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Income thresholds in the remittances-growth association? a case study of Fiji

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ABSTRACT

Research indicates that remittances have mixed effects on growth. In this study, we investigate the role of income thresholds in this association for Fiji. Income thresholds are measured by thresholds in per-worker real GDP and are identified using the self-exciting threshold autoregression model over the period 1980 to 2017. A threshold autoregressive distributed lag model is subsequently developed. A single threshold in per-worker real GDP is estimated at US$5891. Remittances promote growth if income exceeds the threshold but is negative otherwise. Hence, remittances support growth-enhancing activities at high-income levels but may finance imports at the expense of domestic production at lower income levels.

KEYWORDS

Self-exciting threshold autoregression; threshold autoregressive distributed lag model; remittance led growth; small island developing states

I. Introduction

Workers' remittances represent an important financial flow for low- and middle-income countries (LMIC) (Cazachevici, Havranek, and Horvath 2020). It has grown tremendously in recent years from US$ 3.3 billion in 1975 to US$548 billion in 2019 (World Bank 2020). The value of international remittances is comparable to foreign direct investments and about three times the volume of foreign aid received worldwide (Cazachevici, Havranek, and Horvath 2020). The outlook for remittances in 2020 was uncertain (World Bank 2020). Mr. David Malpass of the World Bank had stressed the importance of remittances for developing countries and the need to quicken recovery in developed countries from the recession induced by COVID-19. Remittances were expected to fall by 20% worldwide, and by at least 13% in the Asia-Pacific region in 2020 (World Bank 2020). Defying predictions, remittances to the LMIC reached US $540 billion falling by just 1.6% in 2020 (World Bank 2021).

The objective of this paper is to determine the presence of income thresholds in the remittance-growth association in Fiji. Income in our study refers to the total income of the remittance recipient household (c.f. Brown 2008). We proxy total household income with real GDP per worker (c.f. Nolan, Roser, and Thewissen 2019). Theoretical motivations for income thresholds stem from the New Economics of Labour Migration (NELM) and selection bias in migration. Remittances can be saved by wealthier households but usually support consumption and daily needs at lower incomes (Fransen and Mazzucato 2014). In Fiji, remittances help purchase household goods and finance social activities such as weddings and funerals (RBF 2016). Remittances can also be used for investment purposes such as construction, setting up small businesses, and education (RBF 2016). Income thresholds help distinguish between wealthy and poor households. Using the NELM framework, we hypothesize that remittances promote growth at higher incomes while it reduces growth at lower income levels in the LMIC.

The study contributes to the literature by theoretically demonstrating the importance of income thresholds in the remittance-growth association. The growth model is based on an extended neoclassical growth model (Solow, 1956). Consistent with our expectations, the results indicate that remittance's effect on economic growth is significant and positive above the income threshold but is significant and negative below the threshold. The results are robust to an index of financial development (Sobiech 2019), and controls for the effect of

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tourism given its economic significance in Fiji (Kumar et al. 2018), and structural breaks. The methodological contribution of this study is the identification of income thresholds in the remittance-growth association using the self-exciting threshold autoregression (SETAR). The thresholds are incorporated into the autoregressive distributed lag (ARDL) approach. The benefits of the threshold ARDL approach to model the remittance-growth association is also emphasized.

This paper is set as follows: Section 2 justifies the income thresholds for the remittance-growth association, Section 3 presents Fiji's summary statistics, and Sections 4–6 presents methods, results, and conclusions, respectively.

Table 1. Selected statistics of Fiji.

Key Indicators	Value
Land Area (thousand km^2)	18,274
Total Population in 2021	902,906
Remittances in 2020 (USD)	$301 m
Remittances in 2020 (percent of GDP)	7
Households with migrants receiving remittances (percent of total households with migrants)	87
Households receiving remittances (percent of total households)	42
Population below poverty line (percent of total population)	30
Gross savings in 2020 (percent of GDP)	21.97
Import of consumer goods in 2019 (percent of total imports excluding food products, vegetables, and textiles)	44.63
Import of consumer goods in 2019 (percent of total imports)	55.67
Visitor arrivals in 2019	969,000
Tourism's contribution to GDP in 2019 (percent of GDP)	40
RGDP Per Capita 2019 (USD)	6,176
Average Annual GDP Growth Rate (2002–2019)	2.44
Average Annual Inflation Rate CPI (2002–2019)	3.36

Source: World Bank's World Integrated Trade Solution database, Reserve Bank of Fiji, Fiji Bureau of Statistics, and Asian Development Bank.

II. Income thresholds in the remittance-growth association

Income thresholds help distinguish between poor and wealthy households. This distinction is important for the remittance-growth association because it determines how remittances are used by households, specifically, whether remittances are invested into productive assets or are instead used to support daily needs. Stark and Bloom (1985) New Economics of Labour Migration (NELM) framework, and the selection bias in remittances (c.f. Adams 2011) lay the theoretical foundations that determine who receives remittances and how remittances are used. In NELM, migration is conceptualized as a household strategy to generate income from remittances that households can invest, diversify income, or insure against financial risks (Stark and Taylor, 1989). The selection bias implies that wealthier households are more likely to receive remittances because they can easily afford migration compared to poorer households.

The NELM framework proposes three hypotheses. The relative deprivation hypothesis posits that households attempt to improve their wealth through migration (Taylor 1999). However, the selection bias indicates that remittances generally do not reach poorer households that need them the most (Adams 2011). The investment hypothesis posits that remittances relax households' liquidity constraints and are invested in productive income-generating activities such as physical capital, health, and education (Taylor 1999). The insurance hypothesis suggests that remittances received from family abroad are an additional source of income in case the family's main income source falters. Remittances under this hypothesis provide financial protection in unforeseen circumstances and are used to support consumption and daily needs such as utilities, food, and drinking water (Rosenzweig and Stark 1989).

The relative deprivation, investment, and insurance hypotheses are not mutually exclusive. Fransen and Mazzucato (2014) survey recipient households in Burundi and finds that wealthier households may more likely save the surplus income derived from remittances whilst poorer households allocate more for consumption and to meet daily needs. In many developing countries, consumption goods constitute a significant part of total merchandise imports (Prakash and Maiti 2016; Table 1). The relationship between remittances and economic growth can thus be negative because remittances may encourage the import of consumer goods, which may cause a decline in domestic production (Jawaid and Raza 2016). We hypothesize that because wealthier households can save the remittances, this channels remittances into its investment opportunities. In contrast, because poorer households generally use remittances for consumption, this could encourage imports leading to a decline in domestic production.

III. Selected statistics

Table 1 describes the selected statistics for Fiji. Notably, remittances were about 7% of GDP in

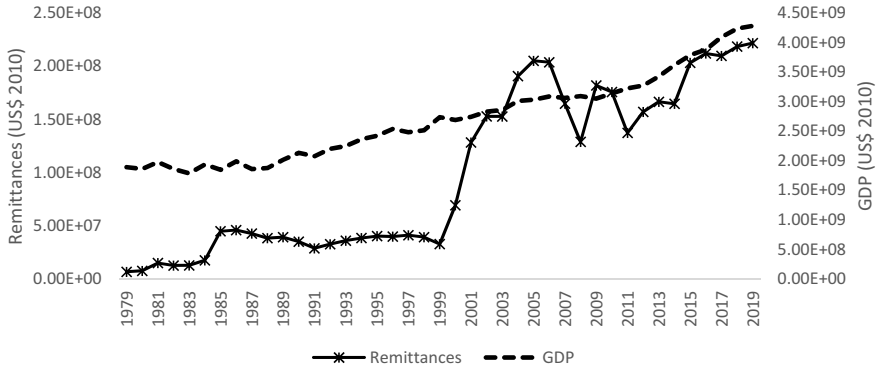

Figure 1. Fiji's Remittances and GDP (1979 to 2019). Source: World Bank's World Development Indicators Database.

2020, rising by 11% from 2019 according to the Reserve Bank of Fiji. Fiji records the highest inflow of remittances amongst the Pacific island countries. Around 87% of households with migrants, or around 42% of total households receiving remittances (Brown 2008). Remittance inflows have consistently risen to Fiji (Figure 1). Moreover, around 56% of imports in Fiji are consumer goods (Table 1).

IV. Methodology

Model

The extended Solow (1956) growth model is applied. In this model, total factor productivity (TFP) is hypothesized to consist of two parts. The first part of technology evolves independently and is described by the Hicks-neutral technical progress (Kumar 2014). The second part assumes that TFP is determined by remittances and tourism. Remittances and tourism enter the production function as shift variables (Kumar 2014). Thus, we get:

$$y_t = A_0 e^{gt} rm_t^{\vartheta} ta_t^{\zeta} \times \ k_t^{\alpha} \qquad (1)$$

where y_t is output per worker, A_0 is the initial stock of technology, g is the exogenous growth rate,t is the time trend, rm_t is inwards remittances per worker, ta_t is visitor arrivals, k_t is physical capital per worker, ϑ is the elasticity of remittances, ζ is the elasticity of tourism, and α is the capital share with the constant returns to scale assumption.

Cazachevici, Havranek, and Horvath (2020) report that the growth effects of remittances in existing studies are inconclusive with many studies reporting positive, negative, and insignificant effects. One reason for the observed disagreement is that remittances affect growth through many channels such as investments, financial development, output volatility, and the real exchange rate (Sobiech 2019). According to Sobiech (2019), studies on the direct growth effect of remittances suggest a negative, or at best an insignificant linear relationship. Correcting for publication biases, Cazachevici, Havranek, and Horvath (2020) report small positive effects but with noticeable regional differences. Specifically, remittances promote growth in Asia but not in Africa. We do not predict how remittances may affect economic growth in Fiji in linear growth models but expect it to promote growth after the threshold and retard growth below the threshold.

Nunkoo et al. (2020) in contrast report that research on the tourism-led growth hypothesis indicates that tourism promotes growth despite publication biases. Song and Wu (2021) underscore that research designs without appropriate theoretical foundations may result in unreliable and misleading conclusions. They suggest using the Solow growth model to study tourism's impact on technical progress and the productivity of capital and labour. Nunkoo et al. (2020) recommend applying new methodologies and estimation techniques to remedy potential publication biases. Nonlinear threshold modelling is an emerging technique in the tourism-growth association and is considered by Sahni, Nsiah, and Fayissa (2020) who finds that tourism has stronger economic growth effects below a threshold level of tourism receipts in African countries. Consistent with prior research

in Fiji (c.f. Kumar et al. 2018), we predict a positive effect of tourism on growth but do not predict how the effects may vary across the threshold.

Threshold ARDL model

Income thresholds are identified using the SETAR approach (Hansen 2011). We commence with a standard multiple linear regression model with T observations and m unknown threshold producing m +1 regime. The SETAR model is a threshold regression model that combines an autoregressive specification with a lagged dependent threshold variable as the optimal delay parameter. The threshold effects of the explanatory variables are separated by an indicator function (Hansen 2011). The optimal number and value of the data-specific thresholds are identified with the Bai and Perron (2003) sequential regime methodology.

Threshold decompositions are defined as follows (c.f. Sahni, Nsiah, and Fayissa 2020):

$$x_t^+ = x_t I(x_t \geq \gamma) \text{ and } x_t^- = x_t I(x_t < \gamma) \quad (2)$$

where γ is the threshold parameter that demarcates the two regimes, $I(.)$ is the indicator function that identifies the two regimes, and x_t is a time-series variable.

The threshold identified from the SETAR methodology is used to decompose the remittances and tourism variables. The final estimation is conducted with the ARDL bounds approach. This method enables cointegration to be examined between time-series data that can be either stationary at levels, stationary on first difference or has a combination of stationarity based on the levels or first-order differencing. The approach avoids endogeneity bias because of lagged explanatory variables that work as instruments. Moreover, the chosen lags do not need to be symmetric, and cointegration can be identified in multivariate systems (Pesaran, Shin, and Smith 2001).

For estimation, we incorporate the threshold decompositions in the linear ARDL model. The threshold ARDL model is specified below:

$$\Delta y_t = \mu_1 + \beta_1 y_{t-1} + \beta_2^+ x_{t-1}^+ + \beta_2^- x_{t-1}^- + \text{shortrunterms} + u_{1,t} \quad (3)$$

where μ_1 is the deterministic component which includes the intercept, time trend, and structural breaks, x_t^+ and x_t^- are the values of the explanatory variables for values above and below the SETAR income threshold parameter respectively, 0 otherwise. The adjustment coefficient is given by $-1 < \beta_1 < 0$, and u_t is the error term. The null hypothesis of symmetric effects of x_t is rejected if the p-value of the asymmetric effects test is less than 5%. The bounds test invokes OLS to test whether the lagged level variables in eq. (3) are significantly different from zero. Cointegration is confirmed if the F-statistic exceeds the upper bound, rejected if below the lower bound, and is inconclusive if the F-statistic is between the upper and lower bounds. In the final step, we extract the asymmetric cumulative dynamic multipliers on y_t for unit changes in x_t^+ and x_t^- (c.f. Shin, Yu, and Greenwood-Nimmo 2014). Dynamic multipliers provide important information on the adjustment path and duration so the disequilibrium asymmetric parameters.

The threshold ARDL estimates control for the effects of structural breaks. To identify the number and location of the structural breaks, the Bai and Perron (2003) multiple break test is applied. The approach tests for the presence of ℓ vs. ℓ+1 break using a sequential testing procedure. The number of breaks and segments are obtained by globally minimizing the sum squared residuals of the test regression. The test determines the number of breaks by testing for additional breaks in the subsequent segments until non-rejection occurs. The structural break dummies are defined according to Bai and Perron (2003) and set to 1 from the current break period to one period before the next identified break with multiple breaks.

V. Results

The data is integrated of a maximum order 1 using the augmented Dicky-Fuller and Phillips-Perron unit root tests. The maximum lag length and optimum lag structure are determined by the Akaike information criterion. The bounds test indicates that the preferred model is strongly cointegrated at the 1% level. The preferred model is free from both auto-correlated residuals and heteroscedasticity, is

properly specified, and has normally distributed residuals based on standard diagnostic tests. The preferred ARDL model and estimates are also stable.

Main estimates

Two breaks are identified, and the results are presented in Table 2. The first break, 1986, is positive but insignificant in the subsequent estimates and is dropped from the analysis. The second break, 2009, has a negative and significant effect on growth. This may reflect the repeal of Fiji's constitution, suspension from the Pacific Islands Forum regional bloc in May, and Fiji's suspension from the Commonwealth in September after the interim military government refused to hold general elections in 2010 (BBC News 2020).

We set the SETAR delay parameter to 3 and find a single threshold of 8.68 in the log of per-worker GDP. The income threshold is estimated at US $5890.86. Asymmetric effects around the identified threshold are confirmed (Table 3).

The threshold results for tourism are like Sahni, Nsiah, and Fayissa (2020) where tourism has stronger growth effects at lower income levels but is an important driver of growth at all levels of growth. Remittances harm growth below the income threshold. This implies that remittances are primarily used non-productively at lower income levels, and given Fiji's relatively large imports of consumer goods of about 55% (Table 1), may drive purchases of imported consumer goods at the cost of local production (c.f. Fransen and Mazzucato 2014; Jawaid and Raza 2016). With income above the threshold, remittances promote growth which suggests that remittances no longer act as compensatory transfers to support consumption and are instead invested into productive assets (Fransen and Mazzucato 2014). The time trend has a positive and significant coefficient which indicates macroeconomic policies in favour of productivity growth. The capital share is estimated at 0.54. The error correction term indicates that about 96% of equilibrium errors are corrected each year. The asymmetric dynamic multipliers in Figure 2 suggest that the model parameters converge to their long-run values in Table 4.

Table 2. Multiple break test.

Hypothesized Number of Breaks	F-Test Statistic	Critical Value
0 vs. 1	14.29[A]	11.47
1 vs. 2	30.45[A]	12.95
2 vs. 3	3.90	14.03

Break dates: 1986; 2009.
Estimated in EViews 11. A significant at 5% level. Non-break variable – remittances.

Table 3. Asymmetric effects test.

Null Hypothesis	Long-run	Short-run
No threshold effects in remittances	$\chi^2(1) = 30.30^A$ [<0.01]	$\chi^2(1) = 20.68^A$ [<0.01]
No threshold effects in tourism	$\chi^2(1) = 37.21^A$ [<0.01]	$\chi^2(1) = 25.11^A$ [<0.01]

Estimated in EViews 11. A significant at 1% level.

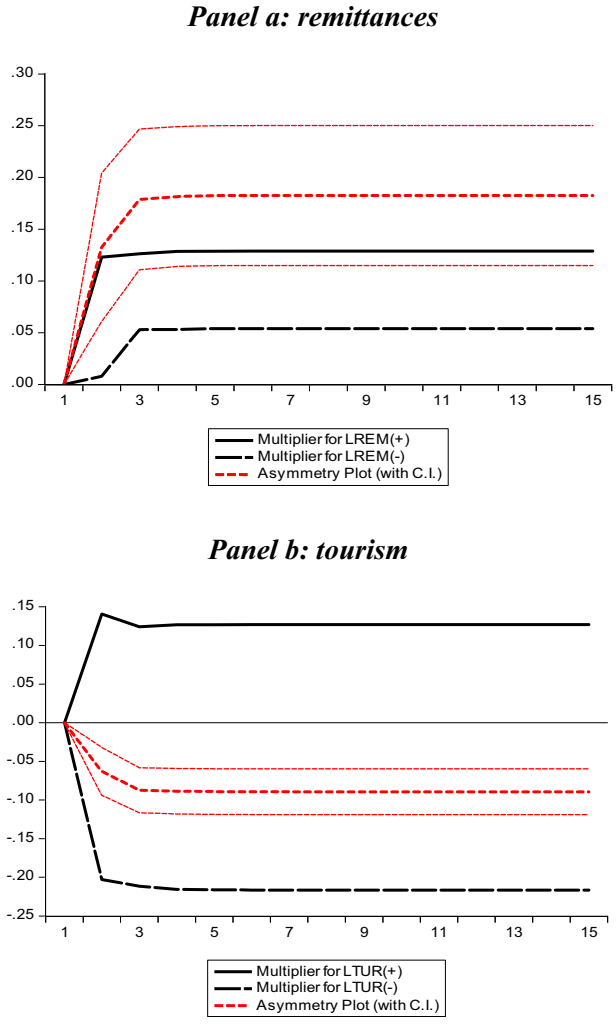

Figure 2. Asymmetric dynamic multipliers. Estimated in EViews 11. The solid black (dashed) line indicates the response of the dependent variable with a unit increase (decrease) in explanatory variables.

Table 4. Threshold ARDL estimates.

Variable	Coefficient	Standard Error	T-Statistic	P-Value
Panel a: short-run				
Above threshold: $\ln y_{t-3} \geq 8.68$				
$\Delta \ln rm_t^+$	0.12[A]	0.0334	3.6704	<0.01
$\Delta \ln ta_t^+$	0.14[A]	0.0408	3.4290	<0.01
Below threshold: $\ln y_{t-3} < 8.68$				
$\Delta \ln rm_t^-$	−0.01	0.0137	−0.6362	0.54
$\Delta \ln ta_t^-$	0.20[A]	0.0357	5.6563	<0.01
Non-threshold				
$\Delta \ln k_t$	0.51[A]	0.0911	5.6390	<0.01
$TB_{2009\text{-}2017}$	−0.07[A]	0.0180	−4.0942	<0.01
Linear Trend	0.01[B]	0.0023	2.5223	0.01
ECT_{t-1}	−0.96[A]	0.1115	−8.6068	<0.01
Panel b: long-run				
Above threshold: $\ln y_{t-3} \geq 8.68$				
$\ln rm_t^+$	0.13[A]	0.0311	4.1094	<0.01
$\ln ta_t^+$	0.12[B]	0.0488	2.4834	0.02
Below threshold: $\ln y_{t-3} < 8.68$				
$\ln rm_t^-$	−0.05[A]	0.0109	−4.9500	<0.01
$\ln ta_t^-$	0.21[A]	0.0464	4.5364	<0.01
Non-threshold				
$\ln k_t$	0.54[A]	0.0807	6.6295	<0.01
$TB_{2009\text{-}2017}$	−0.08[A]	0.0156	−4.9196	<0.01
Linear Trend	0.01[A]	0.0020	3.0516	<0.01
Intercept	1.10	0.9372	1.1808	0.25
Panel c: statistics				

Adj. R^2 =0.9849; AIC =−4.7451; SER =0.0198; DW =2.3630; $\chi^2_{hc}(10)$=6.3001 p-value =0.79; $\chi^2_{sc}(1)$=2.4199 p-value =0.12; $\chi^2_{n}(1)$=1.3230 p-value =0.52; $\chi^2_{ff}(1)$=0.1982 p-value =0.66; Bounds statistic: 12.77[A], lower bound: 4.85, upper bound: 6.51.
Estimated in EViews 11. A, B indicates significance at 1 and 5% levels. SER-standard error of regression; hc-heteroscedasticity; sc-serial correlation, n-normality, FF-functional form, DW-Durbin Watson.

Further tests

Two further tests are considered. First, the SETAR delay parameter is set to 2. This results in a threshold value of US$5943.18 which is similar to the earlier estimate. Second, financial development, which is underscored as a key factor in the remittances-growth association, is considered as a control variable (Sobiech 2019). A recent development is the construction of a financial development index which encompasses the size of the financial system, financial institution depth, and institutional efficiency (Bettin and Zazzaro 2012). We construct an index from these dimensions using Principal Component Analysis. Liquid liabilities to GDP ratio is used to measure the overall size of the financial system, monetary and domestic sector credit to private sector ratio is used to measure financial institution depth, and institutional efficiency is measured by the lending-deposit interest rate spread (Sobiech 2019).

The eigenvalue for component one exceeds 1 which indicates its relevance following the Kaiser criterion. The factor loadings indicate that monetary and domestic sector credit ratios enter the index with similar weights (Table 5). Incorporating the indicator, we re-estimate the long-run models (Table 6). Financial development is considered as a non-threshold variable (Model 1), non-threshold variable interacted with remittances (Model 2), a threshold variable (Model 3), and as a threshold variable and interacted with remittances (Model 4). Financial development is found insignificant in all cases. This signals that remittances and financial development are neither complementary nor alternative sources of development finance. It could also indicate a general lack of awareness of financial development or potential financial exclusion. The

Table 5. PCA results.

Component	Eigenvalue	Proportion	Factor Loadings	Correlation with Index
Liquid liabilities/GDP	3.339	0.835	0.532	0.975
Monetary sector credit/private sector ratio	0.628	0.157	0.539	0.976
Domestic sector credit/ private sector ratio	0.032	0.008	0.539	0.977
Interest spread	0.001	0.001	0.370	0.522

Estimated in Stata 15 and Eviews 11.

Table 6. Long-run threshold ARDL estimates with financial development.

Variable	Model 1	Model 2	Model 3	Model 4
Above threshold: $\ln y_{t-3} \geq 8.68$				
$\ln rm_t^+$	0.12^A	0.18^A	0.13^A	0.22^B
	[0.0307]	[0.0612]	[0.0297]	[0.0783]
$\ln ta_t^+$	0.15^A	0.13^B	0.15^A	0.12^B
	[0.0508]	[0.0644]	[0.0495]	[0.0639]
$\ln fd_t^+$			−0.07	0.27
			[0.0757]	[0.2851]
Below threshold: $\ln y_{t-3} < 8.68$				
$\ln rm_t^-$	-0.05^A	−0.04	-0.06^A	−0.03
	[0.0105]	[0.0242]	[0.0105]	[0.0299]
$\ln ta_t^-$	0.23^A	0.22^A	0.23^A	0.24^A
	[0.0475]	[0.0625]	[0.0472]	[0.0669]
$\ln fd_t^-$			−0.02	0.24
			[0.0208]	[0.0277]
Non-threshold				
$\ln fd_t \times \ln rm_t$		−0.05		−0.06
		[0.0386]		[0.0494]
$\ln fd_t$	−0.03	0.18		
	[0.0202]	[0.1665]		
$\ln k_t$	0.49^A	0.54^A	0.50^A	0.57^A
	[0.0833]	[0.1077]	[0.0819]	[0.1096]
$TB_{2009\text{-}2017}$	-0.08^A	-0.07^A	-0.08^A	-0.08^A
	[0.0158]	[0.0184]	[0.0152]	[0.0179]
Linear Trend	0.01^A	0.01^A	0.01^A	0.01^A
	[0.0020]	[0.0027]	[0.0019]	[0.0027]
Intercept	1.33	0.80	1.16	0.33
	[0.9042]	[1.3278]	[0.9015]	[1.4460]
Adjusted R^2	0.9849	0.9841	0.9840	0.9844
ECT_{t-1}	-0.96^A	-0.79^A	-0.95^A	-0.77^A
	[0.1071]	[0.1392]	[0.1060]	[0.1401]

Estimated in Eviews 11. A, B-significance at 1 and 5% levels. Standard error in [.].

coefficients of remittances and tourism remain similar to Table 4.

VI. Conclusions

Remittances have growth effects after the income threshold but are negative below the threshold. The findings suggest that income thresholds, which demarcate the poorer and wealthier households, is an important element that needs to be considered when studying the remittance-growth association. To justify the role of income thresholds in the remittance-growth association, the study draws theoretical insights from the predictions of the New Economics of Labour Migration and selection bias in migration behaviour. Against the findings, one caveat is that the threshold could represent a simple regime change where the demarcating period in the time series could represent the development of more appropriate economic policies favouring remittances. The findings however are robust to the inclusion of a financial development index that considers the effect of the financial sector size, institutional depth, and institutional efficiency. Future research exploring the effects of remittances on economic growth may consider threshold models with better proxies of household income and wealth to delineate between poor and wealthy households (c.f. Nolan, Roser, and Thewissen 2019). Future research could also implement surveys on the likelihood of lower- vs. higher-income households' choice in allocating remittances to locally produced goods vs. imports and whether income thresholds affect labour force participation rates.[1] Our study nevertheless highlights the importance of income thresholds in the remittance-growth association.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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[1]We thank the anonymous reviewer for highlighting this point.

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Data appendix

Table A1. Data.

Variable	Measurement	Range
Real GDP	Constant 2010 US$	1960–2019
Gross fixed capital formation (Investment)	Percent of GDP	1981–2017
Total population	Count	1960–2019
Labour force participation rate	Percent of labour force	1990–2019
Remittances received	Percent of GDP	1979–2019
Tourist arrivals (Tourism)	Count	1975–2019
Liquid liabilities	Percent of GDP	1961–2019
Bank credit to the private sector	Percent of GDP	1961–2019
Domestic credit to the private sector	Percent of GDP	1961–2019
Interest rate spread	Percent of GDP	1990–2019
Final sample (n = 38)		1980–2017

The capital stock is calculated using the perpetual inventory method. The initial capital stock is set to 1.5 times the 1980 real GDP, and the depreciation rate is set to 5% thereafter (Kumar et al. 2018). The average labour force participation rate is multiplied by population to derive the labour series.

Data sources: World Development Indicators. Investment data from 2013 to 2018 is handpicked from the Asian Development Bank's Key Indicators for Asia and the Pacific. Tourism data is handpicked from the Fiji Bureau of Statistics (Table A1).