

UNIVERSITY OF WAIKATO

**Hamilton
New Zealand**

**Are there Significant Externality Effects
of Remittances in Asian Economic Growth?**

Gazi M. Hassan and Shamim Shakur

Department of Economics

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Corresponding Author

Gazi M. Hassan

Economics Department
University of Waikato
Private Bag 3105
Hamilton, 3240
NEW ZEALAND

Email: gmhassan@waikato.ac.nz

Shamim Shakur

School of Economics & Finance
Massey University
Private Bag 3105
Palmerston North
NEW ZEALAND

Email: s.shakur@massey.ac.nz

Abstract

This paper estimates the externality effects of remittances for selected Asian countries. According to Romer (1986), externality generated by the education sector can raise nationwide productivity. Because a portion of remittances income is invested on education, remittances stock can also generate such externalities. Using a Romer-type production function and panel cointegration, we find that the externality effects of remittances are small but highly significant.

Key Words

remittances
externality effects
endogenous growth
panel cointegration
group-mean panel dynamic OLS

JEL Classification

O10; F22

1. Introduction

Workers' remittances to developing countries were estimated at just US\$47 billion in 1980 (constant 2011 dollars), and by 2010 the figure rose to a massive \$321 billion. This unprecedented change in the flow of international transfers has left economists surprisingly unsure of its development effects. Some advocates a positive developmental impact of remittances, directly or indirectly (see, for example, Giuliano and Ruiz-Arranz 2009, Catrinescu *et al.* 2009, Rao and Hassan 2011). Others advocate a negative growth effects of remittances (see Chami *et al.* 2003). A strikingly pessimistic view is that remittances hardly contributes positively to economic growth because there is no example of a country in which remittances-led growth contributed significantly to development (see Barajas *et al.* 2009).

In deviation from previous literature, this paper endeavours to assess the externality effect of remittances on economic growth rather than its direct impact on development. In doing so, it is found that the externality effects of remittances are unambiguously positive even after controlling for the estimation problems associated with endogeneity, cross-sectional dependence and heterogeneity in the data.

2. The Model

Romer (1986) showed that externalities generated by the education sector can raise economy-wide labour productivity further. Likewise, remittances flows are also capable of generating positive externality because they can enhance the educational outcomes of the recipient households (Cox-Edwards and Ureta 2003). We extend Lau and Sin (1997) framework using a special form of Romer (1986) type production function:

$$y_{jit} = Ak_{jit}^{\alpha} \left[(1 + \gamma)^t l_{jit} \right]^{1-\alpha} \tilde{K}_{it}^{\lambda} \tilde{R}_{it}^{\varphi} \varepsilon_{it} \quad (1)$$

$$i=1\dots N, t=1\dots T, A>0, \text{ and } 0 \leq \alpha, \text{ and } \lambda < 1 \quad (1a)$$

where y_{jit} , k_{jit} , and l_{jit} are the output, physical capital and labour inputs of agent j at time t in country i and ε_{it} is the error term. \tilde{K} and \tilde{R} are respectively available aggregate level of (congestion adjusted) stock of private physical capital (K) and remittances (R) in the economy, and are considered external inputs in an agent's production function which can produce spillover effects by facilitating investments in social and human capital. The parameters λ and φ represent the externality effects of country-wide physical capital and remittances. For K_{it} and R_{it} , the congestion effect is defined as follows:

$$\tilde{K}_{it} = \frac{K_{it}}{K_{it}^{\phi} [(1 + \gamma)L_{it}]^{1-\phi}} \quad \text{and} \quad \tilde{R}_{it} = \frac{R_{it}}{K_{it}^{\phi} [(1 + \gamma)L_{it}]^{1-\phi}} \quad (2)$$

where $0 \leq \phi \leq 1$. K_{it} and R_{it} represent the aggregate level of K and R external to the production function outlined above. Substituting (2) in (1), and assuming that $y_{jit} = y_{it}$ and $k_{jit} = k_{it}$ gives the following growth equation:

$$y_{it} = Ak_{it}^{(\alpha + \lambda - (\lambda + \phi)\phi)} (1 + \gamma)^{t(1 - \alpha - (\lambda + \phi)(1 - \phi))} r_{it}^{\phi} \varepsilon_{it} \quad (3)$$

The lower case variables are all in per capita terms, and the model allows us to estimate the externality effects of remittances on economic growth.

3. Data and Empirical Specification

The model in equation (3) is tested for some Asia countries that received substantial remittances flows over the period 1970-2009. The countries are chosen mainly from South Asia but also complemented with some East and Southeast Asian counterparts. The countries are Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Lao, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Vietnam. India is largest net remittances recipient in the world followed by China and Philippines. Data up to 2003 on y_{it} (real GDP per person) and k_{it} (physical capital stock per person) are taken from Bosworth and Collins (2003) and updated to 2009.

Note that equation (3) requires data on remittances stock per person (r_{it}) rather than remittances flow per year. Remittances stock is constructed analogous to the perpetual inventory method used to measure physical capital stock. We assume fifty percent of the yearly remittances flow is invested into business enterprise, land and housing, education and health. The initial period remittances stock, which varies according to country and year, is assumed to be one third of the value of the first officially recorded remittances flows in each country. Five percent of the previous period's remittances stock is assumed to be depreciated each year. Data on remittances flow is gathered from World Bank's World Development Indicator (2011).

Note that the growth model in equation (3) can be expressed in log form as follows¹:

$$\ln(y_{it}) = \beta_1 + \beta_2 \ln k_{it} + \beta_3 \ln r_{it} + \beta_4 t + \ln \varepsilon_{it} \quad (4)$$

where

$$\begin{aligned} \beta_1 &= \ln(A); \quad \beta_2 = (\alpha + \lambda - (\lambda + \phi)\phi), \\ \beta_3 &= \phi \text{ and} \\ \beta_4 &= \gamma(1 - \alpha) - [(\lambda + \phi)(1 - \phi)] \end{aligned} \quad (5)$$

¹ We assume, γ is small such that $(1 + \gamma)$ is approximated by γ (see Lau and Sin 1997b).

Equation (4) is the econometric specification of the growth model given by equation (3) which is taken to the data, making possible to estimate the externality effects of remittances flows via β_3 .

4. Results

Our methodology involves estimating a long-run relationship between log of per capita output, capital and remittances stock per head using panel cointegration. Although in theory, the presence of three variables leaves open the possibility that there is more than one panel cointegrating vector present, our prime concern is with the overall long-run relationship between y and k, r encapsulated in the single equation (4).

Our empirical procedure is divided into two parts. The first part includes unit root testing and panel tests for joint non-cointegration. The second part includes estimation of the long-run growth model given by equation (4).

We first check for cross-sectional dependence (CD) in the data because of common shocks and unobserved components that ultimately become part of the error term (Pesaran, 2004). Table 1 shows the results of Pesaran (2004) CD-test confirming cross-sectional dependency among the variables y and k, r as well as on the residual based on a fixed effect regression. In Table 2 we report the Pesaran (2007) CIPS unit root test which allows for CD and heterogeneity in the data on y and k, r including 3 lags in the ADF regressions², where all three variables are found non-stationarity. That is y, k, r are $I(1)$ in level and $I(0)$ in first differences.

Table 1. Pesaran (2004) Cross-Section Dependence (CD) Test

Variable	CD-test	p-value	correlation	Decision
y	40.98	0.00	0.87	CSD
k	27.52	0.00	0.58	CSD
r	40.85	0.00	0.87	CSD
Residual	11.60	0.00	0.24	CSD

Note: Under the null hypothesis of cross-section independence $CD \sim N(0,1)$

Table 2. Pesaran (2007) CIPS Panel Unit Root Tests

Variable	Intercept only	Intercept and trend	Variable	Intercept only
y	3.350	5.441	Δy	-2.522***
k	6.485	5.723	Δk	-2.204**
r	4.573	4.411	Δr	-3.361***

Note: ***, ** and *: Significant at 1, 5 & 10 percent level, respectively.

² Some robustness checks show that the results reported do not change when varying the number of lags included in the ADF regression.

We test for co-integration among the I(1) variables using the tests developed by Pedroni (1999, 2004) where under the alternative hypothesis of cointegration, the autoregressive coefficient is allowed to vary across countries, allowing one to model potential heterogeneity across countries. Pedroni provides seven test statistics that can be used to test the null of no cointegration in the multivariate case. These test statistics are grouped into two categories: ‘group mean’ statistics and ‘panel’ statistics.

Table 3 presents the results of Pedroni (1999, 2004) panel cointegration test for the full model. As a procedure to correct for the cross sectional dependency in our panel data we have subtracted out the common time effects from the three variables in our model using the time-demeaning method prescribed in Pedroni (2004). Six out of seven test statistics reject the null of no-cointegration at one percent level of significance. Therefore our results strongly advocate that a long-run cointegrating relationship exists between y , k , and r .

Table 3. Panel Data Cointegration Tests

A: Pedroni (1999, 2004) Panel Cointegration Test		
	Test statistic	p-Value
Within dimension		
Panel V-Statistic	3.577	0.000***
Panel rho-Statistic	-2.379	0.008***
Panel pp-Statistic	-6.451	0.000***
Panel ADF-Statistic	-7.598	0.000***
Between dimension		
Group rho-Statistic	0.265	0.604
Group pp-Statistic	-5.927	0.000***
Group ADF-Statistic	-5.387	0.000***

Notes: Variables are time demeaned and trend included. Individual lag lengths are based on the SIC. ***, ** and * denote rejection of the null of non-cointegration at the 1, 5 and 10% significance levels.

We now estimate equation (4) where the variables are co-integrated using Panel Dynamic OLS (PDOLS) (Pedroni, 2001) estimator. For comparison purpose we also report results by the fixed-Effects (FE) and Pooled Mean Group (PMG) (Pesaran et al., 1999) estimators. Standard dynamic panel data models fail to account for country specific heterogeneity by imposing common coefficients, and hence are not employed.

The PDOLS estimator is a panel extension of the single time series Dynamic OLS (DOLS) estimator that was proposed by Stock and Watson (1993). Given that the variable r is most likely endogenous in the model, the use of PDOLS estimator is well justified because DOLS estimator is asymptotically unbiased and normally distributed even in the presence of endogenous regressors. Additionally, the PDOLS does not require exogeneity assumptions nor does it require the use of instruments. In addition, the group-mean PDOLS estimator is

super-consistent under cointegration, and is robust to the omission of variables that do not form part of the cointegrating relationship. To account for certain forms of cross-sectional dependence, the PDOLS procedure allows time-demeaning the data.

Table 4 reports the results of the long-run estimation of equation (4) by the PDOLS estimator in column 1. It can be seen that the estimated sign on the variable remittances stock (r) is positive and it is significant at 1 percent. Being a log-log model, the coefficient imply that a 1 percent increase in r can increase y by 0.06%. This is the estimated size of the externality effect of remittances on economic growth, which is small but significantly positive. For comparison we look at the FE and PMG estimates in columns 2 and 3 respectively. In both cases the externality effects of remittances are positive and significant at 1 percent. The estimated coefficient of r is 0.05 in the FE estimates and 0.13 in the PMG estimates. PMG estimator can lead to a higher estimated coefficient of r because economic conditions are restricted to be common across countries in the long-run, while allowing for heterogeneous short-run dynamics.

Table 4. Estimation of Long-Run Relationship for the Variables in Equation (4)

Variables (Coefficients)	Dependent Variable: y		
	(1) PDOLS	(2) FE	(3) PMG
k (β_2)	0.222 (6.43)***	0.226 (9.68)***	0.383 (13.22)***
r (β_3)	0.059 (5.26)***	0.049 (3.92)***	0.138 (8.13)***
Adj – R ²	0.87	0.86	
Observations	281	304	289
Number of Countries	14	14	14

Notes: ***, **, * indicate significance at the 1 per cent, 5 per cent and 10 per cent level respectively. t statistics are in brackets. Variables time demeaned, constant and a trend are included. Lags and leads in the PDOLS chosen according to SIC.

5. Conclusions

This article estimates the externality effects of remittances for a selected Asian countries. According to endogenous growth models, externality generated by education sector can raise nationwide productivity. Because a portion of remittances income is invested on education of the children of the recipient households, remittances stock can also generate such externalities. Using a Romer type production function and panel cointegration, we find that the externality effects of remittances are small but highly significant. In particular, there exists a cointegrating relationship between per capita output, capital and remittances stock. Using group-mean PDOLS methodology, the major finding of our paper is that the externality effects of remittances are small but unequivocally positive after factoring in endogeneity of remittances and the heterogeneity and cross-sectional dependence in data in a group of Asian countries.

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