Agricultural Marketing and Commercialization Journal
7(1), 119-130, 2023, ISSN Print: 2676640X, ISSN online: 2676-7570

Test of the effect of access, use and skills in the field of information and communication technology and the variable of the ratio of liquidity to GDP on the employment rate of the BRICS countries and Iran

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Received: 10 February 2023/ Revised: 25 March 2023/ Accepted: 01 May 2023/ Published: 01 June 2023

Abstract

The main goal of this research is to test the effect of the degree of access, use and skill in the field of information and communication technology and the variable ratio of liquidity to GDP on the employment rate of BRICS member countries and Iran. For this purpose, in the first step, the generalities of the research and the literature and the background of the research have been reviewed. Then, based on the information collected from the data of the research variables for the period from 2002 to 2020, a research model was designed for 5 BRICS countries (Brazil, Russia, India, China and South Africa) and Iran. In the next step, in order to analyze the data (test the research hypotheses), the panel model was aligned using the random effects method. The results show that all research hypotheses were confirmed. In other words, it can be said, the degree of development of ICT (degree of access), e-commerce (use and skills in the field of ICT), the ratio of liquidity to GDP (financial development), foreign direct investment, research and development expenses, labor and capital. It has a significant impact on the employment rate in BRICS member countries and Iran. At the end, the research results and suggestions based on it are presented.

Key Words: Degree of Access, Financial Development, Research and Development Expenses, Labor and Capital, Employment Rate, BRICS Agreement

Introduction

The recent revolution of technology is transforming the methods and speed of thinking, communication, cooperation, design and construction, identification and utilization of resources, use of equipment, conducting research, analyzing and predicting the future, marketing, moving products, transferring credits. And in one word, it is changing the way of life and business. Other factors such as economic changes, population, globalization, facilitation of communication, tremendous changes in technology and the emergence of new jobs, have caused the emergence of a

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new labor market whose workforce needs new skills and training. Many consider information technology to be synonymous with computers. This idea, since the driving engine of this technology is the computer, is not so useless. When daily activities are mechanized and productivity increases, production and delivery costs are reduced. In other words, the finished price of the goods for the buyer is reduced and accordingly, the demand for purchase increases. Also, information technology has made accurate and up-to-date information always available to applicants and enables them to make better and timely decisions. This reduces the costs, increases the profit and facilitates the growth of productivity. It is a fact that as a result of the mechanization of activities, the demand of some industries for labor force decreases. But on the other hand, new jobs enter the job market, which can be jobs such as web page design, website maintenance and management expert, multimedia systems expert, satellite transmission technician, global positioning system technician, and business specialists. Electronica pointed out that these jobs require knowledge, skills and capabilities that sometimes do not exist in the description of previous or even current jobs in some developing countries, regardless of the independent effects of information technology and electronic commerce on the growth and development of economic productivity. There are interrelationships between these variables that, if ignored, can reduce the beneficial effects of each of them. (Bagherzadeh, 2011)

With the development and progress of new technologies in different countries, especially in advanced countries and the subsequent explosion of information in all parts of different societies, responding with traditional methods is no longer responsive to humans in the field of rapid information transfer, and therefore there is a need for newer methods. It was strongly felt. With the arrival of the computer, a great transformation took place in the matter of transferring and retrieving information. In fact, the use of computers can be considered as the third great development after the invention of the font and the invention of printing. In the last few years, the rapid growth of information technology followed by the development of communication networks has brought about significant changes in the place of human life. Nowadays, information and communication technology, digital era, computer, mobile, satellite and electronic era are talked about everywhere. Internet as one of the manifestations of information and communication technology, before it is a source of information; It is considered an interactive and comprehensive media in which the whole world is present. The occurrence of tremendous developments, such as the use of computers, mobile phones, the Internet, and websites, from the second half of the 1990s, caused the "information and communication revolution"; In such a way that the occurrence of this revolution has made the current era different from other eras.

Research Background

The concept and definitions of information and communication technology:

Information and communication technologies include all forms of technology for creating, storing, exchanging and using information in various forms: commercial information, voice conversations, still and moving images, multimedia presentation and other forms that have not yet been created. (Fathiyan, 1391 and Rasoulinejad and Nouri, 1392).

Organization of economic cooperation, information and communication technology is the total production and service industries that are used to store, transmit and display data and information electronically; knows The Secretariat of Iran's Higher Informatics Council considers information technology to be an interconnected set of methods, hardware, software, and communication equipment that collect, store, retrieve, and process information in various forms (sound, image, and text). transfer or supply (Rahmani and Hayati, 2012).

Lucas defines information and communication technology as follows: "Information and communication technology is applied to all types of electronic information processing and storage technologies. For this purpose, equipment such as computers, communication equipment and networks, fax machines, and any controllable electrical package are used" (Abdulaziz, 2019).

(Shefard, 2012) has considered information technology as a superior technology and stated that it affects everything in reality.

(Bahan and Holmes, 2013) defined information and communication technology in their study as follows: "The term information and communication technology is used to describe technologies that allow us to record, store, process, retrieve, transmit and receive. Information helps.

E-commerce and its types

E-commerce in its current form was realized in 1991. Since then, thousands of businesses have entered this world. In fact, e-commerce was defined to facilitate economic transactions electronically. The use of this technology, such as the electronic exchange of information and the electronic transfer of funds, which were both introduced in the late 1970s, allowed companies and organizations to send electronic documents and to do business by sending commercial documents such as purchase orders or invoices in electronic form.

In e-commerce, like traditional business, there are four categories: B2B, B2C, C2B and C2C.

- •B2B (business to business) involves companies doing business with each other. For example, manufacturers who sell their product to distributors and wholesalers who sell products to retailers.
- •B2C (business to consumer) includes businesses that sell goods to the general

public through online stores and without the need for any human interaction. This is the idea that most people have of "e-commerce". For example, you can Amazon online store pointed out.

•C2B (consumer-to-business) In C2B e-commerce, consumers submit a project online with a specified budget, and companies bid on the project. The consumer then reviews the bids and selects the company they want. The Elance website is an example of this type of e-commerce (Mashbari Khozani, 2011).

• C2C (consumer-to-consumer) This type of business takes place in online classified ads, forums, or marketplaces where people can buy and sell goods with each other. Craigslist, eBay, and Etsy are examples of this type of e-commerce (Imam Vardi, 2012).

Financial development

Financial development is a comprehensive concept that is defined in six different dimensions as follows:

1. Development of the banking sector:

In most economies, banks are the center of the financial system and payments, and they play an important role in the process of processing savings, identifying investment opportunities, and diversifying risk. Therefore, the size, structure and efficiency of the banking sector is considered as an independent dimension of financial development. Banks' profitability, payment credits and easy access of the private sector to bank credits are examined in this dimension. Based on the studies conducted, the activity Banks will have more efficiency and growth in a competitive environment, including less government intervention, less market concentration and more possibility for foreign banks to enter.

2. Development of the non-banking financial sector:

It examines the developments of the non-banking financial sector, the development of capital resources and alternative financial services. This sector includes stock markets, mortgage and rental financial institutions, securities markets, insurance companies and pension funds. The variety of products and diverse markets in this sector, while creating the background for the evolution of the system's functions, enables companies and households to improve their financing in terms of cost in an efficient way; prepare financial resources; supervise the management of the financial sector and distribute risks (Safari, 2014).

3. Development of the monetary sector and monetary policy:

In this dimension, in addition to the financial depth index, the limits of governments' use of indirect monetary policy tools, interest rates, the efficiency of the monetary policy-making institution, and also credit rationing are examined.

4. Banking regulations and supervision:

Due to the existence of asymmetric information and market failure in financial transactions, appropriate control and supervision are considered important aspects of financial development. Financial authorities prevent corruption to ensure the interests of depositors in the banking system. The careful monitoring of banks, the degree of independence of the central bank and the transparency of financial and monetary information are measured in this dimension of financial development (Branon, 2014).

5. Openness of the financial sector:

Another aspect of financial development is the rank and position of the domestic financial system in the cross-border transfer of financial resources. The openness of the financial markets to the entry and exit of capital, appropriate currency regimes and restrictions on the exchange of financial assets or currency instruments of foreigners and residents in this country. It will be examined later (Soroush and Sadeghi, 2012).

6. Institutional environment:

The legal and political environment has a decisive role in the quality of services provided by financial institutions in India. For example, in some developing countries, banks are not very interested in increasing loans, because the judicial system is ineffective or the political and administrative institutions are corrupt. They prevent the repayment of loans. The quality of legal institutions, property rights, the quality of the judiciary and the accountability of the government affect the performance of the financial system. For this purpose, the institutional environment is considered as one of the dimensions of financial development (Fathi, 2013).

The concept of employment rate and its relationship with economic growth:

Employment rate: Employment rate, which is calculated as a ratio of the number of working population compared to the active population, and is one of the factors affecting the economic growth rate. (To calculate the employment rate quantitatively, we subtract the country's unemployment rate from one.)

Economic growth: In a country is an increase in the real national production per capita of that country in a long-term period of time, and it is an important indicator for measuring the progress and development of a country (Ruzbahan, 2016). Based on this concept, it can be said that economic growth can be realized in two ways:

1. *Balanced economic growth*: in which growth takes place in a balanced and coordinated manner in all elements and components and economic sectors of the society in different urban and rural areas.
2. *Unbalanced economic growth*: in the path of growth, only one of the economic sectors or geographical regions or social pillars is relied upon. In general, it can be said that economic growth is a continuous and long phenomenon that is extremely

complicated, and on the way, various stages must be passed in order to achieve economic growth.

Methods and Methodology

According to the purpose, this research is of applied type and according to the method of implementation, it is a descriptive method of causal correlation type is.
Also, the statistical population of the research is 5 BRICS member countries (emerging economies) and Iran. Because the size of the statistical population of the research is less than 30, in order to maintain the degree of freedom of the research model, the entire statistical population is selected as a sample (total sampling method). The research period is between 2002 and 2020.

Research hypotheses

Research hypotheses: In this research, the following hypotheses are tested:
- The degree of ICT development (degree of access) has a significant effect on the employment rate in BRICS member countries and Iran.
- Electronic commerce (use and skills in ICT) has a significant impact on the employment rate in BRICS member countries and Iran.
- The ratio of liquidity to GDP (financial development) has a significant effect on the employment rate in BRICS member countries and Iran.
- Foreign direct investment has a significant impact on the employment rate in the BRICS member countries and Iran.
- Research and development expenses have a significant impact on the employment rate in the BRICS member countries and Iran.
- The labor force has a significant impact on the employment rate in the BRICS member countries and Iran.
- Capital has a significant effect on the employment rate in BRICS countries and Iran.

Research model and variables

Taking into account the empirical studies presented regarding the test of the effect of the degree of access, use and skill in the field of information and communication technology and the variable ratio of liquidity to GDP on the employment rate of BRICS member countries and Iran, such as the study of Payal (2015) model The regression of the research is according to the following relationship:

$$EMP = f(ICT, INT, MG, K, L, FDI, GRD)$$

Variables

Employment rate (EMP): GDP includes the total value of final goods and services that are produced in a country during a certain period, usually one year.
MG: The ratio of liquidity to GDP is an indicator of financial development.

INT: The Internet Bank variable that indicates electronic commerce or the use and skill in the field of ICT.
FDI: represents the net inflow of foreign direct investment as a share of GDP.
K: capital, L: labor force, ICT: indicates access to ICT or ICT development index. This index has been published by the World Telecommunication Union since 2000 and includes three main components of access, use and skill. The rating of this index is based on a score of zero to ten. A higher score means a high degree of ICT development and a lower score means a low degree of ICT development of countries. GRD: Government spending on research and development.

Result

First, to determine whether the use of the panel method in estimating the model is more efficient or the consolidated data method, the Chow test is used.
Limer's F test: As table number (1) shows, prob <0.05 and the calculated value of Limer's F statistic is significant. Therefore, the null hypothesis that the data are mixed is rejected, and in fact the opposite hypothesis, which indicates the suitability of the FE method for model estimation, is accepted.

Table 1. Summary of the Limer F test method

prob	d.f	The value of F test statistic
0.0309	(6,214)	10.145247

Source: research tissues

Hausman test: After Limer's F test determined that the width from the origin is not the same for different sections, the next step should be to distinguish between two alternative approaches, i.e. fixed effects and random effects, using Hausman's test. In the Hausman test, the H0 hypothesis of the independence of the explanatory variables is a disturbance component, and if it is rejected, the fixed effects method is consistent and the random effects method is inconsistent, and the fixed effects model must be used. The results of this test are given in the table below.

Table 2. Summary of the Hausman test method

prob	d.f	The value of H test statistic
0.2012	6/3251	6.3254

Source: research tissues

As can be seen in Table 4, the significance level of the Hausman test is calculated to be more than 0.05, so the Hausman test shows that the initial hypothesis based on random effects cannot be rejected, so it can be said that the research model

is a panel data type with random effects. is

Estimation of the research model based on the method of RE and hypothesis testing

The results of model estimation by panel method and using random effects are presented in Table (3).

Table 3. Regression model estimation results

Dependent variable = employment rate Method: RE. Panel EGLS				
prob	t	S.D	Coefficient	Independent variables
0.0000	3.521450	2.584214	0.419651	*C*
0.0009	3.215403	0.201245	0.040587	Use or proficiency in ICT or Internet Bank (INT), (e-commerce)
0.0341	3.236541	0.032514	0.092992	Access to ICT (ICT Development Index)
0.0410	5.125403	0.021412	0.033590	MG or ratio of liquidity to GDP (financial development)
0.0234	3.032145	0.012547	0.064285	K
0.0001	3.02147	0.054123	0.159473	L
0.0020	4.230154	0.084715	0.119438	GRD
0.0005	2.958120	0.032145	0.561714	FDI
F= 4.632540 prob = 0.000 DW= 1/74 =0.94200 R^2				

Source: research findings *significance level of 5%

Conclusion

1. *The first hypothesis:* The first hypothesis: the degree of development of communication and information technology (the level of access to ICT) has a significant effect on the employment rate in BRICS member countries and Iran. According to the calculation probability for this variable which is equal to 0.0341 and this probability is less than 0.05. It can be concluded that the null hypothesis is rejected and as a result, the degree of development of communication and information technology has a significant effect on the employment rate in BRICS member countries and Iran. And this shows that the first research hypothesis is confirmed.
2. *The second hypothesis:* The second hypothesis: the level of use and skill in the field of ICT (electronic commerce) has a significant effect on the employment rate in BRICS member countries and Iran. According to the calculated probability for this variable, which is equal to 0.0009, and this probability is less than 0.05. It can

be concluded that the null hypothesis is rejected and as a result, e-commerce has a significant effect on the employment rate in BRICS member countries and Iran. This shows that the second hypothesis of the research is confirmed.

3. *The third hypothesis:* MG or the ratio of liquidity to GDP (financial development) has a significant effect on the employment rate in BRICS member countries and Iran. According to the calculation probability for this variable, which is equal to 0.0410 and this probability is less than 0.05, it can be concluded that the null hypothesis is rejected, and as a result, financial development has a significant effect on the employment rate in BRICS member countries and Iran. And this shows that the third hypothesis of the research is confirmed.
4. *The fourth hypothesis:* Foreign direct investment has a significant effect on the employment rate in the BRICS member countries and Iran. According to the calculation probability for this variable, which is equal to 0.0005, and this probability is less than 0.05, it can be concluded that the null hypothesis is rejected, and as a result, foreign direct investment has a significant effect on the employment rate in the BRICS member countries and Iran. And this shows that the fourth research hypothesis is confirmed.
5. *The fifth hypothesis:* R&D expenditures have a significant effect on the employment rate in BRICS member countries and Iran. According to the calculated probability for this variable, which is equal to 0.0020, and this probability is less than 0.05. It can be concluded that the null hypothesis has been rejected and as a result research and development expenditure has a significant effect on the employment rate in BRICS member countries and Iran. This shows that the fifth hypothesis of the research is confirmed.
6. *The sixth hypothesis*: the labor force has a significant effect on the employment rate in the BRICS member countries and Iran. According to the calculation probability for this variable which is equal to 0.0001 and this probability is less than 0.05 It can be concluded that the null hypothesis has been rejected and as a result, the labor force has a significant effect on the employment rate in the BRICS member countries and Iran. And this shows that the sixth research hypothesis is confirmed.
7. *The seventh hypothesis*: capital has a significant effect on the employment rate in BRICS member countries and Iran. According to the calculated probability for this variable, which

is equal to 0.0234, and this probability is less than 0.05. It can be concluded that the null hypothesis is rejected and as a result, capital has a significant effect on the employment rate in BRICS member countries and Iran. and this shows that the seventh hypothesis of the research is confirmed.

According to the results of the Chow test for the regression model, the significance level of the Chow test is less than α=0.05 and it is confirmed with 95% confidence that the model can be estimated using the panel method (Table 4).

Table 4. results of hypothesis

Row	Hypothesis	Results
1	The degree of development of communication and information technology (the level of access to ICT) has a significant effect on the employment rate in BRICS member countries and Iran. (access level)	Accept
2	The level of use and skill in the field of ICT (electronic commerce) has a significant effect on the employment rate in BRICS member countries and Iran.	Accept
3	The ratio of liquidity to GDP (financial development) has a significant effect on the employment rate in BRICS member countries and Iran.	Accept
4	Foreign direct investment has a significant effect on the employment rate in the BRICS member countries and Iran.	Accept
5	Research and development expenses have a significant impact on the employment rate in the BRICS member countries and Iran.	Accept
6	The labor force has a significant impact on the employment rate in the BRICS member countries and Iran.	Accept
7	Capital has a significant effect on the employment rate in BRICS member countries and Iran.	Accept

Source: research findings

Recommendations

According to the results of this research, the following suggestions are presented:

1. Iran and BRICS member countries should pay more attention to improving the level of development of communication and information technology considering its positive and significant impact on their employment rate.
2. Iran and BRICS member countries should pay more attention to the development of e-commerce considering its positive and significant impact on their employment rate.
3. Iran and the member countries of the BRICS agreement should pay more attention to the promotion of financial stability, considering its positive and significant impact on their employment rate.

4. Iran and BRICS member countries should pay more attention to increasing foreign direct investment, considering its positive and significant impact on their employment rate.
5. Iran and the member countries of the BRICS agreement should pay more attention to increase research and development expenses, considering its positive and significant impact on their employment rate.
6. Iran and the member countries of the BRICS agreement should pay more attention to increase the number of workers, considering its positive and significant impact on their employment rate.
7. Iran and the member countries of the BRICS agreement should pay more attention to the positive and significant impact on their employment rate in order to increase capital.

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