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Remittances and growth nexus in three transitional countries in the ASEAN region: A panel study with Static Random Effect Model

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Abstract

Inward remittances (REM) are playing a major part in the economic growth process in the East Asia and Pacific region. Among the ten members of the Association of Southeast Asian Nations (ASEAN), six are low middle income countries (LMICs), which are supported by growing annual remittances from the rest of the world as well as four members of ASEAN, namely Brunei and Singapore, which are, two high income countries; and two upper middle income countries namely Malaysia and Thailand. Aside from augmenting real resources in the form of foreign exchange reserves, REM contributes to the alleviation of poverty by supplementing the recipient households' incomes. Among the six LMICS of ASEAN, three countries, Cambodia, Laos and Vietnam, known as transitional countries since the mid-1990s towards a full market regime, received much less attention from researchers due to the inadequate number of annual data series for empirical studies. This paper is an attempt to fill the gap by a panel econometric study on REM and growth nexus during the 18-year period (2000-17). The findings are: (i) the REM inflows have been promoting economic growth; and (ii) the spread of Information and Communication Technology (ICT) has had a positive and significant influence, thereby confirming the similar finding of studies elsewhere that ICT plays an effective contingent role in the remittance-growth nexus.

Keywords: *Remittances; financial sector development; output*

JEL Classification: F24 P43 O40 C13 N17

Introduction

Inward remittances (REM) received by low- and middle-income countries (LMICs) have emerged in recent years to be not only more reliable but also have become larger than the traditional capital transfers, which include official development assistance (ODA) ,

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popularly known as foreign aid, besides foreign direct investment (FDI). Global REM flows in 2018 recorded a new high at $528 billion (World Bank Group, 2018). The REM inflows being in foreign currencies from migrants residing and working overseas are additions to the recipient country's real resources. Their biggest contribution lies in the area of reduction of poverty, as they supplement the income of their families left behind.

Among the ten member countries in the Association of Southeast Asian Nations (ASEAN) in East Asia, which is one of the vibrant regions of growth in the developing world, Brunei and Singapore are two high income countries; Malaysia and Thailand are upper middle income (UMICS); and the remaining other six countries are lower middle income countries (LMICs). They are Cambodia, Indonesia, Laos, Myanmar, the Philippines, and Vietnam which are have been experiencing rising annual inflows of REM. While there are empirical studies on REM and economic growth nexus in these ASEAN countries, Cambodia, Laos and Vietnam (the CLV countries), which have many commonalities including being called as transitional countries, have not received much attention. One of the reasons is their database is of recent origin, which does not provide longer time series of relevant information needed for country studies.

Additionally, the world witnessed the emergence of information and communication technology (ICT) since the mid-1990s, as a factor towards boosting output and labour productivity. The ASEAN region was much benefitted and the CLV countries were no exception. Spread of ICT with mobile voice and data networks has resulted in improving access to financial services, which has promoted banking habits. With increased mobility of their labour seeking employment opportunities overseas, the three CLV countries have also been receiving REM from their nationals residing and working. As a result, they now happen to be figuring in the list of top ten REM recipient countries not only in the East Asia and Pacific region, but also in the top ten list of the world. Rapid usage of mobile phones and access to banks without buildings in brick and mortar, and the new, hitherto unknown financial products have enabled REM recipients to deposit savings out of regular and periodical REM inflows to rural families. Therefore, it will be of interest to investigate the impact REM on their economic growth through overcoming the hurdles imposed by the limited number of annual observations, covering a period of 18 years (2000-2017) by resorting to a static panel analysis and using fixed and random effects models

This paper is organized along the following lines. The second section gives a brief literature review, whereas the third section reviews the trends in REM and growth with a focus on the three countries under study. The fourth section outlines the methodology, modeling and estimation procedures and results of empirical study. The final section presents summary and conclusions with policy implications.

A Brief Literature Review

A major part of literature on the relationship on REM and growth nexus in poor countries is based on the benefits derived by LMICS from inflows of REM. Various studies, (Leon-Ledesma and Piracha, 2001; Page and Adams, 2003; Hildebrandt and McKenzie, 2005; Yang, 2008; Giuliano and Ruiz-Arrranz, 2009) have brought that regular REM inflows to LMICs (i) promote wellbeing of the families left behind by migrants; (ii) assist the beneficiaries in upgrading their dwellings; (iii) improve their farming and other earning activities; and (iii) help households to pay children's education fees and bear the costs of the aged dependents' medical care. Further, REM flows add to foreign reserves of the recipient countries, raising their credit worthiness in the eyes of international financing agencies, and h enabling them to resort to borrowing more for funding the growth enhancing investments.

In the absence of banking services in rural areas, savings tend get spent on wasteful consumption. Studies by Chami et al., (2008) and Chami et al., (2003) have highlighted the need for mobilizing the savings out of the steady annual inflows of REM. Mobilization of savings by banks and other financial sector institutions, referred to as financialization of savings, adds to reserves in banks, thereby enabling them to step up greater lending to a large number of small, aspiring entrepreneurs in non-banked areas. Growth in credit is a logical consequence to financial deepening and financial sector development (FSD), one of the indicators along with rising deposits (Aggarwal et al., 2011).

Role of ICT in FSD and financial inclusion

Beneficial impact of REM on economic growth can be enhanced when financial sector institutions spread to rural areas for mobilizing savings from the REM recipients into bank deposits, which promotes financial inclusion of the bypassed regions and disadvantaged sections of the society, thereby facilitating intensification of FSD. Opening a bank account with some minimum deposit is the key to access to all financial products for all the citizens. When REM inflows are deposited, bank reserves go up and banks have incentives to lend more, as opportunity cost of excess reserves would mount in the absence of non-lending. Experiences have indicated nearly 80 percent of small and mini businesses in LMICs were compelled to seek funds at much higher rates of interest outside formal financial sector (Mashayekhi, 2014). The first step is depositing savings from REM inflows in bank accounts, which is now increasingly made possible with the advent of ICT (Mohan and Ray, 2017).

By late 1990s, developing countries which were late comers began to liberalize the ICT sector as part of general economic reforms, by doing away with government monopolies and encouraging new entrants and supporting investment in ICT infrastructure in close

partnership with private sector. This in turn promoted interest in developing inventing cheaper devices and spreading the use of ICT across various sectors of economic activities. One immediate impact of growth in ICT investments in developing counties was seen as a major incentive for the spurt in foreign direct investment (FDI) inflows. Attracted by progress in ICT amongst others, FDI led to rise in local employment and use of local resources, aside from transfer of technology and upgrading of skills (Jayaraman, Choong and Ng 2017). The ICT has now been well recognized as an essential infrastructural component for promoting growth in various sectors, including financial sector.

High transaction costs faced by banks have were singled out as a major reason for the hesitancy of the urban based banks to get out of the comfort zone offered by availability of roads and electricity and office space of brick and mortar buildings and other facilities. They were not keen to reach the low income regions, which are not easily accessible because of poor roads and absence of electricity, and places with low density of population. The World Economic Report (2009), after a review of progress since the beginning of the New Millennium acknowledged the contribution of ICT in helping developing countries to overcome the hurdles imposed by the three dimensions of economic geography of, density, distance and division.

Mohan (2011) in his study on India refers to the big reduction in cost of maintaining records, as one of the most important benefits of introduction of ICT in banking operations. Consequently, the servicing costs of large number of small loans in rural areas have become much less expensive than before. With the availability of new technology and fall in the prices of mobile devices, which are needed to extend deposit and credit services in far-flung areas, many of the past challenges to financial inclusion have now faded.

The ICT is now utilized to issue identity cards credit and debit cards to all bank account holders. These innovative measures facilitate almost immediate payment for purchases and receipt of remittances by mobile phones from and in to one's own bank account are changing the landscape of payments system. The positive effects of ICT on FSD are obvious. The mobilization of resources from the rural areas which were once unbanked before is now made possible. The financial deepening gets intensified further in terms of rise in deposit to GDP ratio, enabling greater lending to small borrowers. These small loans ultimately lead to increasing productive and growth enhancing activities in the hitherto neglected regions and among the once excluded sections of the society (Jayaraman and Makun, 2019).

Empirical Studies

Quantitative studies on impact of ICT on FSD by Wilson (1993) and Freund, Konig and Roth (1997) and industry level research studies of the 1990s by Wilson (1993) and Jordan

and Katz (1999) confirm positive correlation between ICT investment and bank efficiency. Focusing on eight ASEAN5 +3 countries comprising Malaysia, Thailand, Singapore, Indonesia, Philippines, Japan, Korea and China and by using panel data series covering a period of 32 years (1975-2006), Ahmed and Ridzuan (2012) investigated the effect of ICT on economic growth. They employed a standard production function with real gross domestic product (GDP), as dependent variable, the independent variables being real capital stock and labour (number of people employed as proxy of human capital) , and ICT investment. With a fixed effect for model 1 (ASEAN5, namely comprising Malaysia, Thailand, Singapore, Indonesia and Philippines) and random effect for model 2 (ASEAN5+3: Malaysia, Thailand, Singapore, Indonesia and Philippines plus China, Japan and Korea), the two authors concluded that labour, capital and telecommunications investment had a positive relationship with GDP.

Furthermore, Kumar *et al.* (2015) studied the role of ICT on economic development in small South Pacific island countries and found that ICT development in the long run contributed to economic output. Aghaei and Rezagholizadeh (2017) and Niebel (2018) also showed that ICT enhanced economic growth in Organization of Islamic Cooperation (OIC) countries. Majeed and Ayub (2018) in their panel study on 149 economies during a 36-year period (1980-2015) used several ICT indicators, came to the conclusion that developing countries did indeed benefit from ICT. Pradhan et al., (2017) in their panel study on 11 countries, comprising Bangladesh, Egypt, Indonesia, Iran, South Korea, Mexico, Nigeria, Pakistan, Philippines, Turkey, and Vietnam and covering the period from 1961 to 2012 studied the impact of ICT revolution that took place in several waves from basic telephone to fixed broad revolution on FSD and economic growth in six different periods. Their panel study results show that causality linkages ran from ICT penetration to economic growth.

Trends in remittances, FSD and ICT spread in three

While the global aid flows rose from the five-year average of US$65 billion during 2000-04 to US$159 billion in 2017, the corresponding figures of FDI flows rose from US$ 947 in 2000-04 to US$2459 billion in 2017. During 2000-04 REM averaged in 2000-04 US$ 162 billion which went up to US$ 551 billion in 2017. For LMICs, although aid flows increased from US$ 63 billion on an average per annum during 2000-04 to US$159 billion in 2017, its importance in terms of percentage to GDP has declined. In addition, FDI's contribution as percent of GDP went up from 2.54 during 2000-04 to 1.88 per cent in 2017.

Turning to CLV countries, which are the focus of our study, capital transfers have all registered increases from the ten-year period (2000-2009) averages to higher figures over time. This is indicated in Figure 1. While foreign aid increases were not substantial increases in FDI flows were impressive: The maximum FDI flows were in the case of Vietnam. In

regard to REM inflows, we find Vietnam again the leader among the three with US$ 13.8 billion in 2017, as compared to US$ 3.5 billion, which was the ten year average during 2000-09, followed by Cambodia (US$ 1.3 billion in 2017 as compared to US$ 0.15 billion during 2000-09) and Laos (US$ 0.25 billion in 2000-09 as compared to US$ 0.01 billion in 2000-09).

Table 1. Capital Transfers Received by World, Low and Middle income countries and (LMICs) from year 2000 to 2017 (US$ billion in current prices)

	2000-04	2005-09	2010	2011	2012	2013	2014	2015	2016	2017
World										
Foreign Aid	65	115	131	142	134	151	162	153	158	159
	(0.17)	(0.21)	(0.20)	(0.19)	(0.18)	(0.20)	(0.20)	(0.20)	(0.21)	(0.20)
FDI	947	2,130	1,864	2,290	2,119	2,137	1,861	2,411	2,458	2,459
	(2.59)	(3.74)	(2.74)	(3.03)	(2.72)	(2.57)	(2.28)	(3.15)	(3.16)	(2.35)
Remittances	162	339	419	470	495	525	559	565	550	551
	(0.45)	(0.61)	(0.65)	(0.65)	(0.67)	(0.69)	(0.72)	(0.77)	(0.74)	(0.73)
LMICs										
Foreign Aid	63	115	130	141	133	151	162	153	158	159
	(0.98)	(0.87)	(0.65)	(0.60)	(0.53)	(0.57)	(0.58)	(0.58)	(0.60)	(0.56)
FDI	163	453	611	722	652	738	665	629	560	561
	(2.54)	(3.30)	(3.03)	(3.05)	(2.57)	(2.74)	(2.38)	(2.41)	(2.14)	(1.88)
Remittances	104	235	302	340	367	387	417	431	416	417
	(1.62)	(1.74)	(0.65)	(0.60)	(0.53)	(0.57)	(0.58)	(0.58)	(0.60)	(0.56)

Source: World Bank (2019)

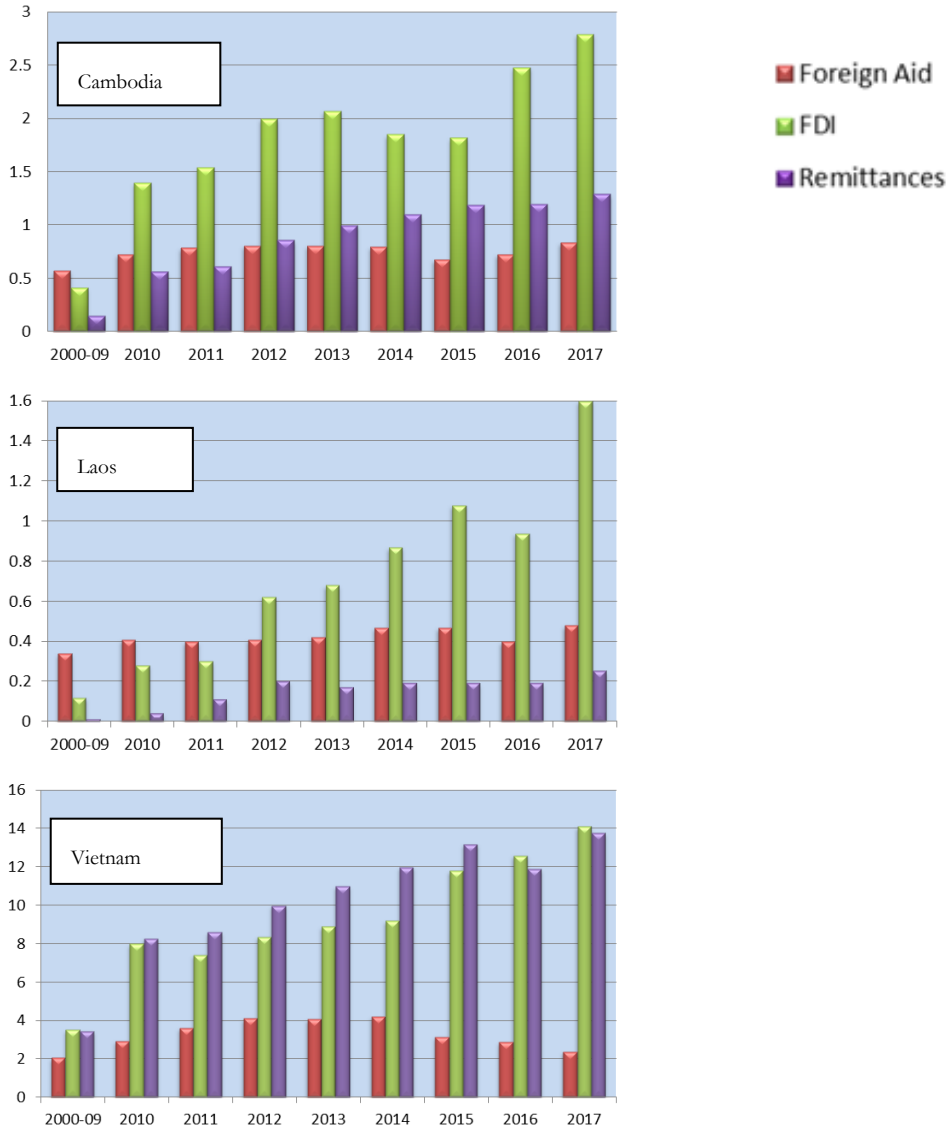
Note: Figures in parentheses are in percentages of GDP

Figure 2 shows the receipts of aid, Aid, FDI and REM for Cambodia, Laos and Vietnam as percentages of GDP. In terms of importance attached to capital flows, a comparison of percentages of these contributions to GDP in regard to each of the three transfers will be useful. Aid for Cambodia has decreased from the annual average of 9.0 percent during 2000-09 has steadily decreased to the lowest in 2017 at 3.8 percent, while the corresponding figures for Laos were 9.94 percent and 3.21 percent; and for Vietnam 3.68 percent; and 1.12 percent. Vietnam's receipt of aid was the least of all and it was only 1.12 percent of GDP. On the other hand FDI and REM as percentages of GDP have steadily increased over the period.

Referring to Table 2, rising REM inflows have placed Vietnam in the world's top ten recipients list in the last three years. In East Asia and Pacific region, Vietnam has been figuring in the top ten lists of REM recipients as well for the last three years. In the earlier years, all the three countries which are the focus of our study were among the top ten

recipients REM. In the latest 2018 list of top ten recipients (Table 3), only two are included, namely Vietnam and Cambodia. Vietnam and Cambodia are maintaining their rank at three and eight for the three years in a row.

Figure 1. Resource Transfers of Cambodia, Laos and Vietnam from year 2000 to 2017 (US$ billion)



Source: World Bank (2019)

Figure 2. Receipts of Aid, FDI and Remittances for Cambodia, Laos and Vietnam from year 2000 to 2017 (percentage of GDP)

Source: World Bank (2019)

The data series on internet use and fixed broadband connections in the three countries are not consistent as they suffer from missing information for some years during the 18- year period during 2000-17. However, information on cellular phone subscriptions is available without any breaks. Table 4 shows that there has been a rapid rise in the usage of mobile phones in the CLV countries. The usage of cellular phone has given a big boost to access to financial services overcoming the hurdles imposed by distance.

Table 2. World's Ten Top Remittance Recipients Countries from year 2016 to 2018

2016		2017		2018	
Country	**US$ billion**	**Country**	**US$ billion**	**Country**	**US$ billion**
India	63	India	69	India	79.5
China	61	China	64	China	67.4
Philippines	30	Philippines	33	Mexico	33.7
Mexico	28	Mexico	31	Philippines	33.7
Pakistan	20	Nigeria	22	Egypt	25.7
Nigeria	19	Egypt	20	Nigeria	25.1
Egypt	17	Pakistan	20	Pakistan	20.9
Bangladesh	14	**Vietnam**	**14**	Ukraine	16.5
Vietnam	**13**	Bangladesh	13	Bangladesh	15.9
Indonesia	9	Indonesia	9	**Vietnam**	**15.9**

Source: World Bank Group (2018, 2017 and 2016)

Table 3. Top Remittance Recipient Countries in East Asia and the Pacific Region from year 2016 to 2018

2016		2017		2018	
Country	**US$ billion**	**Country**	**US$ billion**	**Country**	**US$ billion**
China	62.9	China	63.9	China	67.4
Philippines	32.8	Philippines	32.8	Philippines	35.7
Vietnam	**13.8**	**Vietnam**	**13.8**	**Vietnam**	**15.9**
Indonesia	8.7	Indonesia	9	Indonesia	11.2
Thailand	6.6	Thailand	6.7	Thailand	7.5
Malaysia	1.5	Malaysia	1.6	Myanmar	2.8
Myanmar	0.7	Myanmar	0.7	Malaysia	1.8
Cambodia	**0.4**	**Cambodia**	**0.5**	**Cambodia**	**0.4**
Mongolia	0.3	Mongolia	0.3	Mongolia	0.3
Laos	**0.1**	Tonga	0.1	Fiji	0.3

Source: World Bank Group (2018, 2017 and 2016)

Table 4. Remittance and Mobile Usage for Cambodia, Laos and Vietnam from year 2000 to 2017

	2000-09	2010	2011	2012	2013	2014	2015	2016	2017
Cambodia									
Remittance (% of GDP)	2.45	4.96	4.76	6.08	6.59	6.60	6.57	5.99	5.84
Mobile Phones subscriptions per 100 inhabitants	13.10	56.96	94.63	129.2	134.8	133.9	134.3	126.3	116.0
Laos									
Remittance (% of GDP)	0.15	0.59	1.26	1.99	1.43	1.42	1.31	1.20	1.50
Mobile Phones subscriptions per 100 inhabitants	14.69	64.09	86.54	67.03	71.02	70.23	55.93	58.57	54.12
Vietnam									
Remittance (% of GDP)	5.48	7.12	6.35	6.42	6.42	6.44	6.83	5.79	6.16
Mobile Phones subscriptions per 100 inhabitants	29.86	126.1	142.3	145.5	135.2	147.1	128.5	127.5	125.6

Source: World Bank (2019)

Note: The value for year 2000-09 represent the average value of resources transfers from year 2000 to 2009.

Table 5 provides financial inclusion indicators over the last six year period based on the data of the recently initiated surveys by the World Bank (2018) conducted once in two years. Performance by the three countries in regard to per cent of adults having accounts with banks and in financial institutions is generally below that of the world, LMICs and East Asia Pacific region, there has been notable progress in Cambodia, Laos and Vietnam since 2011. What is striking is the usage of credit card for borrowing and savings in banks is higher in the three countries when compared with LMICs.

Table 5. Financial Inclusion Indicators of the World, LMICS, East Asia and Pacific, and Cambodia, Laos and Vietnam

	World	Lower Middle Income	East Asia and Pacific	Cambodia	Lao, PDR	Vietnam
Population Age (+ 15)	5.5 bil	2.1 bil	1.6 bil	10.8 mil	4.5 mil	71.3 mil
GNI (per capita) USD	10,308	2,078	6,667	1,140	2,150	2,060
Account with Banks of all adults (% , Age +15)						
2017	68.50	57.80	70.60	21.70	29.10	30.18
2014	62.00	41.90	69.10	22.20	NA	31.00
2011	50.60	28.90	55.10	3.70	26.80	21.40

Table 5. continued.

	World	Lower Middle Income	East Asia and Pacific	Cambodia	Lao, PDR	Vietnam
Financial Institutions Account (All adults, % , Age +15)						
2017	67.10	56.10	70.30	17.80	29.10	30.00
2014	61.20	40.60	68.90	12.60	NA	30.90
2011	50.60	28.90	55.10	3.70	26.80	21.40
Mobile Money Account (All adults, % , Age +15)						
2017	4.40	5.30	1.30	5.70	NA	3.50
2014	2.10	3.20	0.40	13.30	NA	0.50
Account by Individual Characteristics (year 2017)						
Women	64.80	53.00	67.90	21.50	31.90	30.40
Adults belonging to poorest 40%	60.50	50.70	59.30	14.30	17.40	20.30
Adults in rural area	66.00	57.60	68.80	19.20	22.40	25.20
Digital payments in the past year, made or received payments (%, age+15) for year 2016						
Used an account to pay utility bills	22.30	7.50	28.80	5.70	0.60	2.90
Used an account to receive private sector wages	15.90	5.50	15.90	1.10	2.60	8.90
Used an account to receive government payments	16.30	8.30	12.20	2.90	NA	3.00
Used internet to pay bills or buy online	29.00	6.80	38.60	3.80	7.10	20.50
Used mobile phone or internet to access an account	24.90	8.30	31.00	5.90	1.60	9.20
Used debit or credit card to make purchase	32.60	6.80	33.10	NA	2.40	6.20
Savings in past year (%, age +15)						
2016	26.70	15.90	30.60	5.30	18.00	14.50
2014	27.30	14.40	36.70	3.40	NA	14.60
Credit in the past year (borrowed from financial Institution/used credit card)						
2016	22.50	9.80	21.50	26.70	8.60	21.70
2014	22.30	10.00	19.50	28.40	NA	19.50

Source: World Bank (2018)

Econometric Modeling and Results

We adopt the neoclassical production function approach of Solow (1956) for investigating the effect of potential determinants as shift variables on economic growth. The technological factor known as the Solow residual is an important parameter in this model. It incorporates other factors that cannot be explained by the production function with labour and capital. Given that growth is expected to be impacted by REM and ICT, we use both of them as shift variables, besides capital stock, and population (which is the proxy for labour) as fundamental variables.

Hence, following Solow (1956) framework, the output per capita is expressed as:

$$y_t = A_t {k_t}^{\alpha} \qquad 0 < \alpha < 1 \qquad (1)$$

where:

y_t = output per capita

A_t = total factor productivity.

k_t = stock of capital

α = share of capital.

Our empirical model is to assess ICT development's impact on the remittances-income nexus. Hence, the total factor productivity A_t can be transformed into the following:

$$A_t = f(REM, MOB, REMMOB) \qquad (2)$$

where,

REM = remittances percent of GDP

MOB = mobile subscription per 100 inhabitant, representing ICT.

REMMOB = interaction term of REM and MOB

The effects of REM, MOB, and REMMOB on A_t (total factor productivity) are realized when the right hand side variables come into the functional form as shift variables. By substituting equation (2) into (1), the Cobb-Douglas function is further modified as:

$$y_t = (REM, MOB, REMMOB){k_t}^{\alpha} \qquad (3)$$

For the purpose of estimation, the above model is transformed into natural log and rearranged as:

$$lny_t = \beta_0 + \beta_1 lnk_t + \beta_2 lnREM_t + \beta_3 lnMOB_t + \beta_4 LnREMlnMOB_t + \varepsilon_t \qquad (4)$$

The hypotheses which have to be tested are:

I. the explanatory variable, capital per capita stock is directly associated with real output per capita lny_t and henceforth, the sign of lnk_t should be positive;
II. the explanatory variable, remittances is expected to positively influence real output per capita lny_t. Therefore, the sign of $lnREM_t$ should be positive;
III. the ICT indicator facilitates growth in real output per capita by absorbing remittances into the financial system and hence the sign of $lnMOB_t$ is expected to be positive.

On the other hand, there cannot be any *a priori* conclusion about the interaction term, ln*REMMOB*. If the interaction term is estimated to be positive and significant as well, it would mean that the combined growth effects of the interaction term are enhanced in a deeper financial system. However, if the interaction variable occurs with a negative coefficient and is also significant, ICT and REM are substitutes for each other. If the interaction variable has a negative sign and is found nonsignificant, the two variables are independent of each other.

Panel Analysis

In the context of a small number of observations for each of the three countries, a panel data analysis is the most appropriate one. Hsiao (2007) highlights the chief advantage of panel data analysis, namely higher data accessibility. Hurlin (2010) identified a few more reasons as well: (i) it permits larger degrees of freedom; (ii) it allows greater scope for economic analysis relative to single country time series; and (iii) it enables the researcher to control the likely bias arising from omitted variables. However, Hurlin (2010) cautions against the unobserved heterogeneity in panel analysis as a large dataset does not necessarily provide more information.

If the number of annual observations (T) for a given set of countries (N) is small, and if the number of independent, explanatory variables exceeds N, dynamic models are not appropriate, as they require lags which are not possible in the restricted case of a small number of annual observations. So the obvious choice is static models. In these circumstances, we have a choice amongst three approaches, which are pooled ordinary least square (POLS), fixed effects model and random effects model. The POLS technique helps the researcher to use all the datasets for all countries in the panel (N*T) for running regressions ignoring the cross section and time series effects. Since the technique does not distinguish the countries from the other among countries, all of them would have the same coefficients, which is realistic (Gujarati and Porter, 2009). In the present research study, although countries are similar in terms of their characteristics as they are from the same region, each one of them is unique in some ways, at least in their ICT sectors. Putting all the countries jointly would ignore potential heterogeneity. One way in which the endogeneity propagates is through the omitted variable bias.

The fixed effect model is more reasonable for modeling the unobserved individual heterogeneity across economies and controlling for omitted variable bias (Blundell and Bond, 1998; Williams, 2017). The fixed model effect addresses likely heterogeneity between three countries with each country having a different intercept. However, the intercept does not vary over time and it is time-invariant. For the fixed effect model to perform efficiently, there should be variability within the subject of variables. Williams (2017) argues that if there is no variability within the subject, fixed effect estimation result could produce very

high standard errors. Similarly, Nwakuya and Ijomah (2017) argue that the fixed effect model cannot examine the time invariant cause of the variables. On the other hand, the random effect model enables random variability across countries and it is not correlated with explanatory variables. Hence, it will utilize all dataset, produce unbiased coefficients and give lower standard errors of estimates (William, 2017).

To check the appropriateness of fixed effect and random effect models, we have to conduct redundant fixed effect and correlated random Hausman-test.

Data

The dependent variable is real GDP per capita (in 2010 prices), which is represented by *y*. The capital stock per capita is represented by *k*. Remittances (*REM*) are in percent of GDP. The explanatory variable of *ICT i*s represented by mobile subscription per 100 inhabitants (MOB). The interaction term*, REMMOB* is the product of each of two variables. The data source for real GDP per capita, REM, MOB is *World Development Indicators* (World Bank, 2019).

While the data series of capital stock are obtained from Pen World Tables, the rest of the variables are sourced from World Development Indicators (World Bank 2019). The variables were converted into their log form before they were used in the regressions analysis. The process of utilizing the variables in log form not only reduces errors but also enables us to obtain elasticity estimates of the variables (Gujarati & Porter, 2009). The summary statistics of variables and correlation matrix are reported in Table 5.

Empirical results

Out of the three approaches for panel analysis, we conducted random effect model estimation exercise. Table 6 reports the results. The estimated coefficients of the independent variables have emerged with the expected signs and they are also found statistically significant either at 1 per cent or 5 percent level. The hypotheses which were sought to be tested are now seen confirmed. In addition to the fundamental variable namely capital stock per capita, both REM and Mob positively contribute to growth in per capita income. Further the interaction term is found positive and statistically found significant, indicating that they are complementary to each other and mutually supportive. Both F test and high R-squared statistics are high, confirming that the model is indeed a well-fitted one.

Table 6. Summary statistics of the variables: 2000-17

	Lny	**lnk**	**lnREM**	**lnMOB**	**lnREM* lnMOB**
Mean	6.8774	8.9578	0.5748	3.1292	13.1736
Median	6.8700	8.9150	1.0473	3.9600	6.1581
Maximum	7.5100	9.8900	2.0769	4.9900	34.4608
Minimum	6.0700	7.8900	-3.5065	-1.4400	-0.0860
Std. Dev.	0.3628	0.5485	1.6753	1.7929	12.9634
Skewness	-0.2354	-0.1211	-1.4159	-0.7838	0.5337
Kurtosis	2.4600	2.0804	3.7641	2.3994	1.5254
Jarque-Bera	1.1548	2.0344	19.3563	6.3408	7.4557
Probability	0.5613	0.3616	0.0000	0.0419	0.0240
Observations	54	54	54	54	54
Correlation coefficient Matrix					
	Lny	**lnk**	**lnREM**	**lnMOB**	**lnREM* lnMOB**
Lny	1.0000	0.9755	0.2577	0.7303	0.5254
Lnk	0.9755	1.0000	0.1152	0.6265	0.3867
lnREM	0.2577	0.1152	1.0000	0.5084	0.6684
lnMOB	0.7303	0.6265	0.5084	1.0000	0.7277
lnREM	0.5254	0.3867	0.6684	0.7277	1.0000
lnMOB					

Note: y is real GDP per capita; *k* is capital stock per capita;, *REM is* remittances as per cent of GDP ; *MOB is* the mobile subscription per 100 inhabitants and *REM *ICT* is the interaction term.
Source: Authors' calculations.

Diagnostic tests

The diagnostic test results show the disturbances are cross-sectional independent and random effect model is appropriate. The Jarque~Bera test is on whether the sample is normally distributed and whether the sample is afflicted with any issues of skewness or kurtosis and the hypothesis is that the sample is normally distributed. The test results indicate their respective p-values (0.8423, 0.8756, 0.7386) are not at significant level (1% or 5%). We conclude that we cannot reject the null hypotheses, including the random effect model being an appropriate model, which is free from any econometric issue.

Table 7. Summary of Random Effect Results

Variable	Coefficient	Std. Error	t-Statistic	Probability
lnREM	0.0120**	0.0049	2.4682	0.0171
lnMOB	0.0185***	0.0057	3.2119	0.0023
Lnk	0.5825***	0.0143	40.7933	0.0000
lnREM lnMOB	0.0023***	0.0008	3.0102	0.0041
Constant	1.5647***	0.1188	13.1685	0.0000
R-squared				0.9826
Adjusted R-squared				0.9812
F-statistic				692.0122***[0.0000]
Diagnostic tests				
Cross-section Dependence test (Pesaran CD)				0.1989 [0.8423]
Hausman Test				2.6987 [0.8756]
Normality (Jarqua-Bera)				0.6060 [0.7386]

Notes: the significance at the 1, 5 and 10 per cent levels are denoted by the asterisks ***, ** and *. Figures for probability value are in [.].

Conclusions and policy implications

This paper undertook a panel analysis of three small ASEAN countries, Cambodia, Laos and Vietnam for studying the impact of remittances on their growth during an 18-year period (2000-17). As the number of annual observations was small, a simple random effect model was resorted to. The findings of the first-ever quantitative study reveal that remittances have had a significant and positive impact on growth; and ICT spread has been supportive. By promoting a higher degree of financial inclusion with improvements in banking habits over time, the proxy variable for ICT which is the usage of mobile phones, has indeed helped as a contingency factor to absorb rising remittances into a growth enhancing process. The interaction between REM and ICT has also been found positive and acting in a complementary way and mutually supporting each other. Although the magnitudes of elasticity coefficients of REM and ICT are small, the indications are clear. With a greater degree of financial deepening, supported by the spread of ICT penetration in the economy and encouraged by appropriate government policies including public and private partnership in the area of ICT development, the prospects of economic growth are bigger and brighter.

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