DOES ICT PROMOTE INTERNATIONAL TRADE?

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ABSTRACT

This paper uses country-level Information and Communication Technology (ICT) data and international trade to examine whether or not ICT development can be a deterministic element to promote international trade. Empirical results show that ICT development causes trade. The prevalence of Internet has overcome many barriers by reducing time and the disadvantage of location and promoting efficiency in many fields. ICT positively affect productivity through ICT-leveraged innovations and ICT-induced externalities. ICT can play a vital role in the pathway to international trade and economic growth. However, these could cause inequality. Using the Gini coefficient as inequality in the economy tells us ICT development causes inequality. ICT skill does not significantly shrink inequality. Each country in some cases should consider this fact for sound economic development. On the other hand, exchange rate fluctuations and English proficiency are both not significantly related with international trade. English is an important element to promote businesses in many aspects; however, recent data show us that it is not a deterministic element to promote international trade. Other factors except English proficiency many have impacts on international trade.

Keywords: English, export, Gini coefficient, ICT, trade

INTRODUCTION

This article employs an indicator of ICT skill to examine the relationship between ICT skill and export growth. The establishment of the Internet has overcome many barriers in our world by reducing time and the disadvantage of location and promoting efficiency in many fields in businesses and our daily lives. The Internet still allows many possibilities. ICT can and will be able to play a vital role in the pathway to international trade and economic growth.

Chou, Chuang, and Shao (2014) indicated that ICT positively affects productivity by which ICT-leveraged innovations and ICT-induced externalities occur. Wang and Li (2017) showed that a country's export one industry increases 10% if the country's ICT development index increases 1 standard deviation. Intuitively, development of ICT is associated with international trade and decreases in income inequality. This is because ICT development lowers the cost of access to

business including international ones. ICT does not require initially expensive large infrastructure. ICT development which has led to faster, cheaper, and mode efficient modes of business by reducing transaction costs would be possible (Tayebeh & Reza, 2012). This also improves productivity and confers efficiency of capital allocation (Dimitris & McAdam, 2013) and reduces inequality of opportunities by facilitating funding to poor individuals with productive investments (see, for example, Galor & Zeira, 1993). Compared with heavy industries, ICT does not cost much in general.

Lirong and Hiranya (2013) showed that Internet subscriptions and Internet hosts have positive effects on exports and imports. Anura (2013) showed that managing human factors in the export process using ICT is critical to boosting the export. However, Greenwood and Jovanovic (1990) presented a nonlinear relationship between financial skill, inequality, and economic growth. There is some possibility that ICT causes significant digital divide (World Bank, 2016). Also, there is little study about the relationship between ICT, export, and inequality. There is no absolute consensus about the relationship (Claessens, Djankov, Fan, & Lang, 2002). There is much room for discussion.

There are some kinds of related studies. Bloom, Sadun, and Reenen (2012) showed that ICT improve organizational efficiencies by ICT-enabled organizational change and people management practices. Stanislaw and Magdalena (2014) examined ICT sector from the perspective of Schumpeterian technology gap and catching up. Eva (2015) showed that there is a relationship between the decision to export and the ICT usage of firms. Richard & Jonathan (2016) indicated that there is a causal effect from the internet on trade in business services, however, no evidence for an effort on trade in services. Shahbaz & Kaliappa (2016) found that education is a key factor in realizing the service exports. Finally, Eva & Patricia (2017) indicated that different ICT capacities are related with post-upper secondary ICT education.

This paper empirically examines the relationship between ICT skill and export growth and equality by using the indicator of ICT compiled by the IMD World Competitiveness Yearbook to proxy the degree by which people are able to use digital/technical skills. Section 2 provides a theoretical analysis of the links between ICT skill and export growth/inequality. Section 3 shows the empirical analyses and analyzes them. Finally, this article ends with a brief summary.

1. Theoretical Analysis and Data

This article uses regressions shown by Beck, Demirguc-Kunt, and Levine (2007), Chor (2010), Prete (2013), and Wang and Li (2017). Net export growth rate and Gini coefficient are employed as the dependent variables. Both of the variables are regressed by some variables. For explanation variables, ICT skills (digital/technological skills from the IMD), English proficiency

(TOEFL also from the IMD), and real GDP growth percentage (from International Financial Statistics by IMF) are included in the regression and analyzed. For ICT, ICT is usually intensively used in research and development (R&D) investment (Hall, Lotti, & Mairesse, 2012). R&D is taken into account in empirical studies. Data of R&D are from the IMD. As globalization is ongoing in the economic field, competent English ability seems to increase business activity. It cannot be denied that English proficiency is one of the most important qualifications to possess in global business. When analyzing the skills needed for international trade development, IT skills and English skills and economic scales should be considered. Exchange rate fluctuations are also considered in this analysis. In the past, exchange rate fluctuations had strongly negatively impacts on international trade. However, they seem to have not so much influence on international trade as the spreading use of forward/future transactions to hedge/cover the exchange rate risk. Average parity change from national currency to SDR (2014) is used. Parity change are in absolute values. Finally, for GDP, Kais, Ben, and Sami (2015) showed that there is a relationship between the growth rate of GDP and the index of ICT. Also, gravity models for international trade use scale off the economies, namely, GDP in many cases. Net export growth rate and Gini coefficient are regressed by these variables. The next section shows the empirical methods and analyses.

2. Empirical Analysis

This article uses the IMD World Competition Yearbook to proxy the degree by which people are able to understand and use two macroeconomic variables. The Yearbook compiles indicators from many fields. The indicators are computed based interviews with senior business leaders in many countries. The estimated countries are Argentina, Australia, Austria, Belgium, Brazil, Canada, China, Chile, Columbia, Croatia, Czech, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Kazakhstan, Korea, Jordan, Lithuania, Luxembourg, Malaysia, Mexico, Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Singapore, Slovak, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Kingdom, United States, and Venezuela. The selections of these countries are based on data availability. The sample period is from 2010-2016. The data is yearly. Before the regressions are preformed, each variable is checked statistically. Table 1 shows descriptive statistics (Table 1a) and correlations (Tables 1b and 1c) for these variables.

Table 1a. Descriptive Statistics

	Gini Coefficient	IT Skill (0~10)	English proficiency (0~10)
Mean	35.60	7.69	87.14
Median	1.20	7.73	89.11
Maximum	59.48	9.38	100.00
Minimum	25.00	4.86	70.00
Std. dev.	8.91	0.89	7.73
Skewness	-0.02	-0.48	-0.64
Kurtosis	0.71	3.28	2.64

Table 1b. Correlations among Variables (net export)

	Net export	IT skill	English proficiency
Net export	1		
IT skill	0.43	1	
English proficiency	0.23	0.20	1

Table 1c. Correlations among variables (Gini coefficient)

	Gini Coefficient	IT skill	English proficiency
Gini coefficient	1		
IT skill	0.33	1	
English proficiency	0.18	0.21	1

It is clear that ICT skill is strongly and positively related to net export. English proficiency also correlate positively with net export. On the other hand, for the Gini coefficient, all of the coefficients are smaller than ICT skill. However, the significance should be analyzed in more detail.

To analyze how ICT skills empirically influence net international trade growth the equation is regressed as follows:

NETEXPORT= α＋β1ICT＋β2ICT*R&D＋β3EXCHAGERATE+β4REALGDP+β5ENGLISH＋ε   (1)

NET EXPORT means the growth rate of net export and ε is the error term. The sample period is from 2010 to 2016. Along with ordinary least squares (OLS), Robust estimation is used for estimation. Robust estimation is unlike maximum likelihood estimation. OLS estimates for regression are sensitive to the observations that do not follow the pattern of the other observations. This is not a problem if the outlier is simply an extreme observation from the tail of a normal distribution; however, if the outlier is from non-normal measurement error or some other violation of standard OLS, it compromises the validity of the regression results if a nonrobust regression method is employed. The empirical results of OLS and Robust least squares are shown in Table 2a (equation (1) and (2)) and 2b (equation (3)~(10)).

Table 2a. Regression results (dependent variable: trade)

	(1)	(2)
C	17.08	216.71***
	(0.24)	(5.91)
ICT	6.55***	4.20***
	(4.06)	(6.20)
ICT	2.95***	2.34***
*R&D	(4.48)	(7.43)
Exchange	-2.56	-86.26***

Rate	(-0.17)	(-7.60)
Real	0.48***	1.44***
GDP	(4.25)	(6.56)
English proficiency	0.17	-1.49
	(0.26)	(-0.24)
Adj.R	0.85	0.99
D.W.	2.60	14.62
method	LS	Robust squares

Note. Parentheses are t-statistic (LS) and z-statistic (robust squares). *** denotes significant at 1%, ** denotes at 5%, and * denotes at 10%

Table 2b. Regression results (dependent variable: trade)

	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C	79.02**	79.50**	14.57***	14.55***	12.73***	12.75**	101.63	108.80
	(3.22)	(2.81)	(9.61)	(8.90)	(8.83)	(7.04)	(0.60)	(0.58)
ICT	7.83**	7.89**						
	(2.66)	(2.32)						
ICT *R&D								
Exchange Rate			-5.80	-4.28				
			(-0.22)	(-0.15)				
Real GDP					0.27	0.28		
					(1.29)	(1.07)		

							-0.89	-0.96
English proficiency							(-0.51)	(-0.50)
Adj.R2/ Adj.Rw2	0.60	0.73	-0.15	0.004	0.10	0.34	-0.13	0.06
D.W.	1.39		1.75		1.47		1.78	
Schwarz criterion		7.35		8.65		13.26		8.99
method	LS	Robust squares	LS	Robust squares	LS	Robust squares	LS	Robust squares

Note. Parentheses are t-statistic (LS) and z-statistic (robust squares). *** denotes significant at 1%, ** denotes at 5%, and * denotes at 10%.

The results are almost conclusive. ICT skill promotes net export growth expansion. These findings also suggest that ICT skill promotes business and economic growth. ICT skill would contribute to economic growth. It should not be forgotten that introducing ICT is usually not expensive compared to other industries, and it would be beneficial for developing economies. However, there would be some possibility that spreading ICT would promote inequality of the economy.

Next, the Gini coefficient instead of net export growth rate is used for the dependent variable. The Gini index used here is generally used, and it denotes that the case of absolute equal distribution of income is 0, and the case of absolute inequality is 100. The estimated equation is equation (2)

$$GINI = \alpha + \beta 1 ICT + \varepsilon \quad (2)$$

GINI denotes Gini coefficient, and the data are from the IMD. The results are shown in Table 3.

Table 3. **Regression results (dependent variable: Gini coefficient)**

	(11)	(12)
C	37.29***	37.13***
	(20.86)	(19.83)
ICT	1.00***	0.98***
	(4.39)	(4.10)
Adj.R2/ Adj.Rw2	0.75	0.79
D.W.	1.95	
Schwarz criterion		12.09
method	LS	Robust squares

Note. Parentheses are t-statistic (LS) and z-statistic (robust squares). *** denotes significant at 1%, ** denotes at 5%, and * denotes at 10%.

It is interesting to note that the coefficient of ICT is positive, which means that inequality expands with the acquisition of ICT skill; also, the coefficient is significant at 1% level. As has been suggested by some researchers, growth and inequality may interact during the process of economic growth (Greenwood & Jovanovic, 1990; King & Levine, 1993; Galor & Moav, 2004). It is difficult to judge, but the possibility exists that bipolarization in life would increase. Competent, knowledgeable, and skilled people use ICT skill more effectively than those who do not have such abilities. ICT skill enhances the use of services to access many businesses, which are frequently used by high income individuals and well-established firms. Thus, this situation widens inequality as shown by Greenwood and Jovanovic (1990). As suggested by some researchers, market imperfections should be taken into account while considering the preponderance of persistent inequality (Becker & Toms, 1979; Galor & Zeira, 1993; Mookherjee & Ray, 2003).

One important point in the solution of inequality depends on low or high wage earners (Jerzmanowski & Nabar 2007). Financial constraint in many fields should be taken into account (Bancerjee & Duflo, 2005; Evans & Jovanovic, 1989; Evans & Leighton, 1989; Holtz-Eakin, Joulfaian, & Rosen, 1994). The coefficient of inequality is significant and the result shows that the improvement of ICT skill does not significantly shrink inequality. Each country in some cases should consider this fact for sound economic development.

3. Conclusion

This paper examined the relationship between ICT skill and net export growth. The results suggest that ICT skill confers net export growth; however, there is no clear relationship between (1) English proficiency and net export growth and (2) exchange rate fluctuation and net export growth. Moreover, ICT skill does not reduce the inequality.

Finally, there is some room for further study. Expansion of the number of countries and the sample period may enable a more in-depth analysis. It may be possible to regress by other variables and by other methods. Consideration of different judgment standards for the same variables should be taken into account. For example, the term English ability in business can be evaluated by other elements. Also, much more theoretical background may be necessary to analyze the reason for economic growth and inequality as there are many ways to encourage economic growth and inequality. For this paper, ICT skill does not significantly shrink inequality. Some countries should consider this fact for sound economic growth.

Acknowledgments

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