Disruptive Digital Technology and Cambodia's International Trade: Empirical Analysis and Policy Implications

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Abstract

This research paper studies and observes the impact of digital technologies, Information, and Communication Technology (ICT), on Cambodia's international trade. The objectives of this research study consist of two folds. Firstly, this study aims to empirically explore the relationship between digital technology proxies by ICT infrastructure, *namely fixed-broadband subscriptions, mobile cellular subscriptions, and internet users* on Cambodia's international trade with the proposed gravity model with ICT by employing Bayesian with Markov chain Monte Carlo (MCMC) inference. This research uses panel data covers 14 main Cambodia's trading partners spanning from 2002 to 2018, a total of 238 observations. Secondly, it aims at providing policy suggestions for the Royal Government of Cambodia (RGC) and other relevant institutions to improve the ICT infrastructure in Cambodia.

The empirical result reveals that Cambodia's digital technology, which proxies by ICT infrastructure, indicates a positive relationship with Cambodia's international trade. In that, *fixed-broadband subscriptions* display to be one of the significant majors among ICT infrastructure (large estimated mean compared to the other two variables) in determining Cambodia's international trade. It implies that access the high-speed internet and expanding network coverage would essentially encourage trade activities by bringing down the trade cost. Besides that, economic size and market represented by GDP and population, respectively, free trade agreement (FTA) display a positive correlation with Cambodia's international trade. Meanwhile, distance represents the cost of trade between Cambodia to each respective trading partners confirms a negative relationship, in line with theories and previous empirical studies. The study suggests that the development and improvement of broadband played a fundamental step in enhancing the development of digital technology in Cambodia and promoting the country's international trade.

I. Introduction

Digital technologies have increasingly become popular and attracted public attention to discuss and identify as well as leverage its potential for today-utilization. These digital technologies are interconnected and dynamic but need ICT infrastructure for its operation as well as ICT services (Velde, 2018). Hence, ICT widely becomes a measure to capture digital technologies. The concept of information and communication technology (ICT) was introduced in the 1940s. As of present, the term ICT in the world has not been defined. In general, ICT can often be viewed as a synonym for information technology (IT) or the extension of IT concepts. Compared with IT technology, the concept of ICT covers communication technology, computer technology, and assistive technology related to both. In the traditional sense, communication technology is regarded as the sending and receiving technologies for message transmission, while IT focuses on encoding, decoding, as well as the processing of information. As technology evolves, these two technologies are slowly becoming inextricably linked and are gradually emerging into one category, namely, the concept of ICT (Yang, 2019).

Again, the digital technologies, ICT itself, has shaped the global economy through various aspects such as day-to-day businesses, communication, and trade as well as investment. In the globalized world, countries exchange goods and services to promote economic growth. Given the disparity in geographical conditions, population structure, specialization, and innovation dynamics, trade is beneficial for individual economic actors who participate. However, free trade has certain limits due to the trade costs in searching, information, bargaining, decision, policing, and enforcement (Coase, 1937). The fall of the trade costs may lead to an increase in international trade argued by (Venables, 2001) that ICT firstly contributes to more transparency on the markets and reduces the cost of searching, matching, and communication. Secondly, ICT use in the trade leads to the reduction of the monitoring and management costs of the firms. Thirdly, ICT application may cause the deduction of the shipping costs because of the organizational changes and digitalization. Fourthly, using ICT may also save time in transit and other related costs.

Also, there has been investigating the role of business and social networks in international trade that tried to find that if the business and social network can occupy the informal trade barriers and promote international trade. (Rauch, 2001) believed that international trade is a searching and matching process between buyer and seller. It inevitably will be influenced by the problem of information and contract cost. Yet, in businesses and social networks, much of the problems of information and contract cost can be solved, and it can be a tool for facilitating international trade with the ICT involved to decrease the trade barrier and facilitate international trade. With internet access, information technology has become a key role in development within a country. In terms of trade, information technology has also been a component of competitiveness among companies and countries where the information-processing efficiency of companies and countries directly builds their ability to be internationally competitive.

Likewise, given the leapfrogging of the ICT situation, Cambodia's international trade has witnessed a significant increase. The gradual development of ICT is expected to increase the country's international trade through alleviating trade barriers aiming to reduce trade cost, the cost of import and export, and also promoting time efficiency by reducing the administrative and clearance custom procedures.

1.1 An Overview of Cambodia's international trade

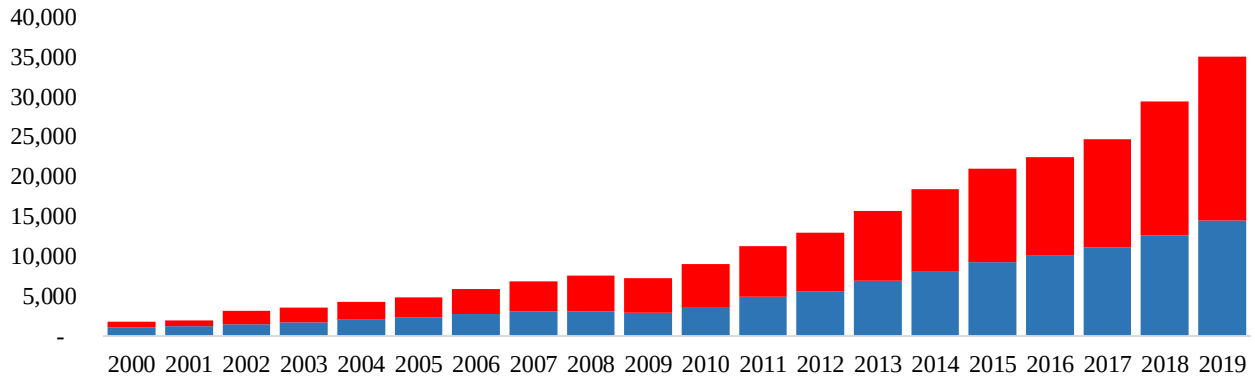
With a small open economy, Cambodia has increasingly been exposed to the external economy through international trade. Following the disruptive inward nationalist policies employed under the Khmer Rouge, the country has rebuilt its international and trade reputation. Becoming an official member state in ASEAN since 1999, Cambodia has reaped a variety of interests. More than twenty years down the road, it has integrated its economy through the expansion of economic relations and connectivity in ASEAN and other regional and global organizations, allows Cambodia to potentially access an essential bilateral as well as a multilateral trading system and markets (Charadine, 2020). Several years later after participating in the ASEAN, Cambodia became a full

member state in the WTO in 2004. By joining the WTO, Cambodia took the chance by integrated its economy and expanding international trade both bilateral and multilateral through the increase market access and foster investment under the Most-Favored National (MFN) status to new member's export as well as the Generalized System Preference (GSP) from the EU and the US (Siphana, 2005). Recently the FTA between Cambodia and China has officially signed in October 2020. With an upcoming FTA, Cambodia's trade volume is expected to gradually expand through an expected increase in agricultural and agro-processing products.

Cambodia's trade volume has remarkably increased over almost 2 decades in line with consistent and impressive economic growth on average at a rate of 7.0%. Based on Figure 1, the total trade volume reached 35 billion USD in 2019 from 1.8 billion USD in 2000. Cambodia's exports have increased and diversified over the years in terms of both products and destinations. Meanwhile, the country's import is also seen as an increase in construction and garment material imports as well as consumer goods which is explained through a gradual increase in domestic demand. According to Figure 1, the country's export has gradually jumped to 14.5 billion USD in 2019 up from 1.1 billion USD in 2000 due to a gradual increase in export of garment products followed by traveling goods and electrical parts to the EU and the US. Meanwhile, the country's import has also exhibited a slight increase from 0.7 billion USD in 2000 to 20.6 billion USD in 2019, reflects an accelerated domestic consumption and production.

Figure 1: Cambodia's trade volume

(in million USD)

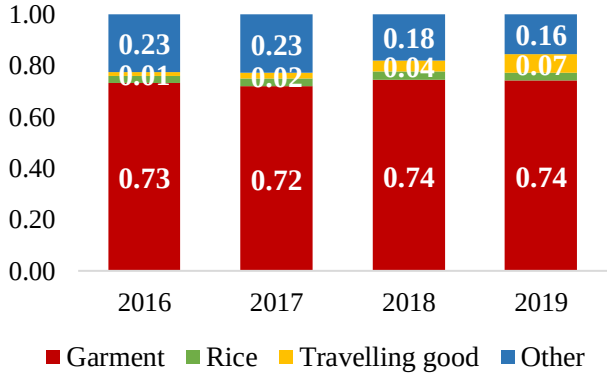


Source: Ministry of Economy and Finance (MEF)

The country's export depends mainly on textile products, namely, clothes, shoes and other garment products. As of 2019, garment export reached 10.8 billion USD, accounted for 74.3% of total export accompany by the export of traveling goods, almost 1.1 billion USD, accounted for 7.3% of total export. EU displays one of the largest markets for Cambodia's export follows by the U.S (Figure 2b).

Figure 2a: Share of export by product

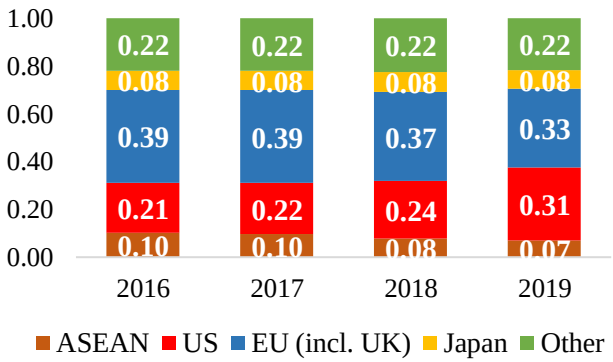
(in percent of total export)



Source: Ministry of Economy and Finance (MEF)

Figure 2b: Share of export by destination

(in percent of total export)

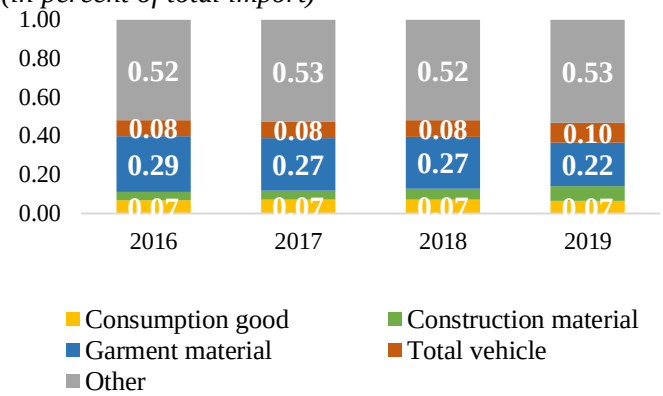


Source: Ministry of Economy and Finance (MEF)

Cambodia's import largely relies on garment material imports and vehicle imports accompany by construction material consumption goods. As of 2019, total garment material imports reached 4.6 billion USD, accounted for 22.4% of total imports while imports of the vehicle jumped up to 2.1 billion USD, equivalent to 10.3% of the country's imports. Construction material and consumption good imports increased by 1.5 billion USD and 1.4 billion USD, accounted for 7.5% and 6.6%, consecutively (Figure 3a).

Figure 3a: Share of import by product

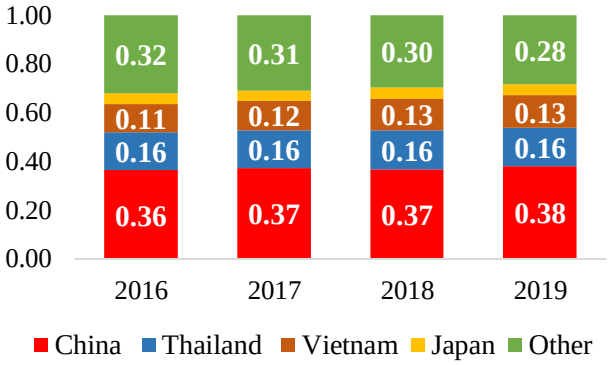
(in percent of total import)



Source: Ministry of Economy and Finance (MEF)

Figure 3b: Share of import by product

(in percent of total import)



Source: Ministry of Economy and Finance (MEF)

China displays one of the largest markets of Cambodia's import, accounted for 38% of the country's import, as of 2019, mainly on garment and construction material accompanied by Thailand, Vietnam, and Japan, equivalent to 15.6%, 13.4%, and 4.6%, consecutively (Figure 3b).

1.2 An Overview of Cambodia's ICT situation

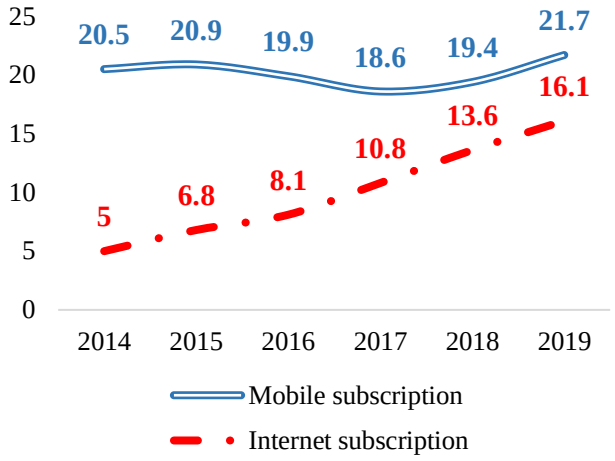
The ICT sector in Cambodia has gone through dramatic progress in tandem for the last two decades. Some institutions have been in charge of the ICT sector, the Ministry of Post and Telecommunications (MPTC), the Telecommunication Regulator of Cambodia (TRC), and the National ICT Development Agency (NIDA) has put under the MPTC for almost seven years. The MPTC charged with producing and executing the policies and strategies related to telecommunication. MPTC has a leading role in overseeing the ICT sector, formulating related policies, and forming guidance in developing the ICT sector in Cambodia. NIDA was established in 2000 to develop and promote ICT technology, is under the office of the Council of Ministers. Later in 2013, NIDA was integrated into MPTC to smooth its function aims to improve and promote public service delivery, efficiency, and effectiveness. TRC, moreover, officially established in 2012 to formulate telecommunication policies and regulations as well as monitor telecommunication services, ensure a standard for the use of telecommunication infrastructures and networks and acts as a regulator body and resolve a dispute relating to the ICT sector. In 2016, the Royal Government of Cambodia (RGC) implemented its Telecommunications and ICT Development Policy 2020 (RGC, 2016) to standout a roadmap, objectives, and mechanism for successful development and enhancement of the ICT sector in Cambodia.

Cambodia has potentially improved substantial progress on the basic digital infrastructure includes mobile telecommunication, internet backbone, fixed-broadband, network infrastructure, data center, platform, and user device are the foundation of connections and other digital activities. However, among those digital infrastructures, mobile technologies have been embraced with a dramatic increase in subscriptions over the past decade by jumpstarting its telecommunication infrastructures with mobile phones. As of 2019, the mobile subscriptions has reached 21.6 million subscribers while the internet subscriptions for both fixed and mobile subscriptions went to 16.1 million subscribers[1](Figure 4a).

[1] Telecommunication Regulator of Cambodia, (TRC, 2020). Accessed July 2020. https://www.trc.gov.kh/km/internet-subcribers/ and https://www.trc.gov.kh/km/mobile-phone-subcribers/

Figure 4a: Mobile and Internet Subscriptions

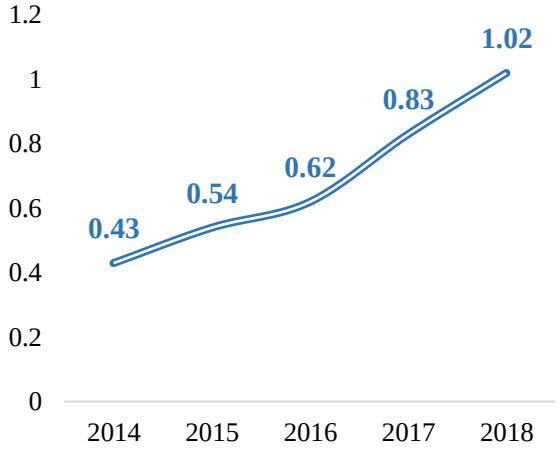
(in million subscriber)



Source: Telecommunication Regulator of Cambodia (TRC)

Figure 4b: Fixed broadband subscriptions

(per 100 people)



Source: World Bank

Although Cambodia has a large number of internet subscriptions, the service coverage and quality of data are still limited to only urban areas. Current internet infrastructures permit only basic 2G and 3G mobile cellular networks in rural areas while providing limited coverages for 4G network connection. While this 4G connection is essential for high-speed internet access that is critical underpin to digital economy development, Cambodia is still facing two major issues: building network capacity and expanding network. In this regard, in 2017, only around 660 thousand Cambodian people have the access to the 4G networks while the number of people who connected to the 3G network already reach up to 3.4 million. The 5G network is promising, but the investment cost is relatively high. This is a challenge for telecom companies since the mobile broadband price in Cambodia has dropped significantly in recent years as the result of competitions in the market. While overcoming this 5G infrastructure development is already a challenge, users must also have appropriate devices and applications to engage with this new technology, giving this 5G network a low possibility to reach many poor people. Thus, another problem remains on the affordability of Cambodian internet users in owning new high-tech devices ready for the introduction of the 5G.

Despite a dramatic increase in mobile and internet subscriptions, broadband subscriptions in Cambodia is still relatively low making users difficult to access to a high-speed internet connection (Figure 4b). In developing countries includes Cambodia, people tend to own smartphone rather than a laptop as their first computing device. That is why telecom companies invest more in mobile-broadband. Meanwhile, in 2017, Cambodia has only around 27,100 kilometers of optical fiber backbone provided by three telecom operators: Telecom Cambodia, Viettel (Cambodia) Pte Ltd, and Cambodia Fiber Optic Cable Network (CFOCN). Thus, limited availability of optical fiber in rural areas, the low number of households with a computer, and the relatively low price of mobile-broadband internet compared to fixed-broadband internet are still the issues in Cambodia.

1.3 Linkages between digital technology (ICT) and Trade

There are several possible channels through which ICT can influence international trade among countries (Nath, 2013). It helps reduce the cost of trade and increases trade flows between countries by eliminating unnecessary commercial transactions and addressing some uncertainties that possibly sluggish the transmission of relevant information.

In Cambodia, owing to the gradual development of the ICT sector, the Royal Government of Cambodia (RGC) has been taking advantage of technological advancement to serve the country's international trade. It composes of several aspects where digitization has been applying to several public services includes trade activities. However, two remarkable institutions have been leading the use of digital technologies (ICT) in promoting trade, namely the Ministry of Commerce (MoC) and Ministry of Economy and Finance (MEF) (Sovann, 2020). MoC has digitized

trade information and trade services. Besides that, MoC has also made necessary information available online, including but not limited to Trade Agreement, Commodity Price, Annual Report, Trade Information Books, Bulletins, Trade Statistics, Commercial Counselors and links to WTO, ASEAN, and Cambodia's Special Economic Zones[2]. Besides online trade information, MoC has transformed its three-core service into online procedures. Those are the Certificate of Origin (CO), Company Registration, and Trade Mark Registration, which has been encouraging trade through reducing trade cost and promoting time efficiency. MEF made another impressive initiative to improve the trade facilitation is Automatic System Custom Data (ASYCUDA), undertaken by the General Department of Custom and Excise (GDCE) of the MEF. ASYCUDA is known as an electronic system which could be able to replace manual custom processes with online procedures, aiming to reduce the logistic cost and time as well as promote transparency and trade[3]. In 2019, the MEF has launched the Cambodia National Single Window (CNSW). This system is designed to be an electronic, online service to facilitate faster and more transparent international trade procedures, reduce costs and provide consistency and certainty to the total process from the start of the regulatory requirements to the clearance of goods. More than that, in June 2020, the MEF has also officially launched Online Business Registration with a collaboration of many remarkable and relevant institutions such as the Ministry of Commerce (MoC), General Department of Taxation (DGT), Ministry of Labor and Vocational Training (MLVT), Ministry of Interior (MoI), Ministry of Economy and Finance (MEF) and Council Development of Cambodia (CDC). This system aims at facilitating business registration procedures to be more friendly through reducing the cost of doing business, bureaucratic issues, and promoting time efficiency. This online system also helps firms to reap multiple benefits that are provided by public institutions includes a chance to receive the QIP projects which are provided by the CDC. Theses online procedures help improve and promote significantly the productivity of both international and domestic firms that also influences international trade through reducing cost of trade and eliminating regulatory barriers.

II. Theory and Literature Reviews of ICT and International Trade

Getting to know the trade cost is a fundamental step to figuring out the effects of digital technology, ICT on trade. ICT contributes to the generation and diffusion of information flows across territories, regardless of territorial disaggregation. Higher ICT use and a greater amount of ICT infrastructures could potentially bring down fixed transaction costs which include, among others, entry costs to a foreign market (Freund, 2004), coordination costs related to the production processes (Demirkan et al, 2009), interaction costs between the firms and the customers (Adjasi, 2009) and information costs, such as the customers being able to compare the prices set by different sellers (Welfens, 2009). An increase in using ICT also encourage time efficiency (improve the handling of the customs procedure and promote the logistic efficiency) and the reduction of leakages at cross-border.

Beyond trade costs, various channels that ICT causes the disruption of international trade. Complementary between ICT and innovation can be denied, given that technological progress is related not only exogenous but also to investments in research and development. Innovation also influences trade through many factors: (i) innovation increases product differentiation, (ii) innovation reduces the cost of production, and (iii) innovation lowers transaction costs. A large degree of innovation is thus related to the existence of comparative advantage.

Numerous papers and studies such as (Vu, 2016) have observed the effects of digital technology on economic growth and confirmed that technologies have a positive impact on growth through increasing domestic production. However, (Weinhold, 2002) became an initial paper that studied the relationship between ICTs and international trade using internet penetration as one of the explanatory variables. He confirmed the relationship between ICTs and international trade by enhancing export performance. Later, (Wallsten, 2007) found that in the transition economies of Eastern Europe and Central Asia, enterprises with internet access tended to influence exports more than enterprise without it. This result aligns with the assertion that the internet has increased globalization through

[2] Ministry of Commerce, Trade Information, (MoC, 2020). Accessed July 2020. http://www.moc.gov.kh/en-us/trade- information

[3] Ministry of Economy and Finance, Public Financial Management Reform Program, (MEF, 2020) Accessed July 2020. http://www.pfm.gov.kh/index.php/en/about-pfm/pfmbackground

its use, it might facilitate trade for companies to communicate with foreign buyers and improve information accessibility for markets and consumers, among other things. (Freund, 2004) use a gravity model with data from 56 countries from the 1995-1999 period. They found that a 10 percentage-point increase in the relative number of web hosts in any given country caused an approximately one-percentage-point rise in trade. They also found that the effect of internet usage on trade has been more significant for poor countries than for rich countries and the impact of the internet application has been the strongest correlation on trade flows among developing countries. (Carsten Fink et al, 2005) developed a simple multi-sector model of impeded trade that generates testable hypothesis in a gravity-type estimation framework, to analyze the effects of communication cost on international trade. They found that international variation in communication cost has had a significant effect on bilateral trade patterns. Importantly they suggested that the impact of communication costs on trade has been as much as one-third larger than that on trade-in homogenous products. (F. Thiemann, 2012) observed the impact of ICT on international trade of major importing and exporting countries for the period 1995 to 2009 using gravity model. The empirical result revealed that mobile phone penetration significantly stimulates trade in vegetables and fruit and oranges by exporting countries. Moreover, internet usage has a positive effect on trade in imports of tomatoes. (Demirkan et al, 2009) who studied the impact of technology on international trade; estimated a 2005 cross-section for 175 countries. The empirical results indicate that internet user has a potential impact on international trade in a whole sample and the effects would be strongly in a small economy. (Siddiqi, 2009) analyzed the effects of ICT infrastructures and internet penetration on international trade for a panel of 64 countries between 1985 and 2005. They found that a 10 percent increase in internet usage could lead to a 2 percent growth in bilateral trade. While (Choi, 2010) revealed that a doubling of internet usage would augment a country's export of services by 2 to 4 percent among 151 countries from 1990 to 2006. Employing time series data, (Ahmad et al, 2011) estimated the effects of Malaysian internet and mobile phone subscriptions, personal computers, and internet users on Malaysian trade. The empirical result shows that there all variables have a positive significance on Malaysian international trade. (Wilson, 2012) studied the effects of hard (physical and infrastructure and ICT) and soft infrastructure which is border and transport efficiency and the business regulatory environment) on international trade. The study found that both hard and soft infrastructure statistically influence international trade. (Nath, 2013) found that internet subscriptions and internet hosts were positively and significantly related to trade performance in 40 emerging market economies from 1995–2010. (Yushkova, 2014) used the business internet usage index to estimate the effect of the internet on total exports of goods in 2011 for 40 countries (OECD countries plus Brazil, China, India, Indonesia, Russia, and South Africa). She finds that internet usage by business communities in both exporting and importing countries had a positive link with the export flows between these countries. (Xing, 2018) studied the impact of ICT and e-commerce on international trade. The study revealed a positive relationship of broadband subscriptions, internet users, and mobile subscriptions with trade flow between country *i* and country *j* in 21 developing and least developing countries with 30 OECD countries. The research concluded the positive relationship between ICT variables and export. It implies that being connected to the internet, the use of high-speed broadband and secured servers are essential ingredients for exporters/producers and enterprises to overcome traditional limitations associated with restricted access to information on potential markets for their products. Recently, (Soeng, 2020) studied the impact of ICT on goods export performance of Cambodia and confirmed that broadband subscriptions, internet penetration, and mobile phone subscriptions display positive sign with Cambodia's export performance.

To sum up, digital technologies, ICT, allows for reduction in trade cost by alleviating issues around (i) ***transport costs*** (lowering the shipping costs) ***(ii) time cost of transport*** (improve the handling of the customs procedure and other administrative procedures and speed up the time for shipping) ***(iii) information asymmetry*** (mapping between producers and consumers, including marketing, advertising and searching cost) and ***(iv) cost of production*** (coordination associated with the cost of producing goods as well as an innovation which helps reduce the cost of production).

III. Research Problems and Objectives

Cambodia has enjoyed favorable economic growth over the past decades with an annual growth rate of 7.0% and diversified its economy and export both in terms of markets and products where trade volume has significantly increased and positively contributed to growth. However, Cambodia is still one of the least competitive countries among regions especially in ASEAN (Schwab, 2019). Digital technology and also ICT usage is still in the infancy stage that would be able to impose a tremendous challenge for the country's international trade onward especially post-COVID-19 where the world is expected to move to the new normal. Having experienced several years of consistent and impressive economic growth, Cambodia must be looking towards the economic potential under digital transformation in international trade. Hence, this research paper aims at exploring the relationship between digital technologies, ICT, and Cambodia's international trade. This paper also proposes policy suggestions, especially for the RGC, in embracing and improving ICT to promote trade activities as well as to cope with any challenges toward the new normal.

IV. Research Methodology

Analyzing the relationship between digital technologies on Cambodia's international trade, this study proposes Cambodia's specific gravity model. The gravity model is known as the trade model that is increasingly employed in both academics and some studies. In this study, Bayesian with Markov chain Monte Carlo (MCMC) inference is used to estimate Cambodia's gravity model.

4.1 Gravity Model, Theory and Application

The gravity model is begun by looking at Newton's Law of Universal Gravitation. The law states that particle in the universe would be able to attract any other objects, thanks to a force that is proportional to the product of their masses and inversely proportional to the square of their distance. The same rule applies to the international trade point of view, states that just as particles are mutually attracted in proportion to their sizes and proximity, countries trade in proportion to their respective market size (e.g. GDP refers to market demand). To apply the initial application of Newton's Law, (Ravenstein, 1885) and (Tinbergen, 1962) used the gravity model to capture the immigration and trade flows, consecutively. Same with the law of granitization, the intuitive gravity model for trade could be written as below:

$$X_{ij} = C.\frac{Y_i Y_j}{t_{ij}} \tag{1}$$

Where

X_{ij} is export or trade volume from country i to country j,
C is gravitational constant
$Y_i and\ Y_j$ is economic masses which is generally represented Gross Domestic Product (GDP) of country i and country j, respectively
t_{ij} is trade cost between country i and country j which is generally represented by distances between exported and imported countries,

Based on (1), export (or trade) between the two countries depends on their economic masses and negatively related to trade costs between them. Estimating the gravity model, the logarithm form is applied to the gravity model. Hence (1) could be written as:

$$ln(X_{ij}) = \delta 0 + \delta 1\ ln(Y_i) + \delta 2\ ln(Y_j) + \delta 3\ ln(t_{ij}) + \varepsilon i \tag{2}$$

Where $\delta_1\ and\ \delta_2 > 0$ and $\delta_3 < 0$

Later, (Wincoop, 2003) added multilateral resistance terms to the simple gravity model under their *"Structural Gravity Model"* making the model more structural and dynamic. Numerous empirical studies have incorporated the

gravity model with specific purposes together with multilateral resistance effects to make the model more dynamic. (Chan-Hyun, 2001) analyzed Korea's trade patterns based on the gravity model by incorporating the dummy variable to capture the effects of a regional trading arrangement (RTA) which represents multilateral resistance. Meanwhile, (Xing, 2018) employed the gravity model to study the impacts of information and communication technology (ICT) and E-commerce on bilateral trade flows using panel data of 21 developing countries and least-developed countries and 30 OECD countries. The study takes into account ICT variables and some dummy variables of e-commerce, together with the applied gravity model to capture its effect on trade flow.

4.2 Cambodia's Gravity Model for Digital Technology and International Trade

4.2.1 Model Specification

In this study, based on the basic gravity model, we apply the effects of digital technologies on Cambodia's international trade. First, this study uses some variables for the gravity model, namely, economic size and market that represent GDP and population, respectively (e.g. Lee, 2006 and Fidrmuc, 2008). Then, this study applies ICT infrastructure that represents digital technologies such as *fixed broadband subscriptions* and *mobile cellular subscriptions* (e.g. Xing, 2018) and *internet users* measured by the percentage of individuals using the internet (e.g. Nath, 2013). In the case of Cambodia, the research includes multilateral resistance that is free trade agreement (FTA) is one of the significant factors (trade cost) to increase trade flow that is confirmed by (Wincoop, 2003).

Hence, Cambodia's international trade based on the gravity model could be written as follow:

$$\ln X_{ij} = \delta_0 + \delta_1 \, lnGDPPC_i + \delta_2 \, lnGDPPC_i + \delta_3 \, lnPOP_i + \delta_4 \, lnPOP_j + \delta_5 \, lnDis + \delta_6 \, Internet\ User_i + \delta_7 \, Internet\ User_j + \delta_8 \, Broadband_i + \delta_9 \, Broadband_j + \delta_{10} \, Mobile_i + \delta_{11} \, Mobile_j + \delta_{12} \, FTA_{ij} + \sigma_{ij} \quad (3)$$

Where

- lnX_{ij} is the natural log of Cambodia's trade volume (export and Import) to country *j*;
- $lnGDPPC_i$ is the natural log of Cambodia's GDP per capita in USD;
- $lnGDPPC_j$ is the natural log of trade partner's GDP per capita in USD;
- $lnPOP_i$ is Cambodia's population represents Cambodia's market size
- $lnPOP_j$ is Trading partner's population represents trading partner's market size
- $lnDistance_{ij}$ is the log of physical distance between the capital cities of Cambodia to each capital cities of trade's partner which represents trade cost;
- $Internet\ User_i$ refers to individual accessing the internet (% of the population) of Cambodia;
- $Internet\ User_j$ refers to individual accessing the internet (% of the population) of trade's partner;
- $Broadband_i$ refers to the fixed broadband subscription (per 100 people) of Cambodia;
- $Broadband_j$ refers to the fixed broadband subscription (per 100 people) of trade's partner;
- $Mobile_i$ refers to the mobile cellular subscription (per 100 people) of Cambodia;
- $Mobile_j$ refers to the mobile cellular subscription (per 100 people) of trade's partner;
- FTA_{ij} is dummy variable which takes 1 if Cambodia has a free trade agreement (FTA) with its partner's country and 0 otherwise;
- ε_{ij} is the disturbance term

4.2.2 Variable Selection and Data Collection

All variables are categorized into three main categories. Firstly, the economic variable which consists of the GDP of both Cambodia and its trading partners represent economic size, the population of both Cambodia and its trading partners represents the market size, and the distance between the capital city of Cambodia to each respective trade's partners represents trade cost. Secondly, the ICT variable which represents the digital technologies that this study

aims to observe its effects on international trade. The digital technology variables consist of fixed-broadband subscriptions, internet users, and mobile cellular subscriptions. Ideally, to measure a country's access the digital technologies, many indicators should be considered such as cloud computing, IoT, AI, etc. However, Cambodia is characterized as low digital readiness, data on internet penetration, and related indicators could be used to capture digital technologies (Velde, 2018). Last but not least, the dummy variable. In this study, we propose a single dummy variable that is a free trade agreement (FTA) between Cambodia and its trading partners. Free Trade Agreement (FTA) refers to the bilateral or multilateral agreement between Cambodia and its trading partners (Appendix 2). All dataset extracted from many official sources, namely, Ministry of Economy and Finance (MEF), Cambodia, The World Bank, International of Technology Union (ITU), and World Integrated Trade Solution (WITS). This research paper employs panel data spanning from 2002 to 2018 with 14 Cambodia's export partners consist of 238 observations (Appendix 1) meanwhile (Appendix 4) displays a summary of all statistical variables

4.3 Estimating Cambodia's Gravity Model

In this research study, we propose Bayesian panel data estimation with Markov chain Monte Carlo (MCMC) inference to estimate Cambodia's gravity model. The Bayesian approach is one of the advanced econometric models that is used in almost every literature and analysis. Unlike the conventional approach, Bayesian concerns how to update belief, namely, before being the posterior by knowing the likelihood or dataset. In Bayesian, θ assumes to be a random and unknown variable. It can describe by a probability distribution that is called *prior distribution*. By accessing the likelihood, the prior will be transformed into a clear picture and known as *posterior*. The posterior can be computed by the below notation:

$$Posterior = Prior \times Likelihood \tag{4}$$

Let assume that x observes from the distribution with a parameter of θ. We want to make an inference about another random variable θ, where θ is drawn from some distribution π(θ). Hence, it can be written:

$$(\theta|x) = \frac{\pi(\theta)p(x|\theta)}{p(x)} = \frac{\pi(\theta)p(x|\theta)}{\int p(x)p(x|\theta)d\theta} \tag{5}$$

With the Bayesian approach, we could be able to estimate the posterior distribution $p(\theta|x)$ by integrating the full Bayes equation that consists of likelihood and prior. The integrating could not be perfectly done when there is not a high dimension and univariate. However, when there are so many parameters as in high dimension (there are 12 parameters in this research study), there is sophisticated computation in integrating the likelihood function. Markov chain Monte Carlo (MCMC) plays an essential tool in approximating the accurate and desired posterior distribution rather than computing complex integration. MCMC methods are significant practical that is determined by the convergence rate of the chain. Unlike maximum likelihood, the MCMC Bayesian method is useful and reliable even a small sample size. We implement MCMC methods and Gibbs Sampling to facilitate the calculating for the posterior estimates.

To be able to employ Bayesian inference with MCMC simulation, we transform Cambodia's gravity model (3) into a basic econometric equation as follow:

$$y_t = \beta_0 + X_i\beta_i + \varepsilon_t \tag{6}$$

The Bayesian model uses the MCMC method based on the Gibbs Sampling procedure (Chib, 1995). Gibbs sampling is computed by sampling all conditional posterior distributions from (6). The prior distribution of (β, σ^2) is assumed to be conditionally multivariate normal distribution and inverse gamma distribution, respectively.

$$\beta|\sigma^2 \sim N(\beta_0, \sigma^2 B_0)\ ,\ \sigma^2 \sim IG(\frac{n_0}{2}, \frac{S_0}{2}) \tag{7}$$

where β_0 is $K \times 1$ known constant vector, B_0 is a $K \times K$ known constant matrix, and n_0 and S_0 are shape and

i

scale of parameters respectively. If $x' = (x_1, x_2, ... x_n)$ *and* $\varepsilon_i = (\varepsilon_1, \varepsilon_2, ... \varepsilon_n)' \sim N\ (0, \sigma^2)$, $n_1 = n_0 + n$. Given y, we obtain the joint posterior distribution:

$$\pi\ (\beta, \sigma^2|y)\ \propto\ \ \pi\ (y|\ \beta, \sigma^2\ )\ \pi(\sigma^2)\ (\pi(\beta) \tag{8}$$

Then we obtain joint posterior distribution of $\pi(\beta, \sigma^2|y)$ given by:

$$\pi(\beta, \sigma^2|y) \propto (\sigma^2)^{-\left(\frac{n_1}{2}+1\right)} \times exp\left\{-\frac{1}{2}\sum_{i=1}^{n}\frac{1}{\sigma^2}(y_i - x_i'\beta)^2\right\}$$

$$\times\ exp\left\{-\frac{1}{2}(\beta - \beta_0)'\frac{1}{\sigma^2 B_0}(\beta - \beta_0) - \frac{S_0}{2\sigma^2}\right\} \tag{9}$$

The conditional Posterior distribution of β is:

$$\pi(\beta|\ \sigma^2, y)\ \propto exp\left\{-\frac{1}{2}\sum_{i=1}^{n}\frac{1}{\sigma^2}(y_i - x_i'\beta)^2 - \frac{1}{2}(\beta - \beta_0)'\frac{1}{\sigma^2 B_0}(\beta - \beta_0)\right\}$$

$$\times\ exp\{-\frac{1}{2}(\beta - \beta_1)'\frac{1}{\sigma^2 B_1}(\beta - \beta_1)\} \tag{10}$$

where $B_1^{-1} = B_0^{-1} + \sum_{i=1}^{n}\tilde{x}_i'\,\tilde{x}_i\,, \beta_1 = B_1(B_0^{-1}\beta_0, + \sum_{i=1}^{n}\tilde{x}_i'\,\tilde{y}_i)$

The conditional Posterior distribution of σ^2 is:

$$\pi(\sigma^2|\ \beta, y) \propto\ (\sigma^2)^{-\left(\frac{n_1}{2}+1\right)}\ exp\left\{-\frac{1}{2\sigma^2}\left[\sum_{i=1}^{n}(y_i - x_i'\beta)^2 + S_0\right]\right\}$$

$$\times\ exp\left\{-\frac{S_1}{2\sigma^2}\right\} \tag{11}$$

Where $S_1 = y'y + \beta_o' B_0^{-1}\beta_0 + S_0 - \beta_1' B_1^{-1}\beta_1$

The conditional posterior distributions (10) and (11) could be written as:

$$\beta|\sigma^2, y \sim N\ (\beta_1, \sigma^2 B_1) \tag{12}$$

$$\sigma^2|y \sim IG\left(\frac{n_1}{2}, \frac{S_1}{2}\right) \tag{13}$$

Then, we sample from the conditional posterior distributions using Gibbs Sampling:

Algorithm Gibbs Sampling

1) Initialize β *and* σ^2
2) Sample $y|\beta, \sigma^2$

   Generate $y_i|\ \beta, \sigma^2 \sim N_{(-\infty,+\infty)}(x'\beta, \sigma^2)_i$, $i = 1,2\ , \ldots\ldots, n - k$,
3) Sample $(\beta, \sigma^2)|\ y$

   3.1) Sample $\sigma^2|y \sim IG\left(\frac{n_1}{2}, \frac{S_1}{2}\right)$

   3.2) Sample $\beta|\sigma^2, y \sim N\ (\beta_1, \sigma^2 B_1)$
4) Go to step 2 and Repeat

V. Empirical Result and Analysis

The empirical result is divided into two main parts, the estimated coefficients of Cambodia's gravity model and the diagnostic test to confirm the coefficients are unbiased based on the convergence and stability in each chain of the process of MCMC simulation. Furthermore, part one consists of two significant tables, namely Table 1 and Table 2. Table 1 is the output of the MCMC simulation that resulted from running the MCMC simulation with 500,000

sample draws with 5,000 as a burn-in period[4]. Table 1 contains "Mean" which represents the estimated coefficient of Cambodia's gravity model, "SD" stands for standard deviation of the estimated mean, "Naïve SE" represents the standard error which is the ratio of the standard deviation to the number of observations.

Table 1: MCMC Output of Cambodia's gravity model

Description	Mean	SD	Naïve SE
$lnGDPC_i$	-5.817	2.622	0.370
$lnGDPC_j$	1.254	1.779	0.002
$lnPOP_i$	21.290	1.662	0.023
$lnPOP_j$	1.191	0.103	0.000
lnDis	-1.223	0.143	0.000
$Broadband_i$	0.366	1.209	0.001
$Broadband_j$	0.050	0.011	0.000
$Internet\ User_i$	0.007	0.016	0.000
$Internet\ User_j$	0.013	0.007	0.000
$Mobile_i$	0.001	0.005	0.000
$Mobile_j$	0.014	0.003	0.000
FTA	3.119	0.344	0.000
Sigma2	1.182	0.112	0.000

Source: Author's calculation

Table 2: Quantile of each variable

Description	2.5%	25%	50%	75%	97.5%
$lnGDPC_i$	-9.315	-7.011	-5.820	-4.678	-2.355
$lnGDPC_j$	0.912	1.136	1.254	1.379	1.606
$lnPOP_i$	-11.340	10.120	21.290	33.471	55.041
$lnPOP_j$	0.986	1.121	1.190	1.261	1.395
lnDis	-1.504	1.319	-1.223	-1.129	-0.943
$Broadband_i$	-2.005	-0.447	0.366	1.123	2.689
$Broadband_j$	0.026	0.042	0.050	0.057	0.072
$Internet\ User_i$	-0.024	-0.003	0.007	0.018	0.039
$Internet\ User_j$	-0.001	0.008	0.013	0.018	0.028
$Mobile_i$	-0.010	-0.002	0.001	0.004	0.012
$Mobile_j$	0.008	0.012	0.014	0.016	0.021
FTA	2.442	2.888	3.119	3.344	3.789
Sigma2	0.981	1.104	1.175	1.262	1.433

Source: Author's calculation

Table 2 displays the quantile of interest of the estimated mean taking value in five certain quantiles, 2.5%, 25%, 50%,75%, and 97.5% in 95% as the confidence interval. Table 2 expresses the normality of each explanatory variable based on the prior assumption that each explanatory variable has a normal distribution while variance displays as an inverse gamma distribution.

Raftery-Lewis diagnostic test, Table 3, reports the convergence of the chain of the MCMC simulation process with

[4] Once very long chain will ensure the stability and convergence in the chain which is suggested by (Geyer, 1992)

500,000 sample draws and 5,000 as burn-in. Rafter test reports how big to make *N* based on our needs, and how much burn-in to throw away. *Nmin* refers to the minimum total number of iterations that should be running assumes independent samples. *I* refers to the dependence factor interpreted as the proportional increase in the number of iterations irrefutable to serial dependence. High dependence factors (>5) are worrisome and may be due to influential starting values, high correlation, and in-convergence in the chain (Lam, 2020). The test plays an essential tool to access the stability and convergence in each chain. Stability and convergence imply an unbiased estimated mean. Based on Table 3, all dependence factors take values of approximately 1 (< 5). Hence, it indicates that all chains are converged and concludes that the estimated means of Cambodia's gravity model are unbiased.

Table 3: Raftery-Lewis Diagnostic Test

Description	Burn-in (M)	Total (N)	Lower bound (Nmin)	Dependence Factor (I)
$lnGDPC_i$	2	3760	3746	1.00
$lnGDPC_j$	1	3755	3746	1.00
$lnPOP_i$	2	3735	3746	0.99
$lnPOP_j$	1	3754	3746	1.00
lnDis	2	3760	3746	1.00
$Broadband_i$	1	3749	3746	1.00
$Broadband_j$	1	3755	3746	1.00
$Internet\ User_i$	2	3739	3746	0.99
$Internet\ User_j$	2	3758	3746	1.00
$Mobile_i$	2	3764	3746	1.00
$Mobile_j$	2	3778	3746	1.01
FTA	2	3765	3746	1.01
Sigma2	2	3801	3746	1.01

Source: Author's calculation

MCMC output also produces some visual plots, namely, kernel density plot, running mean plot, and trace plot. Kernel density plot reports the normality (to emphasize Table 2) of each variable. Explanatory variable distributes as a normal distribution while variance *(Sigma2)* distributes as an inverse gamma distribution. The running plot, furthermore, displays the convergence and stability of each variable; to visually ensure the chain of each variable is converged. Last but not least, the trace plot tells the mixing of each chain where a well-mixed chain indicates convergence and stability. Based on (Appendix 5a), the kernel density plot of each variable and variance display normal distribution and inverse gamma distribution, respectively. The running plot and trace plot shows evidence of stability and good mixing that indicate convergence (Appendix 5b) and (Appendix 5c), respectively. Based on Raftery-Lewis diagnostic test and three necessary plots, estimated means of Cambodia's gravity model are applicable to be interpreted. Since this study focused on the effects of digital technology, namely the impact of ICT on Cambodia's international trade, this study deeply analyzes in more detail ICT infrastructure on the country's international trade.

5.1 The Empirical Result

Based on Table 1, digital technology proxies by ICT infrastructures, namely *fixed-broadband subscriptions, mobile cellular subscriptions, and internet users* reveal a positive relationship with Cambodia's international trade. The empirical result supports some theoretical frameworks mentioned in the previous section indicated that usage of ICT would encourage trade activities by bringing down the cost of a trade. The result, moreover, is in line with some empirical studies, namely (Xing, 2018). The study revealed a positive relationship of broadband subscriptions, internet users, and mobile subscriptions with trade flow between country *I* and country *j* in 21 developing and least

developing countries with 30 OECD countries where the study concluded the positive relationship between ICT variables and export implies that being connected to the internet, use of high-speed broadband and secured servers are essential ingredients for exporters/producers and enterprises to overcome traditional limitations associated with restricted access to information on potential markets for their products. (Soeng, 2020) studied the impact of ICT on goods export performance of Cambodia and confirmed that broadband subscriptions, internet penetration, and mobile phone subscriptions display positive signs with Cambodia's export performance.

According to Table 1, the ICT infrastructure of both Cambodia and its trading partners play an essential role in promoting Cambodia's international trade. In that, ($Broadband_i$) represents Cambodia's fixed broadband displays positive relationship with a large estimated coefficient, 0.366 accompanying by internet users ($Internet\ Users_i$), and mobile cellular subscriptions ($Mobile_i$) with an estimated coefficient, 0.007 and 0.001, respectively. The positive significant between ICT infrastructures and Cambodia's international trade implies that an increase in internet connection and access the high-speed internet could stimulate international trade. These can explain through alleviating the trade cost *(i)* ***transport costs*** (lowering the shipping costs), *(ii)* ***time cost of transport*** (improve the handling of the customs procedure and other administrative procedures and speed up the time for shipping), *(iii)* ***information asymmetry*** (mapping between producers and consumers, including marketing, advertising and searching cost) and *(iv)* ***production costs*** (coordination associated with the cost of producing goods as well as an innovation which helps reduce the cost of production).

Besides the ICT variable, trading partners' GDP per capita ($GDPC_j$), Cambodia, and its trading partner's population (POP_i *and* POP_j) and FTA also have a positive relationship with Cambodia's international trade. It implies that the increase in demand ($GDPC_j$) and market size (POP_j) of Cambodia's trading partners would enhance Cambodia's trade performance. The positive sign between FTA and Cambodia's international trade implies that once Cambodia signs more trade agreement with other countries both bilateral or multi-lateral, there is room for country to promote its international trade especially export under the trade agreement and special tariff scheme such as EBA which is offered by the EU in entering EU's market with tariff-free together with GSP which is provided by the U.S for Cambodia's traveling goods. Currently, FTA between Cambodia and China is seen as an opportunity for Cambodia to enjoy the tariff scheme that is worth more than 90% in agricultural and agri-business products with about 340 different items that could potentially robust Cambodia's international trade. On the other hand, Cambodia's GDP per capita displays a negative correlation with its international trade that is surprisingly different from numerous previous studies. The negative relationship, on the other hand, supports the study of (Dhakal et al, 2010). This empirical study revealed a negative relationship between domestic demand and export performance. This study concluded that domestic demand is a less significant factor in explaining comparative advantage. Supply-side, namely factor endowment, and factor intensities may play an essential role in promoting trade and export. Hence, the negative sign of Cambodia's GDP per capita (GDP_i) represents domestic demand with Cambodia's international trade seems to be explained that the gradual increase in domestic demand may not play an important factor in leading the trade volume to increase. However, factor endowment such as labor and capital display one of the sources in enhancing Cambodia's international trade since garment products accounted for more than 70% of total Cambodia export where this sector is labor-intensive.

5.2 Effect of ICT on Cambodia's International Trade Evidence

Again, the empirical result confirms the positive relationship between ICT infrastructure and international trade of Cambodia. As mentioned in previous section, the impact of ICT on trade activities can be seen and explained in many aspects. Higher ICT use and greater amount of ICT infrastructure could potentially bring down fixed transaction costs. Those include entry costs to foreign market (Freund, 2004) coordination costs related to the production processes (Haluk Demirkan, 2009), interaction costs between the firm and the customer (Adjasi, 2009) and information costs, such as the customer being able to compare the prices set by different sellers (Welfens, 2009). An increase in using ICT also encourages the time efficiency (improve handling of custom procedure and promote the logistic efficiency) and the reduction of leakages at cross-border which, refer to *transport cost, time*

cost of transport, information asymmetry and cost of production.

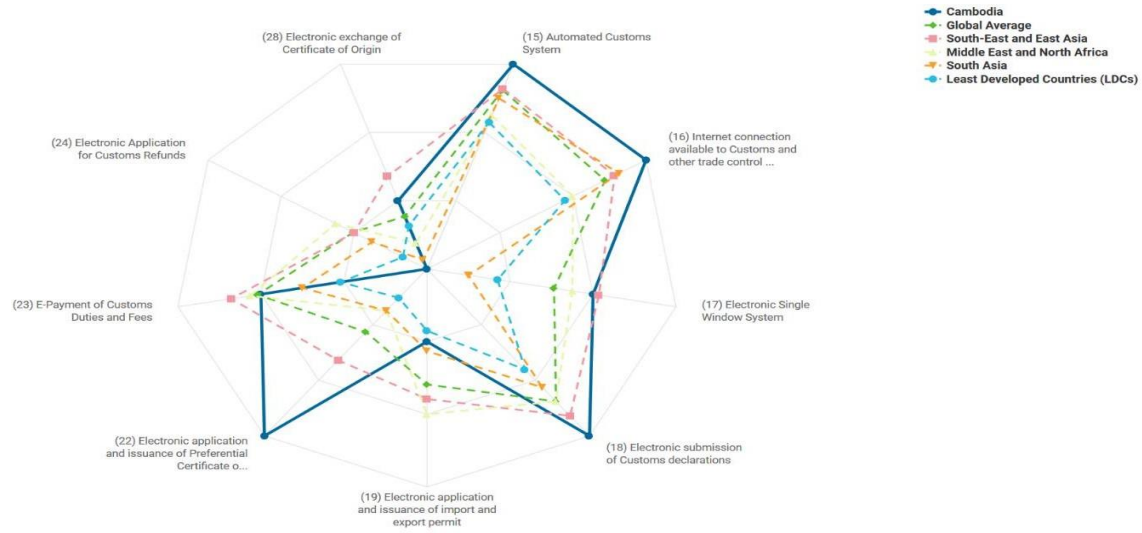
Given the leapfrogging of ICT, Cambodia launched the ASYCUDA system electronic based in 2008. The electronic Single Administrative Declarations (SAD) was introduced and integrated into a single system with an initial introduction of the system in five major customs inspections points covering nearly half of all inspections: Phnom Penh International Airport, three dry ports in Phnom Penh, and Sihanoukville Autonomous Port. By now, The ASYCUDA system is implemented at all ports and checkpoints, and it covers all SAD and trade volume data. At the same time, e-Customs has also been developed by in-house resources to complement the ASYCUDA on certain procedures. Those include:

- General Goods and Petroleum Product Transportation Permit Management Module
- Customs Summary Declaration and De-minimis Module, International and National Customs Transit Module
- Guarantee Deposit Management Module
- Container Scanning Result Module
- Petroleum Product Transport Document Management Module
- QIP Transport Document Management Module and
- e-Payment Module.

Cambodian Customs has also launched mobile apps such as the Customs Tariff and Customs Clearance Handbook to strengthen transparency in trade-related information. More than that, the ASYCUDA provides for Electronic Data Interchange (EDI) between traders and Customs using EDIFACT (Electronic Data Interchange for Administration, Commerce, and Transport) rules and also generates trade data that can be used for statistical economic analysis. With the ASYCUDA World, most paper-intensive Customs processes have been replaced with online procedures, and the reduction of documents to just a SAD (MoC, SWAp, 2015).

Resulting from the launch of the ASYCUDA, SAD, and e-Customs, customs clearance times were reduced from 6.5 days in 2004 to 1.4 days in 2014. As of 2017, the average time for clearing a shipment, i.e., the time between the lodgment of the SAD and cargo release, was less than 2 hours. The overall time to export was reduced from 43 days in 2006 to 22 days in 2015. Similarly, the overall time to import reduced from 54 days in 2006 to 24 days in 2015 (World Bank, 2018). In an enterprise survey, the proportion of firms for whom customs/trade was reported as a “severe” or “very severe” constraint dropped from 26 percent in 2004 to 4 percent in 2014. The proportion of exporters for whom customs/trade was a “severe” or “very severe” constraint declined from 34 percent in 2004 to 20 percent in 2014 (Bank, 2014).

Figure 5: Trade paperless implementation



Source: UN Global Survey on Digital and Sustainable Trade Facilitation, 2019

By that, Cambodia has scored relatively well in the UN Survey on Digital and Sustainable Trade Facilitation about the application of modern ICT to trade-related services (Figure 5). High scores include the internet connectivity at customs and other trade control agencies, electronic submission of the customs declaration, electronic application, and issuance of the preferential certificate of origin and Automatic Custom System. High scores of trade-related services resulted from a gradual improvement of broadband and the ICT sector as the whole.

Despite a remarkable increase in the trade volume of both products and destination, Cambodia's international trade is still encountering many challenges that need to be consecutively solved. Those significant challenges include high logistic cost compared to neighboring countries, complex regulation and informal fees, and weak supply chain links between foreign and domestic firms. These remaining challenges still have been protracting Cambodia's trade and also sluggish the improvement of the level of the country's competitiveness. Hence, to promote trade, Cambodia might need to provide an additional comprehensive integrity strategy that includes automation systems for border management and port operations by digitizing/automating processes entailing cross-border trade to the extent of technological feasibility. Yet, the automation system and other online trade services require high internet and broadband connections as well as other ICT infrastructures.

VI. Policy Suggestions

Again, to promote digital technology as well as encourage Cambodia's international trade, RGC should take into account improving ICT infrastructure. The improvement of ICT Infrastructure not only promotes the trade but also prepares and improves Cambodia's competitiveness caught up with the new normal for post-COVID-19 where the trade pattern is anticipated to shift. Based on the empirical study, improving broadband as well as related ICT infrastructure is one of the fundamental steps that RGC should take into account by ensuring the network coverages and access the high-speed internet.

National Strategic Development Plan-NSDP (2019-2023) listed down the policy on telecommunications, information, and communication technology. Improving ICT infrastructure is a fundamental step to enhance the ICT sector in Cambodia. With that, the RGC continues to *expand the telecommunications backbone infrastructure to remote rural areas and potential economic and tourism potentials. Through building fiber-optic networks to all the provinces and districts that fill the ICT and building a submarine fiber-optic network from Cambodia to China and developing the Greater Mekong Sub region-based telecommunications infrastructure* (MoP, 2019).

ICT Master Plan 2020 has laid out the policy in improving ICT infrastructure and pointed the role of RGC in inaugurating three objectives as following (KOICA, 2014):

1. *Improving service accessibility of telecom and broadcasting for all people*
2. *Expanding ICT infrastructure through government assistance and activating private investment*
3. *Setting the base environment for diverse ICT convergence such as voice & data, wire & wireless, and telecom & broadcasting*

A broad vision which has been illustrated in ICT master plan 2020 is to expand the broadband coverage of 100% in urban areas and 70% in rural areas, 80% of internet penetration rate and 10% Internet of Thing (IoT) or connected devices in the network and many others.

To robustly increase the country's competitiveness as well as to promote international trade, improving and speeding up ICT infrastructure development, broadband is one of the core duties to expand the digital technology in Cambodia. *So, this study suggests some several aspects in enhancing the ICT infrastructure where the RGC should gear with as follows:*

1. Making a competitive structure for the provision of broadband in Cambodia

- Eliminating any unnecessary regulatory barriers and constraints such as some burden administrative procedures and investment in the broadband service provider
- Leading in ICT investment especially ICT infrastructure to reduce initial investment as well as creating

financial support such as funded technical development projects

- Ensuring and adopting market competition simulation with price regulation
- Fostering the development and improvement of public internet more widely especially to potential areas such as businesses and trade
- Promoting and supporting the private sector in investing and connecting high-speed internet network especially sub-marine fiber optic network and satellite to mitigate the disruption within network operation

2. Accessibility and affordability of broadband in Cambodia

- Providing certainty about the definition and initial entry service characteristics as well as affordable price as a part of the Universal Service Scheme
- Establishing a Universal Service Scheme in Cambodia which includes the following aspects:
  - Individual and community broadband access objectives and targets
  - The development of broadband content in subject-areas
  - Capacity building (ICT skill) and service development
- Promoting investment environment as well as with designing an incentive for the private sector in engaging with broadband service providing investment
- Enabling tax incentive associated with broadband in Cambodia and determine a whole-of-government approach to promote private investment in broadband infrastructure and service development for extending services to even urban and rural area and potential direct subsidies to users

3. Leading Applications in Government Programmes

- Fostering the draft of the digital economy (digital government) with initial applications being determined based on their likelihood to enhance broadband service take-up
- Initiating and establishing government application for serving public services in key leading sectors such as tourism, health care, education, and trade by using broadband
- Developing comprehensive patient data and storage as well as the exchange data center which enable all Cambodian to be provided with the best possible care and attention (e.g. the establishment of Online Business Registration System which employs *CamDX* in transferring the data and information of all households and businesses that engage in the system
- Accelerating online payment system about the payment to be made (e.g. fostering and improving e-payment of custom and duties fee)
- Making e-custom and other applications in excise and custom to be friendly and cost reduction to promote trade facilitation by taking advantage of available technological advancement

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Appendix 1: Variable selection and source of the data

Type of Variable	Variable	Definition/Measure	Source of Data
Economic variable	Cambodia's export and import	In Million USD	MEF and WITS
	Cambodia's nominal GDP	In Million USD	MEF
	Cambodia trade's partner nominal GDP	In Million USD	The World Bank
	Cambodia's population and its trading partner's population	People	Calculation
	Distance from Cambodia to its trade's partner	Distance from Capital city of Cambodia to each capital city of Cambodia's trading partner (km)	website: www.happyzebra.com/distance-calculator
ICT variable	Individual using internet	Internet users are individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc. (% of total population)	ITU and The World Bank
	Fixed broadband subscription	Fixed broadband subscriptions refers to fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s. This includes cable modem, DSL, fiber-to-the- home/building, other fixed (wired)-broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband. (Measure as per 100 people)	
	Mobile cellular subscription	Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology. The indicator includes (and is split into) the number of postpaid subscriptions, and the number of active prepaid accounts (i.e. that have been used during the last three months). The indicator applies to all mobile cellular subscriptions that offer voice communications. (Measure as per 100 people)	
Dummy variable	Free Trade Agreement	Measure as 1: If Cambodia has bilateral or multilateral trade agreement with its trading partner and 0 otherwise.	Author

Appendix 2: Cambodia and Free Trade Agreement

Cambodia	ASEAN Free Trade Agreement (AFTA)	Singed and In Effect	1999
Cambodia	ASEAN-China Free Trade Agreement (ACFTA)	Singed and In Effect	2010
Cambodia	ASEAN-Japan Comprehensive Economic Partnership (AJCEP)	Singed and In Effect	2008
Cambodia	ASEAN-India Free Trade Agreement (AIFTA)	Singed and In Effect	2010
Cambodia	ASEAN-Korea Free Trade Agreement (AKFTA)	Singed and In Effect	2010
Cambodia	ASEAN-Australia-New Zealand Free Trade Agreement (AANZFTA)	Singed and In Effect	2010
Cambodia	ASEAN-Hong Kong Free Trade Agreement (AHKFTA)	Singed and In Effect	2019
Cambodia	Cambodia-China Free Trade Agreement (CCFTA)	Signed	2020
Cambodia	Regional Comprehensive Economic Partnership	Concluded	
Cambodia	Cambodia-Korea Free Trade Agreement (CKFTA)	Negotiating	

Appendix 3: List of Cambodia's trade volume with its trading partners **(**as Million USD)

Country	2002	2010	2018	2019
United States	964	2,027	3,335	4,844
Japan	83	246	1,792	1,996
Germany	127	129	1,196	1,158
China	206	1,251	6,827	8,455
United Kingdom	147	242	1,069	1,038
France	87	108	503	495
Vietnam	131	583	2,489	2,992
Thailand	246	841	2,934	3,417
Hong Kong	810	1,940	897	766
South Korea	96	273	757	870
Malaysia	81	185	478	648
Singapore	148	586	431	633
Philippines	6	10	65	74
Indonesia	79	179	537	667

Source: WITS (2000-2010) and MEF-ASYCUDA (2018 and 2019)

Appendix 4: Statistical summary of all variables

Description	*lnEX*	*lnM*	*lnGDPCi*	*lnGDPCj*	*lnPOPi*	*lnPOPj*	*Broadi*	*Broadj*	*Interi*	*Interj*	*Mobilei*	*Mobilej*	*lnDis*	*FTA*
Mean	4.39	4.95	6.64	9.46	16.48	18.10	0.28	17.61	8.50	55.86	69.05	103.89	7.85	1
Median	4.73	5.16	6.67	10.14	16.48	18.13	0.20	15.50	1.26	64.20	56.95	105.30	7.85	1
Maximum	8.02	8.70	7.32	11.10	16.60	21.05	1.02	44.78	40.00	96.02	134.86	269.98	9.58	1
Minimum	-0.05	1.48	5.83	6.06	16.35	15.23	0.00	0.00	0.23	1.85	3.01	2.33	5.40	0
Observations	238	238	238	238	238	238	238	238	238	238	238	238	238	238

Source: Author's calculation

Appendix 5: Figure of Diagnostic test

Figure 5a: Kernel density plot

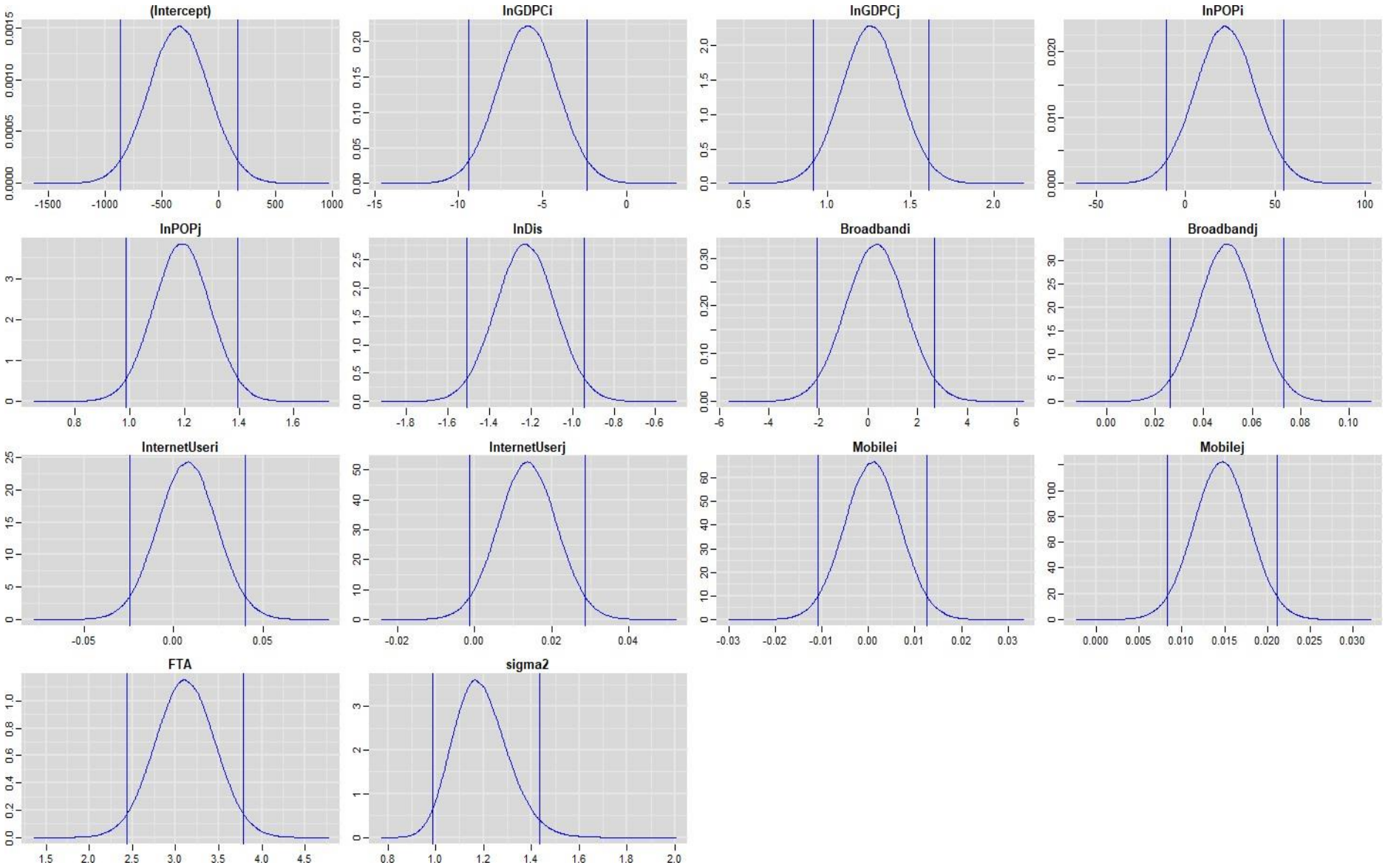

Figure 5b: Trace plot

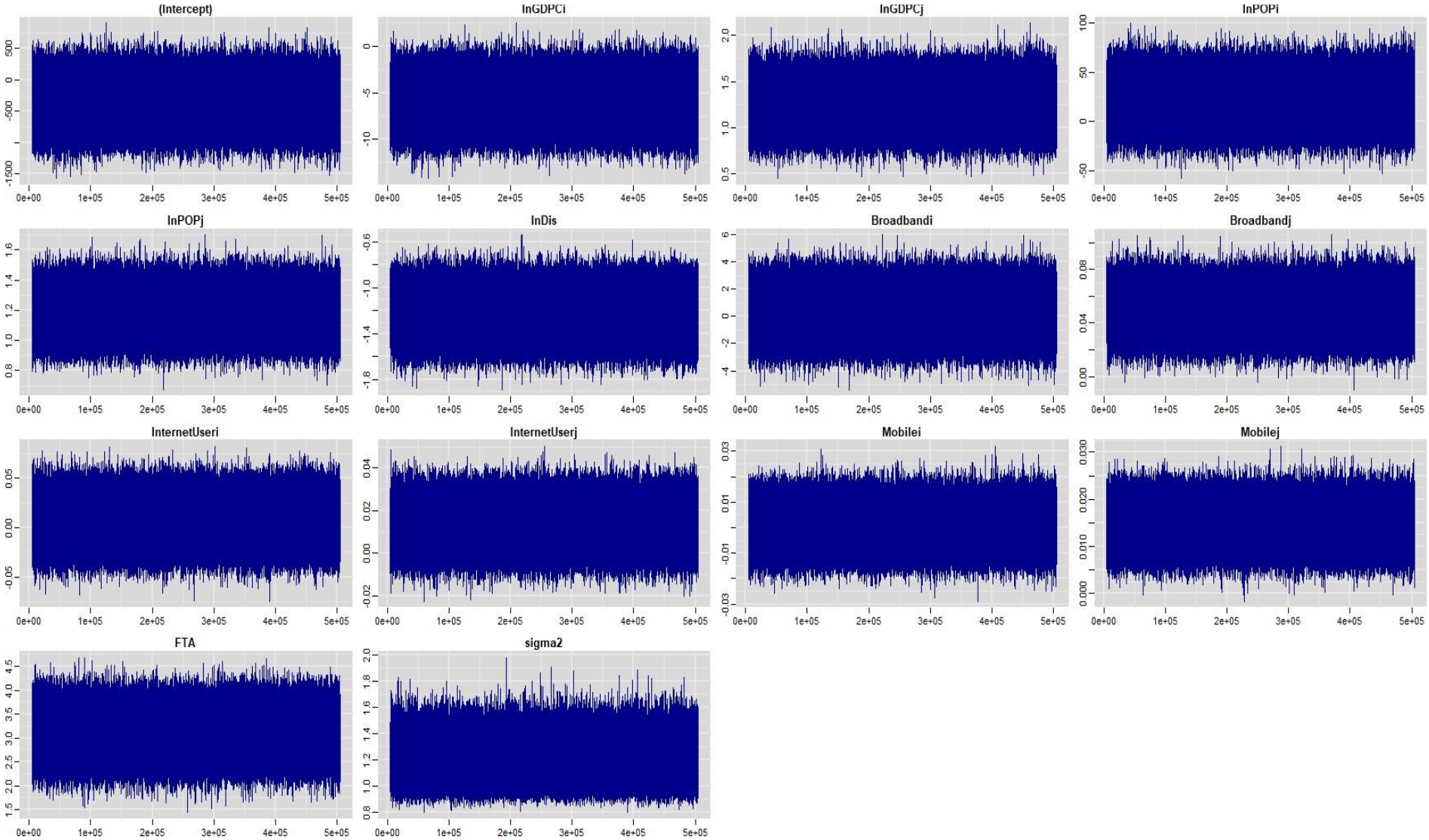

Figure 5c: Running mean plot