ICT, AS A CONTINGENT FACTOR IN REMITTANCES AND GROWTH NEXUS IN CAMBODIA, LAOS AND VIETNAM A PANEL STUDY: 2000-17

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Abstract: *Inward remittances (REM) are playing a major part in the economic growth process of low and middle income countries (LMICs). In the East Asia and Pacific region, REM received by LMICs excluding upper middle income countries, in recent years have exceeded inflows of foreign direct investment and foreign aid both in absolute dollars and in terms of percentages of their gross domestic products. Aside from augmenting real resources in the form of foreign exchange reserves, REM contributes to alleviation of poverty by supplementing the recipient households' incomes for raising their consumption levels. Simultaneously, the ongoing efforts in the region for promoting financial inclusion are now being facilitated by spread of information and communication and technology (ICT). Growing financial inclusion through mobile money and other new products has been seen to speed up financial sector development (FSD), enabling the remittance recipients to deposit their savings in and borrow from banks for investments in housing and mini-and micro-enterprises. Among the ASEAN countries, Cambodia, Laos and Vietnam have not received much attention, as their database is not adequately long enough for country specific studies. This paper is an attempt to fill the gap by an econometric investigation with focus on the role of ICT as a contingency factor by way of a panel study during the 18-year period (2000-17). The findings of this study are: (i) the REM inflows have been promoting economic growth in the three ASEAN countries; and (ii) the spread of ICT has had a positive and significant influence, thereby confirming a similar finding of studies elsewhere that ICT plays an effective contingent role in the remittance-growth nexus.*

Keywords: Remittances, ICT, Panel Study, Random Effect Model, Cambodia, Laos, Vietnam

1. Introduction

Recent reports from international agencies including World Bank reveal that inflows of remittances[1] (REM) to low- and middle-income countries (LMICs)[2] have emerged to be not

[1] The World Bank (2019) defines the term remittances as the sum of personal transfers and compensation of employees. Personal transfers include all current transfers in cash or in kind between resident and non-resident individuals, independent of the source of income of the sender. Compensation of employees, which refers to the

only more reliable but also have become larger than the traditional capital transfers, which include official development assistance (ODA)[3], popularly known as foreign aid, besides foreign direct investment (FDI). Global REM flows in 2018 reached a new high at $528 billion (World Bank Group, 2018). Annual 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 alleviation of poverty, as they supplement the income of their families left behind.

Among LMICs in the ASEAN region, excluding two high as well as two upper middle income countries (UMICs), namely Malaysia and Thailand, LMICs have been experiencing rising inflows of REM. While there are empirical studies on REM and growth nexus in several ASEAN countries, Cambodia, Laos and Vietnam, which have many commonalities, 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. These three countries, which have many commonalities, have become more open and liberalized with greater mobility of their labour seeking employment opportunities overseas have been receiving REM from their nationals residing and working receiving REM inflows such that they now happen to be figuring in the list of top ten REM recipient countries not only of the East Asia and Pacific region, but also in the top ten list of the world. Therefore, as it will be of interest to study the impact REM on growth of the three countries, it is considered that the most appropriate way is to resort to a panel study of the three countries, which would enable the researchers to overcome the hurdles imposed by the limited number of annual observations. This paper seeks to fill the gap by undertaking a panel study, covering a period of 18 years (2000-2017).

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 three countries. The fourth section outlines the methodology, modeling and estimation procedures and results of empirical study. The last section presents a summary and conclusions with policy implications.

2. A Brief Literature Review

Substantial part of literature on the relationship between remittances and economic growth in poor countries since the early years of 21st century is based on the benefits derived by LMICS

income of border, seasonal, and other short-term workers who are employed in an economy, represents remuneration in return for the labor input to the production process contributed by an individual in an employer-employee relationship with the enterprise.

[2] The income criteria for classifying the countries in 2017 are on the basis of gross national income (GNI) per capita (World Bank 2017b): (i) Low income Countries: GNI less than $1,025 per capita; (ii) Lower middle income countries : between GNI $1,026 per capita and $4,035 per capita; (iii) Upper middle income countries : between GNI $4,.036 per capita and $12,475 per capita; and high-income countries for those with more than GNI $12,.475 per capita. Cambodia Indonesia whose per capita GNI is US$ 3,540, is classified as a low middle income country.

[3] Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant element of at least 25 % (calculated at a rate of discount of 10 %).

from inflows of REM. Various studies, (Leon-Ledesma and Piracha, 2001; Page and Adams, 2003; Hildebrandt and McKenzie, 2005; Yang, 2008; and 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 inflows add to foreign reserves of the recipient countries, raising their credit worthiness in the eyes of international financing agencies, which enabling them to resort to borrowing more for funding the growth enhancing investments.

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. In the absence of banking services in rural areas, savings tend get spent on wasteful consumption. 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 aspiring entrepreneurs in their small enterprises 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).

In this context, emergence of information and communication technology (ICT) since the mid 1990s, as a factor towards boosting output and labour productivity, has attracted wide attention. Rapid spread of ICT with mobile voice and data networks have resulted in improving access to financial services, which has promoted banking habits including depositing and savings out of regular remittance inflows to rural families.

Financial inclusion

Beneficial impact of REM on economic growth can be enhanced when financial sector institutions spread to rural areas for mobilizing savings from REM recipients into bank deposits furthering financial sector development. About 80 percent of micro and small businesses in LMICs who do not have access to bank credit are compelled to look for funds at much higher rates of interest outside formal financial sector (Mashayekhi, 2014). Giuliano and Ruiz-Arranz (2009) observe that in countries where financial sectors are weak, remittances become a substitute for bank finance.

Opening a bank account with some minimum deposit is the key to access to all financial products. The first step is depositing savings from REM inflows in bank accounts, which is now increasingly possible with the advent of ICT (Mohan and Ray, 2017). Impressed by ICT's contribution to economic progress in the advanced countries, LMICs being late comers are now speeding up development of ICT sector as a major focus of general economic reforms. The ICT is now perceived as a contributor to savings in operating costs by banks which were a major reason for the hesitancy of the urban based banks to get out of the comfort zone offered by the availability of roads and electricity and office space of brick and mortar buildings and other facilities in cities and town, preventing them to spread their operations to rural and low income regions. Mohan and Ray (2017) point out to substantial savings involved in keeping records as a single most significant advantage of ICT, which contributed to reduction in the costs of servicing a large number of small loans to poor families. With the availability of new technology and fall in the price of smart phones, which

are used for mobile banking services in the rural areas, many of the past hurdles to FSD have now faded.

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.

4. Econometric Modeling

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 conditional or 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:

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

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:

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

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

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

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, *REM*MOB.* If the interaction term is estimated to be a positive and significant as well, it would mean that the combined growth effects of 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 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 small number of annual observations. So the obvious choice is static models. In these circumstance, we have a choice amongst three approaches, which are pooled OLS (POLS), fixed effects model and random effects model.

The POLS technique helps the researcher to 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 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 same ASEAN 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 to model the unobserved individual heterogeneity across economies and control for omitted variable bias (Williams, 2017). The fixed model effect addresses likely heterogeneity between three countries with each country having 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) argue 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, 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 model, we have to conduct redundant fixed effect and correlated random Hausman-test. The null proposition for redundant fixed effect test is that the fixed effects are redundant, while the null hypothesis for Hausman test is that REM is appropriate.

Data

We cover a period of 18 years (2000-2017). The dependent variable is real GDP per capita in US dollars and in 2010 prices), which is represented by *y*. The capital stock per capita which is represented by k is also in US dollars in 2010 prices. 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, *REM*MOB* 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). The data series of capital stock are obtained from Pen World Tables.

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 due to likely 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 8.

Table 8: Summary statistics of the variables

	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* lnMOB	0.5254	0.3867	0.6684	0.7277	1.0000

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.

Empirical results

Table 10: 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 [.].

Out of the three approaches for panel analysis, we choose is the random effect model estimation exercise. Table 10 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 Mobile 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. Based on the diagnostic tests, we conclude the model is free from any econometric issues.

5. 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 with the role of ICT as a contingent factor during a 18-year period (2000-17). As the number of annual observations is 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; ICT spread has been supportive by promoting a higher degree of financial inclusion through improvements in banking habits over time. The proxy variable for ICT which is usage of mobile phones has indeed helped as a contingency factor to absorb rising remittances in 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 greater degree of financial deepening, supported by 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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