous variables must be instrumented in order to obtain valid estimates. Given the

difficulty of finding valid instruments, the existence of multiple endogenous variables makes it impractical, if not impossible to use estimation based on excluded IVs.

The GMM Result

The difficulty of finding reliable external instrumental variables makes the use of GMM estimation an attractive alternative. While GMM is usually employed to estimate dynamic panel models, i.e., models in which the lagged dependent variable is included as an explanatory variable, no first-order serial correlation in the dependent variable, *Cosmopolitanism*, is detected by the Woodridge test, $F(1,25) = 3.3$, $p > 0.5$. This means that the past level of cosmopolitanism is a poor predictor of its later level, which is likely to be caused by the 10-year gap between each round of observations in the data. Therefore, the lagged dependent variable is not included as a RHS variable. The use of GMM to estimate non-dynamic panels has been discussed in previous literature and illustrated by other studies (Aguirregabiria, 2009; Alonso-Borrego, 2010; Biswas & Kennedy, 2016).

In the current analysis, the two-step system GMM approach developed by Blundell and Bond (1998) is used. The two-step system GMM utilizes the lagged level and lagged difference of the endogenous variable as the instruments for the differenced equation and the level equation, respectively and is generally preferred to the conventional difference GMM (Davidson & MacKinnon, 2004). The result of the two-step system GMM estimation is reported in Table 5.

Table 5. The Two-Step System GMM Results

Dependent variable: *Cosmopolitanism*	**Coefficients**	**Robust SE**
Internet	-0.09	0.06 $^{+}$
Internet^2	0.002	0.0005 **
Older	0.35	0.38
Rural	-0.04	0.09
College	-0.02	0.06
GDPpc	-0.0002	0.0003
Trust	0.59	0.27 *
Trust^2	-0.007	0.002 *
Liberal	0.16	0.09
Suppression	-0.23	0.32
Openness	-0.09	0.04 *
Openness^2	0.0003	0.0001 *
Constant	4.58	10.02
# of Instruments	22	
Obs - Countries	78-26	
AR(1) p-value	0.63	
Sargan test p-value	0.14	
Hansen test p - value	0.39	
F (15, 25)	22.11	

Note: Year dummies are added in the model. Unstandardized coefficients are reported. Numbers in the brackets are heteroscedasticity-robust standard errors. *** $p < 0.001$, **$p < 0.01$, *$p < 0.05$, $^{+}$ $p < 0.1$. *Rural*, *Older, College, Liberal* and *Suppression* are regarded as exogenous variables, and all other variables are treated as endogenous. To avoid having more instruments than the observation groups, the collapse function in STATA was used, and no country-fixed effects were added. The AR (2) test is unavailable because there are only two time periods in the first-differenced equation.

Given the relatively small sample size, only the one-year lags are used as the instruments for the endogenous variables to avoid having more IVs than the number of countries. The two over-identification tests, Sargan and Hansen tests both show that the null hypothesis that the instrumental variables are jointly exogenous cannot be rejected. Therefore, the instruments and the use of GMM method are valid.

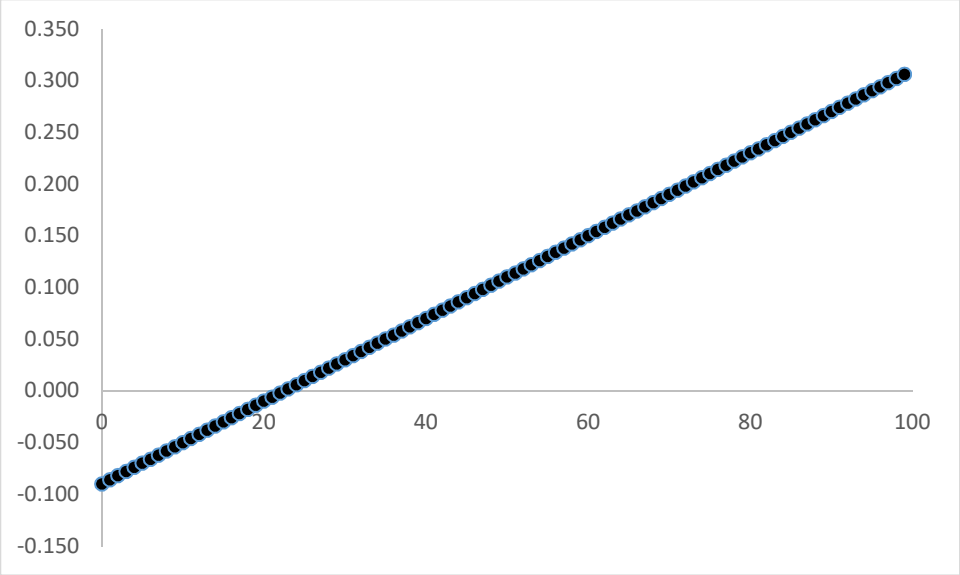
Interpretation of the Results

According to the GMM estimates, the cosmopolitan tendency of a country is significantly influenced by the percentage of Internet users, economic openness and the

general level of social trust. Rather than displaying a uniform influence on cosmopolitanism, those factors have non-linear effects on cosmopolitanism.

At a low level of diffusion, an increase in Internet users seems to generate a negative impact on the overall cosmopolitan orientation of a country. After the percentage of the population who use the Internet reaches 23%[4], an increase in Internet adoption would start generating positive influence on the country's cosmopolitan orientation. The effect of 1 percentage-point increase at each level of Internet diffusion is presented in Figure 4.

Figure 3. The Effect of Internet Use on Cosmopolitanism



When the diffusion of the Internet is at its early stage, a 1% increase in its adoption would generate a negative effect that is marginally significant on the general cosmopolitan tendency of the country. However, when the Internet diffusion reaches the critical point, 23%, having a one-percentage-point increase in the users, i.e., from 23% to

[4] According to the estimates, the effect of Internet is expressed as -0.09 x *Internet* + 0.002 x *Internet*^{2}. Taking the first derivative gives eq (1) = -0.09 + 0.004 x *Internet*. Setting eq (1) = 0 and solving the equation gives *Internet* = 22.5.

24%, would generate a positive impact of 0.002 percentage-point increase in the population with cosmopolitan orientation. As more people become Internet users, the marginal effect of 1-percent-point more adoption becomes larger. For example, when the percentage of the population who use the Internet changed from 89% to 90%, the population with cosmopolitanism worldview would increase by 0.27 percentage point, as compared to 0.002 when the adoption rate increases from 23% to 24%.

Similarly, the economic openness of a country first displays a negative but increasingly smaller impact on cosmopolitanism and then after a critical level, starts to generate positive influence at an accelerating rate. Noticeably, the turning point emerges when the share of trade in GDP reaches 150%. In the sample of this study, only four countries had trade share of GDP over 150% in some years. Therefore, this result suggests that for most countries, the effect of increasing economic openness on cosmopolitanism is de facto negative.

The effect of social trust on cosmopolitanism also displays a non-linear characteristic. Specifically, when the general level of social trust is below 43%, an increase in the population who generally believe others would increase the cosmopolitan tendency of the country. However, after the level of social trust surpasses the critical point, an increase of people who generally trust others starts to be associated with a downward change of the cosmopolitan tendency of the country.

Contrary to the findings in prior studies, the estimation does not provide evidence that older population, rural residents, education attainment, GDP per capita and political suppression have significant effects on cosmopolitanism. The implication of the insignificant effects of these factors is discussed in the next section.

Robustness Check

As the result shows, Internet use has a non-linear effect on cosmopolitanism. However, several countries in the sample had just undergone or were in the middle of major political changes that could have tremendous effect on the population's view about the world, and those political changes are hard to be captured by the model. Therefore, three additional estimations are conducted to see whether the effect of Internet use significantly changes after those "special countries" are excluded from the analysis.

First, the two former Yugoslavian countries (FYS), Croatia and Slovenia, are removed from the analysis. Second, the three former Soviet Union Countries (FSS) in the sample, Estonia, Latvia and Lithuania, are excluded from the analysis. The results of the reduced-sample analysis are presented in Table 6.

Table 6. The Two-Step System GMM Results with Different Samples

Dependent variable: *Cosmopolitanism*	**Without FYS**	**Without FSS**
Internet	-0.11 [0.06] $^{+}$	-0.08 [0.06] $^{+}$
Internet^2	0.002 [0.0004] **	0.002 [0.001] **
Older	0.26 [0.31]	0.27 [0.39]
Rural	-0.07 [0.09]	-0.03 [0.09]
College	-0.04 [0.04]	-0.02 [0.06]
GDPpc	0.0002 [0.0002]	-0.0001 [0.0001]
Trust	0.47 [0.17] *	0. 61 [0.25] *
Trust^2	-0.006 [0.002] **	-0.007 [0.002] *
Liberal	0.10 [0.11]	0.16 [0.08] $^{+}$
Suppression	-0.37 [0.22]	-0.11 [0.28]
Openness	-0.10 [0.05] *	-0.098 [0.05] $^{+}$
Openness^2	0.0003 [0.0001] *	0.0002 [0.0001] $^{+}$
Constant	9.27 [6.86]	4.07 [11.14]
# of Instruments	22	22
Obs - Countries	72-24	69-23
AR(1) p-value	0.58	0.32
Sargan test p-value	0.17	0.17
Hansen test p - value	0.49	0.54

As the results show, using different sets of countries, the analysis produces similar results. The non-linear effects of Internet use, economic openness and social trust on cosmopolitanism are observed regardless of the sample selection, although the critical points at which the effects start to change from a negative (positive) one to a positive (negative) one move slightly. A noticeable distinction in the result is that when the former Soviet Union countries are excluded, the percentage of population holding a liberal political position is shown to have a positive impact on the cosmopolitan tendency of a country. As Ekiert, Kubik, and Vachudova (2007) have noticed, liberalism, both as a political force and as a social ideology, has taken root in a small proportion of the people in a very limited number of former Soviet Union states. This observation coincides with the EVS data: while in general the percentage of population holding liberal positions changed from 18% to 29%, the figure in the three former Soviet Union states on average only changed from 10% to 12%. Therefore, when these three countries with little change in the liberalism variable are removed, a clearer pattern where the rise of liberalism paralleled a rise of cosmopolitanism emerges, and a positive effect of liberalism is observed.

Conclusion and Discussion

The role of the Internet in fostering cosmopolitanism has long been discussed. On the one hand, many scholars believe that the unique characteristics of the Internet make it a perfect agent of cosmopolitanism (Jeffres et al., 2006). On the other hand, some argue that as a response to the destruction of the meanings of locales, peoples and groups as a result of Internet use, nationalism will be strengthened (Castells, 1996). Although conceptual and theoretical discussions about the relationship between Internet usage and

cosmopolitanism abound, empirical analysis of this subject is very limited. In light of prior studies about Internet and cosmopolitanism, this study provides a quantitative analysis of how Internet use affects the cosmopolitan orientation at the country level. Using the EVS data, this study employs the system GMM estimation method to address the endogeneity of Internet usage, which is largely unattended to in the existing studies about Internet and cosmopolitanism.

According to the estimation result, when the Internet is at its early diffusion stage, i.e., less than 23% of a country's population is using the Internet, an increase in the population using the Internet would have a marginally significant negative impact on cosmopolitanism. After the diffusion passes the critical level, more people using the Internet would lead to more people developing a cosmopolitan worldview. This finding furthers the current understanding of the relationship between Internet usage and cosmopolitanism and has a significant theoretical contribution, as it provides a possible reconciliation to the two conflicting arguments regarding the impact of the Internet on national identities. In his discussion on the effect of the Internet on society, Castells (1996) argued that when facing the destruction of the meanings of locales, peoples and groups at least partially caused by the network, members of a society often retreat to the previous state of stability and certainty. In this process, national identity is often strengthened, and nationalism is likely to rise. The initial negative impact of Internet adoption on cosmopolitanism observed in this study gives a perfect illustration of the destruction phase and the society's response to it. However, the Internet not only destroys but also reconstructs. As more people become Internet users, constant exposure to and interaction with people and cultures different from the users' become the new social

reality. In this new social reality, the morality that "each person you know about and can affect is someone to whom you have responsibilities" (Appiah, 2006, xxiii) becomes the response. As a result, a rise in cosmopolitan orientation is observed. The existence of such a critical mass places the two contradictory arguments about the role of the Internet in national identity formation in one continuum. The two opposite arguments are not incompatible but point to the effects in different phases of Internet diffusion.

Although this study focuses on the national cosmopolitan orientation, the result of the analysis can also shed light on the impact of Internet usage at the individual level. As several studies suggest, early Internet adopters tend to belong to the elite social group, who are more global-oriented and cosmopolitan (Rössel & Schroedter, 2015; Lunn & Suman, 2008). As the technology diffuses into all social classes, people who are less interested in foreign content gradually become the majority of Internet users. Examining this observation with the direction of the effects found in this study leads to a discrepancy, which could have two possible causes. First, it could suggest a non-uniform effect of Internet usage on early adopters and late adopters: while Internet usage makes the elite, global-oriented early adopters focus more on domestic issues and possibly, less cosmopolitan, it makes the local-oriented, late adopters focus more on foreign issues and possibly, more cosmopolitan. Second, if the early adopters of the Internet are indeed well-educated, high-income elites, the negative effect of Internet usage on cosmopolitanism found in this study would suggest that some of the fundamental beliefs about the relationship between a person's socioeconomic status and cosmopolitan orientation might need to be revisited.

Besides the effect of Internet usage, this study also examines the influence of several other factors on cosmopolitanism. First, although the share of international trade has a similar non-linear effect to that of Internet usage, the inflection point emerges only at 150%, meaning that trade in effect has a uniformly negative effect for most of the countries. This finding is in line with other studies focused on developed economies (Colantone & Stanig, 2018) but in contrast to studies focused on developing countries (Lan & Li, 2015). Thus, it is reasonable to speculate that the effect of economic openness on cosmopolitanism varies considerably across countries in different development stages.

Although some studies have suggested that a society with a high level of social trust would be more cosmopolitan (Steenkamp, 2009; Sharipova, Burkhanov & Alpeissova, 2017), the analysis shows that the effect of social trust is more complicated. A high level of social trust is a contributor to cosmopolitanism until a critical point. When more than 43% of the population trust others in general, an even higher level of social trust is found to be negatively associated with the cosmopolitan tendency of the country. One possible explanation, among many, of the seemingly counterintuitive relationship lies in the implications of a society with a high level of social trust. When the respondents were asked the question whether they trust people in general, it is reasonable to expect that the reference group they used to determine their answer are the ones with whom they regularly interact with, namely, their families, colleagues and friends, who, with a good chance, are their compatriots. Thus, a high level of social trust could in fact signal a high level of within-group solidarity in the society where people have strong identification with their own culture and compatriots less so with foreign cultures and people of other countries.

Contrary to the findings in earlier studies, no impact is found in several factors, such as age, rural population, education and income level, which are believed to be strong predictors of cosmopolitanism (Szerszynski & Urry, 2002; Pichler, 2008; Rössel & Schroedter, 2015). Also, this study does not provide evidence to support that a society with a higher level of social trust tends to be more cosmopolitan, as suggested in several studies (Steenkamp, 2009; Sharipova, Burkhanov & Alpeissova, 2017). It should be noted that in the studies which examine the effects of those socioeconomic and demographic factors, either the Internet is not included in the model at all or the endogeneity in Internet use is largely neglected. Hence, the fact that those factors become insignificant predictors after the effect of Internet usage is properly controlled for could indicate that the effects of those demographic, cultural and socioeconomic factors on cosmopolitanism are by and large mediated by the use of the Internet. In addition, the insignificant effects of those factors could also be at least partially attributed to the loss of variation as they are aggregated to the national level.

Limitation and Future Studies

It is worth emphasizing that all the findings and implications of this study must be considered under the context of its limitations. First, it has to be acknowledged that the rise and fall of cosmopolitanism in a country is a complicated process caused by a myriad of factors, many of which can be country-specific and thus very difficult, if not impossible, to include in the model. As a result, the analysis inevitably is reductionist. Caution must be used when using the findings of this study to analyze the emergence of cosmopolitanism for specific countries. Second, this study utilizes EVS data and only explores the relationship between Internet usage and cosmopolitanism in 26 European

countries. However, the effect of Internet use on cosmopolitanism is likely to vary across countries of different cultural backgrounds and economic development stages. Future studies could benefit from a sample which includes more countries of various economic status and cultural characteristics. Third, although some factors pertinent to the country's characteristics such economic openness and political suppression are added to the model, for the most part, individual-level factors with potential impact on cosmopolitan orientation are converted to the corresponding national-level equivalence. However, some individual-level factors, for example, the number and strength of international social ties people form, are difficult to translate to a national level variable. This study could serve as a starting point for future works to build a framework for national-level cosmopolitan orientation. Last, although the national level analysis offers a unique perspective, much of the variation in the cosmopolitan orientation could be lost when it is aggregated to the national level. Thus, future studies could benefit from an analysis at more granular levels such as cities and regions.

Chapter 4 INTERNET USE AND INTERNATIONAL ONLINE COMMUNICATION

Introduction

Does the use of the Internet promote cross-border communication? At least according to the volume of international IP traffic, the answer to this question seems obvious. From 2013 to 2018, cross-border IP traffic increased from 25,234 petabytes per month to 50,350 petabytes per month (Cisco, 2014; 2018). If no one uses the Internet for cross-border communication, how can such an increase in international IP traffic be possible? Indeed, it is not a mistake to say that the wide adoption of the Internet around the globe is associated with the increase in the volume of international data traffic. However, if we change the question a little bit and ask: does the increase in Internet use always lead to the growth of international online communication? The answer is no longer that obvious.

Besides the increase in cross-border IP traffic, the Cisco data (2014; 2018) also show that in each of the six years examined, domestic IP traffic always surpassed the international traffic, and the growth rate of domestic traffic was bigger. Although there is no direct evidence, several studies imply that the Internet might be first and foremost a tool used not for international communication but to connect to people and locales nearby (Barnett & Park, 2005; Blum & Glodfarb, 2006; Tramos & Nijkamp, 2013). The Internet might have reduced the cost of cross-border communication to literally zero, as many scholars suggested (Cairncross, 1997; Bakos, 1997; Shapiro & Varian, 1999). Nevertheless, the fact that a technology *can* be used for international communication does not necessarily mean that people *will* use it for that purpose.

Defining international online communication broadly as any form of cross-border IP data exchange, this study explores whether countries with more Internet users tend to generate a larger volume of international online communication. In light of the studies on international trade, the cross-border online communication is conceptualized as the cross-border flow of data, and the gravity model, which is a widely used framework in the international trade analysis, is modified and applied as the analytical framework.

The Internet is widely recognized as an important propeller of global economic integration (Freund & Weinhold, 2004; Gnangnon & Iyer, 2018) and the formation of the global village (McLuhan, 1962) based on shared morality and tolerance of different cultures (Appiah, 2006). To a large degree, the promising world these scholars described is based on the untested conventional wisdom that as more people adopt the Internet, there will be more cross-border communication. At the global level, the volume of cross-border online communication is indeed on the rise. However, several critical questions remain unanswered. Is this increase a manifestation of a universal, positive effect of Internet adoption on international communication, or is the positive effect, if it does exist, manifested in only a small number of countries? Also, while early Internet adopters tend to belong to the elite social group (Lunn & Suman, 2008), who are more globally oriented (Rössel & Schroedter, 2015), as the technology diffuses into all social classes, people who are less interested in foreign content become the majority of Internet users. Then, the question arises whether the increase in the number of Internet users always leads to the growth of international communication, or the effect becomes less prominent as the diffusion of the Internet enters the later stage. By analyzing the data collected for a mix of 17 developed and 38 developing countries, this study seeks to check the

conventional wisdom about the role of the Internet in the globalization process and answer those pressing questions.

The structure of the study is as follows. In the next section, prior studies on the relationship between the Internet and international communication are reviewed. Then, the empirical model, data and analytical methods are introduced, followed by the result section. The last part of the study gives a summary of the findings of the study and its implications. The limitation is also discussed in this section.

Literature Review

It is widely believed that the Internet is an agent of globalization as it greatly facilitates cross-border communication (Cairncross, 1997; Bakos, 1997; Shapiro & Varian, 1999). Indeed, numerous examples can be found where people use the Internet for international communication, defined broadly as any form of cross-border information transmission or exchange. Around the world, many people living in marginalized communities leverage the "anti-spatial" nature of the World Wide Web (Mitchell, 1995, p.8) to access information hosted in servers in other countries for information critical for their life, education and economic well-being (Heeks, 2018). According to the estimate by the McKinsey Global Institute (2016), 914 million social media users, or 35% of all social media users, have at least one international contact on the site. In the business world, multinational and transnational companies rely extensively on the Internet to coordinate their operations at a global level and increasingly, small and medium businesses have utilized the Internet to communicate with their partners and customers in foreign countries (Rauch, 1999; Borcuch, Piłat-Borcuch & Świerczyńska-Kaczor, 2014).

Although many scholars argue that advanced telecommunication technologies allow its users to bypass physical distance and possibly, many of the cultural or economic hurdles which limit their ability to communicate with the outside world, at the country-level, many studies suggest that the distance-bridging promise of the Internet is far from fulfilled. Based on the world-system theory which distinguishes the central, more economically and technologically advanced countries from the less developed peripheral countries (Wallerstein, 2004), many scholars warn that even with the potential capability to communicate with literally all countries in the world, the peripheral countries still predominantly communicate with the core countries in their respective regions, reinforcing the existing communication flows shaped by the core-peripheral pattern (Gunaratne, 2005).

In *A Structural Theory of Imperialism*, Galtung (1971) identified several patterns of international communication, as follows: 1) most cross-border communication takes place between the core countries and the peripheral counties and 2) there is very little cross-country communication among peripheral countries. Barnett (2001) examined the frequency of international telephone calls among 81 countries from 1978 to 1996 and discovered a pattern consistent with Galtung's observation: the U.S., Canada and Western Europe were clearly the centers to/from which most international communication was made. In another study, Barnett, Chon and Rosen (2001) analyzed the interconnection pattern of hyperlinks in websites with top-level country domain names of OECD countries. The result indicates that even within the OECD block, a clear pattern emerged where the U.S., Canada, UK, Germany and Australia were the centers to which most of the hyperlinks were connected. Later studies also show that the international Internet

bandwidth and the most visited websites are highly concentrated around a few high-income countries (Barnett & Park, 2012).

However, even though for many countries, the emergence of the Internet might not expand the range of countries they communicate with, the volume of the cross-border communication could still increase as the new communication technology is adopted. Therefore, these studies do not directly answer the research question of this study: does the use of the Internet increase international communication?

To the best of this author's knowledge, there is very little empirical research that can answer this question. The few empirical studies on this topic offer, at best, some partial and indirect answers: they show that physical distance, in many cases, remains a major constraining factor in cross-border online communication, which implies that the use of the Internet might not necessarily lead to an increase in international online communication, but "enables selective connections between people and information" (Graham, 1998, p. 180). For example, in a long-term survey of the communication patterns of residents in East York, Canada from the 1970s to 2005, Mok, Welleman and Currasco (2010) compared the frequency of use of various types of communications, such as interpersonal and online communication. They concluded that online communication became more frequent than other types of communication when the contact is 3000 miles or further away. Since Mok et al. only examined various forms of interpersonal communication and one form of online communication, email, the result might not show the whole picture of international communication. The study by Tramos & Nijkamp (2013) provides more indirect evidence that weakens the mainstream assumption that Internet adoption means increased international communication. After

examining the links established among 29,040 Internet nodes in 224 countries, they found that although the interconnected nature of the Internet makes all places reachable in seconds, the actual links established diminished as the distance between the two nodes increases. Such a distance-sensitive characteristic of interconnection points has also been found in several other studies on the topology of the Internet (Riccaboni, Rossi & Schiavo, 2013; Wu & Taneja, 2016). However, as the authors themselves pointed out, the established links only indicate the existence of data connections between two nodes rather than the intensity of data exchange, thus leaving the volume of international online communication unanswered.

The study by Blum and Goldfarb (2006) is another empirical analysis of the distance-compressing effect of the Internet. Focusing on the web surfing behaviors of American users, their analysis shows that Americans tended to visit websites hosted in nearby countries to consume taste-dependent content, whereas physical distance is not a determinant of web surfing behaviors when it comes to taste-independent content. Although Blum and Goldfarb's study only covers one aspect of international communication – browsing foreign websites, and it only measures one-direction communication from the U.S. to other countries, it makes a significant methodological contribution by introducing the gravity model, which is widely used in international trade studies, to the analysis of the pattern of international communication. Building on Blum and Goldfarb's study, the current research modifies the gravity model and uses it to analyze the impact of Internet adoption on the volume of international Internet communication at the country level.

Although the reviewed studies cannot directly answer whether the use of Internet necessarily leads to an increase in international online communication, they suggest a possibility that the increased international online volume might be only driven by users in a few core countries. Therefore, it is questionable whether the widely believed positive relationship between Internet use and cross-border communication truly exists in all types of countries. Also, these studies imply that the Internet is first and foremost used to connect locales that are geographically closer. Thus, it is reasonable to question whether the increase in Internet adoption would always lead to the growth of international communication.

Method and Data

The Empirical Model

First developed by Isard (1954), the gravity model is a commonly adopted tool used to analyze the volume of bilateral trade. The original form of the model is expressed by the following equation.

$$Trade_{ie} = C \cdot \frac{GDP_i^a GDP_e^b}{Distance^r}$$

Specifically, the trade volume between two countries is assumed to be positively related to the economic sizes of the countries, usually measured as the total GDP, and inversely related to the distance between the two countries. *C* is a constant used to capture the effects of factors other than the economic size of the countries and the geographic distance. When estimated, the model is usually augmented by including other potential influencers such as historical ties and Internet adoption (Freud & Weinhold, 2004; Lin, 2015; Gnangnon & Iyer, 2018).

Although the gravity model is mainly used to analyze the bilateral international flow of goods and services, its fundamental logic could also be applied to the volume of international online communication, conceptualized as the cross-border flow of IP data. Particularly, advanced communication technologies may have made cross-border information transfer costless. However, as Blum and Goldfarb (2006) pointed out, distance still plays a critical role as an indicator of the proximity in cultures, customs and consumer tastes, especially when the information exchange involves cultural products, such as music, movies, games and books. Since 82% of the global IP traffic is generated by consumers (as compared to business traffic), and 83% of the consumer IP traffic is generated by entertainment-related activities (Cisco, 2014; 2018), it is expected that physical distance would still be an important predictor of the cross-border Internet traffic.

To evaluate the impact of Internet use on international IP communication, this study modifies the gravity model as expressed by the following equation:

$$Intercom_{ij} = C \cdot \frac{Internet_i^a Internet_j^b}{Distance^r}$$

As the equation shows, the volume of IP data traffic between country$_i$ and country$_j$ (*Intercom* $_{ij}$) is positively related to the number of Internet users in each country (*Internet*$_i$, *Internet*$_j$). This effect could potentially come from two sources. First, as there are more Internet users, the demand for all types of content, including the one hosted in foreign countries, would rise. Second, having a larger body of Internet users could mean that more online content is produced, and users in other countries, if they are searching for foreign content, could access the content produced in the country, resulting in an increase in the outgoing Internet traffic. Although many scholars believe that the Internet has made physical distance irrelevant in cross-border communication (Cairncross, 1997;

Goolsbee, 2000), some studies suggest that the volume of online communication is still larger between two geographically closer countries (Blum & Goldfarb, 2006). Therefore, the physical distance ($Distance_{ij}$) is still included in the model.

Following many other studies which use the gravity model, the basic model is augmented with several other factors which could potentially influence the volume of international IP traffic of a country. The model is then expanded as:

$$Intercom_{ij} = A.\ Suppression^{a}_{i} * Suppression^{b}_{j} * Openness^{r}_{i} *$$

$$Openness^{v}_{j} * GDPPC^{p}_{i} * GDPPC^{w}_{j}$$

First, although it is assumed that countries with more Internet users will generate more international data traffic, it is under the condition that the users can freely access foreign content. Some countries, such as Russia and China, though having a considerable number of Internet users, cannot freely access foreign content because of censorship and control on the net (Warf, 2011). Therefore, the Freedom on the Net Index calculated by Freedom House is included in the model to control for the negative impact caused by Internet control and censorship ($Suppression_i$, $Suppression_j$).

Also, the economic openness ($Openness_i$, $Openess_j$), measured by the share of trade (export and import) in GDP is also included in the model for two considerations. First, countries with an economy heavily dependent on international trade tend to have more overseas social ties (Olivier, Thoenig & Verdier, 2008), and thus, are likely to have higher need to communicate with foreign countries. Second, as the study by Coyne and Williamson (2009) shows, countries which are more open to trade are more likely to have a culture that promotes interest in other cultures and social interactions. Therefore, the economic openness could also be seen as a proxy for the “extroversion” of a country.

Lastly, the GDP per capita ($GDPPC_i$, $GDPPC_j$) is assumed to have an impact on a country's international IP traffic for two reasons, although the nature of the effect can be complicated. First, as an indicator of the general economic development status, GDP per capita could proxy for the general technological and economic infrastructure and institution that enable the production of online content for international users to consume. However, as more online content is produced, the Internet users in the country could be less dependent on foreign content, thus decreasing the international IP traffic of the country. Also, GDP per capita is also an indicator of the general income level of the citizens. People with higher income are more likely to have the financial and technological resources to access foreign content. Second, as several studies have shown, at the individual level, people with higher income are more likely to be interested in foreign cultures and globally oriented (Szerszynski & Urry, 2002; Pichler, 2008; Rössel & Schroedter, 2015). This study extends this relationship into the national level and hypothesizes that rich countries are more likely to interact with other countries. Applying natural log on both sides, the extended gravity model for bilateral international IP data traffic can be expressed as:

$$Ln\ (Intercom_{ijt}) = Constant + \beta_1 Ln\ (Internet_{it}) + \beta_2 Ln\ (Internet_{jt}) + \beta_3 Ln\ (Distance_{ijt}) + \beta_4 Ln\ (Supression_{it}) + \beta_5 Ln\ (Supression_{jt}) + \beta_6 Ln\ (Openness_{it}) + \beta_7 Ln\ (Openness_{jt}) + \beta_8 Ln\ (GDPPC_{it}) + \beta_9 Ln\ (GDPPC_{jt}) + \beta_{10} T + \mu_{ijt}$$

, where T is the year dummy.

The Dependent Variable

Ideally, the bilateral Internet traffic between country pairs should be used as the dependent variable. However, due to the lack of such data for a sufficient number of

countries, an alternative, the international Internet bandwidth consumed per user, is collected from the International Telecommunication Union's ICT Development Index (ICTDI) database (ITU, *n.d.*). Different from the international bandwidth which measures the maximum possible capacity of international data exchange of a country, the consumed international bandwidth refers to the actually utilized capacity of all Internet links connecting the country to the outside world. According to ITU, in the calculation of the indicator, the total international IP traffic of a country over the 12 months of a year is estimated and then converted to bits per second per Internet user. Therefore, it represents the fraction of the capacity actually utilized by the users and can be treated as a measurement of the average international IP traffic generated by each user per second[5].

Since the dependent variable of this study is the total volume of international Internet traffic of a country in a year, the consumed international Internet bandwidth is converted to the annual total volume using the following procedure. First, the reported numbers (bits/second per user) are multiplied by the total number of Internet users in the country. Then, these calculated numbers (bits/second) are multiplied by 31557600 (total seconds in a year). Third, to accommodate the large volume of traffic, the obtained numbers, the total bits transmitted over a year, are divided by 10^{15} and converted to petabits.

Although the used international Internet bandwidth provides a relatively accurate measurement of the total international IP traffic at the country level, it does have several limitations. First, since the Internet is a bidirectional communication network, i.e., it sends out and receives data simultaneously (Comer, 2006), the metric used in this study

[5] See the method used in the calculation at https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2017/methodology.aspx

cannot distinguish between outgoing traffic and incoming traffic. Second, the lack of bilateral data means that no specific "partner countries" exist, or in other words, for any given country, all the other countries in the world as a whole are its potential partner. The independent variables are operationalized accordingly to accommodate this limitation.

The Independent Variables

The number of Internet users. The percentage of the population using the Internet in all countries of the world is available in the World Bank databank. Using the information and the total population, the number of Internet users can be calculated. Since for any given country, all other countries in the world as a whole is considered to be its partner, the Internet users in all other countries as a whole is calculated as:

$$World\ Internet\ Users = P \cdot I - p \cdot i$$

where p and i stand for the population and the percentage of the population using the Internet in country i, respectively, and P and I represent the world population and the percentage of the world population using the Internet, respectively.

The remoteness of a country. Since no specific partner country is identified, the conventional measurement of the geographical distance between two countries cannot be applied. This study uses an alternative measure, remoteness, to capture the potential effect of distance on international IP traffic. The definition of remoteness is given by the following equation (Melitz, 2007):

$$R_i = \frac{1}{n-1} \sum_{j=1}^{n} x_j d_{ij} \ , i \neq j$$

where d_{ij} is the physical distance between country i and country j, n is the total number of countries, and x_j is the share of country j's output in that of the rest of the world. The remoteness of country measures its average distance to all other countries, weighted by

the economic importance of other countries, and is often used in trade studies as an indicator of how far away, in general, a country is from its markets (Wei, 1996). According to the calculation by Melitz (2007), the Netherlands is the least remote country in the world. Therefore, following Gnangnon and Iyer (2018), the *Distance* in the model is operationalized as the physical distance between the country and the Netherlands.

Economic openness. The data on the share of trade (export and import) in total GDP for all countries in the world is available in the World Bank databank. Similarly, for each country, an economic openness indicator is calculated for its partner, i.e., all other countries in the world.

$$\textit{World Economic Openness} = 100 \text{ x } \frac{GDP \cdot TS - gdp \cdot ts}{GDP - gdp}$$

where *gdp* and *ts* are the GDP and share of trade in GDP, respectively, for country *i,* and *GDP* and *TS* are the equivalents for the world. This index shows the overall economic openness of all the states (excluding country *i*), considered as one entity.

Suppression. To measure the severity of Internet censorship and control, the Freedom on the Net Index calculated by the Freedom House is used. The level of Internet censorship and control for the world is not included as in the case of other independent variables. As mentioned above, for any given country, all other countries in the world are its potential partner. However, the Freedom on the Net Index is only available for 65 countries. Therefore, a world-average index calculated based on the Freedom House sample will provide a biased representation of the overall severity of Internet censorship and control in the world. For this consideration, only the country level index is included in the model.

GDP per capita. The data on GDP per capita (in current US $) of all the countries in the world is available at the World Bank databank. For country *i*, the following equation is used to calculate the GDP per capita of its hypothetical partner:

$$World\ GDPPC = \frac{GDP - gdp}{P - p}$$

where *gdp* and *p* are the GDP and total population of country *i*, respectively, and *GDP* and *P* are the world's GDP and total population, respectively.

Since the Freedom on the Net Index is only available from 2012 to 2016, all other data were collected accordingly. Although the ICTDI data is available for all the countries in the world, a considerable number of countries have missing data in some years between 2012 and 2016. Also, the Freedom on the Net Index is available for only about 60 countries per year. In order to construct a strongly-balanced panel dataset, observations with missing data were deleted, and the final sample used for analysis includes 55 countries for 5 years from 2012 to 2016 (See Appendix C for the list of countries in the sample). The variables and descriptive statistics are provided in Table 7.

Table 7. Variables and Descriptive Statistics

Variable	Definition	N	Mean	Std.	Min	Max
lnintercom	International IP traffic	275	8.82	2.36	2.02	13.65
lnInternet	Number of Internet users in the country	275	16.42	1.65	12.32	20.41
lnWorldInternet	Number of Internet users in other countries	275	21.77	0.13	21.34	21.95
lnRemote	Remoteness of the country	275	8.50	0.78	5.92	9.60
lnSupression	The severity of Internet censorship	275	3.61	0.55	1.79	4.50
lnOpen	The share of trade in the country's GDP	275	4.07	0.57	2.91	5.90
lnWorldOpen	The share of trade in GDP of other countries	275	4.08	0.04	4.02	4.26
lnGDPPC	The GDP per capita of the country	275	8.79	1.36	6.15	11.13
lnWorldGDPPC	The GDP per capita of other countries as a whole	275	9.26	0.05	8.99	9.46

Note: All variables are in natural log. Five years of data, from 2012 to 2016, were collected for 55 countries.

As discussed in Chapter 2, endogeneity is a common problem in the analysis of the social and economic impact of the Internet. In this study, the fixed effect estimation (FE), random effect estimation (RE), two-stage least square instrumental variable estimation (2SLS IV) and system generalized methods of moments (system GMM) are employed to tackle this issue. The data preparation, variable transformation and statistical analysis were conducted on STATA 15.

Analyses and Results

The baseline results obtained from the fixed effects and random effects estimations are presented in Table 8. As shown in Table 8, the estimation indicates that the number of Internet users in a country has a positive effect on its total international IP data traffic. Although in most cases, the fixed effect model is preferred, since the unobserved, time-invariant heterogeneity can be completely removed, random effect model gives more efficient estimates under the condition that the unobserved heterogeneity is uncorrelated with independent variables (Woodridge, 2010). To decide which model is better, the Hausman test was conducted. The result indicates that the fixed effect model would be more appropriate, $Chi^2(10) = 26.24$, $p < 0.001$.

Table 8. Fixed and Random Effect Estimation Results

Dependent variable: *lnIntercom*	**FE**	**RE**
lnInternet	0.96 [0.33] **	1.02 [0.09] ***
lnWorldInternet	4.68 [0.74] ***	4.16 [0.56] ***
lnRemote	n/a	-0.15 [0.14]
lnSupression	-0.60 [0.66]	-0.47 [0.25] $^{+}$
lnOpen	0.07 [0.23]	0.23 [0.15]
lnWorldOpen	3.66 [4.09]	0.52 [2.07]
lnGDPPC	-0.60 [0.43]	0.56 [0.10] ***
lnWorldGDPPC	1.35 [2.19]	0.89 [1.23]
Constant	-129.15 [23.76] ***	-111.91 [22.87] ***
R^2	0.68	0.85
F/Wald Chi^2	F (11, 54) = 27.66	Wald Chi^2 (12) = 628.18

Note: Unstandardized coefficients and heteroscedasticity-robust standard errors are reported. *** $p < 0.001$, $^{+}p < 0.1$. Year dummies are included in the model to control for time trend.

Based on the FE estimation result, only the two Internet use variables have a significant impact on the country's cross-border IP traffic. However, the fixed effect estimation only removes the time-invariant unobserved heterogeneity in the observation units. Thus, although the world Internet use might be treated as an exogenous variable, the country-level Internet use could still suffer endogeneity caused by other sources such as reverse causality and time-variant heterogeneity. In order to further address the endogeneity in the number of Internet users at the country level, the 2SLS IV estimator is used.

The 2SLS IV Result

In light of prior studies (Czernich et al., 2011; Kolko, 2012), the number of telephone subscriptions and cable TV subscriptions are used as potential IV candidates. For reasons discussed in Chapter 3 and to ensure that data is available for all the countries, the total cable TV and telephone subscriptions in 2007 are used in this study. The result of the first-stage regression is reported in Table 9.

Table 9. The First-Stage FE Regression Result

Dependent Variable: *lnInternet*	**Coefficient**	**Std. E**	**R^2**
IV: *lnTelephone subscriptions*	0.22***	0.06	0.55
IV: *lnCable TV subscriptions*	0.38	0.51	0.53

Note: The two IVs are transformed into natural log form in the regression. The endogenous variable, *lnInternet*, is regressed on the potential IV and other independent variables which are assumed to be exogenous, i.e., *lnWorldInternet*, *lnRemote*, *lnWorldOpen* and *lnWorldGDPPC*, *** $p < 0.001$.

According to the result of the first stage regression, only the telephone subscriptions have a strong correlation with Internet adoption. Therefore, it is used as the IV for *lnInternet*. The result of the second stage regression is reported in Table 10. As the result shows, after the endogenous variable is instrumented by the telephone subscriptions, its impact on the country's international IP traffic becomes insignificant. However, since only one excluded instrument is used, the Sargan test cannot be run. Thus, it is not clear whether the IV is strictly exogenous.

Table 10. 2SLS IV FE Regression Result: Second Stage

Dependent variable: *lnIntercom*	**Coefficient**	**Standard Error**
lnInternet	1.04	1.85
lnWorldInternet	4.61	1.83 **
lnRemote	n/a	-0.15
lnSupression	-0.59	0.65
lnOpen	0.07	0.23
lnWorldOpen	3.89	6.51
lnGDPPC	-0.64	1.01
lnWorldGDPPC	1.30	2.66
Constant	-128.86	24.97 ***
R^2	0.68	
Wald Chi^2	$Chi^2(12) = 266.82$	

Note: Unstandardized coefficients and heteroscedasticity-robust standard errors are reported. *** $p < 0.001$, **$p < 0.01$.

Moreover, it is likely that some other independent variables, such as *lnSupression*, *lnOpen* and *lnGDPPC*, are endogenous, too. For example, it is possible that the rise in

international communication leads to more trade and increases the GDP per capita of a country. If the endogeneity caused by the reverse causality is not properly addressed, these variables would also be correlated with the error term and bias the coefficient estimates for all the variables (Woodrdige, 2016). Given the difficulty of finding valid instruments, the existence of multiple endogenous variables makes it impractical, if not impossible, to use any estimation strategy based on excluded IVs for this analysis.

The GMM Result

As Hall (2005) pointed out, many phenomena in social sciences have a dynamic nature, that is, the current value of an observable is influenced by its past value. Based on the results from the Woodridge serial correlation test, the current volume of international IP traffic is indeed influenced by its past value, $F(1, 54) = 5.84$, $p < 0.05$. Therefore, the one-year lag of the dependent variable, *lag_ lnIntercom*, is created and added to the model. Since the difference-GMM method often suffers from weak instrument problems when the dependent variable is highly persistent over time (Stock & Wright, 2000), which is exactly the case for this study, the two-step system GMM approach developed by Blundell and Bond (1998) is used. The results of the two-step system GMM estimation are reported in Table 11.

Table 11. The Two-Step System GMM Results: *LnIntercom*

Dependent variable: *lnIntercom*	**Model 1**	**Model 2**	**Model 3**
lag_ lnintercom	0.51[0.19] *	0.46 [0.16] **	0.53 [0.14] **
lnInternet	0.48 [0.20] *	0.55 [0.18] **	0.47 [0.16] **
lnWorldInternet	1.88 [0.86] *	2.07 [0.76] **	1.67 [0.76] **
lnRemote	-0.03 [0.11]	0.02 [0.12]	-0.05 [0.13]
lnSupression	-0.16 [0.57]	-0.65 [0.65]	0.05 [0.65]
lnOpen	0.34 [0.16] *	0.40 [0.16] *	0.31 [0.15] *
lnWorldOpen	1.35 [2.43]	1.05 [2.29]	1.99 [3.27]
lnGDPPC	0.29 [0.16] $^{+}$	0.27 [0.17]	0.23 [0.27]
lnWorldGDPPC	0.03 [1.22]	1.51 [2.29]	-0.87 [1.73]
developed	x	-3.29 [4.18]	x
developed x lnInternet	x	0.19 [0.06] *	x
penetration	x	x	0.02 [0.05]
penetration x lnInternet	x	x	-0.001 [0.003]
Constant	-53.03 [25.25] *	-60.43 [28.04] *	-43.11 [26.75]
Observations - Countries	220 - 55	220 - 55	220 - 55
# of Instruments	32	35	38
AR (1) p-value	0.02	0.03	0.02
AR (2) p-value	0.59	0.58	0.56
Sargan test p-value	0.30	0.22	0.29
Hansen test p-value	0.27	0.24	0.33

Note: Unstandardized coefficients and heteroscedasticity-corrected standard errors are reported. **p < 0.01, *p < 0.05, $^{+}$p < 0.1. Except for *LnRemote, lnWorldInternet*, *lnWorldOpen* and *lnWorldGDPPC* and the interaction terms, all other independent regressors are treated as endogenous variables. All the available lags are used as internal instruments. To avoid having more instruments than the number of countries, the collapse function is used. Year dummies are included in the model.

All the validity indicators show that the use of GMM method for this estimation is appropriate, as the Sargan and Hansen test results are insignificant, indicating the satisfaction of the overidentification condition, and the insignificant AR (2) serial correlation test result implies that the error term does not contain second-order serial correlation.

The result of the base model (Model 1) estimation shows that an increase in the number of Internet users has a positive effect on the country's total international IP data traffic. Specifically, a 1% increase in the number of Internet users would lead to a 0.48%

increase in the volume of international IP traffic. Also, the international internet traffic of a country influenced by the number of Internet users in all other countries: a 1% increase in Internet users of other countries would lead to a 1.88% increase in the international IP traffic of a country. Given that the incoming and outgoing traffic is not differentiated in the data nor does the hypothetical partner represent any specific country, it can be hard to explain the difference. Nevertheless, one possible cause of it is the characteristic of the sample used. Since 70% of the sampled countries are medium- and low-income economies, the difference in the effects could reflect the unique characteristics of the international traffic of developing countries. Specifically, due to the lack of necessary resources or skills to produce online content or the generally low interest in foreign content, an increase in Internet use in developing countries might generate less international traffic. One additional estimation is ran using only developed countries (not reported), which shows a remarkably different result: Internet use in the home country has a larger effect on its international IP traffic than that abroad does. This result lends some support to the proposed explanation, although the answer is still indefinite[6].

Besides the number of Internet users, the economic openness of a country, measured as the share of trade in the country's GDP, is another significant predictor of the volume of the country's gross international IP data traffic. The estimation shows that a 1% increase in the share of trade in GDP would lead to a 0.34% increase in the country's international IP traffic. The estimation also indicates a marginally significant

[6] With the number of countries reduced to 17, the number of instruments (N = 14) is quite large, even when the lag used in the IV is limited to 1, and the collapse function used. With a large number of IVs, the results of the model validity tests can be misleading. A more serious issue is that, with only one-year lags used, the endogeneity in Internet use and thus, the bias in its estimation could be insufficiently addressed. Therefore, the estimated coefficients could be used only as a tentative reference.

effect of GDP per capita on the volume of a country's gross international Internet traffic: a 1% increase in the country's GDP per capita would boost the total cross-border IP data traffic by 0.29%. As discussed in the last section, people with higher income are more likely to be globally oriented and have more financial and technical resources to access foreign content, which could lead to an increase in the outgoing IP traffic. Also, a higher GDP per capita could indicate the higher quality of the technological and economic infrastructure and institution in a country, which increases the production of online content and attracts foreign web users. However, having more domestically made content available could also mean that Internet users of the country have less demand for foreign content, leading to a decrease in international traffic. Therefore, the marginally significant effect found is likely to be the manifestation of the complicated influence of GDP per capita on international IP traffic rather than its irrelevance.

In order to test whether the effect of Internet adoption is contingent on the economic development status of the country, a dummy variable, *developed* (*developed* =1 for high-income countries, otherwise *developed* = 0)[7] and the interaction term between the dummy variable and *lnInternet* are added to the model (Model 2). If the effect of Internet use in high-income countries is different from that in low and middle -income countries, the estimated coefficient of the interaction term should be significant. According to the estimation result, although developed and developing countries do not differ in terms of the volume of international IP traffic, 1% increase in the number of Internet users generates significantly different impact in countries of different

[7] The classification is based on World Bank standard. See the classification of countries based on its income level at https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

development stages. While a 1% increase of Internet users would lead to 0.55% more international traffic in low- and middle-income countries, the same growth in Internet use would generate 0.74% (= 0.55 + 0.19) increase of international IP traffic in developed countries.

Although the results suggest that an increasing number of Internet users always leads to a growth in the country's international IP traffic, it is possible that the effect varies depending on the level of Internet diffusion. To test whether it is the case, in Model 3, the percentage of the population using the Internet, *penetration* and its interaction with *LnInternet* are added. If the effect of increasing Internet use is dependent on the level of Internet diffusion, the coefficient of the interaction term should be significantly different from zero. Based on the result, there is no evidence suggesting that the effect of Internet use varies depending on the stage of Internet diffusion in the country.

The adding of the lagged dependent variable as a regressor offers the GMM estimation another advantage that it can reveal both the short-term effect, i.e., the effect of the regressor on the dependent variable in the same time period and the long-term effect, i.e., the effect of the regressor in the past time period on the current value of the dependent variable (Hall, 2005). This feature of the GMM method is often utilized in estimations where reverse causality is a potential issue (Lin, 2015; Gnangnon & Iyer, 2018). The short-term effect is simply shown by the direct estimates of the regressors, while the long-term effect can be calculated by $\frac{\widehat{\beta}_{ind}}{1-\widehat{\beta}y_L}$, where $\hat{\beta}_{ind}$ is the estimated coefficient of the independent variable and $\hat{\beta}y_L$ is the estimated coefficient of the lagged dependent variable. Using this equation, the long-term effect of the number of Internet

users in a country on its international data traffic volume can be calculated. The result suggests that the long-term impact of Internet use, which is 0.98 (= 0.48/0.49), more than doubles its short-term effect.

Conclusion and Discussion

It is widely believed that the Internet greatly contributes to the globalization process by facilitating cross-border communication (Cairncross, 1997; Bakos, 1997; Borcuch, Piłat-Borcuch & Świerczyńska-Kaczor, 2014). However, such a claim is by and large based on the affordance of the technology, i.e., what it can do, and individual cases rather than rigorous, national level empirical evidence. Conceptualizing international online communication as the import and export of IP data, this study modifies the gravity model, which is widely adopted in international trade studies, and uses it to analyze the impact of Internet use on the volume of international Internet traffic at the country level.

Based on the result of the system GMM estimation, other things being equal, an increase in the number of Internet users does lead to a larger volume of international IP traffic, irrespective of the stage of Internet diffusion in the country. Specifically, a 1% increase in the number of Internet users would lead to a 0.48% increase in a country's international Internet traffic. This finding provides the first concrete empirical evidence to validate the conventional wisdom that the Internet does facilitate globalization by promoting cross-border communication.

Although some studies imply that the positive effect of Internet use on international communication is only realized in the core countries (Barnett & Park, 2012), it seems that the finding of this study does not support this proposition. If peripheral and core countries are at the same stage of Internet diffusion, there is no difference in the

volume of international IP traffic they generate. However, it is critical to emphasize that the international traffic variable used in the study does not distinguish outgoing and incoming data flow. Therefore, little is known about the nature of the traffic. Even though the core countries and peripheral countries generate the same amount of international traffic, it is possible that the traffic generated by developing countries is predominantly downloading data which originates from the developed countries.

Even though the positive effect of Internet use on international Internet communication is universal, it is not of equal sizes across countries in different development states. While in developed countries, a 1% increase of Internet users would generate 0.74% increase in the country's cross-border IP traffic, the same growth in developing countries would only lead to a 0.55% increase in its international IP traffic. Consistent with prior studies based on the world-system theory, this finding suggests that the peripheral countries are still somewhat disadvantaged in the information age. This discrepancy could be caused by several factors. First, it is possible that as more people become Internet users in the developing countries, they tend to have a higher demand for online content, which the domestic media and information market cannot supply. Therefore, they turn to foreign websites and information sources, generating incoming international traffic to the country. As a comparison, in developed countries, an increase in Internet users would generate both the demand and supply of online content. As a result, both the incoming and outgoing traffic grows. Or alternatively, as several studies have shown, Internet users in the Global South have increasingly engaged in indigenous content production (Choi & Park, 2014; Wu & Taneja, 2016). It is reasonable to expect that the indigenous content will compete against the content produced by other, possibly

Western countries and reduces the international traffic by a certain degree. If so, the smaller effect of Internet use on international data traffic might signify the advancement of peripheral countries in the production chain of online content rather than their marginalization.

This study also tested whether the effect of Internet use on the volume of international IP traffic varies with the stages of Internet diffusion. Contrary to the implications of some prior studies (Lunn & Suman, 2008; Rössel & Schroedter, 2015), the growth in Internet use always increases international IP traffic, regardless of the stages of the technology's diffusion in the country. Nevertheless, even in the first year of observation (2012), only about 20% of the countries had an Internet adoption rate below 16%. Therefore, according to the Innovation Diffusion Theory (Rogers, 2013), the increase in Internet adoption in most of the sampled countries came from relatively late adopters, namely, "the early majority", "the late majority" or "the laggard" (2003, p.283). It is possible that the effect of Internet use in the earlier stages of Internet diffusion is significantly different from that when the diffusion has entered the later stages, which this analysis cannot show.

This study also reveals the difference between the short-term, immediate effect and the long-term, delayed effect of Internet use on the volume of international Internet traffic. Noticeably, the delayed effect more than doubles the short-term effect. Although much attention has been given to the Internet primarily as a tool for long-distant and international communication, this larger delayed effect found in this study implies that it might be unrealistic to assume that the growth of population using the Internet in a

country would immediately lead to a proportional rise in its cross-border online communication.

Limitation of the Study

This study has several limitations which need to be addressed in future studies. First of all, due to the limitation of data, the inward and outward data traffic cannot be distinguished. Thus, the potential differentiated impact of Internet use on information import and export cannot be tested in this study. Second, to accommodate the data, each examined country was matched with a hypothetical "partner" – all other countries in the world as a whole. This operationalization leads the loss of much variation in the real-world partner a country has and should be considered in the interpretation of the non-significant effects of several control variables. Third, the volume of cross-border data flow does not reflect the real content of the communication. For example, it is possible that a user who wants to see a domestically made film would download it from a website hosted in a server in a foreign country. Therefore, a large volume of international IP data traffic does not necessarily mean there is real interaction with foreign Internet users or online content.

Chapter 5 INTERNET USE AND INTERNATIONAL TRADE

Introduction

In spite of frequent fluctuations, international trade, in general, has been growing rapidly over the last two decades (see, for example, the World Bank Open Data). One of the critical factors contributing to the expansion of global trade is the rise of new communication technologies, pioneered by the Internet (Borcuch, Piłat-Borcuch & Świerczyńska-Kaczor, 2012). Although the trade-promoting effect of the Internet has been well documented in international trade literature (Freund & Weinhold, 2002, 2004; Lin, 2015; Lechman & Marszk, 2015), some critical questions are yet to be answered.

Traditionally, international trade studies tend to focus more on the trade in goods either because not enough data are available for the trade in services or services remained a small part in international trade (Gervais, 2013). Recently, more attention has been given to the trade in services due to its rapidly increasing share of global trade (Loungani, Mishara, Papageorgiou & Wang, 2017). Unlike the trade in goods where transportation costs, although in decline, are still nonnegligible (Hummels, 2007), the trade in services could benefit immensely from the wide use of the Internet as it could significantly lower the cost of cross-border communication, a major barrier to service trade in which interpersonal interaction plays an important part (Huang, 2007; Christen & Francois, 2010). Moreover, many services that used to be considered as non-tradable, such as business consulting and education, can now be easily delivered via the Internet (Nath & Liu, 2017). Therefore, it is often assumed that the trade-boosting effect of the Internet would be greater in the trade in services than in the trade in goods (Freund & Weinhold, 2004; Gnangnon & Iyer, 2018). However, to the best knowledge of the author, there is no

empirical research which rigorously compares the nuanced effects of the Internet in different types of trade. Utilizing the bilateral trade data between the U.S. and 52 partner countries over the 2006 -2016 period, this study seeks to fill this gap by comparing the effects of the Internet in trade in goods and services.

In the *Condition of Postmodernity*, Harvey (1990) proposed a widely accepted concept: with the help of advanced communication technologies, information can now travel across a great distance in much less or even in no time. Therefore, the distance has been "compressed" (p. 5) by speed. Has the distance-compression effect of the Internet been realized in international trade? The existing literature seems to suggest it is not the case. Even after the Internet has been widely used, geographic distance remains a critical barrier to trade as shown in many studies (Disdier & Head, 2008; Lin, 2015). However, even if the distance still is an obstacle to trade, is it possible that the Internet has *weakened* the effect of geographic distance? Building on the analysis by Freund and Weinhold (2002) which uses trade data before the advent of the fast-speed Internet, this study also provides an updated answer to this important question.

The structure of this chapter is as follows. In the next section, prior studies on the effect of the Internet on international trade and on the relationship between the Internet and the distance effect in international trade are reviewed. Then, the third section introduces the data and analytical strategies used in the study, followed by the results of the analyses. The last section provides a summary of the main findings. The implications and limitation of the study is also discussed in the section.

Literature Review

The Internet and International Trade

With the adoption of the Internet around the globe, a growing body of literature has focused on the economic impact of the new communication technology, including its effect on international trade. In one of the earliest studies which examine the effect of the Internet on trade, Freund and Weinhold (2002) examined the effects of Internet penetration, operationalized as the number of top-level domain names assigned to each country, on the trade in services. Focusing on the service trade of the U.S. with 31 countries from 1996 to 1999, they found that a 10% increase in Internet penetration in the partner country is associated with a 1.2% increase in its export of business, professional and technical services to the U.S., while U.S. export of services is not associated with the Internet penetration in the partner country. Distinctively, their study found no significant effect of geographic distance on the U.S. export of services. Another study conducted by Freund and Weinhold (2004) focused on the trade in goods among 56 countries from 1995 to 1999. They found that a 10 percent points increase in the number of web hosts in a country would lead to a 0.2 percent point increase in the country's export growth, while the increase in Internet penetration in the partner country has no significant effect.

Although the two studies by Freund and Weinhold (2002; 2004) are frequently cited, the results of their analyses can be misleading because the potential endogeneity in the Internet penetration caused by reverse causality is not properly addressed. Using the strictness of data service regulation as the instrumental variable, Clark and Wallsten (2006) estimated the effect of Internet penetration, measured as web hosts per 100 people, on the share of a country's total export in its GDP. Their findings suggest a non-

uniform effect of Internet penetration. While higher Internet penetration would increase the share of trade in the GDP of developing countries, such an effect is not observed for high-income countries. Similar to the earlier studies (Freund & Weinhold, 2002; 2004), Clark and Wallsten (2006) found that Internet penetration in the exporting countries is more important than that in the importing countries as a driving force of export. Using the simultaneous equation estimation to address the endogeneity issue, Meijers (2014) analyzed the impact of Internet use on the share of total exports and total imports in a country's GDP for 162 countries and found a universally positive effect of the Internet on trade though the effect is smaller in high-income countries. Focusing on the total volume of bilateral trade, Vemuri and Siddiqi (2009) tackled the endogeneity issue by applying the Hausman-Taylor instrumental variable approach and estimated the effect of Internet penetration on trade among 64 countries over 21 years. Their analysis also indicates a strong positive relationship between Internet penetration and bilateral trade volume, irrespective of the development stage of the country. Similarly, a positive effect of the Internet on the volume of export is also found in the Mattes, Meinen and Pavel's study (2012) which focuses on the trade within EU countries.

Several recent studies have paid attention to the dynamic nature of international trade and used the generalized methods of moment (GMM) estimation strategy to assess the effect of the Internet. For example, Lin (2015) applied the two-step system GMM method to estimate the effect of Internet use on the value of bilateral export. The finding suggests that a 10% increase in the Internet users in a country would generate a 0.2% - 0.4% growth in its export, while the export is not influenced by Internet use in the partner country. By analyzing several subsamples, Lin's study also shows that the positive effect

of the Internet on export is universal regardless of the types of countries examined. In one of the most recent studies about the role of the Internet in trade, Gnangnon and Iyer (2018) analyzed whether closing the gap between Internet adoption in a country and the world average would increase the share of the country's commercial service trade value in that of the world. Based on the two-step system GMM estimation, the authors concluded that as countries close the gap in Internet adoption, their share of commercial service trade in the world would increase.

Although various measurements of Internet penetration or usage and international trade are used in prior studies, the literature generally supports a positive effect of the Internet on international trade. In studies which do differentiate between Internet penetration or use in exporting and importing countries, the Internet penetration or usage in the exporting countries is found to have a positive effect on the export, while the penetration or use in the partner country has a much smaller, or in some cases, insignificant effect (Freund & Weinhold, 2002; 2004; Clark & Wallsten, 2006; Lin, 2015). Since the exporting country's export is the partner country's import, these findings also imply that the positive effect of the Internet on international trade is mainly manifested in the promotion of export rather than import.

The Internet and trade in services. Although it is not directly addressed in most of the existing studies, the estimated effect of the Internet on service trade is found, in general, larger than that on goods trade. Indeed, several unique characteristics of services could make them more sensitive to the trade-boosting effect of the Internet. First of all, conventionally conceived as non-tradable, many types of services, such as consulting, entertainment services and educational services, can be delivered via the Internet as

"intangible goods" (Kumar & Loebbecke, 2000, p. 3). Second, as Nath and Liu (2017) pointed out, the wide adoption of ICTs, including the Internet, has created a booming sector of ICT-related or ICT-enabled services, such as international telecommunication services and software services. Third, the use of the Internet could also lower the search, communication and coordination costs (Huang, 2007), which could eventually lower the barrier to the international flow of services even if the services themselves cannot be delivered digitally.

Although numerous studies have examined the effect of the Internet on international trade in services, and generally, a positive impact has been found (Freund & Weinhold, 2002; Choi, 2010; Nath & Liu, 2013, 2017; Gnangnon & Iyer, 2018), very few rigorous empirical studies exist which compare the effects of the Internet in goods trade and service trade. Prior studies do imply that the Internet has a larger boosting effect on service trade than on goods trade. Nevertheless, given the different samples and measurements of Internet use and trade used in those studies, a direct comparison of the estimated effects would be very misleading. One notable exception is the study conducted by Kimura and Lee (2006). Focusing on the bilateral trade between 10 OECD countries and their partner countries, they found that several factors, such as GDP and Population, that are found to be important predictors for bilateral trade in goods have a smaller but still significant impact on the trade in services. Also notable is that the geographical distance constitutes a larger barrier to trade in the service sector than in the goods sector. Similar findings are also discovered by Lejour and Verheijden (2007) which applies the gravity model to analyze the bilateral trade between Canada and other OECD countries. However, neither of the two studies include and compare the effect of

the Internet in their study. Building on the work by Kimura and Lee (2006) and Lejour and Verheijden (2007), the current study fills this gap in the literature by applying the widely used gravity model to analyze the impact of the Internet in goods and services trade using the same sample of country pairs and examining whether the effect of the Internet in service trade is different from that in goods trade.

The Internet and the Distance Effect

The physical distance between trading partners has long been recognized as one of the most persistent barriers to international trade (Disdier & Head, 2008). According to Rauch (1999), the physical distance between trading partners constitutes a barrier to trade in two ways. First, long distance usually means higher transportation cost, measured in both monetary and time terms (Hotelling, 1929). Second, the cost of communication with countries further away is higher, leading to the lack of accurate and updated information about potential markets and business partners and the difficulty of coordinating business transactions (Christen & Francois, 2010). In addition, Blum and Goldfarb (2006) also pointed out that distance can be an indicator of the proximity in culture and customs and therefore, impacts the trade in taste-sensitive products or services. Although the Internet may have little to do with the reduction of transportation costs, many studies have shown that it could effectively lower the cost of cross-border communication and in some degrees, offset the trade resistance caused by different cultures and tastes.

In one of the earliest studies which explore the effect of Internet use on closing the information gap, Daly and Miller (1998) surveyed more than 100 firms in 16 developing countries and found that more than 50% of the firms with Internet connection used the Internet to search for information about domestic and international market

opportunities and potential business partners. Gebauer and Segev (2001) discussed the role of the Internet in the supply chain management and showed that the adoption of the Internet could effectively facilitate and streamline the procurement process by drastically lowering the cost of coordinating with distant suppliers. The Internet is also found to significantly reduce the barrier to accessing foreign market information, which greatly facilitates and boosts cross-border financial investment (Gajewski & Li, 2015).

Although it is still debatable whether the rise of new communication technologies pioneered by the Internet has led to the homogenization of different cultures (Bhawuk, 2008), several studies do suggest that Internet use could lead to greater interest in and identification with foreign cultures and fosters a cosmopolitan worldview that all humans belong to the same community (Jeffres, Atkin & Bracken, 2004; Norris & Inglehart, 2009; Verboord, 2017). Therefore, it is likely the constraining effect of physical distance is weakened by the Internet even in the trade of products or services conventionally believed to be taste-sensitive.

The studies reviewed above all imply that Internet use is likely to weaken the negative effect of geographic distance in international trade. However, at best, they only provide some indirect evidence. There are very few studies that directly answer the question of whether the Internet has decreased the effect of physical distance in international trade. Freund and Weinhold (2000) examined the effect of distance on the total volume of trade among 56 countries from 1995 to 1999. Using a stepwise regression strategy, they found that after the number of web hosts is added to the model, there is little change in the size of the distance effect. Based on this finding, the authors argued that the Internet does not alter the effect of the geographic distance in international trade.

In a later study, Freund and Weinhold (2004) added an interaction term between a dummy variable which equals 1 if the distance between the two countries is greater than the average distance among the countries in the sample and the Internet variable. The insignificant coefficient of the interaction term suggests that the negative effect of geographic distance is not weakened by the Internet. This interaction-term strategy is also adopted in Gnangnon and Iyer (2018), which shows that closing the Internet adoption gap in the geographically remote countries could partially offset the negative effect caused by the remoteness of the country.

Data and Method

The Empirical Model

To evaluate whether the Internet has made physical distance less important in international trade, this study employs the widely used gravity model first proposed by Isard (1954). According to the model, the bilateral trade volume is positively related to the economic size of the two countries and inversely related to the distance between them.

In addition to the three basic determinants, many studies have proposed and examined the effects of other factors, including the Internet, on the bilateral trade (Freund & Weinhold, 2002, 2004; Kimura & Lee, 2006; Lin, 2015; Gnganon & Iyer, 2018). Based on prior studies, the following augmented gravity model is proposed.

$$Ln\ (Trade_{1pt}) = Constant + \beta_1\ Ln\ (GDPPC_{1t}) + \beta_2\ Ln\ (GDPPC_{pt}) + \beta_3\ Ln\ (Distance_{1p}) + \beta_4\ Ln\ (Internet_{1t}) + \beta_5\ Ln\ (Internet_{pt}) + \beta_6\ Ln\ (Pop_{1t}) + \beta_7\ Ln\ (Pop_{pt}) + \beta_8\ Ln\ (REER_{1t}) + \beta_9\ Ln\ (REER_{pt}) + \beta_{10}\,\mathrm{FTA}_t + \beta_{11}\ Language + \beta_{12}\ T + v_p + u_{1pt}$$

To compare the effects of the Internet in different types of trade, the model is estimated three times with different dependent variables: export of goods, exports of services excluding the ICT-enabled services (hereinafter referred to as non-ICT services) and export of digitized services. According to prior studies (Kumar & Loebbecke, 2000; Nath & Liu, 2017), the Internet is more likely to boost trade in services that can be digitally delivered. Given the lack of consensus on the scope of services that can be delivered via the Internet, the export of digitized services is measured as the outflow of a conservative selection of services that are ICT-related or ICT-enabled based on the categorization proposed by Grimm (2016), including telecommunication, computer and information services, financial services, insurance services and charges for intellectual property use. Admittedly, this selection does not include all the services that can be digitally delivered. For example, many business consulting and educational services can be easily delivered via the Internet. Nevertheless, the conservative selection ensures that to the maximum possible degree, little movement of commodities or people is involved in the selected services.

A number of country-specific factors, such as GDP per capita (*GDPPC*), population (*Pop*)[8] and the real effective exchange rate of the country's currencies (*REER*) are included in the model. *FTA* is a dummy variable that equals 1 if country *1* and its partner, country *p*, have a free trade agreement. *Language* is a dummy variable which equals 1 if citizens of two countries speak a common language. Time dummies (*T*) are also included to control for the time-specific fixed effects. v_p is the country-specific

[8] The total GDP is not included because of strong multicollinearity with population. Since *ln (Total GDP) = Ln (GDPPC x Pop) = Ln (GDPPC) + Ln(Pop)*, by including both *ln(Pop)* and *ln(GDPPC)*, this model has in effect controlled for the effect of total GDP.

effect. The main variables of interest are the percentage of the population using the Internet (*Internet*) in each of the countries.

Data

The data on the values of export from the U.S. to its partner countries adjusted by inflation are downloaded from the U.S Census Bureau for trade in goods and the OECD EBOPS2010 dataset for trade in services. Although the bilateral trade volumes (in goods) among literally all the countries in the world are available in several data sources, this study only focuses on the U.S export for the following considerations. First, one of the main purposes of the current study is to compare the effects of the Internet in trade in goods and services. In order to have a valid comparison, the samples for goods and service trade should contain the same country pairs, which is difficult to achieve due to the missing data on service trade for a great number of country pairs. Thus, to make it manageable to construct comparable samples for service and goods trade, this study focuses only on one developed economy, the U.S., for which the data on both goods and services are relatively well documented. The sample construction started from identifying countries with reported service trade with the U.S. (including zero trade flows reported). Then, the values of digitized service and goods trade are matched to the identified country pairs. Second, even though the U.S. trade data are relatively well documented, there is still a number of cases where the import of services is unavailable. Therefore, to fully utilize the advantages provided by the inter-unit differences in panel data, this study focuses on the export from the U.S. to other countries. Focusing on the bilateral trade among a small set of countries, or even only the bilateral trade between one country and its partners is common in studies which compare the service and goods trade due to

limited data availability (Kimura & Lee, 2006; Lejour & Verheijden, 2007). The final sample includes 52 partner countries of the U.S., for which the data on trade in goods and services are both available. Among the 52 countries, 34 are high-income economies, and 18 are medium- and low- income economies (see Appendix D for the list of countries in the sample). To accommodate the fewer time periods available for the data on the trade in digitized services, 11 years of data, from 2006 to 2016, are downloaded.

Although this study mainly focuses on estimating the effect of the Internet on U.S. export, it is worth pointing out that the analysis result may also shed some light on the impact of the Internet on import. Specifically, the dependent variable, from the perspective of the partner countries, is the import from the U.S. Thus, while the estimate of $LnInternet_{1t}$ indicates the effect of Internet use in the U.S. on its export, the estimate of $LnInternet_{pt}$ could show the effect of Internet use in the partner country on its import, although, as discussed in the last section of the paper, caution must be used when interpreting the Internet effect on import.

The focus on the U.S export ensures that the same country pairs can be examined for different types of trade. Nevertheless, it also introduces a potential selection bias: the result of this study only reveals the effect of the Internet for countries with reported trade data with the U.S. Although it is not uncommon to treat all missing data as zero trade between two countries (Helpman, Melitz & Robinstein, 2008; Liu & Nath, 2013), such a treatment might not be appropriate in the context of this study. Notably, in several years, about 2% - 3% of the U.S. service exports went to unidentified countries. Therefore, the possibility cannot be ruled out that some countries with missing data could in fact have imported U.S. services. Lin (2015) compared the significance, direction and size of the

effects of the Internet on the bilateral export value in three different estimations in which 1) the missing data are deleted; 2) zero values are assigned to the missing data, and all observations are used and 3) only the reported data are used while the selection-bias is addressed by the Heckman two-step regression. The result shows that the direction and significance of the effects remain stable, although the size of the estimated effect is slightly smaller in the latter two types of estimations than that obtained using only the countries with reported trade data. Therefore, although only using the observations with reported trade flow might result in some sample selection bias, it is expected to cause less problem than mistakenly assigning zero trade flows to countries.

The data on the percentage of population using the Internet, the real effective exchange rate of the currencies and the total population are downloaded from the World Bank Open Data website. Information on the countries with free trade agreements with the U.S. and the year when the agreement went into effect is available at the U.S. Department of State website. Since the exporting country is the U.S., the countries with a common language are the English-speaking ones or those with a considerable proportion of its population who can speak English. Using the English-Speaking Map created by Crystal (1997), countries with more than 50% of its population who can speak English are identified. The definitions and descriptive statistics of the variables are provided in Table 12.

Table 12. Variables and Descriptive Statistics

Variable	Definition	N	Mean	Std.	Min	Max
$LnGoods_{1pt}$	The value of U.S goods export to the partner country	572	8.61	1.78	4.58	12.65
$LnServ_{1pt}$	The value of U.S service export (non-ICT) to the partner country	572	7.92	1.97	0	11.12
$LnDigServ_{1pt}$	The value of U.S. digitized service export to the partner country	572	6.79	2.01	0	10.34
$lnInternet_{1t}$	% of population using the Internet in the U.S.	572	4.29	0.03	4.23	4.33
$lnInternet_{pt}$	% of population using the Internet in the partner country	572	4.02	0.59	1.03	4.59
$lnGDPPC_{1t}$	GDP per capita of the U.S.	572	10.84	0.07	10.75	10.96
$lnGDPPC_{pt}$	GDP per capita of the partner country	572	10.14	0.68	8.17	11.54
$lnDistance_{1p}$	The distance between the U.S. and the partner country	572	8.97	0.43	7.59	9.64
$lnPop_{1t}$	Total population of the U.S.	572	19.56	0.03	19.51	19.59
$lnPop_{pt}$	Total population of the partner country	572	16.52	1.63	12.62	21.04
$lnREER_{1t}$	The real effective exchange rate of U.S. dollar	572	4.64	0.06	4.55	4.77
$LnREER_{pt}$	The real effective exchange rate of the partner country's currency	572	4.59	0.14	4.04	6.66
FTA_t	=1 if the country has a free trade agreement with the U.S.	\	\	\	\	\
$English_p$	=1 if more than 50% of the population can speak English	\	\	\	\	\

Note: Trade in goods, services and digitized services are in million $. All variables are transformed to the natural log form. Trade in non-ICT services and digitized services are transformed using ln(1 +x) to accommodate zero trade flows. All data are available for 11 years from 2006 to 2016. The distance between the geographic centers of the U.S. and the partner country is used.

The Empirical Strategy

As many studies have shown, international trade has a dynamic nature: the current trade volume is greatly influenced by its past values (Liu & Nath, 2013; Lin, 2015). The Woodridge test confirms that strong serial correlation exists in the data for trade in goods ($chi^2 = 31.78$, $p < 0.01$), non-ICT services ($chi^2 = 101.09$, $p < 0.01$) and digitized services ($chi^2 = 105.79$. $p < 0.01$). Thus, the one-year lag of the dependent variable is included as a RHS variable in the model.

Another issue that must be dealt with is the endogeneity in the Internet use variable. The most common way to address the endogeneity issue is the instrumental variable (IV) method. However, finding valid IVs which strongly correlate with Internet use and at the same time, satisfy the overidentification condition is a difficult task. Some

commonly used strategies are to instrument Internet use by the adoption of related technologies, such as telephones and cable TVs, before the first year of observation (Czernich, Falck, Kretschmer & Woessmann, 2011) or country-specific factors that could influence network deployment, such as population density or percentage of mountainous areas in a country (Kolko ,2012). However, these IVs are not appropriate in this study. First, valid IVs require that their influence on the dependent variable be largely mediated by the instrumented variable, i.e., the IVs do not directly influence the dependent variable neither do they have strong correlation with other independent variables (Woodridge, 2016). However, arguably, all these potential IVs are strongly correlated with the GDP per capita of the country. Moreover, besides Internet use, the two variables capturing the effect of GDP could also be endogenous, since both the volume of trade and GDP per capita could be caused by some unobserved factors. Since the Internet and GDP per capita are likely to have a strong correlation (Koutrompis, 2009; Czernich et al., 2011), the endogeneity in GDP per capita could cause the estimate for the Internet's effect to become inconsistent and biased. Given the difficulty of finding valid external IVs, this study addresses the endogeneity issue in Internet use with the two-step system generalized methods of moments (GMM) estimation. In order to avoid having more IVs than the number of countries, the depth of the lags in the IVs is limited to 7, and the collapse function in STATA is used.

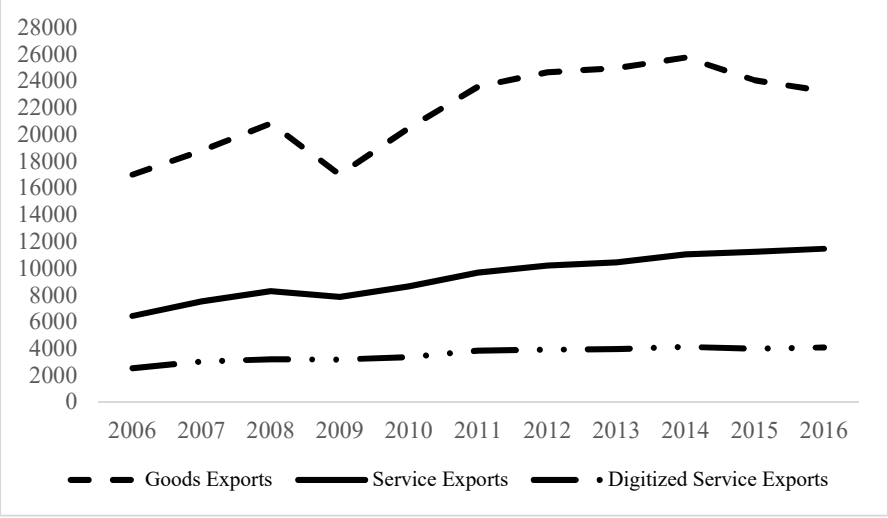
Another limitation, not caused by the use of GMM but the focus on the U.S. export, is that the time dummies cannot be estimated. Since the U.S. is the only trade partner for all the 52 countries, in any given year, the percentage of the U.S. population using the Internet, GDP per capita and real effective exchange rate of the U.S remain

constant and thus, have perfect multicollinearity with the year dummies. Therefore, to control for the time-specific effects to the largest possible degree, a new set of time dummies are created where *T1* = 2006, *T2* = 2007 and 2008, *T3* = 2009 and 2010, *T4* = 2011 and 2012, *T5* = 2013 and 2014, *T6* = 2015 and 2016. Admittedly, some nuanced effects of each specific year are lost in this treatment. However, this transformation allows the variables for the U.S. to vary and thus, removes the perfect multicollinearity.

Analyses and Results

As Figure 5 shows, the mean values of U.S. goods and non-ICT service exports to a partner country (in million $) in general increased during the 2006-2016 period, although a notable decrease in goods exports is observed for 2009. The export of digitized services remained relatively stable during the same period.

Figure 4. The Mean Value of U.S. Exports from 2006 to 2016 (Million $)



If the value of export is determined by a certain time trend, the estimates would be plagued by spurious causality. Therefore, it is worthwhile examining the stationarity property of the panel data. Although there are many methods to test for unit root, most of them require that the number of cross-sectional units be small relative to the number of

time periods (Choi, 2001). Thus, the method proposed by Harris and Tzavalis (1999) is adopted which allows for a large number of units and a relatively smaller number of time periods.

Table 13. Harris – Tzavalis Unit Root Test for U.S. Exports

	Null Hypothesis: Panels contain unit root	
	p-value	*z* value
lnGoods	0.00	-7.88
LnServ	0.03	-2.23
LnDigServ	0.02	-2.87

The results of the tests for the trade in goods, services and digitized services, reported in Table 13, show that there is no unit root in the data, and the data is stationary. Given this stationarity property in the panel data, it is concluded that the change in the value of exports is not mainly caused by time trend over the period 2006 to 2016.

The GMM Results

The results of the GMM estimation for the U.S. export of goods, non-ICT services and digitized services are reported in Table 14. As the table shows, the p values of the second-order autocorrelation test are consistently higher than 0.1. The insignificance of the Sargan and Hansen overidentification tests shows the null hypothesis that the instruments are jointly exogenous cannot be rejected. The F tests indicate that the independent variables are jointly significant. Taken together, these diagnostic test results suggest that the two-step system GMM estimation is a valid method for this empirical analysis.

According to the estimation results, as the percentage of the population using the Internet increases, the U.S. exports of goods, non-ICT services and digitized services to partner countries would also increase. Moreover, the results provide some evidence that

the trade-boosting effect of the Internet is larger in the service trade. Specifically, although there is no considerable difference observed for the Internet's effects in trade in goods and non-ICT services, its effect is four times larger in the trade of digitized services than in the trade in goods. According to the estimation result, a 1% increase in the U.S. population using the Internet would generate a 0.02% increase in the U.S. export of goods and a 0.03% increase in the U.S service export, while the same increase in Internet use would lead to a 0.13% increase in the U.S. export of digitized services.

Table 14. Two-Step System GMM Estimation Results

	LnGoods	*LnServ*	*LnDigServ*
$LnInternet_{1t}$	0.02 [0.009] *	0.03 [0.007] *	0.13 [0.04] **
$LnInternet_{pt}$	0.006 [0.003] *	-0.001 [0.003]	0.001 [0.04]
$LnGDPPC_{1t}$	0.75 [0.22] **	0.59 [0.16] **	0.76 [0.28] **
$LnGDPPC_{pt}$	0.82 [0.23] ***	0.17 [0.11] *	0.57 [0.29] *
$LnDistance_{1p}$	-0.43 [0.17] *	-0.08 [0.03]	- 0.12 [0.13]
$LnPop_{1t}$	-1.40 [0.43] **	-1.10 [0.43] ***	-2.11 [0.61] **
$LnPop_{pt}$	0.59 [0.14] ***	0.13 [0.06] *	0.29 [0.13] *
$LnREER_{1t}$	-0.26 [0.01] ***	-0.15 [0.43] **	1.05 [0.61]
$LnREER_{pt}$	0.04 [0.02] *	0.11 [0.08]	0.03 [0.13]
FTA_t	0.75 [0.19] ***	0.11 [0.05] *	0.18 [0.08] *
$English_p$	0.33 [0.12] *	0.12 [0.06] *	0.32 [0.16] *
Constant	223.62 [71.02] **	179.34 [71.19] ***	313. 73 [81.59] **
# of Instruments	46	46	46
Obs - Countries	520-52	520-52	520-52
AR (1) p-value	0.01	0.00	0.03
AR (2) p-value	0.71	0.11	0.38
Sargan test (p-value)	0.08	0.08	0.09
Hansen -J test (p – value)	0.16	0.26	0.13
F test (p-value)	0.00	0.00	0.00

Note: The one-year lags of the dependent variables and time dummies (not reported) are included in the model. Numbers in the brackets are heteroskedasticity-robust standard errors. $LnInterent_{it}$, $LnInternet_{pt}$, $LnGDPPC_{1t}$, $LnGDPPC_{pt}$, $LnREER_{1t}$, $LnREER_{pt}$, and the lagged dependent variables are entered as endogenous variables. The number of lags used in the IVs is limited to 7, and the collapse function in STATA is used to avoid having more instruments than the number of countries.

Similar to the findings in other studies (Freund & Weinhold, 2002; Clark & Wallsten, 2006; Lin, 2015), the results indicate that Internet use in the partner country is,

in general, less important as a driving force of export: while it can boost the U.S. exports of goods, it does not have any significant impact on the U.S. exports of services. Also, a 1% increase in the partner country's population using the Internet would only lead to 0.006% increase in the U.S exports of goods. From the perspective of the partner country, this result indicates that the effect of Internet use on goods import is much smaller.

The effect of geographic distance also varies depending on the types of trade. While a 1% increase in the distance would lead a 0.43% decrease in the U.S. export of goods, the U.S. export in services is not influenced by how far the partner country is. This finding is in line with the earlier study conducted by Freund and Weinhold (2002), which also focuses only on the U.S. trade, but different from some other studies (Kimuara & Lee, 2006; Lejour & Verheijden, 2007). The implication of this finding is discussed in the next section.

Although not the main focus of this study, the effects of other independent variables are also reported. The GDP per capita of the U.S. and the partner country both have a significant positive impact on the U.S. export. Having a free trade agreement significantly boosts the U.S. export to the partner country. Consistent to the findings in other studies (Nath & Liu, 2013, 2017), while the growth in the partner country's population leads to an increase in the U.S. export, the U.S. population growth generates a downward push to the country's export, suggesting that the increase in demand as a result of population growth, in general, overpowers the increase in the production and supply caused by the population growth. The appreciation of U.S. dollars is negatively related to the U.S. export, while the appreciation of the partner country's currency would generate more import from the U.S. Noticeably, however, the effects of currency appreciation are

mainly manifested in the trade in goods. The import-promotion effect of the appreciation of the partner country's currency is not observed in trade in services, and neither the change in the value of U.S dollars nor the partner country's currency influences the U.S. export of digitized services. The analysis also shows that the U.S. tend to export more to countries where English is widely spoken.

Although the three models reported in Table 14 show the effects of the physical distance when the effect of the Internet is controlled, they do not directly answer the question whether the use of the Internet has increased or decreased the effect of distance. Particularly, although geographic distance remains a significant obstacle in the trade in goods, the Internet might have weakened its effect to some degree.

To test whether the Internet has made the distance a less important barrier to trade, the interaction terms between the percentage of population using the Internet and the distance between the U.S. and its trading partner are created and added to the model. If the negative effect of distance becomes smaller as more people use the Internet, the coefficients of the interaction terms should be significant and positive. It is worth pointing out that even though distance is not a major barrier in service trade, the interaction effect can still provide some crucial information about whether the effect of the Internet on service trade remains the same or changes as the distance increases. The estimated coefficients of the interaction terms obtained from the GMM estimation are reported in Table 15.

Table 15. GMM Results with Distance-Internet Interactions

	LnGoods	*LnServ*	*LnDigServ*
$LnInternet_{1t}$	0.09 [0.03] *	0.10 [0.04] *	0.15 [0.05] **
$LnInternet_{pt}$	0.02 [0.01] *	-0.01 [0.02]	0.02 [0.03]
$LnGDPPC_{1t}$	0.27 [0.07] ***	0.22 [0.05] **	0.12 [0.06] *
$LnGDPPC_{pt}$	0.91 [0.25] ***	0.21 [0.15]	0.59 [0.25] *
$LnDistance_{1p}$	-0.48 [0.27] *	-0.08 [0.03]	- 0.29 [0.89]
$LnPop_{1t}$	-0.94 [0.43] *	-0.76 [0.15] ***	-0.66 [0.24] **
$LnPop_{pt}$	0.71 [0.13] ***	0.17 [0.08] *	0.53 [0.17] **
$LnREER_{1t}$	-0.15 [0.03] ***	-0.38 [0.12] **	-0.56 [0.17] ***
$LnREER_{pt}$	-0.07 [0.06]	0.30 [0.32]	-0.37 [0.52]
FTA_{t}	0.74 [0.20] ***	0.09 [0.08]	0.37 [0.19]
$English_{p}$	0.54 [0.19] *	0.17 [0.07] *	0.51 [0.18] **
$LnInternet_{it}$ * *Distance*	-0.03 [0.21]	0.03 [0.02]	0.15 [0.21]
$LnInternet_{pt}$ * *Distance*	0.07 [0.47]	0.14 [0.19]	0.21 [0.28]
Constant	77.93 [91.49]	130.96 [73.82]	110.58 [90.01]
# of Instruments	48	48	48
Obs - Countries	520-52	520-52	520-52
AR (1) p-value	0.01	0.00	0.00
AR (2) p-value	0.77	0.15	0.16
Sargan test (p-value)	0.09	0.08	0.15
Hansen -J test (p – value)	0.16	0.16	0.18
F test (p-value)	0.00	0.00	0.00

Note: All other independent variables and time dummies are included in the model (not reported). Numbers in the brackets are heteroskedasticity-robust standard errors. *LnInterentit, LnInternetpt, LnGDPPC1t, LnGDPPCpt, LnREER1t, LnREERpt*, and the lagged dependent variables are entered as endogenous variables. The collapse function in STATA is used to avoid having more instruments than the number of countries.

According to the results, in goods trade, in which physical distance is a significant barrier, the effect of distance does not change as the level of Internet adoption increases. Thus, physical distance always imposes a negative impact on the trade in goods, and this negative effect does not become any smaller even with a high Internet adoption rate. In service trade, where physical distance is not a major barrier, no evidence is found that the effect of the Internet varies based on how far the partner country is. In other words,

Internet use in the exporting country always has a positive impact on the export, and such an effect does not become smaller or bigger as the distance increases.

Conclusion and Discussion

Although there are abundant studies which explore the relationship between the Internet and international trade, two critical questions remain unsatisfactorily answered. Does the effect of the Internet in goods trade differ from that in the service trade? Does the Internet weaken the barrier to trade imposed by geographic distance? And if it does, is the distance-transcending effect universal or is it just manifested in certain types of trade? This study answers these pressing questions by analyzing the effect of Internet use on the export of U.S. goods and services to 52 partner countries over the 2006-2016 period. According to the analysis results, increased Internet use in the U.S. boosts the U.S. exports of goods and services, and this positive effect is four times larger in the trade in ICT-enabled and ICT-related services. As one of the few empirical studies which compare the effect of the Internet in goods trade and service trade using the same sample of country pairs and consistent measurements of trade, the analysis provides concrete evidence which shows the nuanced effects of the Internet in different types of trade. Also, by applying the gravity model, this study shows a remarkable difference in the effect of physical distance in goods and service trade. Even with the wide adoption of the Internet, physical distance remains a constraining factor in the trade in goods. However, the service export is not influenced by the distance between the U.S. and its partner countries.

A unique contribution of this study is that it examines whether the effect of distance on trade varies based on the level of Internet adoption and whether the effect of Internet use is dependent on how far the partner country is. According to the GMM estimation, the negative effect of physical distance in goods trade is not mitigated by the Internet. This finding, to some extent, reveals the nature of the challenge imposed by physical distance in goods trade. Although the difficulty in communication and coordination between partners in different countries constitutes a major barrier to trade, in goods trade, the transportation-related costs remain the most important obstacle, which the Internet can do very little to offset.

The finding that the service trade is not influenced by physical distance does provide some evidence to support the distance-compression effect of the Internet. It can be argued that the wide adoption of the Internet has made cross-border communication and thus, cross-border coordination so convenient that physical adjacency is no longer a necessary requirement for service trade to happen. Also, nowadays many services can be easily delivered by the Internet, thus making physical distance irrelevant. However, there are still services that require personnel or goods movement. This study also shows that physical distance is an irrelevant factor even in the trade of non-ICT related or enabled services. Without further testing, it is hard to conclude whether or to what extent the insignificant distance effect in those service trade sectors is the result of Internet use. Moreover, the insignificant effect of physical distance could be attributed to the uniqueness of the sample used in the study. As a country with one of the largest service industries in the world, the U.S. has a dominant position in several sectors such as technology, business, educational, research and entertainment services, many of which

are difficult to replace by other countries (Peterson Institute for Economics, 2015). Therefore, the strong demand for the services provided by the U.S. may have defied the negative influence of geographic distance.

The analysis of the distance-Internet interaction effect, this study also indicates that the positive effect of the Internet on export is not dependent on how far the partner country is. This positive effect, interpreting together with the weak evidence supporting that the Internet has made physical distance a lesser obstacle in international trade, leads to the conclusion that the effect of the Internet is better summarized as *aspatial* rather than what Mitchell called "anti-spatial" (1995, p.8) in that it generates a uniform, positive effect on trade no matter how far the country is but does not necessarily achieve this by mitigating the challenges imposed by physical distance.

The results of the analysis reveal an asymmetrical effect of the Internet on import and export. Although the increase in the population using the Internet in the exporting country contributes to its export, the increase in the importing country has a much smaller or even insignificant effect on its import. Such asymmetry is also discovered in the few studies which do distinguish the Internet use in the exporting country from that in the importing country (Freund & Weinhold, 2002, 2004; Lin, 2015), and very little explanation has been given. Although the source of the phenomenon can be attributed to the different natures of export and import, one possibility cannot be overlooked: the export reported by the exporting country does not necessarily correspond to the import of the partner country. The asymmetry in data is a well-recognized issue in international trade (United Nations, 2018). According to the estimates by OECD Office for National Statistics (2018) based on UK trade data, the mismatch between the reported export and

the actual import ranges from 3% to 22% in trade in goods and 3% to 43% in trade in services. Given such a big discrepancy in the data, it is highly questionable whether the smaller or insignificant effect truly indicates the Internet impact on the country's import. Therefore, the current analysis only indicates that the Internet could generate a positive impact on a country's export. Although some evidence is found that the Internet might have a smaller or no impact on import, more work is needed to further explore the asymmetric effects of the Internet.

Limitations of the Study

This study has several limitations that should be addressed in future works. To conduct a meaningful comparison, this study only focuses on the U.S. export with countries that reported values of trade with the U.S., which results in a dataset containing the U.S. export to 52 countries for an 11-year period. This sample might cause several issues. First of all, the findings might be overwhelmingly influenced by the unique patterns in the U.S. export and are not necessarily generalizable to the trade among all countries in the world. Second, by deleting all the countries with missing data, the results of the analysis must contain some sample section bias, although previous studies have shown that this issue does not severely change the empirical results in the context of international trade (Lin, 2015). Last, due to the limitation of the statistical method used in this study, a limit on the depth of lags has to be applied to the instrumental variables to avoid having more IVs than the number of countries. Although the diagnostic tests show that the IVs used in the analysis are valid, it is possible that the endogeneity in some explanatory variables is not fully addressed. Besides the potential issues caused by the sample, the same set of variables are used in the gravity models for goods and service

trade. Although this makes it easy to compare the effects of the Internet, in reality, it is likely that the determinants of goods trade are different from those for service trade.

Chapter 6 FINAL CONCLUSION AND DISCUSSION

Advanced communication technologies pioneered by the Internet are often believed to have compressed distance by the speed of information exchange and shrunk the world into a global village (McLuhan, 1962). The manifestation of the distance-compression effect is often summarized as the following two observations. First and most obviously, with the help of advanced communication technologies, information exchange among people and places far away from each other takes only milliseconds at minimal costs. Therefore, if distance is measured by time, as people have always been doing (Warf, 2008), the world now is indeed a global village. Second, as media ecology scholars have long emphasized (Meyrowitz, 1985; Scolari, 2002), communication technologies not only change people's behaviors but also alter the ways in which people feel, perceive and understand the world. In the context of time-space compression, it is not only the use per se of the Internet for long-distance communication that is important, but how such use changes the way people perceive distant places and people. The global village describes not only a forming reality but also a perception of the world as a (small) single community.

In Chapters 3 and 4, the two aspects of the effects of the Internet —fostering cosmopolitanism and increase international online communication— are tested. In Chapter 3, the effect of Internet use on the national cosmopolitan tendency is examined using three waves of European Value Study data collected in 26 European countries for 1990, 1999 and 2008. The result suggests a non-linear effect of the Internet on cosmopolitanism. When the Internet diffusion is at a relatively low level, i.e., before 23% of the population are using the Internet, the effect of Internet use on cosmopolitanism is

inconclusive. Based on the estimation, it could be either a very small positive or a marginally significant negative effect. Nevertheless, after the diffusion of the Internet reaches the critical mass of 23%, increased Internet adoption would generate a completely positive effect on the national cosmopolitan orientation. Using the ITU ICT Development Index data over the 2012-2016 period, the impact of Internet use on the volume of international IP traffic for 55 countries is examined in Chapter 4. According to the estimation, a 10% increase in the number of Internet users would lead to a 4.8% increase in a country's international Internet traffic, and this positive effect is not subject to change with the stage of Internet diffusion. Therefore, the widely accepted argument that the Internet greatly boosts cross-border communication (Borcuch, Piłat-Borcuch & Świerczyńska-Kaczor, 2012) is not unfounded.

The findings in these two studies provide concrete empirical evidence that the Internet does contribute to the rise of cross-border online communication and the emergence of the worldview that all humans belong to the same community. Given these two pieces of evidence, it is reasonable to expect that the negative effect of physical distance imposed on international trade should be much smaller. In Chapter 5, the effect of the Internet on the distance effect in international trade is examined using the bilateral trade data between the U.S. and 52 of its trade partners over the period of 2006 to 2016. Internet use does significantly increase the volume of trade. However, very limited has been found which suggests that the positive effect of the Internet achieved through weakening the challenges caused by physical distance.

To summarize the main findings of the three studies, the use of the Internet does lead to increased international online communication and promote a cosmopolitan worldview. However, the fulfillment of these two potentials seems not to have weakened the effect of physical distance in international trade. Admittedly, each of the three studies uses samples containing different countries and data for different time periods. Therefore, it is not appropriate to rush into a final verdict based on a simple synopsis of the three studies. Nevertheless, the strong effects of the Internet in promoting international communication and fostering the cosmopolitan worldview (after the diffusion of the technology reaches a certain level) and the technology's rather limited power in weakening the effect of physical distance does call for a revisit of the common narratives of the role of the Internet in the globalization process.

First, how to understand the nature of the role of the Internet in the globalization process? Very often, its role is summarized as the compression of distance by time (Harvey, 1990), i.e., the constraining effect of long distance on cross-border movement of people and goods is eliminated or at least weakened by the technology. However, this is not supported by the findings of this study. Indeed, the Internet has a uniform and positive impact on international trade, regardless how far two countries are located from each other. Nevertheless, the wide use of the Internet does not seem to weaken the negative effect of physical distance. Admittedly, the finding that U.S. service exports are not influenced by how far the partner country is provides some indirect evidence that the Internet does weaken the effect of physical distance. In some earlier studies which analyze older data and do not include the Internet as an explanatory variable, distance is found to be a larger obstacle in service trade than in goods trade (Kimura & Lee, 2006).

Comparing this finding to the insignificant distance effect observed in the current study, it might imply that the Internet has changed the service sector to the degree that physical distance no longer matters. However, it is hard to tell whether or to what extent the insignificant effect can be attributed to the Internet without further testing. Therefore, based on the current findings, the role of the Internet in the globalization process is better characterized as a distance-compensating rather than a distance-compression effect.

Second, even the distance-compensating effect of the Internet is unevenly manifested in countries of different development stages. The cosmopolitanism-promoting effect of the Internet is only prominent after a certain proportion of the population become users. As of 2016, there were still about 56 countries in the world where the penetration of the Internet was far behind the 23% threshold (see World Bank Open Data), all of which are low- or middle- income countries. For these countries, having more people becoming Internet users would have a very small or even a negative effect on how people there perceive the world. Also, the effect of the Internet on promoting international online communication is found to be more prominent in high-income countries. The significant divide in the effects of ICT use (Scheerder, van Deursen & van Dijk, 2017) is also manifested in the distance-compensating effect of the Internet. Although the Internet might have made the world in effect a global village, it seems to be more of a village for the rich.

Limitations of the Studies

All the findings and implications of the three studies should be considered in view of their limitations given below. First of all, although the three studies are intended to be interconnected, they use different samples and examine data for different time periods.

Therefore, the results obtained might not be directly comparable, and the implications made from a synoptic reading of the findings only indicate a possibility rather than solid evidence. Second, due to data availability, all the studies focus on countries as the unit of analysis. Admittedly, a lot of local variation in the dependent variables could be lost in the aggregation of data to the national level. Moreover, some variables, such as the cosmopolitan orientation, are arguably more suitable to be measured at the individual level. Therefore, future studies would benefit from an analysis at a more granular level. Third, to test whether the Internet leads to the compression of distance, this study focuses on the distance effect in international trade. However, the cross-border flows of goods and services are but one area where geographic distance is a major obstacle. Future studies should extend the analysis to other areas, for example, international tourism and examine whether the Internet has weakened the distance effect in those areas.

References

Abler, R., & Falk, T. (1981). Public information services and the changing role of distance in human affairs. *Economic Geography, 57*(1), 10-22.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel Data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies, 58*, 277–297.

Appiah, A. (2006). *Cosmopolitanism: Ethics in a world of strangers* (1st ed.). New York: W.W. Norton.

Anderson, B. (2006). *Imagined communities*. London, New York: Verso.

Alonso-Borrego, C. (2010). Firm behaviour, market deregulation and productivity in Spain. Banco de España, Documento de Trabajo 1035. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.187.2143&rep=rep1&type=pdf

Bentley, J. H. (1996). Cross-cultural interaction and periodization in world history. *The American Historical Review, 101*(3), 749-770. doi:10.2307/2169422

Bakos, J. Y. (1997). Reducing buyer search costs: Implications for electronic marketplaces. *Management Science, 43*(12), 1676-1692.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*, 115–143.

Barnett, G. A. (2001). A longitudinal analysis of the international telecommunications network: 1978–1996. *American Behavioral Scientist, 44*(10), 1638–1655.

Barnett, G.A., Chon, B., & Rosen, D. (2001). The structure of the Internet flows in cyberspace. *Networks and Communication Studies*, *15*(1), 61–80.

Boyne, R. (2001). Cosmopolis and risk: A conversation with Ulrich Beck. *Theory, Culture & Society, 18*(4), 47-63.

Beck, U. (2002). The cosmopolitan society and its enemies. *Theory, Culture & Society, 19*(1-2), 17-44.

Brock, G. (2002). Liberal nationalism versus cosmopolitanism: Locating the disputes. *Public Affairs Quarterly, 16*(4), 307-327.

Bowden, B. (2003). Nationalism and cosmopolitanism: Irreconcilable differences or possible bedfellows? *National Identities, 5*(3), 235-249.

Bhagwati, J. N. (2004). *In defense of globalization*. New York: Oxford University Press.

Barnett, G. A., & Park, H. W. (2005). The structure of international internet hyperlinks and bilateral bandwidth. *Annales Des Télécommunications, 60*(9), 1110-1127.

Blum, B. S., & Goldfarb, A. (2006). Does the internet defy the law of gravity? *Journal of International Economics, 70*(2), 384-405.

Bhawuk, D. P. S. (2008). Globalization and indigenous cultures: Homogenization or differentiation? *International Journal of Intercultural Relations, 32*(4), 305-317.

Barnett, G.A. & Park, H.W. (2012). Examining the international Internet using multiple measures: New methods for measuring the communication base of globalized cyberspace. *Quality and Quantity, 48*, 563–7510.

Borcuch, A., Piłat-Borcuch, M., & Świerczyńska-Kaczor, U. (2012). The influence of the internet on globalization process. *Journal of Economics and Business Research*, (1), 118-129.

Badger, K. (2014) Cosmopolitanism and globalization: A project of collectivity. *The Journal.* Master of Arts in Liberal Studies. Dartmouth College.

Bolaño, C. R. S., & Vieira, E. S. (2015). The political economy of the internet: Social networking sites and a reply to Fuchs. *Television & New Media, 16*(1), 52-61.

Biswas, T., & Kennedy, P. L. (2016). The Effect of the Internet on bilateral trade. Paper presented at the Southern Agricultural Economics Associations 2016 Annual Meeting, San Antonio, February 6–9.

Carey, J. W. (1988). Technology and ideology: The case of the telegraph, in *Communication as culture: Essays on media and society*. Boston: Unwin Hyman.

Castells, M. (1996). The Net and the self: Working notes for a critical theory of the informational society. *Critiques of Anthropology, 16*(1):9–38.

Crystal, D. (1997). *English as a Global Language*. Cambridge University Press.

Cairncross, F. (1997). *The Death of Distance*. Harvard University Press: Cambridge, MA.

Choi, I. (2001). Unit root tests for panel data. *Journal of International Money and Finance, 20*(2), 249-272.

Conole, G., & Dyke, M. (2004). Understanding and using technological affordances: A response to Boyle and Cook. *Research in Learning Technology, 12*(3)

Comer, H. (2006). *The Internet Book: Everything You Need to Know About Computer Networking and How the Internet Works (4th Edition)*. Pearson.

Clarke, G. R. G., & Wallsten, S. J. (2006). Has the internet increased trade? Developed and developing country evidence. *Economic Inquiry, 44*(3), 465–484.

Christen, E., & Francois, J. (2010). Modes of delivery in services. *CEPR Discussion Paper No. 7912*.

Choi, C. (2010). The effect of the internet on service trade. *Economics Letters, 109*, 102–104.

Catterall, P. (2011). Democracy, cosmopolitanism and national identity in a 'globalizing' world. *National Identities, 13*(4), 329-347.

Czernich, N., Falck, O., Kretschmer, T., & Woessmann, L. (2011). Broadband infrastructure and economic growth. *The Economic Journal, 121*(552), 505-532.

Coyne, C. J., & Williamson, C. R. (2012). Trade openness and cultural creative destruction. *Journal of Entrepreneurship and Public Policy, 1*(1), 22.

Calhoun, C. (2012). Cosmopolitanism liberalism and its limits, in Robertson, R., & Krossa, A. (Eds), *European Cosmopolitanism in Question*. Palgrave Macmillan.

Cisco (2014). *Cisco Visual Networking Index: Forecast and Trends, 2013–2018*. Available at http://www.anatel.org.mx/docs/interes/Cisco_VNI_Forecast_and_Methodology.pdf

Choi, S., & Park, H. W. (2014). Flow of online content from production to consumption in the context of globalization theory. *Globalizations, 11*(2), 171-187.

Cisco (2018). *Cisco Visual Networking Index: Forecast and Trends, 2017–2022*. Available at https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white-paper-c11-741490.pdf

Colantone, I., & Stanig, P. (2018). The trade origins of economic nationalism: Import competition and voting behavior in Western Europe. *American Journal of Political Science, 62*(4), 936-953.

Dye, T. R. (1963). The local-cosmopolitan dimension and the study of urban politics. *Social Forces, 41*(3), 239-246.

Dunbar, G. S. (1977). Some early occurrences of the term "social geography". *The Scottish Geographical Magazine, 93*(1), 15.

Daly, J., & Miller, R. (1998). “Corporations’ use of the Internet in developing countries. *IFC Discussion Paper No. 35*, World Bank, Washington D.C.

Davidson, R., & MacKinnon, J. G. (2004). *Econometric theory and methods*. New York: Oxford University Press.

Dicken, P. (2007). *Global shift: Mapping the changing contours of the world economy* (5th ed.). New York: Guilford Press.

Disdier, A., & Head, K. (2008). The puzzling persistence of the distance effect on bilateral trade. *The Review of Economics and Statistics, 90*(1), 37-48.

Dmitrovic, T., Vida, I., & Reardon, J. (2009). Purchase behavior in favor of domestic products in the west Balkans. *International Business Review, 18*(5), 523-535.

EVS (*n.d.*). *EVS methodology*. Retrieved from https://europeanvaluesstudy.eu/methodology-data-documentation/evs-methodology/

Eriksen, T. H. (2007). Nationalism and the Internet. *Nations and Nationalism, 13*(1), 1-17.

Ekiert, G., Kubik, J., & Vachudova, M. A. (2007). Democracy in the post-communist world: An unending quest? *East European Politics & Societies, 21*(1), 7-30.

Fischer, C. S. (1992). *America calling: A social history of the telephone to 1940*. Berkeley: University of California Press.

Flanagin, A. J., & Metzger, M. J. (2001). Internet use in the contemporary media environment. *Human Communication Research, 27*(1), 153-181.

Freund, C., & Weinhold, D. (2002). The Internet and International Trade in Services. *American Economic Review Papers and Proceedings, 92*(2), 236-240.

Freund, C. L., & Weinhold, D. (2004). The effect of the internet on international trade. *Journal of International Economics, 62*(1), 171-189.

Galtung, J. (1971). A structural theory of imperialism. *Journal of Peace Research, 8*(2), 81-117.

Giddens, A. (1990). *The consequences of modernity*. Stanford: Stanford University Press

Graham, S. (1998). The end of geography or the explosion of place? Conceptualizing space, place and information technology. *Progress in Human Geography, 22*(2), 165-185.

Goolsbee, A. (2000). In a world without borders: The impact of taxes on internet commerce. *The Quarterly Journal of Economics, 115*(2), 561-576.

Gebauer, J., & Segev, A. (2001). Changing the shapes of supply chain: How the Internet could lead to a more integrated procurement function. *Supply Chain Forum, 2*(1).

Gunaratne, S. A. (2005). Public diplomacy, global communication and world order: An analysis based on theory of living systems. *Current Sociology, 53*(5), 749-772.

Gervais, A. (2013). Are services tradable? Evidence from U.S. microdata. World Bank Working Papers. Available at

http://siteresources.worldbank.org/INTRANETTRADE/Resources/Internal-Training/287823-1256848879189/6526508-1349206352261/BradJensen_AST_final4.pdf

Gajewski, J., & Li, L. (2015). Can internet-based disclosure reduce information asymmetry? *Advances in Accounting, Incorporating Advances in International Accounting, 31*(1), 115-124.

Grimm, A. N. (2016). Trends in U.S. trade in information and communications technology (ICT) services and in ICT-enabled services. *Survey of Current Business, 96*(5), 1.

Gnangnon, S. K., & Iyer, H. (2018). Does bridging the internet access divide contribute to enhancing countries' integration into the global trade in services markets? *Telecommunications Policy, 42*(1), 61-77.

Gygli, S., Haelg, F., Potrafke, N., & Sturm, J. (2019). The KOF Globalization Index – revisited. *The Review of International Organizations*, 1-32.

Hotelling, H. (1929). Stability in competition. *The Economic Journal, 39*(153), 41-57.

Hechter, M. (1987). Nationalism as group solidarity. *Ethnic and Racial Studies, 10*(4), 415-426.

Harvey, D. (1990). *The condition of postmodernity*. Malden, MA: Blackwell Publishing

Harris, R. D. F., & Tzavalis, E. (1999). Inference for unit roots in dynamic panels where the time dimension is fixed. *Journal of Econometrics, 91*(2), 201-226.

Hall, A. R. (2005). *Generalized Method of Moments (Advanced Texts in Econometrics)*. Oxford University Press.

Huang, R. R. (2007). Distance and trade: Disentangling unfamiliarity effects and transport cost effects. *European Economic Review, 51*(1), 161-181.

Hummels, D. (2007). Transportation costs and international trade in the second era of globalization. *The Journal of Economic Perspectives, 21*(3), 131-154.

Helpman, E., Melitz, M., & Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *The Quarterly Journal of Economics, 123*(2), 441-487.

Hyun, K. D., Kim, J., & Sun, S. (2014). News use, nationalism, and internet use motivations as predictors of anti-Japanese political actions in china. *Asian Journal of Communication, 24*(6), 589-604.

Heeks, R. (2017). *Information and Communication Technology for Development (ICT4D)*. New York, NY: Routledge.

ITU (*n.d.*). *The ICT Development Index (IDI): Conceptual framework and methodology*. Available at https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2017/methodology.aspx

Isard, W. (1954). Location theory and trade theory: Short-run analysis. *The Quarterly Journal of Economics, 68*(2), 305-320.

Innis, H. A. (2008). *The bias of communication* (2nd ed.). Buffalo, NY; Toronto: University of Toronto Press.

Jain, A. K., & Etgar, M. (1977). Overlap in retail outlet and product innovator characteristics. *Journal of Retailing, 53*(2), 63.

Johnston, R.J., Gregory, D., Pratt, G., & Watts, M. (2000). *The dictionary of human geography* (4th edition). Blackwell. USA.

Jeffres, L. W., Atkin, D. J., Bracken, C. C., & Neuendorf, K. A. (2004). Cosmopoliteness in the Internet age. *Journal of Computer-Mediated Communication, 10*(1).

Kumar, K., & Loebbecke, C. (2000). Digital trade of intangible goods: Technologies, applications, and business models. *Journal of End User Computing, 12*(2), 3.

Kimura, F., & Lee, H. (2006). The gravity equation in international trade in services. *Review of World Economics, 142* (1), 92-121.

Koutrompis, P. (2009). The economic impact of broadband on growth: A simultaneous approach. *Telecommunications Policy, 33*(9), 471-485.

Kolko, J. (2012). Broadband and local growth. *Journal of Urban Economics, 71*(1), 100.

Lotz, A. D. (2007). *The television will be revolutionized*. New York, NY: New York University Press.

Lejour, A., & Verheijden, J. (2007). The tradability of services within Canada and the European Union. *The Service Industries Journal, 27*(4), 389-409.

Lunn, R. J., & Suman, M. W. (2008). A longitudinal examination of internet diffusion and adopter categories. *Observatorio (OBS), 2*(3), 97-110.

Leiner, B. M., Cerf, V. G., Clark, D. D., Kahn, R. E., Kleinrock, L., Lynch, D. C., & Wolff, S. (2009). A brief history of the Internet. *ACM SIGCOMM Computer Communication Review, 39*(5), 22.

Liu, L., & Nath, H. K. (2013). Information and communications technology and trade in emerging market economies. *Emerging Markets Finance and Trade, 49*(6), 67-87.

Lechman, E., & Marszk, A. (2015). ICT technologies and financial innovations: The case of exchange traded funds in Brazil, Japan, Mexico, South Korea and the United States. *Technological Forecasting & Social Change, 99*, 355-376.

Lin, F. (2015). Estimating the effect of the internet on international trade. *The Journal of International Trade & Economic Development, 24*(3), 409-428.

Lan, X., & Li, B. G. (2015). The economics of nationalism. *American Economic Journal: Economic Policy, 7*(2), 294-325.

Loungani, P., Mishra, S., Papageorgiou, C., & Wang, K. (2017). World trade in services: Evidence from A new dataset. *IMF Working Papers, 17*(77), 1.

Lu, J., & Yu, X. (2018). The internet as a context: Exploring its impacts on national identity in 36 countries. *Social Science Computer Review,2018*, 1-18.

McLuhan, M. (1962). *The Gutenberg Galaxy: The making of typographic man*. Toronto, Canada: University of Toronto Press.

Merton, R. K. (1964). *Social Theory and Social Structure*. London: The Free Press.

Marx, K. (1971). *The Grundrisse*. ([1st U.S.]. ed.). New York: Harper & Row.

Meyrowitz, J. (1985). *No sense of place*. Oxford, United Kingdom

Mitchell, W. (1995). *City of Bits: Space, Place and the Infobahn*. Cambridge, MA: MIT Press.

Melitz, J. (2007). North, south and distance in the gravity model. *European Economic Review, 51*(4), 971-991.

Mok, D., Wellman, B., & Carrasco, J. (2010). Does distance matter in the age of the internet? *Urban Studies, 47*(13), 2747-2783.

Mattes, A., Meinen, P., & Pavel, F. (2012). Goods follow bytes: The impact of ICT on EU trade. available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id¼2006481.

Meijers, H. (2014). Does the internet generate economic growth, international trade, or both? *International Economics and Economic Policy, 11*(1), 137-163.

McKinsey & Company (2016). *Digital Globalization: The New Era of Global Flows*.

Available at https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-globalization-the-new-era-of-global-flows

Moak, K. (2017). *Developed nations and the economic impact of globalization*. Palgrave Macmillan

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica, 49*, 1417–1426.

Nussbaum, M. C. (1997). Kant and stoic cosmopolitanism. *Journal of Political Philosophy, 5*(1), 1-25.

Neuendorf, K. A., Atkin, D., & Jeffres, L. W. (1998). Understanding adopters of audio information innovations. *Journal of Broadcasting & Electronic Media, 42*(1), 80-93.

Norris, P. (2000) Global governance and cosmopolitan citizens, in *Governance in a Globalizing World* (Eds) J. S. Nye and J. D. Donahue, Brookings Institution Press, Washington, DC, 155–77.

Norris, P., & Inglehart, R. (2009). *Cosmopolitan communications: Cultural diversity in a globalized world*. Cambridge, New York: Cambridge University Press.

Neuman, W. R. (2010). *Media, technology, and society: Theories of media evolution*. Ann Arbor: Digital Culture Books/University of Michigan Press.

Nath, H. K., & Liu, L. (2017). Information and communications technology (ICT) and services trade. *Information Economics and Policy, 41*, 81-87.

Ogburn, W. F. (1922). *Social change with respect to culture and original nature*. New York: B. W. Huebsch, Inc.

Olofsson, A., & Öhman, S. (2007). Cosmopolitans and locals: An empirical investigation of transnationalism. *Current Sociology, 55*(6), 877-895.

Olivier, J., Thoenig, M., & Verdier, T. (2008). Globalization and the dynamics of cultural identity. *Journal of International Economics, 76*(2), 356-370.

OECD Office for National Statistics (2018). *Asymmetries in trade data - diving deeper into UK bilateral trade data*. Available at http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=STD/CSSP/WPTGS(2018)12&docLanguage=En

Postman, N. (n.d.). What is media ecology? Retrieved from http://www.media-ecology.org/media_ ecology/

Pichler, F. (2008). How real is cosmopolitanism in Europe? *Sociology, 42*(6), 1107-1126.

Pichler, F. (2009). 'Down-to-earth' cosmopolitanism: Subjective and objective measurements of cosmopolitanism in survey research. *Current Sociology, 57*(5), 704-732.

Peterson Institute for Economics (2015). *Has U.S. Competitive Advantage Changed? Does This Affect Sustainability?* Available at https://piie.com/publications/chapters_preview/47/3iie2644.pdf

Robertson, R. (1992). *Globalization, social theory and global culture*, Sage Publications, London.

Rauch, J. E. (1999). Networks versus markets in international trade. *Journal of International Economics, 48*(1), 7-35.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York, US: Free Press.

Roudometof, V. (2005). Transnationalism, cosmopolitanism and glocalization. *Current Sociology, 53*(1), 113-135.

Roodman, D. M. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics, 71*(1), 135-158.

Riefler, P., & Diamantopoulos, A. (2009). Consumer cosmopolitanism: Review and replication of the CYMYC scale. *Journal of Business Research, 62*(4), 407-419.

Riccaboni, M., Rossi, A., & Schiavo, S. (2013). Global networks of trade and bits. *Journal of Economic Interaction and Coordination, 8*(1), 33-56.

Rössel, J., & Schroedter, J. H. (2015). Cosmopolitan cultural consumption: Preferences and practices in a heterogeneous urban population in Switzerland. *Poetics, 50*, 80–95.

Shapiro, C., &Varian, H. R. (1999). *Information Rules: A Strategic Guide to the Network Economy*. Harvard Business School Press: Boston.

Stock, J. H., & Wright, J. H. (2000). GMM with weak identification. *Econometrica, 68*(5), 1055-1096.

Spence, E. (2001). *Cosmopolitanism and the Internet*. Working Paper, Centre for Applied Philosophy and Public Ethics, Charles Sturt University, Australia. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.19.6399&rep=rep1&type=pdf

Szerszynski, B., & Urry, J. (2002). Cultures of cosmopolitanism. *The Sociological Review, 50*(4), 461-481.

Salwen, M. B., Garrison, B., & Driscoll, P. (2004). *Online news and the public*. Mahwah, New Jersey: LEA.

Sinnott, R. (2006). An evaluation of the measurement of national, subnational and supranational identity in cross-national surveys. *International Journal of Public Opinion Research, 18*(2), 211-223.

Steenkamp, C. (2009). Xenophobia in South Africa: What does it say about trust? *The Round Table, 98*(403), 439-447.

Shadish, W. R., & Cooke, T. (2011). *Experimental and quasi-experimental designs for field research*. New York: Taylor & Francis.

Scolari, C. A. (2012). Media ecology: Exploring the metaphor to expand the theory. *Communication Theory, 22*(2), 204-225.

Sharipova, D., Burkhanov, A., & Alpeissova, A. (2017). The determinants of civic and ethnic nationalisms in Kazakhstan: Evidence from the grass-roots level. *Nationalism and Ethnic Politics, 23*(2), 203-226.

Scheerder, A., van Deursen, A., & van Dijk, J. (2017). Determinants of internet skills, uses and outcomes. A systematic review of the second- and third-level digital divide. *Telematics and Informatics, 34*(8), 1607-1624.

Taylor, R. S. (2010). Kant's political religion: The transparency of perpetual peace and the highest good. *The Review of Politics, 72*(1), 1-24.

Tranos, E., & Nijkamp, P. (2013). The death of distance revisited: Cyber-place, physical and relational proximities. *Journal of Regional Science, 53*(5), 855-873.

United Nations (2018). *Bilateral Asymmetries*. Available at https://unstats.un.org/unsd/tradekb/Knowledgebase/50657/Bilateral-asymmetries

Vertovec, S., & Cohen, R. (2002). *Conceiving Cosmopolitanism: Theory, Context, and Practice*. Oxford: Oxford University Press.

Voronkova, A. (2010). Are nationalism and cosmopolitanism compatible? *E-International Relations*. Retrieved from https://www.e-ir.info/2010/11/25/are-nationalism-and-cosmopolitanism-compatible/

Verboord, M. (2017). Internet usage and cosmopolitanism in Europe: A multilevel analysis. *Information, Communication & Society, 20*(3), 460.

Wei, S. (1996). Intra-national versus inter-national trade: How stubborn are nations in global integration? *National Bureau of Economic Research (Cambridge, MA) Working Paper*, No. 5531.

Wright, J. H., Stock, J. H., & Yogo, M. (2002). A survey of weak instruments and weak identification in generalized method of moments. *Journal of Business & Economic Statistics, 20*(4), 518-29.

Wallerstein, I. M. (2004). *World-systems analysis: An introduction*. Duke University Press.

Warf, B. (2008). *Time-space compression: Historical geographies*. London, New York: Routledge.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). Cambridge, Mass: MIT Press.

Warf, B. (2011). Geographies of global Internet censorship. *Geojournal, 76*(1), 1-23.

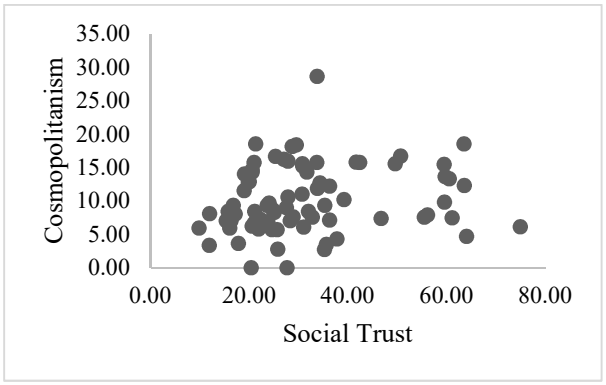
Wu, A. X., & Taneja, H. (2016). Reimagining internet geographies: A user-centric ethnological mapping of the world wide web: User-centric ethnological mapping of the WWW. *Journal of Computer-Mediated Communication, 21*(3), 230-246.

Wooldridge, J. M. (2016). *Introductory econometrics: A modern approach* (Sixth ed.). Boston: Cengage Learning.

Appendix A: Countries in the Sample (Chapter 3)

List of Countries in the Sample		
Austria	Germany	Poland
Belgium	Hungary	Portugal
Bulgaria	Iceland	Romania
Croatia	Ireland	Slovak Republic
Czech Republic	Italy	Slovenia
Denmark	Latvia	Spain
Estonia	Lithuania	Sweden
Finland	Malta	United Kingdom
France	Netherlands	

Appendix B: Scatter Plot: *Trust* versus *Cosmopolitanism*



Appendix C: Countries in the Sample (Chapter 4)

List of Countries in the Sample				
Angola	Colombia	India	Malaysia	Sri Lanka
Argentina	Ecuador	Indonesia	Mexico	Thailand
Armenia	Egypt	Iran	Morocco	Turkey
Australia	Estonia	Italy	Nigeria	Uganda
Azerbaijan	Ethiopia	Japan	Pakistan	Ukraine
Bahrain	France	Jordan	Philippines	United Arab Emirates
Bangladesh	Gambia	Kazakhstan	Russian Federation	United Kingdom
Brazil	Georgia	Kenya	Rwanda	United States
Cambodia	Germany	Korea, Rep.	Saudi Arabia	Vietnam
Canada	Hungary	Kyrgyz Republic	Singapore	Zambia
China	Iceland	Lebanon	South Africa	Zimbabwe

Appendix D: U.S. Partner Countries in the Sample (Chapter 5)

High-Income Countries			**Low-and Middle-Income Countries**	
Australia	Iceland	Singapore	Brazil	Romania
Austria	Ireland	Slovak Republic	Bulgaria	Russia
Bahrain	Israel	Spain	China	South Africa
Belgium	Italy	Sweden	Colombia	Venezuela
Canada	Japan	Switzerland	Costa Rica	
Croatia	Korea, Rep.	United Kingdom	Cyprus	
Chile	Latvia		Dominican Republic	
Czech Republic	Luxembourg		Malaysia	
Denmark	Malta		Mexico	
Finland	Netherlands		Morocco	
France	New Zealand		Nicaragua	
Germany	Norway		Nigeria	
Greece	Portugal		Philippines	
Hungary	Saudi Arabia		Poland	

VITA – Yang Bai

Education

Pennsylvania State University, State College, PA
Ph.D. in Mass Communications, 2015 – 2019

University of Southern California, Los Angeles, CA
M.A. in Communication Management, 2013 – 2015

University of International Business and Economics, Beijing, China
Bachelor (Cum Laude) in Economics, 2008 – 2012

Research and Teaching Experience

Instructor, COMM180 Survey of Electronic Media and Telecommunications, 2019
Co-Instructor, COMM310 Digital Media Metrics, 2017 – 2018
Doctoral Fellow, Institute for Information Policy, 2018 – present

Select Publications

Grzeslo, J., **Bai, Y**., Min, G., & Jayakar, K. (2019). Is the 2014 E-rate reform a game changer? An empirical analysis of Pennsylvania data. *Digital Policy, Regulation and Governance, 21*(2), 179-192.

Bai, Y. (2018). Has the Global South become a playground for Western scholars in information and communication technologies for development? Evidence from a three-journal analysis. *Scientometrics, 116* (3), 2139-2153.

Bai, Y. (2017). The faster, the better? The impact of internet speed on employment, *Information Economics and Policy, 44*, 21-25.

Select Conference Papers

Bai, Y. (2019, January). If you fund it, will they come? The impact of Broadband Technology Opportunities Program on county employment. Paper presented at the Pacific Telecommunication Council annual conference, Honululu, HI.

Bai, Y., Grzeslo, J., Min, B. & Jayakar, K. (2018, May). What factors affect the accessibility of government websites? An empirical analysis on U.S. county government online portals. Paper presented at the 2018 International Communication Association conference, Prague, Czech Republic.

Bai, Y., Min, B., & Lee, S. (2017, July). Old ICTs as a precursor to smartphone adoption among senior adults? A structural equation model analysis. Paper presented at the IAMCR 2017 Annual Conference, Cartagena, Colombia