Impact of ICT and E-Commerce on Nepal's Foreign Trade

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Abstract

This study investigates the impacts of Information and Communications Technology (ICT) and e-commerce on Nepal's foreign trade by applying the extended gravity model framework and random effects estimation model. To examine the effects of the ICT Development Index (IDI), Business-to-Business (B2B) e-commerce, and Business-to-Consumer (B2C) e-commerce on Nepal's bilateral trade, this study uses panel data of 82 countries for export and 88 countries for import merchandise trade over 2013–2016. The results show that IDI has a significantly positive impact on Nepal's export trade. B2B e-commerce has a significantly positive influence on both Nepal's export and import trade whereas B2C e-commerce has not shown any significant effect. The impact of ICT and e-commerce has seen higher in export trade than import trade of Nepal. The results are also consistent with 1-year Lagged Model. The study draws some policy implications that the government should enhance internal e-commerce and formulate a long-term vision for the development of the ICT and e-commerce sector with utmost priority. Furthermore, the effective implementation of the National E-commerce Strategy is very crucial to enhance the level of e-commerce development in Nepal. (*JEL F10, F14, O30*)

Keywords: *B2B e-commerce, B2C e-commerce, Nepal's foreign trade, gravity model with panel data, random effects, estimation model*

1. INTRODUCTION

Trade is regarded as an engine of economic growth. Especially for developing countries like Nepal, which is also a landlocked country, international trade plays a vital role in economic growth and development. The commercial uses of ICT and the Internet have simplified and sped up the trade of both domestic and cross-border transactions. After the invention of the Internet in the 1990s, international trade became easier and the communication cost of trade has drastically decreased (Fink et al., 2005). Such tremendous progress in Information and Communications Technology (ICT) has reduced some trade barriers such as geographical distances, social, cultural, language, and political aspects. Information Technology enabled Services (ITeS) such as email, internet, video call, social networks, and online conferences became alternatives of direct communication for merchandize trade which

boost up trade transactions. ICT and e-commerce help to increase the flow of international trade by making the market more competitive and efficient through better information flow, cost reduction in market entry, communication, and distribution channel, and activities of market promotion and advertisement (Freund and Weinhold, 2004; Jungmittag and Welfens, 2009). Various specific applications of ICT for international trade have been emerging which promote paperless trade such as e-invoices, e-signatures, pre-clearance of shipments while goods are in transit, single windowing, and use of blockchain-related to tax or border compliance process. As a result, these ICT applications significantly decrease restrictions, barriers, and delays. Hence, ICT and e-commerce might have a positive influence on international trade. Several previous studies have also shown the positive impact of ICT and e-commerce on international trade (Yushkova, 2014; Ozcan and Nath, 2016; Xing, 2018; Ozcan, 2018; Wardani et al., 2019; Zhang et al., 2020). Many scholars have also shown the positive relationship of the internet on international trade (Freund and Weinhold, 2002; Vemuri and Siddiqi, 2009).

This study explores the impact of ICT and e-commerce on Nepal's foreign trade. The impact analysis is done based on evidence from Nepal's foreign trade with 94 different countries (82 countries for export trade and 88 countries for import trade) applying an extended gravity model framework over a panel data of 2013–2016.

According to the existing literature and our understanding, this is the first empirical study related to the impact of ICT and e-commerce development on Nepal's foreign trade. This study attempts to find the impact of ICT (using IDI index) and e-commerce (using B2B ICT usage and B2C internet usage indexes) on Nepal's foreign trade.

The remaining parts of the study organize as follows. Section 2 presents an overview of Nepal's foreign trade, ICT, and e-commerce development. Section 3 and 4 cover related literature and research methodology, respectively. Section 5 elaborates on data analysis and results. Section 6 reports research findings and policy recommendations. Section 7 concludes.

2. OVERVIEW OF NEPAL'S FOREIGN TRADE, ICT, AND E-COMMERCE DEVELOPMENT

Nepal's economic liberalization process started in the mid-1980s. Nepal deployed various export promotion programs and policies including schemes like export duty drawback and bonded warehouses. To enhance bilateral, multilateral, and regional trade, Nepal became a founding member of SAARC[1)] in 1985. After being the 147th WTO member country on 23 April 2004, Nepal enhanced trade diversification by establishing bilateral trade treaties with 17 countries[2)] up to 2020 (TEPC, n.d.). Meanwhile, in February 2004, Nepal by being a member of BIMSTEC[3)] expanded its regional trade with non-SAARC members Myanmar and Thailand.

Nepal shares about 62% and 38% of its border with India and China, respectively. There are four dry ports/Inland Clearance Depot (ICD) operating on the border with India, one on the border with China, and Tribhuvan international airport at Kathmandu as an air-based route for international trade.

Table 1 displays that India is the major trade partner of Nepal covering more than half of both export and import trade of Nepal followed by the United States and Turkey in export trade and China and France in import trade, respectively.

Regarding foreign trade, Nepal has 69% and 2.1% export trade with India and China, respectively in 2019. For import trade, India and China's share is 65.4% and 13.8% of total imports to Nepal. Table 2 shows major export products of Nepal such as palm oil, yarns, woolen carpets, etc., and major import products such as petroleum products, iron & steel product, machinery & parts, etc. in the fiscal year 2018/19 (TEPC, 2019).

Nepal formulated an IT policy in 2000 for the first time. The recent ICT policy 2015 has focused 8 major sectors to develop which are ICT accessibility, ICT for development, IT industry, e-commerce, human resource development, e-Government, ICT infrastructure, and cybersecurity. To develop the internal and cross-border e-commerce business, Nepal Government introduced the National E-commerce Strategy in 2019 for the first time. This strategy is focused on 6 different areas which are

Table 1: Top 10 countries based on export and import trade in 2018

Rank	Export (%)		Import (%)	
	Country	Share	Country	Share
1	India	59.0	India	64.8
2	United States	11.9	China P. R.	13.5
3	Turkey	4.6	France	2.3
4	Germany	3.8	U.A.E.	1.8
5	United Kingdom	3.4	Thailand	1.0
6	China P. R.	2.8	Indonesia	1.0
7	Bangladesh	1.5	Vietnam	0.9
8	France	1.5	Canada	0.8
9	Italy	1.4	Switzerland	0.8
10	Japan	1.2	Malaysia	0.8

Source: Trade and Export Promotion Center

Table 2: Major export and import products of Nepal in Fiscal Year 2018/19

Rank	Export (%)		Import (%)	
	Product	Share	Product	Share
1	Palm oil	11	Petroleum products	15
2	Yarns	10	Iron & steel and products thereof	12
3	Woolen carpet	8	Machinery and parts	9
4	Iron & steel products	7	Transport vehicles and parts thereof	6
5	Readymade garments	6	Electronic and electrical equipments	4
6	Jute products	6	Cereals	4
7	Juices	5	Gold	2
8	Others	47	Others	48

Source: Trade and Export Promotion Center

Table 3: Current ICT infrastructure status in Nepal

Indicators	Value	Year	Source
Mobile cellular subscriptions (per 100 people)	139.4	2018	WDI
Fixed broadband subscription (per 100 people)	2.82	2018	
Individuals using the Internet (% of the population)	63.81	2017	
Secure Internet servers (per 1 million people)	209.2	2020	

Table 4: Current ICT and e-commerce status in Nepal

Indicators	Value[a]	Rank[b]	Source
ICT Development Index (IDI) 2017	2.88 (0–10)	140 (176)	ITU's Global IDI 2017 Report
B2B ICT usage index	3.8 (0–7)	125 (139)	WEF's Global Information Technology Report 2016
B2C Internet usage index	3.6 (0–7)	115 (139)	
B2C e-commerce Index 2019	35.4%	112 (152)	UNCTAD's B2C e-commerce Index 2019 Report

Notes:
a The range of possible values is shown in brackets.
b The total number of countries included in the study is shown in the brackets.

legal & institutional framework; ICT infrastructure; trade logistics & trade facilitation; payment system; skill development; and value chain & internal supply chain. Tables 3 and 4 provide the latest status of some ICT infrastructure and ICT & e-commerce indicators of Nepal, respectively.

3. RELATED LITERATURE

Several empirical studies emphasize that ICT, internet facilities, and e-commerce increase foreign trade and the performance of domestic firms. For instance, Fariselli et al. (1999) had explored three inter-related issues: globalization; the role of Small and Medium Enterprises; and e-commerce that directly impacts international trade. Freund and Weinhold (2004) studied the effect of the internet on bilateral trade using panel data of 56 countries over 3 years (1997–1999). They concluded that a 10 percentage point increase in web hosting as a proxy of internet usage impacts a 0.2 percentage point increase in export trade. The researchers further predicted that the internet contributed approximately a 1 percentage point increase in export trade annually on average. Clarke and Wallsten (2006) analyzed cross-sectional data of 26 developed and 72 developing countries for export trade in 2001. Their empirical study results that the increase in internet access in developing countries promotes the export trade whereas it does not significantly affect the export trade of developed countries. Vemuri and Siddiqi (2009) argued that the internet and ICT infrastructure have a positive and significant impact on bilateral trade. They concluded this fact based on the study of 64 countries from 1985 to 2005 using the dynamic panel gravity model with the Hausman and Taylor estimation model.

Liu and Nath (2013) investigated the effects of ICT on international trade on panel data of 40 emerging countries between 1995 and 2010 implementing a fixed-effects estimation model. Their empirical result showed that internet subscriptions and internet hosts were significantly positive on bilateral trade. Yushkova (2014) showed the positive relationship of B2B internet usage with foreign trade by examining bilateral trade among 40 countries (OECD countries with Brazil, China, India, Indonesia, Russia, and South Africa) with the data of 2011. Xing's (2018) empirical findings based a panel data of 2014/15 of 21 developing and LDCs and 30 OECD countries using a gravity model with fixed effects estimation indicated that better access to the modern ICT and adoption of e-commerce applications enhanced bilateral trade flows.

Using a fixed effect estimation approach and taking fixed-line telephones, mobile phones, and internet hosts as IT indicators, Tang (2006) investigated the impact of IT on US import trade over the period 1975 to 2000. His research suggested that the development of IT in the exporting countries has a significant impact on US import trade with the evidence that a 10% increase in internet usage of exporter countries leads to a 1% growth of exports of merchandise goods to the US. Similarly, by applying pooled OLS, Fixed Effects, and Random Effects estimators; Ahmad et al. (2011) established the significant and positive

impact of ICT on Malaysia's bilateral export trade with 36 trading countries using panel data between 1980 and 2008.

Ozcan (2018) advised that ICT has a significantly positive association with the foreign trade of Turkey using the gravity model and fixed effect estimation on a panel data of 35 import and 34 export partners in the period 2000 to 2014. Wardani et al. (2019) concluded that ICT development has a significantly positive association with Indonesia's bilateral trade with other ASEAN member countries using the gravity model and random effect estimator on the panel data from 2010 to 2017.

4. RESEARCH METHODOLOGY

4.1 Data and Variables

The research sample consists of data over 4 years (2013–2016). It consists of 2 dependent variables—export and import trade and for each dependent variable, panel data of 82 and 88 countries are taken, respectively (See Appendix 1). The countries are selected based on continuous and significant trade with Nepal for over 4 years. The country selection ensures that every variable has no missing data. The list of variables that are taken for the study is presented in Table 5. The panel data summary statistics of the export and import regression

Table 5: List of variables with units and source

Dependent Variables (Components of International Trade)			
Variable	Variable Explanation	Unit	Source
lnEx	Log of Export	Constant 2010 USD	TEPC, Nepal
lnIm	Log of Import	Constant 2010 USD	
Independent Variables (Trade and Regional Integration)			
lnMS	Log of the product of GDP	Constant 2010 USD	GDP from WDI
lnDist	Log of Distance	Kilometers	CEPII
Border	International border	Dummy variable	
LL	Landlocked country	Dummy variable	
RTA	Regional Trade Agreement	Dummy variable	RTA database, WTO
Independent Variables (ICT Development)			
lnIDI	Log of the product of IDI indices	0–10 (best) scale	ITU
Independent Variables (E-Commerce Development)			
lnB2B	Log of the product of B2B ICT usage indices	1–7 (best) scale	WEF
lnB2C	Log of the product of B2C Internet usage indices	1–7 (best) scale	WEF

Table 6: Panel data summary statistics of export regression model

Variable	Mean	Std. Dev.	Min	Max
lnEx	5.266917	1.227164	1.854271	8.6569
lnMS	21.62463	0.714571	20.2358	23.52841
lnDist	3.750883	0.262187	2.828764	4.246755
lnIDI	1.149091	0.187567	0.476078	1.364151
lnB2B	1.314413	0.06295	1.109579	1.442793
lnB2C	1.246852	0.070474	0.975432	1.379124
Border	0.02439	0.154493	0	1
LL	0.146342	0.353988	0	1
RTA	0.036585	0.188028	0	1

Source: Author calculations.

Table 7: Panel data summary statistics of import regression model

Variable	Mean	Std. Dev.	Min	Max
lnIm	5.95806	1.555491	0.996078	9.566864
lnMS	21.55249	0.752404	20.15979	23.52841
lnDist	3.782608	0.270773	2.828764	4.246755
lnIDI	1.130687	0.192204	0.553009	1.364151
lnB2B	1.310109	0.063045	1.147367	1.442793
lnB2C	1.24201	0.068828	1.021189	1.379124
Border	0.022727	0.149245	0	1
LL	0.113636	0.317821	0	1
RTA	0.034091	0.181721	0	1

Source: Author calculations.

model are shown in Tables 6 and 7, respectively.

4.2 Model

This study proposes an econometric model based on the extended gravity model of trade as follows.

$$\ln Ex_{jt} \text{ or } \ln Im_{jt}=\beta_0+\beta_1 \ln MS_{ijt}+\beta_2 \ln Dist_{ij}+\beta_3 \ln IDI_{ij}+\beta_4 \ln B2B_{ij}+\beta_5 \ln B2C_{ij}+\beta_6 Border_{ij}+\beta_7 LL_j+\beta 8\ RTA_{ij}+\alpha_{ij}+\varepsilon_{ijt}$$

where $\ln Ex_{jt}$ and $\ln Im_{jt}$ are logs of export and import trade between country *i* (i.e. Nepal) and a set of sample countries (*j*) in year *t*. $\ln MS_{ijt}$ denotes a log of market size as the product of GDP of country *i* and *j* in year *t*. $\ln Dist_{ij}$ is a log of geographical distance between the capital cities of countries *i* and *j*. $\ln IDI_{ijt}$, $\ln B2B_{ijt}$ and $B2C_{ijt}$ are logs of the product of ICT development indices, B2B ICT usages indices, and B2C internet usage indices of country *i* and *j* in year *t*, respectively. $Border_{ij}$, LL_j and RTA_{ij} are dummy variables for the common border between country *i* and *j*, landlocked country *j*, and Nepal's regional trade agreement with country *j*. $\beta_0, \beta_1, \ldots\ldots, \beta 8$ are unknown parameters; α_{ij} denotes fixed effect error and ε_{ijt} denotes a time-variant error.

The gravity model enables to show the impact of ICT in international trade based on mutual trade volume, geographical distance, market openness, regional integration so on. Many related studies have applied gravity models such as Vemuri and Siddiqi (2009), Xing (2018), Ozcan (2018), Wardani et al. (2019). In line with this literature, this study has adopted the gravity model by taking the products of variables.

With the panel data, this study selects an appropriate estimation technique among Pooled OLS, Fixed Effects, and Random Effect estimation models. This study uses the F Test to select either Fixed Effects Model (FEM) or Pooled OLS Model (POM); Breusch-Pagan Lagrangian Multiplier (LM) Test to select either Random Effects Model (REM) or POM and Hausman Test to select either FEM or REM. Before applying any estimation models, this study will use the Breusch-Pagan Test to check the cross-sectional heteroscedasticity and Modified Wald Test to check group-wise heteroscedasticity. Similarly, Wooldridge Test will also be conducted to check for autocorrelation in the data. If heteroscedasticity and autocorrelation are seen, they will be adjusted. Finally, a 1-year lagged variable has been used to minimize the endogeneity problem.

5. DATA ANALYSIS AND RESULTS

5.1 Model implementation and testing

If independent variables are strongly correlated, there can be a multi-collinearity issue and if it exists, the result of regression might not be relevant. Suspecting multi-collinearity among variables, a VIF test is conducted. The result of the individual VIF test's value is under 6 and 5, respectively for the export and import regression model as shown in Appendix 2. Kennedy (1992) recommended the critical threshold of VIF should be under 10, otherwise, it points to serious problems. Hence, the obtained result shows that there is an absence

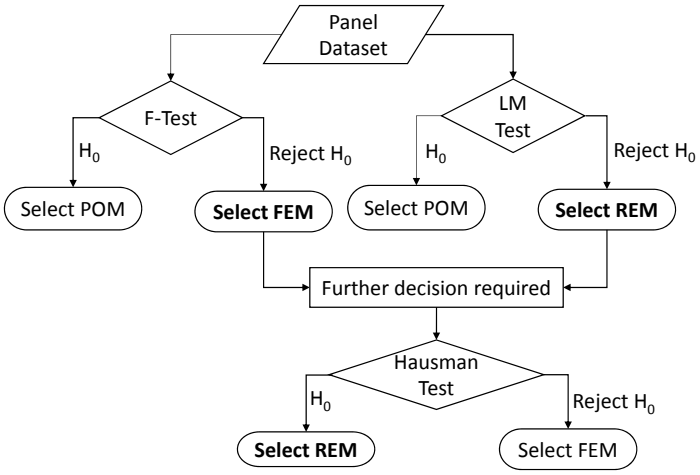

Figure 1: Model selection process

Source: Adopted from Park (2011)

of multi-collinearity among independent variables.

To select the appropriate estimation model for the research, two different tests are conducted in the beginning. Firstly, F-Test for Fixed Effects is implemented to identify whether POM or FEM is suitable. The test has a Null Hypothesis that there are no Fixed Effects in the model. Since both the export and import models showed Prob(χ^2)=0 in F-Test, it rejected the Null Hypothesis and preferred FEM (See Appendix 3). Secondly, Breusch and Pagan LM Test is conducted to select either POM or REM. The test has a Null Hypothesis that there are no Random Effects in the model. Since both export and import models showed Prob(χ^2)=0 in the test, it rejected the Null Hypothesis and favored REM (See Appendix 4). These results showed that both FEM and REM are more effective to deal with heterogeneity than Pooled OLS. Moreover, when unobserved country-specific i.e., time-invariant effects correlate with the dependent variable, the Pooled OLS estimator becomes biased and inconsistent. So, POM is not unsuitable for this research.

Again, to select the most suitable estimator model between the FEM and REM, a Hausman test is conducted. The test has a Null Hypothesis that individual effects do not correlate with regressors in the model i.e., the composite error term υ_ijt does not correlate with an independent variable. According to Hausman Test, FEM is consistent under both the Null and Alternative Hypotheses. However, REM is efficient under the Null Hypothesis but inconsistent under the Alternative Hypothesis. The Hausman test showed Prob(χ^2)=0.5082 for Export Regression Model and Prob(χ^2)=0.2663 for Import Regression Model which is not statistically significant and there is not sufficient evidence to reject the Null Hypothesis. Therefore, this study considers REM because it is more efficient than FEM under the Null Hypothesis. REM has another advantage over FEM in that it can also include time-invariant variables in the model. In the proposed model, the effects of time-invariant variables such as distance, border, landlocked, and RTA are very important to study and these variables cannot be dropped from the model. Previous scholars such as Oh and Prasai (2012) and Wardani et al. (2019) have also implemented REM in their empirical studies. This overall model selection process is shown in Figure 1.

This study uses some tests such as the heteroscedasticity test and autocorrelation test as a robustness test for the result obtained from REM. To obtain a reliable result, the model should be homoscedasticity i.e., the variance of composite error must be constant for different values of independent variables. Normally trade models violate this assumption and consist of heteroscedasticity due to the logarithmic transformation of variables (Rodriguez-Crespo et al., 2019). Although

the presence of heteroscedasticity does not affect the unbiasedness of the model it can provide the wrong estimation of standard errors; ultimately giving an erroneous output of hypothesis testing. Hence, heteroscedasticity testing is necessary. The study checked cross-sectional heteroscedasticity using Breusch-Pagan Test (see Appendix 5) and obtained Prob(χ^2)=0.0002 and Prob(χ^2)=0 for export and import regression models, respectively. Since the observed probability of Chi-square is significant at a 0.05 level of significance, the test rejected the Null Hypothesis of homoscedasticity and showed the presence of heteroscedasticity in the proposed model. Similarly, the Modified Wald Test for group-wise heteroscedasticity for fixed effects is also conducted and it rejected the Null Hypothesis with a probability of Chi-square = 0 for both the Export and Import Regression model (See Appendix 6). Hence, these two tests show that the proposed model consists of heteroscedasticity.

Normally an autocorrelation or serial correlation issue appears in time series data due to time lag among variables. This study examined the Wooldridge Test for autocorrelation in the proposed model to ensure that there is no autocorrelation. As the expectation, the test cannot reject the Null Hypothesis of no first-order autocorrelation since the Prob (F-Value) = 0.4935 and Prob (F-Value) = 0.7686; hence, the proposed model does not include the autocorrelation issue (See Appendix 7). Finally, to deal with heteroscedasticity issues, this study uses REM with a Robust Standard Errors option. Again, to minimize the endogeneity issue, 1-year Lagged Model has also been implemented. There are several sophisticated estimation methodologies to deal with endogeneity such as Instrumental Variables, Arellano-Bond estimator, and System Generalized Method of Moments but due to the lack of long-period panel data, it is not feasible to apply them in this study.

5.2 Regression results

After several adjustments during model implementation, the study presents the regression results of the REM and 1-year Lagged Model.

5.2.1 Results of Random Effects Model

The regression results of Nepal's bilateral export and import trade are shown in Table 8. The positive coefficients of GDP and the negative coefficients of distance confirm the research results follow the concept of the gravity model. This result is consistent with the studies related to Nepal's foreign trade conducted by several scholars such as Oh and Prasai (2012), Thapa (2012), Acharya (2013), Prasai (2014), and Paudel and Wagle (2017). This finding shows that Nepal has a high volume of trade with large economies and comparatively less trade with the countries which are far away from Nepal.

IDI has seen statistically significant and positive with export trade at a 1% level of significance. This is in line with Ozcan (2018) as well as Wardani et al. (2019). This positive impact might be as the ICT development level increases, the trade-related costs such as logistics, market-entry, communication, transportation, advertisement, information collection, processing, etc. decreases. However, it is not significant for import trade. This might be due to the minimal effect of the ICT development level on Nepal's major import products and Nepal's export promotion-oriented trade policy.

B2B ICT usage is also statistically significant and positive for export and import at 1% and 5% significance levels, respectively. The rapid adoption of ICT usage by both export and import firms of Nepal; and strengthening government ICT policy and infrastructure might have a positive influence to increase Nepal's foreign trade.

B2C internet usage is not significant and showed a negative relation with export and import trade. Nepali export traders might not fully utilize B2C internet usage for foreign trade. Moreover, the traditional trade is dominant and major exporting products of Nepal are labor-intensive which might not be much affected by B2C internet usage.

Border and Landlocked variables do not show any significant results. The negative sign of the Landlocked dummy variable implies that Nepal has comparatively less trade with landlocked countries.

The dummy variable RTA showed statistically significant and positive at a 1% level for export trade. This result is in line with Thapa (2012) and Acharya (2013). Nepal has RTA with only SAARC countries and the sample data include Bangladesh, India, and Pakistan as SAARC countries. RTA emphasized increasing trade flow among SAARC

Table 8: Regression results of REM and 1-year Lagged Model

	Random Effects Model		1-year Lagged Model	
Variables	lnEx	lnIm	lnEx	lnIm
lnMS	1.156***	1.402***		
	(0.107)	(0.151)		
lnDist	-0.664*	-1.520***	-0.655*	-1.584***
	(0.364)	(0.515)	(0.378)	(0.491)
lnIDI	1.134***	-0.0615	1.219**	-0.613
	(0.350)	(0.691)	(0.551)	(0.864)
lnB2B	4.081***	2.430**	3.899***	0.866
	(0.855)	(1.170)	(1.494)	(2.037)
lnB2C	-1.294	-0.831		
	(1.143)	(1.797)		
Border	0.399	0.490	0.533	0.526
	(0.334)	(0.382)	(0.351)	(0.357)
LL	-0.0502	-0.165	-0.132	-0.225
	(0.239)	(0.332)	(0.264)	(0.356)
RTA	1.536***	-0.0510	1.645***	0.0799
	(0.523)	(0.552)	(0.563)	(0.565)
lnMS_lag			1.052***	1.240***
			(0.114)	(0.147)
lnB2C_lag			-0.0265	4.396**
			(1.692)	(1.838)
Constant	-22.35***	-20.59***	-21.53***	-20.64***
	(2.153)	(3.050)	(2.509)	(3.326)
Observations	328	352	326	348
Number of Countries	82	88	82	88
Overall R-squared	0.7051	0.5966	0.4197	0.3526

Notes: Robust standard errors are given in parentheses. ***, **, and * indicate significant at the 1, 5, and 10 percent level, respectively.
Source: Author calculations.

countries by reducing trade costs and trade barriers. This might be the reason that RTA has a significantly positive impact on export trade. For import trade, most major products are imported from either India or developed countries rather than Bangladesh and Pakistan. Therefore, RTA does not have a significant impact on import trade.

5.2.2 Results of 1-year Lagged Model

Among several causes of endogeneity, the two-way causal relationship might suffer more in the proposed model. There might be a two-way causal relationship between the dependent variables and some independent variables. That means e-commerce indicators might have a two-way causal relationship with export/import. Similarly, some control variables such as GDP, and RTA also might have reverse causality with export/import. This study implements a 1-year Lagged Model to control the endogeneity problem, which is in line with Vemuri and Siddiqi (2009) and Ozcan (2018).

The independent variables such as lnMS, lnIDI, lnB2B, and lnB2C correlate with their respective previous year's values. To control this, the lag of lnMS is taken from trade-related variables. Similarly, the lag of lnB2C is chosen from ICT-related variables to control the previous year's values and minimize a reverse causality among them.

B2B ICT usage is statistically significant for export but not for import trade. B2C internet

usage is statistically significant and positive for import trade at a 5% significance level. As the use of the internet has been expanding, the consumers' demand for international products became high. This might be the reason for increasing import trade while the increase in B2C internet usage in Nepal.

6. RESEARCH FINDINGS AND POLICY RECOMMENDATIONS

One of the major findings of this research is that the IDI index (a proxy of ICT development) has a significantly positive impact on export trade. Another major finding of the research is that B2B ICT usage (one of the proxies of e-commerce) impacts significantly positive on both export and import trade. Comparatively, ICT and e-commerce have shown more impact on export trade than import trade whereas the proxy of e-commerce i.e., B2C internet usage does not show any significant result.

Furthermore, the significantly positive effect of GDP (a proxy for economic size) and the significantly negative effect of distance justifies the concept of the gravity model on Nepal's foreign trade. The empirical result of REM is the same as that of the 1-year Lagged Model.

Based on the findings, the study suggests the following policy recommendations for ICT and e-commerce development to increase the volume of Nepal's foreign trade.

- The government should prioritize the development of the ICT and e-commerce sectors.
- To improve internal e-commerce, the government should establish ICT infrastructures, enhance the IT skills of people, and improve the readiness environment of e-commerce such as online payment systems, concerning laws, and accurate postal addresses. Internal e-commerce development contributes to cross-border e-commerce.

7. CONCLUSION

Applying the gravity model framework, this study investigated the impact of e-commerce on Nepal's foreign trade using Random Effects Model and the result has also shown consistent with a 1-year Lagged Model. The empirical findings suggest that better readiness in ICT and e-commerce can enhance Nepal's bilateral foreign trade. The results showed that B2B ICT usage as a proxy of e-commerce has a significantly positive relationship with the export and import trade of Nepal. IDI index as a proxy of ICT development has also a significant and positive impact on export trade.

For further study, long-period data might be available in the future. The impact of ICT and e-commerce on sector-wise goods and service trade of Nepal such as tourism, transportation, telecommunication, finance, insurance, etc. can be studied in the future. Some advanced statistical estimators such as Instrumental Variables, Arellano-Bond estimator, and System Generalized Method of Moments with long-period panel data.

NOTES

1) The member countries of South Asian Association for Regional Cooperation (SAARC) include Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.
2) United States (1947), India (1950), United Kingdom (1965), Yugoslavia (1965), Russia (1970), North Korea (1970), South Korea (1971), Egypt (1975), Bangladesh (1976), Sri Lanka (1979), Bulgaria (1980), China (1981), Pakistan (1982), Czech Republic (1982), Romania (1984), Mongolia (1992) and Poland (1992).
3) The member countries of Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) constitute Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka and Thailand.

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APPENDIX

Appendix 1: List of Sample Countries (94 countries)

Argentina**, Australia, Austria, Azerbaijan*, Bahrain, Bangladesh, Belgium, Brazil, Bulgaria, Cambodia, Cameroon**, Canada, Chile, China, Colombia, Costa Rica, Côte d'Ivoire**, Croatia, Cyprus, Czech Republic, Denmark, Egypt, El Salvador**, Estonia, Ethiopia*, Finland, France, Germany, Greece, Guatemala**, Honduras**, Hong Kong SAR, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Korea (Rep.), Latvia, Lebanon, Lithuania, Luxembourg, Malaysia, Malta, Mauritius*, Mexico, Moldova**, Mongolia, Morocco, Mozambique**, Namibia**, Netherlands, New Zealand, Nicaragua**, Nigeria, Norway, Oman, Pakistan, Panama*, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Saudi Arabia, Senegal**, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Tanzania, Thailand, Trinidad and Tobago**, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay*, Vietnam, Zambia*

Notes: 6 countries (with * sign) and12 countries (with ** sign) have only export and import trade, respectively during the period.

Appendix 2: Variance Inflation Factor (VIF) Test

Variable	Export Regression Model	Import Regression Model
lnMS	1.58	1.71
lnDist	1.63	1.60
lnIDI	2.30	2.17
lnB2B	3.41	3.24
lnB2C	5.07	4.76
Border	1.34	1.33
LL	1.10	1.07
RTA	1.91	1.91

Appendix 3: F-Test for Fixed Effects

Regression Model	χ^2 (4) value	Probability (χ^2)
Export	35.69	0.0000
Import	19.29	0.0007

Appendix 4: Breusch and Pagan LM Test for Random Effects

Regression Model	χ^2 (1) value	Probability (χ^2)
Export	247.11	0.0000
Import	253.41	0.0000

Appendix 5: Breusch-Pagan Test for Cross-sectional Heteroscedasticity

Regression Model	χ^2 (1) value	Probability (χ^2)
Export	13.87	0.0002
Import	45.08	0.0000

Null Hypothesis: Constant variance; Variables: Fitted values of the respective dependent variable

Appendix 6: Modified Wald Test for Groupwise Heteroscedasticity

Regression Model	χ^2 value	Degree of Freedom	Probability (χ^2)
Export	3.5e+06	82	0.0000
Import	8.5e+05	88	0.0000

Null Hypothesis: Sigma (i)^2 = Sigma^2 for all i

Appendix 7: Wooldridge Test for Autocorrelation in Panel Data

Regression Model	F Test value	Degree of Freedom	Probability (F)
Export	0.473	1, 81	0.4935
Import	0.087	1, 87	0.7686

Null Hypothesis: No first-order autocorrelation

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