NBC's 7th Annual Macroeconomic Conference

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

By:

Monorith Sean and Somnang Lor

Young Economist

Ministry of Economy and Finance, MEF

December 28, 2020

Outlines

I Digital technology and international trade

II Digital technology and Cambodia's international trade

III Modelling digital technology and international trade

IV Empirical analysis

V Conclusion and Policy suggestion

Digital technology

- Digital technology has increasingly attracted public attention and becomes a popular field in the 21st century.
- It has a broad concept. Yet, it requires ICT infrastructure to enable its operation.
- Some indicators could be used as a proxy for digital technology (Banga & Velde, 2018):
  - Individual using internet
  - Mobile cellular subscriptions
  - Broadband subscriptions

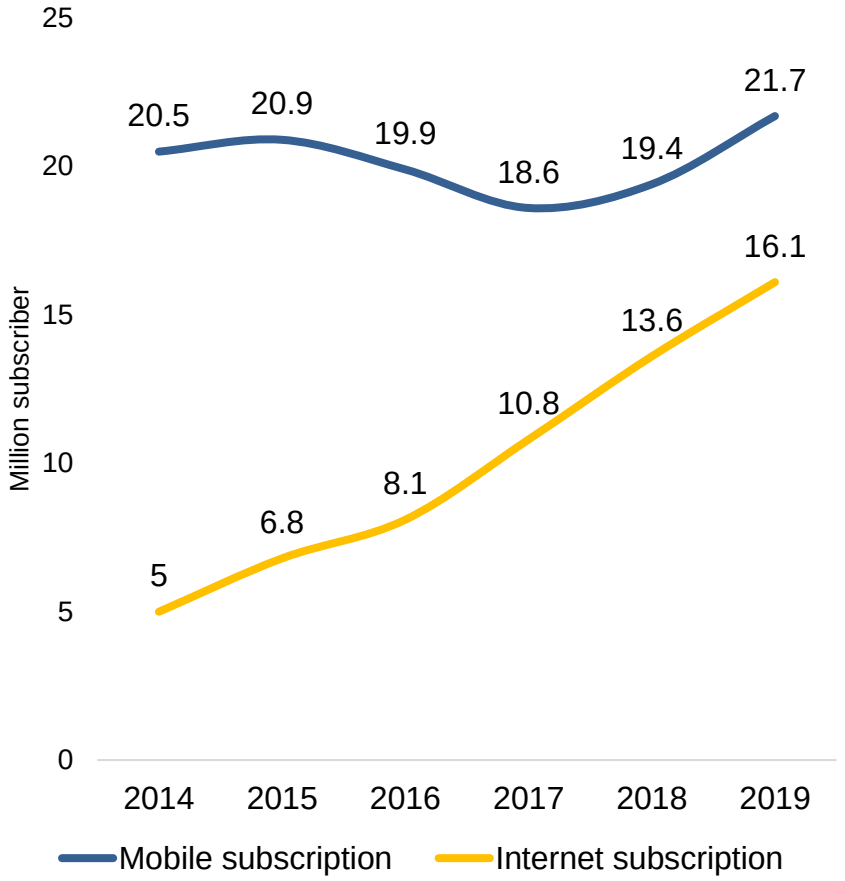
Impact on international trade

- Digital technology has been transforming businesses, communication, and work.
- It has been replacing analog signals for many digital forms dealing with the time constraint and enhancing productivity.
- Digital technology has shaped the global international trade by reducing the trade cost by alleviating:
  - ***Time cost of transport:*** improving the handling of customs as well as other administrative procedures and speeding up the time for shipping.
  - ***Information asymmetry:*** mapping between supplier and consumer including marketing, advertising, and searching cost.
  - ***Cost of production:*** enhancing productivity and reducing cost in the production process.

Cambodia's digital readiness

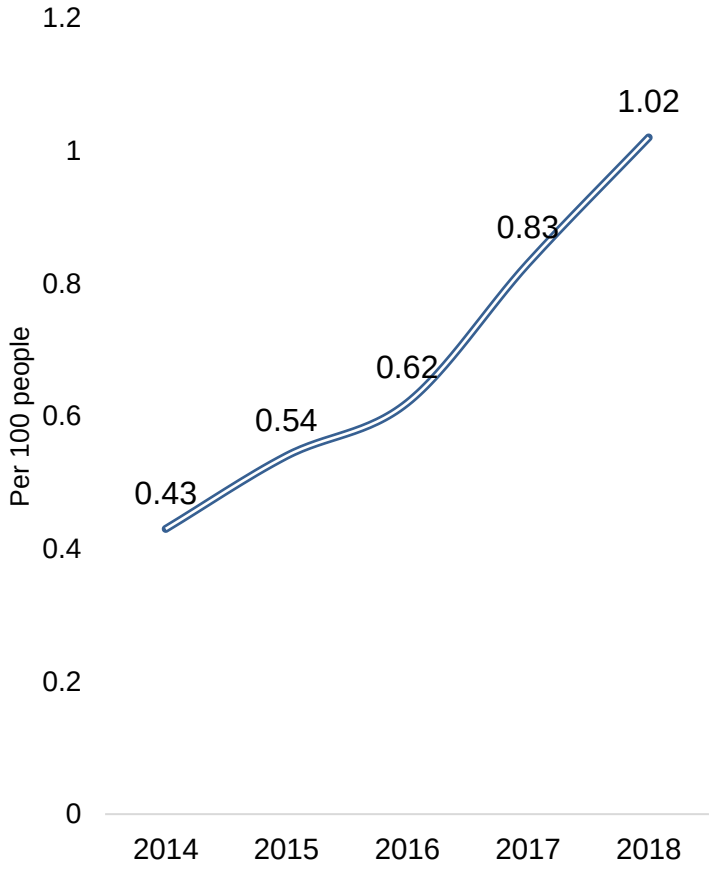
- Cambodia has significantly improved substantial progress on the basic digital infrastructure.
- Yet, service coverage and quality of data are still limited.
- Broadband is still relatively low and limited access to a high-speed internet connection.
- Digital readiness in Cambodia is still in the infancy stage (WEF, 2019) compared to other regional peers.

Mobile and internet subscription



Source: TRC

Fixed broadband subscription

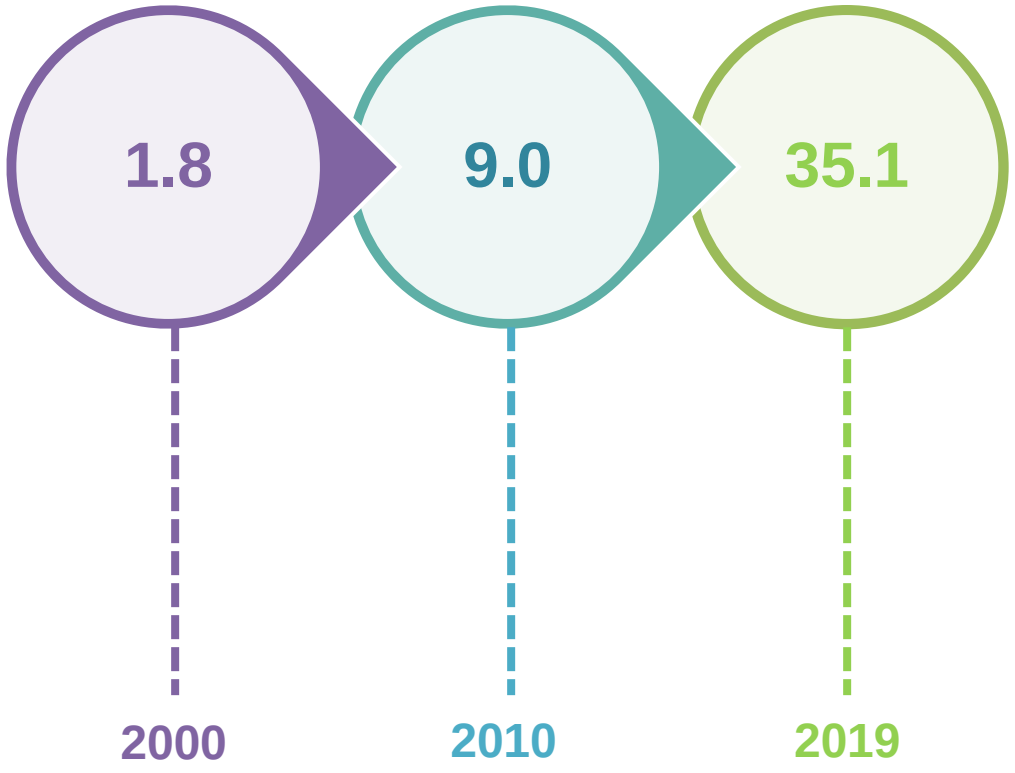


Source: World Bank

Linkages between digital technology and international trade

- Cambodia's international trade has remarkably increased over the last two decades.
- Given the leapfrogging of ICT, RGC has deployed ICT in international trade through MOC and MEF:
  - Initiating online information related to trading activities
  - Transforming analog procedures into the digital platform such as certificate of origin, company registration, and trade mark registration
  - Launching the ASYCUDA system, SAD and e-customs
  - Cambodia National Single Window (CNSW)
  - Online business registration
- ***Hence, the development of ICT would positively impact on Cambodia's international trade?***

Cambodia's trade volume (Billion USD)



Source: MEF

Modelling digital technology and international trade

- Modelling digital technology with Cambodia's international trade, Gravity model (Aderson & Wincoop, 2003) is applied.
- The model equation can be written as follow:

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

- Where:
  - $lnGDPPC_i$ and $lnGDPPC_j$ are the logarithm of GDP per capita of Cambodia and its trading partner, respectively
  - $lnPOP_i$ *and* $lnPOP_j$ are the logarithm of population of Cambodia and its trading partner
  - $lnDis$ is the logarithm of distance between Capital city of Cambodia to each trading partner capital city
  - *FTA* is the dummy variable of a free trade agreement between Cambodia and among other countries. 1 means Cambodia has a free trade agreement with its trading partners and 0 otherwise
  - ICT infrastructure:
    - *Internet User* is individual access to the internet (% of population)
    - *Broadband* is fixed broadband subscriptions (per 100 people)
    - *Mobile* is mobile cellular subscriptions (per 100 people)

Estimating Gravity model

- Bayesian Inference with Markov chain Monte Carlo (MCMC) is used to estimate the gravity model.
- Bayesian is one of the advanced econometric models, unlike classical econometric estimation since it is based on the update of prior (Belief) to posterior given likelihood (Information).
- MCMC allows the process of simulation with the selected iteration and burn-in period to reach the desired posterior distribution.
- With Bayesian MCMC, the posterior distribution is approximated. So, the estimated mean of each ICT variable represents the digital technology with Cambodia's international trade can be determined.
- Bayesian with MCMC also allows the diagnostic test (both numerical and visual test) to check whether the estimated coefficients are all stationary and no evidence of autocorrelation that can be statistically interpreted.

The empirical result

Table 1: MCMC output estimates 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

- *The empirical result points out ICT infrastructure has a positive relationship with Cambodia's international trade.*
- On top of that, broadband is estimated to be one of the essential factors in enhancing trade activities.
- This implies that an improvement in ICT infrastructure would essentially promote Cambodia's international trade.
  - Converting the analog procedure to an online platform (time-saving as well as cost reduction) e.g. the establishing of Cambodia National Single Window (CNSW), ICT based submission for importer/exporter
  - Generating idea and innovation which pushing up the productivity
  - Connecting Cambodia to the global value chain

Note: *We simulate the MCMC with 500,000 iterations and 50,000 as burn-in period that need to drop in the sample*

The empirical result (cont.)

Table 2: Raftery diagnostic test gravity model

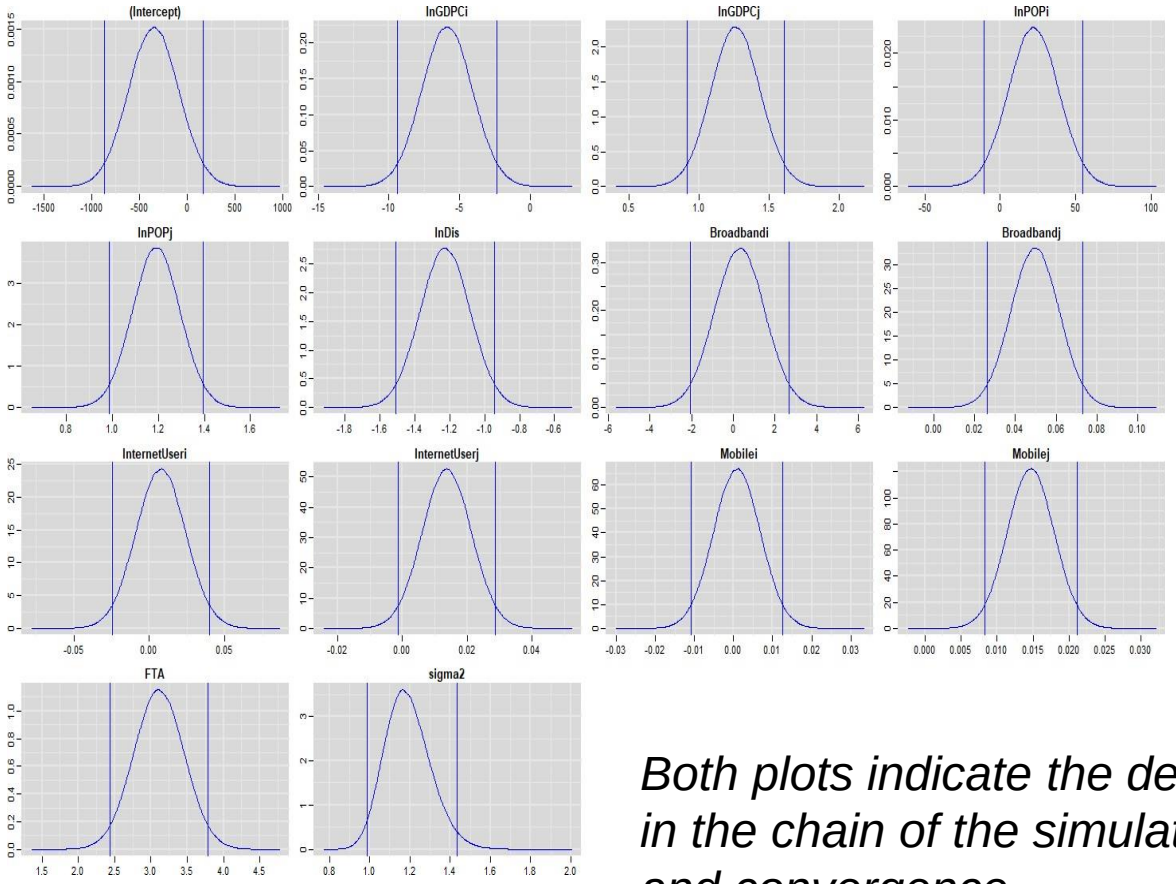
Description	Burn-in (M)	Total (N)	Lower bound (Nmin)	Dependence Factor (I)
lnGDPCi	2	3760	3746	1.00
lnGDPCj	1	3755	3746	1.00
lnPOPi	2	3735	3746	0.99
lnPOPj	1	3754	3746	1.00
lnDis	2	3760	3746	1.00
Broadbandi	1	3749	3746	1.00
Broadbandj	1	3755	3746	1.00
Internet Useri	2	3739	3746	0.99
Internet Userj	2	3758	3746	1.00
Mobilei	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

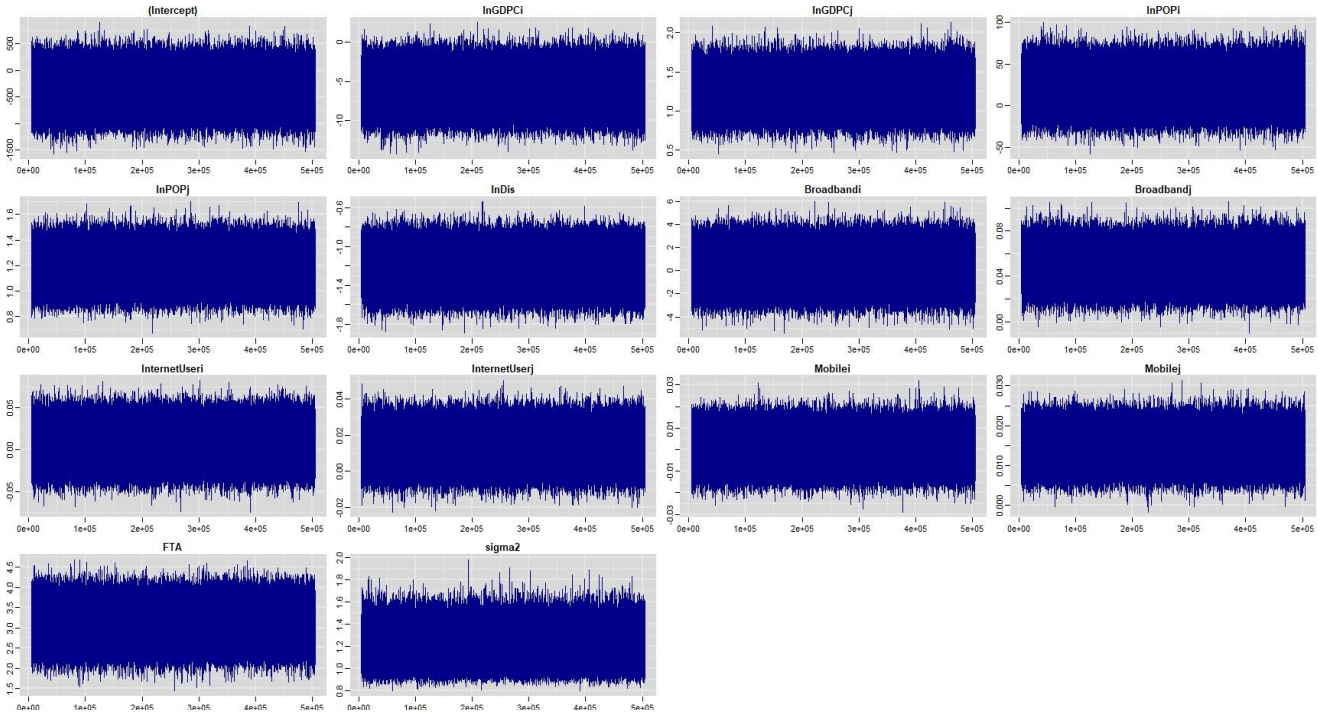
- The test shows that the dependence factor for all variables less than 5 (Lam, 2020) reports stationary distribution resulted from convergence and stability in MCMC chain.
- This implies that the estimated mean reports no evidence of serial correlation. Hence the model equation is applicable for interpretation.

The empirical result (cont.)

Kernel density plot



Trace plot



Both plots indicate the desired distribution and the evidence of convergence and stability in the chain of the simulation process. It implies the estimated gravity model is stationary and convergence.

Effect of ICT on Cambodia's international trade evidence

- Resulting from launching the ASYCUDA, SAD and e-customs, the improvement has clearly seen:

Custom clearance time was reduce from ***6.4 days*** (2004) to **1.4 days** (2014)

Export time was reduce from ***43 days*** (2006) to ***22 days*** (2015)

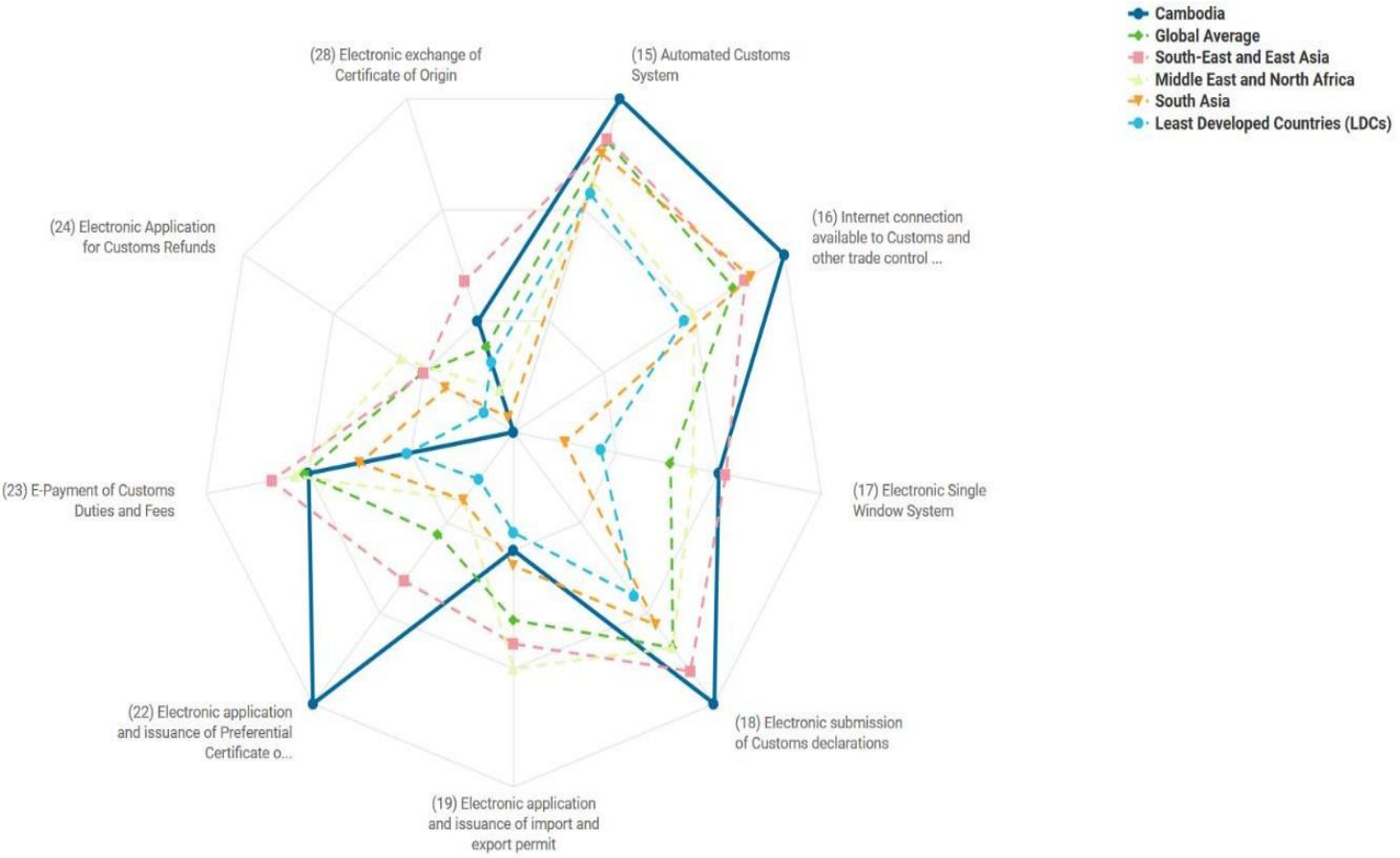
Import time was reduced from ***54 days*** (2006) to ***24 days*** (2015)

The time between the lodgment of the SAD and cargo release was less than ***2 hours***

Source: World Bank

Effect of ICT on Cambodia's international trade evidence (cont.)

Cambodia trade paperless score



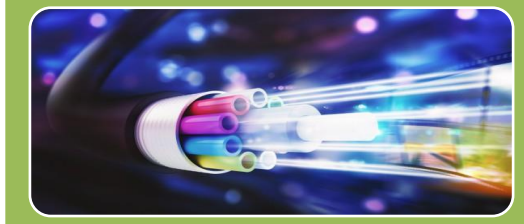
- By that Cambodia has scored relatively well in UN Global survey on digital and sustainable trade facilitation
  - Automated customs system
  - Internet connection available to custom and other trade control
  - Electronic submission of customs declaration
  - Electronic application and issuance of preferential certificate of origin
  - E-payment of customs duties and fees
  - Electronic single window system

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

Conclusion and key takeaway

- Digital technology statistically revealed a positive relationship with Cambodia's international trade
- In that, broadband is one the significant factor in expanding trade activities (large estimated mean compared to other indicators)
- Owing to the gradual development of ICT, Cambodia's international trade has been improving
  - Time to export and import were reduced remarkably
  - Customs clearance time was also minimized gradually
- To sum up, the improvement of digital technology would essentially benefit Cambodia's international trade since:
  - Encouraging the transformation of the analog procedure (e.g. clearance process, single administrative documents, and EDI etc.) to the digital platform which massively reduces trade cost and eliminates time constraint as well as improves speed of handling import/export procedure (e.g. CNSW)
  - Diffusing and generating ideas and innovation which promote the productivity
  - Connecting Cambodia to the global value chain (GVC)
- However, digital readiness in Cambodia is still at the infancy stage that needs to be further improved to benefit trade

Policy suggestions for RGC and policy maker



Making a competitive structure for the provision of broadband in Cambodia

- *Leading ICT investment especially ICT infrastructure to reduce initial investment as well as creating financial support such as funded technical development projects*
- *Promoting and supporting the private sector in investing and connecting high-speed internet networking*
- *Eliminating any unnecessary regulatory barriers constraints such as some burden administrative procedures and investment in the broadband service provider*
- *Ensuring and adopting market competition simulation with price regulation*
- *Fostering development and improvement of public internet more widely*
- *Development and testing of PPP model/framework contract for high-quality broadband services*

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*
- *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*

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, etc*
- *Making e-customs and other applications in excise and custom to be friendly and cost reduction to promote trade facilitation by taking advantage of available technological advancement (e.g. ensuring the process and upgrading the existing procedure CSNW)*

THANK YOU FOR YOUR ATTENTION

List of variables

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

Bayesian Inference

- To be able to apply Bayesian inference, we can transform the gravity model into basic and simple equation:

$$y_t = \beta_0 + X_i \beta_i + \varepsilon_t$$

Where

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

Then we obtain the joint distribution

$$\pi\ (\beta, \sigma^2|y)\ \propto\ \ \pi\ (y|\ \beta, \sigma^2\ )\ \pi(\sigma^2)\ (\pi(\beta)$$

It could be written as follow:

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

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

Bayesian Inference (cont.)

- The we obtain the condition posterior distribution of β and σ^2 as follow:

$$\pi(\beta|\,\sigma^2, y) \propto exp\left\{-\frac{1}{2}\sum_{i=1}^{n}\frac{1}{\sigma^2}(y_i - x_i'\beta)^2 - \frac{1}{2}(\beta-\beta_0)'\frac{1}{\sigma^2 B_0}(\beta-\beta_0)\right\} \times exp\left\{-\frac{1}{2}(\beta-\beta_1)'\frac{1}{\sigma^2 B_1}(\beta-\beta_1)\right\}$$

$$\pi(\sigma^2|\,\beta, y) \propto (\sigma^2)^{-\left(\frac{n_1}{2}+1\right)} exp\left\{-\frac{1}{2\sigma^2}\left[\sum_{i=1}^{n}(y_i - x_i'\beta)^2 + S_0\right]\right\} \times exp\left\{-\frac{S_1}{2\sigma^2}\right\}$$

where

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

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

Then the conditional posterior of β and σ^2 can be written as follow:

$$\beta\,|\,\sigma^2, y \sim N(\beta_1, \sigma^2 B_1)$$

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

Bayesian Inference (cont.)

- Then Bayesian inference allows the Gibbs sampling to sample from condition posterior distribution to reach the desired distribution (simulation)
- The Gibbs sampling will be operated as follow:

1) Initialize $\beta \; and \; \sigma^2$

2) Sample $y|\beta, \sigma^2$

Generate $y_i \;\; \beta, \sigma^2 \sim N\,(-\infty,+\infty)\,(x'\beta, \sigma^2)\;,\; i = 1,2\;,\; \ldots\;.\;.\;,\; n-k,$

3) Sample $(\beta, \sigma^2)|\; y$

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

3.2) Sample $\beta|\sigma^2, y \sim N\,(\beta_1, \sigma^2 B_1)$

4) Go to step 2 and Repeat