Article

Influence of the Internet on the Economic Growth of the Belt and Road Region

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Abstract

As a general technology, the Internet promotes economic growth in various forms. We apply a dynamic panel data approach to measure the impact of the Internet on the gross domestic product (GDP) using data from 65 countries in the Belt and Road Region during the period 1996–2014. The results show that the Internet has a positive and statistically significant effect on the economic growth. These effects strengthen along with the development of the Internet. Many factors such as capital, labor force, technology, industrial structure, international trade, and economic level are essential to explain the differences in the influence of the Internet on the economic growth among the Belt and Road countries. With R-type factor analysis, two factor components can summarize above indicators: one represents the level of economic development and the other represents the level of intensification of the economic development mode. According to the different national situations, the BRI countries must adopt various strategies to actively promote the development of their information industry, and jointly develop the "Digital Silk Road."

Keywords

Internet economics, Belt and Road, Digital Silk Road, regional economics, economic effects

Introduction

As a general-purpose technology (GPT), which can affect an entire economy, the Internet is promoting social progress and economic development. The "Digital Silk Road" with the Internet as the main body has become an important part of the development of the Belt and Road Initiative (BRI). In 2017, Chinese President Xi Jinping at the Belt and Road Forum for International Cooperation proposed to promote "land, maritime, air and cyberspace connectivity" (Xi, 2017), and the "Digital Silk Road" initiative was proposed at the Second Belt and Road Forum for International Cooperation in 2019. The role of the Internet in the development of the BRI is highly valued. Therefore, it is very important to study the mechanism of how the Internet promotes the economic growth and stipulate recommendations to different countries in the BRI.

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Mechanism of How the Internet Promotes the Economic Growth

Economic growth is usually measured by the level of increase in output per person per unit of time in a country. The increases in output are mainly driven by the production sector. The Internet improves the efficiency of the production process, and its influence on production factors and production sectors is the most important mechanism to promote economic growth. Among them, the influence of production factors on capital, labor, and technology is at the core of the economic growth theory (Czernich, Falck, Kretschmer, & Woessmann, 2011; Jin & Jin, 2014; Terzi, 2011). In terms of the production sector, the ICT (information and communication technologies) industry itself drives the national economy through scale expansion, industrial correlative, and spread effect. The Internet promotes the adjustment of industrial structure through the optimization of resource allocation along with the economic growth.

Demand-side factors also promote production. Production is demand-oriented. If the demand increases, the production capacity will also adjust accordingly and result in increasing the output. The continuous development of cross-border e-commerce plays an increasingly obvious role in promoting international trade, which is the driving force to increase the total output (Asosheh, Shahid-Nejad, & Khodkari, 2012; Choi, 2010; Kurihara & Fukushima, 2013; Meijers, 2014). Therefore, demand-side factors including international trade play an important role in the mechanism.

Economic development is fundamental to this mechanism. The higher the economic development, the more resources a country has to improve the level of the Internet development. And higher the level of its input in various fields of production and consumption, the higher will be the impact of the Internet on the economic growth. According to Metcalfe's law of network economics, the value of a network increases by the square of the number of users. V=N(N-1) when the number of users N is infinite, the network value V tends to be N^2. As the Internet brings more people together in the Belt and Road region, information resources generated will increase exponentially, which will have a positive feedback mechanism to amplify the effect, driving the continuous improvement of economic growth rate. This is the compelling nature of the Internet.

The mechanism is also closely related to the external environment (Qu & Chen, 2014). Natural resources, social stability, economic system, market openness, and international situation also play an important role.

Based on the above analysis, the main mechanism of the Internet promoting economic growth can be summarized in Figure 1.

The Level of Development of Economy and the Internet in the Belt and Road Region

Level of Economic Development in the Belt and Road Region

Most of the countries along the Belt and Road are emerging economies and developing countries, with huge potential for economic growth. In the early 1990s, the difference between the output of Belt and Road economies was not much, but entering the twenty-first century, China's economy grew the fastest and surpassed all (Figure 2).

The Belt and Road countries show obvious regional economic differences in development according to the gross domestic product (GDP) per capita. Most countries in Central and Eastern Europe and West Asia show good economic performance, while Southeast Asia, South Asia, and Central Asia have a lower GDP per capita.

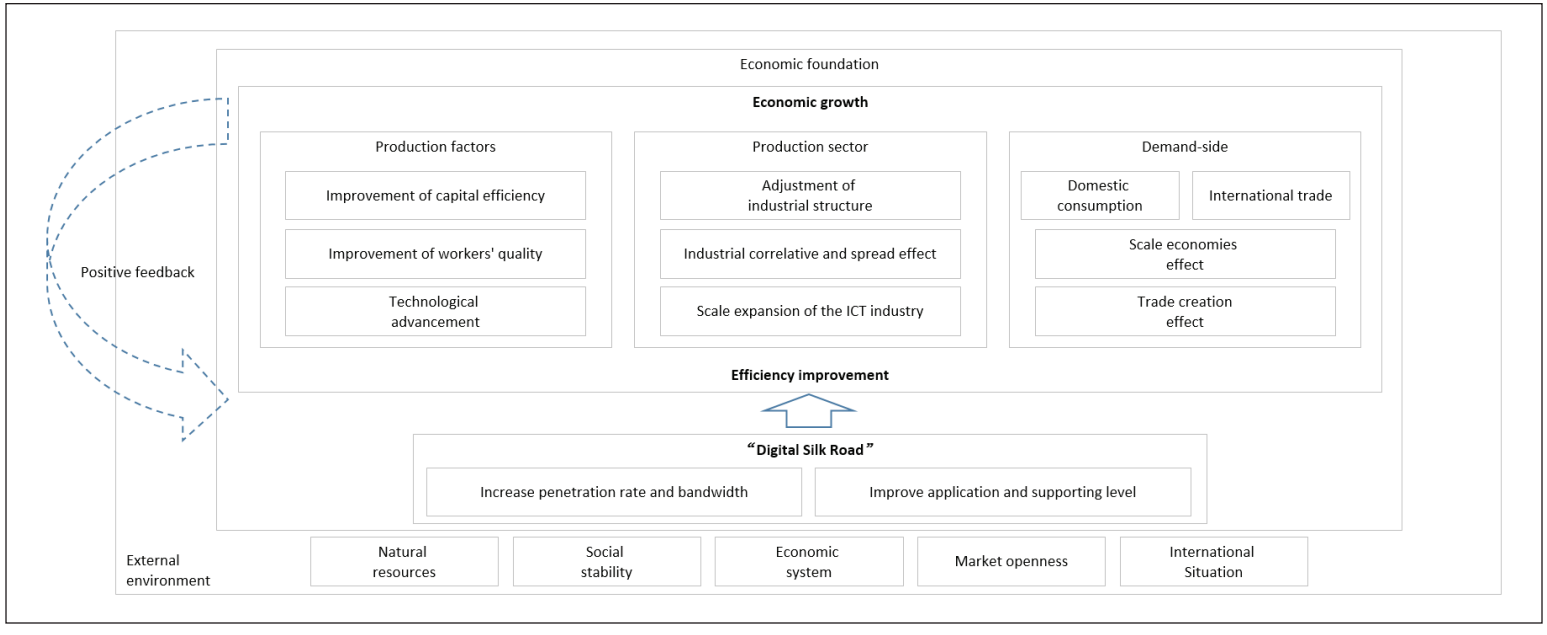

Figure 1. The Diagram of the Mechanism of Effect of "Digital Silk Road" on Economic Growth

Source: The author.

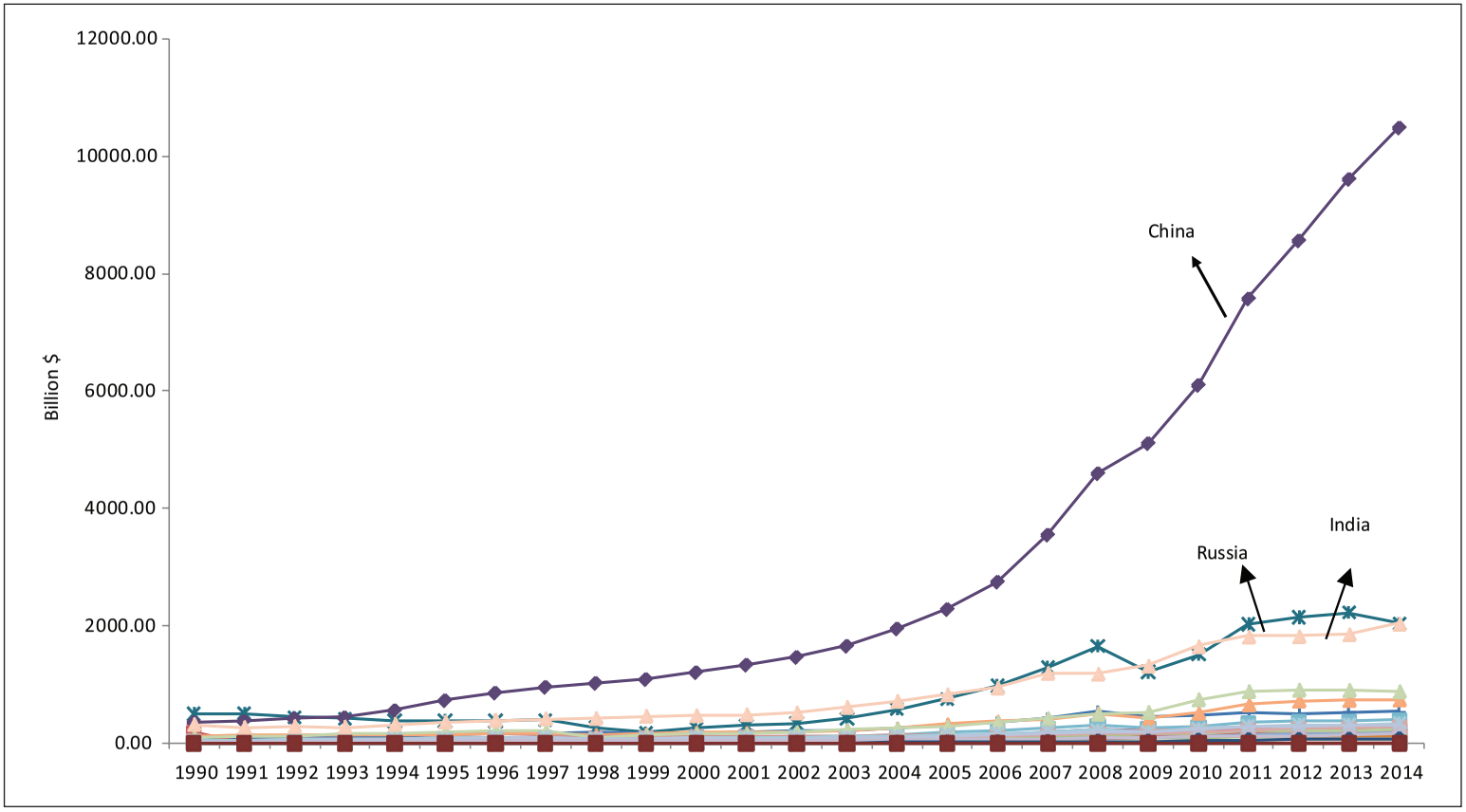

Figure 2. The Gross Domestic Product of Countries in the Belt and Road Region

Source: World Bank Open Data. Retrieved from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

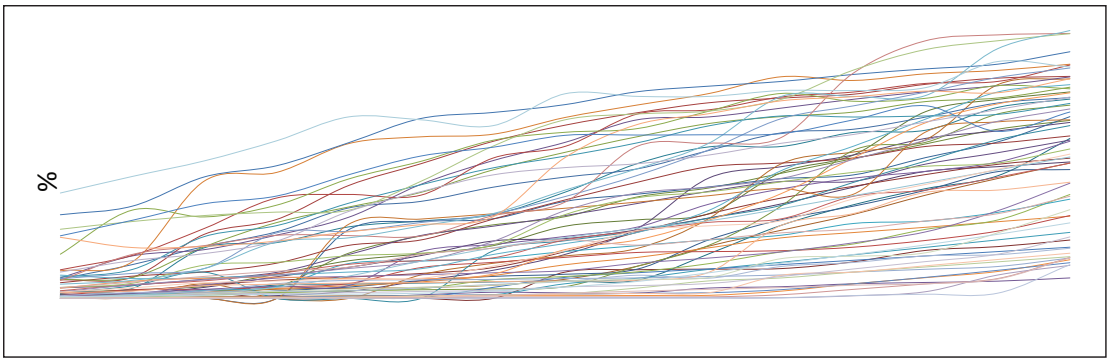

Figure 3. The Chart of Internet Penetration Trend in the Belt and Road Region

Source: International Telecommunication Union Open Data. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

The Level of Internet Development in the Belt and Road Region

From various Internet indicators among the different countries, the regions with high Internet penetration rate are mainly concentrated in the periphery of rich countries in Europe and the Middle East. This difference is due to the economic gap, between the information-rich and the information-poor countries, referred to as the "information gap" or "digital gap." This translates into the "knowledge gap," which is not conducive to the economic development of poor countries and strengthens the "Matthew effect."[1]

Figure 3 indicates that Internet penetration rates in all countries are on the rise. However, many countries' Internet penetration rates are still at a low level and slow to rise. It can be seen that many countries cannot meet the needs of the Internet and economic development. Therefore, it is necessary to take the initiative to strengthen communication and other infrastructure development, which is the key element of the BRI.

Measurement of the Effect of the Internet on Economic Growth in the Belt and Road Region

Model Framework

This article uses widely accepted empirical analysis, based on the extended Cobb–Douglas production function and panel data analysis to estimate the Internet's influence on GDP (Choi & Yi, 2009; Czernich, Falck, Kretschmer, & Woessmann, 2011; Jing, 2014; Najarzadeh, Rahimzadeh, & Reed, 2014). In order to improve the reliability of the estimation, the spatial panel data analysis method is added for verification, and the control variable is used to optimize the analysis model. Taking the Internet as a factor of production similar to capital and labor, the logarithm of the extended Cobb–Douglas production function will be:

$$\ln Y_{it} = \ln A_0 + \alpha \ln K_{it} + \beta \ln L_{it} + \gamma \ln I_{it} + U_{it} \quad (1)$$

Here, Y_{it} is GDP of the country i at the time t, I_{it} is the Internet indicator, K_{it} is capital formation in USD, K_{it} is workforce.

The data are from World Development Indicators, covering all 65 countries of the Belt and Road region from 1996 to 2014.

Varying Impact of the Internet on the Economic Growth of Countries

The influence of the Internet on GDP of each country is calculated according to the panel data of each country. Six countries (Laos, Maldives, Myanmar, Montenegro, Yemen, and Bahrain) were excluded due to missing data, leaving 59 countries for analysis. Taking the Internet penetration rate as a variable of sectional data, the influence coefficient of the Internet on GDP of 59 countries in the Belt and Road region can be obtained. The average influence coefficient of these countries is 0.076, and the estimated influence coefficient has a large deviation from the overall coefficient of the Belt and Road region.

For those countries, in which the production system is seriously damaged, steady economic development is not supported, and the main mechanism by which the Internet promotes the economic growth will not work. The process in which the Internet promotes economic growth will also be affected by technology application, industrial structure, international trade, and level of economic development. Excluding the seven countries with economic system seriously influenced by destabilizing factors (Syria, Afghanistan, Iraq, East Timor, Palestine, Lebanon, and Israel) and the six countries lacking data, 52 countries were selected. After screening, the number of scientific papers, the proportion of nonagricultural industries, the proportion of net exports, and the GDP with a lag of one period are taken as the control variables representing technological progress, industrial structure, international trade, and economic level. The Internet penetration rate is taken as the sectional data variable to conduct panel data regression analysis and obtain new regression results. Compared with the results before the introduction of variables, the coefficient deviation between the overall level and each country is significantly reduced, as shown in Figure 4.

After the introduction of control variables, the differences of the influence of the Internet on GDP are no longer obvious. For countries with low level of Internet penetration, the impact of the Internet on their economy is also small. This indicates that the difference of Internet's influence on the economic growth of the Belt and Road countries is related to the development of the Internet, production factors, industrial sectors, international trade, economic level, and other factors.

Differences in the Economic Impact of the Internet in Different Types of Countries

The differences in the economic impact of the Internet in different countries are related to various factors. We classify the countries according to their level of economic development and intensity of development and compare the differences in the economic impact of the Internet. First, R-type factor analysis was carried out on the basis of the above-mentioned indicators to obtain the factor components of each indicator as shown in the Table 1. It can be understood that factor 1 represents the level of economic development, while factor 2 represents the level of intensification of the economic development mode (hereinafter referred as the level of intensive development).

In the R-type factor analysis, centroid coordinates of various countries are obtained at the same time. In combination with the development level of the Internet, scatter diagrams are drawn to express the correlation between the Internet and the economic development mode of different countries (Figure 5). The vertical axis indicates the level of development, and the top shows that the level of development is higher. The horizontal axis represents the development mode, the right side represents the intensive growth mode

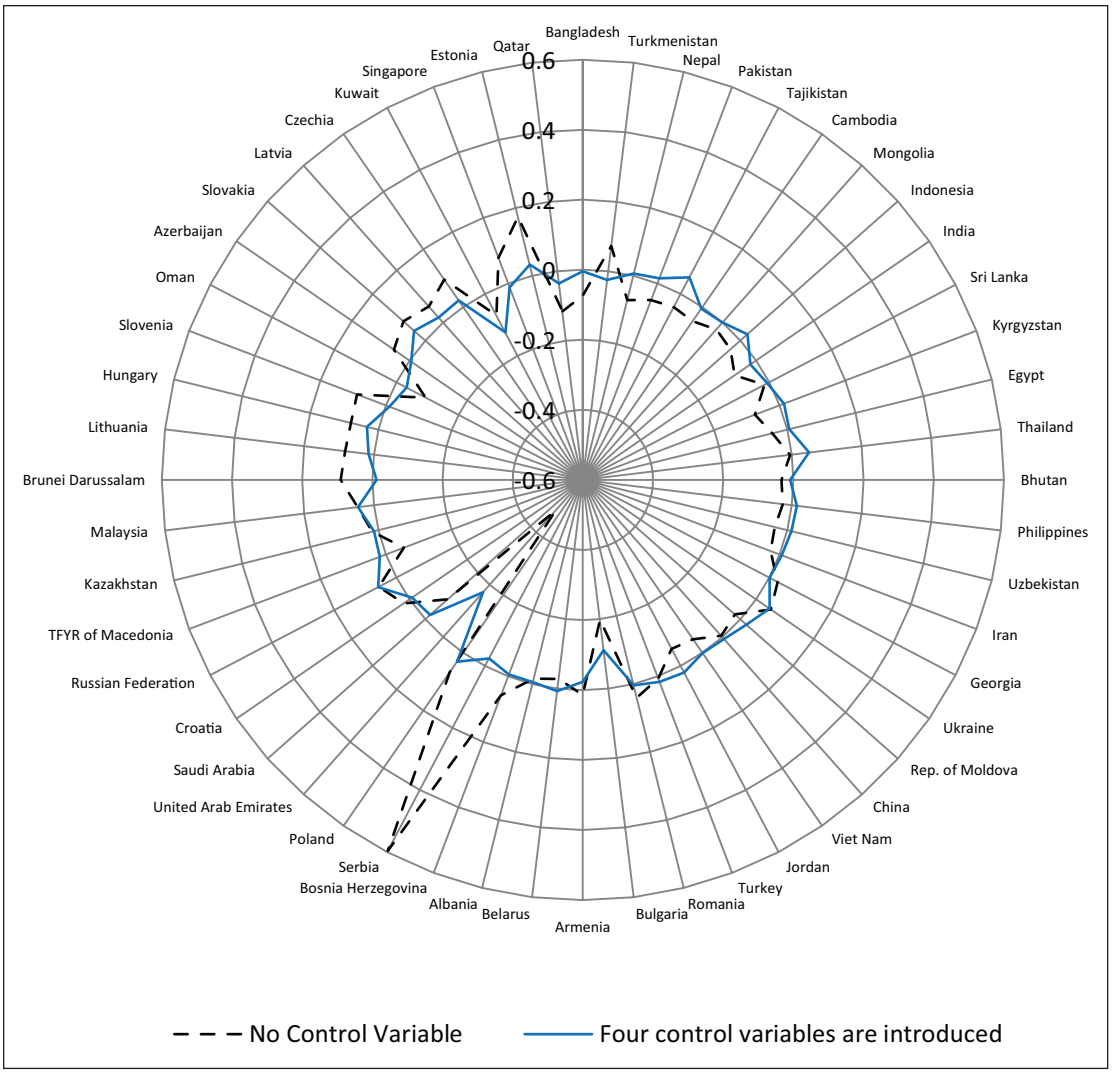

Figure 4. The Effect of Internet Usage on Gross Domestic Product Before and After Using Control Variables

Source: The author.

Notes: The figure shows the difference between the impact coefficient of the Internet on GDP of countries and the overall impact coefficient (= the impact coefficient of the Internet on GDP of countries—the average impact coefficient of the Internet on GDP of the selected Belt and Road countries). The dotted line represents the difference between the influence coefficient of the Internet on GDP of various countries and the average influence coefficient before the introduction of control variables, while the solid line represents the difference between the influence coefficient of the Internet on GDP of various countries and the average influence coefficient after the introduction of control variables.

dominated by technological progress and human capital, and the left side represents the extensive growth mode driven by resource input. The size of bubble represents the Internet penetration rate.

According to the results of the R-type factor analysis, the Belt and Road countries can be divided into three categories: countries with intensive development, countries with extensive development, and coun-

Table 1. Factor Component Matrix

Indicator Type	Indicator Name	Factor Component	
		1	2
Level of economic development	GDP per capita	0.934	−0.217
	the proportion of net exports	0.635	−0.662
	proportion of nonagricultural industries	0.843	−0.147
Level of intensity of development	Higher education enrollment rate	0.675	0.631
	Number of scientific papers	0.779	0.412

Source: The author.

tries with a development potential. The intensive development zone extends to the upper right, indicating that all countries have a high level of Internet development and have high economic development. The extensive development zone is extending to the left, and most countries lying in this zone have a moderately high level of Internet development and a fairly good level of economic development. The potential development zone is below the horizontal axis. Here, most countries have low level of Internet development and low economic development. According to the categories of intensive development, extensive development, and potential development, the influence coefficients of the Internet on the GDP of different types of countries are shown in the Table 2. The countries with intensive development generally promote their economic growth through the implementation of new technologies. The Internet plays an obvious role in promoting the technological progress, so developing the Internet is conducive to economic growth promotion for such countries.

According to the empirical analysis above, the economic development level and intensity development mode are playing an important role in the mechanism of Internet promotion of the Belt and Road economic growth. Stable development environment and stable level of economic development are the basic determinants. The higher the economic level, the greater the influence of the Internet in the promotion of economy. Technological progress and labor force quality are the most important production factors, which can have an overall impact on the economies of countries. The industrial sector is also an important driver of the supply. The industrial structure, dominated by the secondary industry and the tertiary industry, is more conducive for the Internet to play an important role. The export-driving effect is obvious, but rather than resources export, internationally competitive value-added products export should be promoted.

Recommendations for Internet Development of Different Countries

Countries along the Belt and Road route have different economic development bases, levels, modes, and goals. Aiming to expand the role of the "Digital Silk Road" in promoting the economic growth of all countries, we propose the following suggestions for countries with intensive development, countries with extensive development, and countries with development potential.

The countries with intensive development already have advanced Internet technology and their level of economic development is high. However, they can further improve in certain areas of Internet application such as e-commerce, strengthen the advantages of the Internet industry of their country, actively participate in the development of the "Digital Silk Road," drive the development of the ICT industry, and directly gain economic benefits.

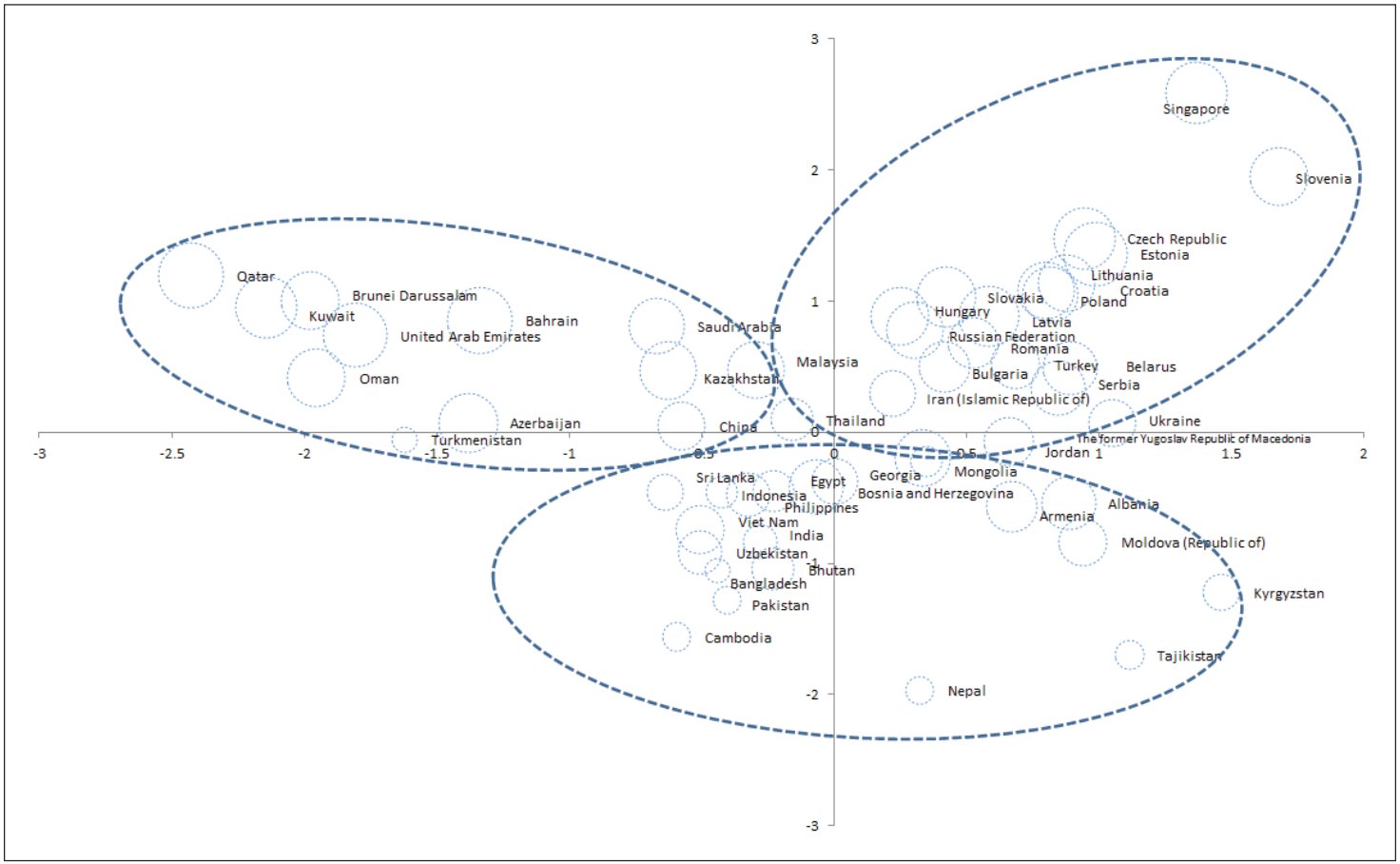

Figure 5. Centroid Coordinates of Various Countries

Source: The author.

Notes: (a) The 19 intensive development countries include Singapore, Slovenia, Czech Republic, Estonia, Lithuania, Croatia, Poland, Slovakia, Belarus, Hungary, Latvia, Serbia, Ukraine, Romania, Turkey, Russian Federation, Bulgaria, Iran, and Malaysia; (b) the 10 extensive development countries include Qatar, Kuwait, United Arab Emirates, Oman, Brunei Darussalam, Saudi Arabia, Azerbaijan, Turkmenistan, Kazakhstan, and China; (c) the 23 potential development countries include Bhutan, Bangladesh, Pakistan, Sri Lanka, Cambodia, Nepal, Uzbekistan, Bosnia and Herzegovina, Indonesia, Egypt, Philippines, India, Georgia, Tajikistan, Viet Nam, Moldova, Jordan, Kyrgyzstan, the former Yugoslav Republic of Macedonia, Armenia, Thailand, Mongolia, and Albania.

Table 2. Comparison of the Economic Influence of the Internet on the Different Types of Countries

	No Control Variable Introduced	The Difference from the Mean After Introducing the Control Variables
Intensive development countries (19)	0.136672	0.034430
Extensive development countries (10)	0.098652	0.006026
Potential development countries (23)	0.048559	0.013811
All 52 countries	0.074114	0.020215

Source: The author.
Notes: The influence coefficient in the table is the overall influence coefficient of the Internet on the economies of different types.

As for the countries with extensive development with a fairly good level of economic development, neither resource export nor extensive production is a long-term solution. The accumulated funds can be used to expand the scale of Internet economy, make good use of the role of the Internet in labor force quality and technology promotion, create competitive domestic Internet industries, optimize the industrial structure, and gradually move toward an intensive development. Those countries that already have certain capabilities in the Internet infrastructure should also actively participate in the development of the "Digital Silk Road" and take this opportunity to accelerate industry development.

Most of the countries with development potential have a low level of Internet and economic development. Countries that are not endowed with many natural resources should try to choose the intensive development mode, make full use of the Internet to promote the economy, and pay attention to the development of cross-border e-commerce. Commonly, their Internet penetration rate is relatively low, while selling products in poor areas via e-commerce can bring short-term outcomes. Therefore, countries with potential development should not miss the opportunity of jointly developing the "Digital Silk Road."

In addition to the overall development, countries can also consider developing their own industries. As for which countries may be capable of developing the ICT industry by taking advantage of the opportunity presented by the "Digital Silk Road," it is necessary to examine the potential market size that countries can reach and the industrial development capacity they can manage. Generally speaking, the markets that most countries can control should be mainly their own domestic market and the international market that they have already captured. For industrial development, they need to accumulate enough capital, professional talent, political support, and other development factors. Table 3 presents the decision-making matrix for the development of domestic ICT industries from the two dimensions of potential market size and industrial development capacity. Countries can examine whether it is suitable for the development of domestic key industries according to the position of relevant industries and other external factors.

If the potential market size, industrial development capacity, and the international competition environment are suitable, then the ICT industry can boom. However, if any of these conditions are not met, the risks involved have to be carefully considered. Comparatively, the information technology (IT) manufacturing industry has an obvious trend toward internationalization, while the telecom industry and IT service industry mainly rely on the development of their own industries. In case the countries are not able to develop their own ICT industry, they can rely on international resources, and must not miss the development opportunities presented by "Digital Silk Road."

Table 3. The Decision-Making Matrix for Domestic Information Industry Development

	Larger Potential Markets	Less Potential Markets
Larger capability	It is suggested to give priority to develop their own ICT industry, and vigorously develop the Internet level in the country.	It is suggested to develop Internet application with higher level and develop ICT industry to face the international market.
Less capability	It is suggested to attract external investment and cooperation to jointly develop the Internet at a medium level and encourage the development part of their own ICT industry.	It is suggested to use domestic and foreign resources, improve the level of Internet development, find key points and breakthroughs, and obtain the best effect on economic growth.

Source: The author.

Conclusion

The Internet promotes the economic growth of the Belt and Road region in many aspects. The main goal of the BRI is to provide public goods to deal with the infrastructure "weaknesses" hindering regional growth. As part of developing the infrastructure connectivity of the BRI, the Internet or "Digital Silk Road" can also promote regional economic growth. The "Digital Silk Road" will expand the cultural exchange and integration, promote the increase of the flow of goods, create consumption demand in a larger region, expand the scale of trade, generate economies of scale and trade creation effect, and drive the economic growth of all countries in the Belt and Road region. The Internet can bring the information and technology to the Belt and Road countries, optimize the allocation of capital, labor, technology, and other resources, improve labor productivity, and promote the economic growth. For different industries, the Internet can improve production efficiency to different degrees, help the resources allocated to efficient industries, optimize and upgrade industrial structure, and contribute to economic growth. Development and growth of the "Digital Silk Road" will directly drive the expansion of internet-related industries in various countries. Furthermore, it can drive the development of various industries in the national economy through "Industrial Correlative and Spread Effect," and further promote economic growth.

This article estimates the promotion effect of the Internet on regional economic growth on the basis of empirical analysis. For reference, a stable development environment, a high economic development level, and an intensive development mode can better leverage the role of the Internet in promoting economic growth of all countries. Therefore, the Belt and Road countries should actively promote the development of the "Digital Silk Road" according to their own situations. With the development and the popularization of the Internet, its influence on regional economic growth will gradually strengthen, it will greatly enhance the level of economic development, promote the innovation of the Internet infrastructure and applications, forming a positive feedback effect for better economic development. The economic strength of the Belt and Road countries will directly enhance their national strength and improve the quality of life of their people. With the joint efforts of all countries, the Belt and Road region is expected to become a huge emerging market and production base with 3/5th of the global population and become the center of world economic development.

Declaration of conflict of interest

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Note

1. A term coined by the sociologist Robert K. Merton in a paper describing the disproportionate share of credit given to already famous scientists when a discovery is simultaneously made. Merton was alluding to the "social law" articulated in The Gospel of Saint Matthew: "For unto everyone that hath shall be given, and he shall have abundance: but from him that hath not shall be taken even that which he hath." [25:29, KJV] (http://thematthewеffect.org/tag/robert-k-merton/)

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