Role of Remittances in Economic Development: An Empirical Study of World's Two Most Remittances Dependent Pacific Island Economies

Jayaraman, T. K. ; Choong , Chee-Keong and Kumar , Ronald
University of the South Pacific, Universiti Tunku Abdul Rahman , University of the South Pacific

May 2011

Role of Remittances in Economic Development: An Empirical Study of World's Two Most Remittances Dependent Pacific Island Economies

T. K. Jayaraman* <jayaraman_tk@usp.ac.fj>
School of Economics, Faculty of Business and Economics, The University of the South Pacific, Fiji Islands

Chee-Keong Choong <choongck@utar.edu.my>
Centre for Economic Studies, Faculty of Business and Finance, Universiti Tunku Abdul Rahman (Perak-Campus), Malaysia

Ronald Kumar <ronaldkmr@yahoo.com>
School of Government, Development & International Affairs, Faculty of Business and Economics, The University of the South Pacific, Fiji Islands

Keywords: Remittances, financial development, economic growth, bounds test, causality, Tonga, Samoa

Abstract

In the context of the ongoing world-wide recession and the consequent dim prospects for exports from small Pacific island countries, mobilization of foreign exchange earnings assumes considerable importance. The dependency of Samoa and Tonga on inward remittances is well known, as the two Polynesian island countries in recent years have been amongst the first top ten remittance recipient countries of the world. This paper examines the long-run nexus between economic growth and inward remittances during a three-decade period (1981-2008). The paper also discusses some important policy implications arising out of the study findings.

Keywords: Remittances, financial sector development, economic growth, bounds test, Samoa, Tonga

JEL Classification – F24, F43

Introduction

Samoa and Tonga are two Pacific island countries (PIC), that figure in list of the top ten remittance recipient countries of the world in 2007 as well as in 2008 (World Bank 2009a). Although there were clear indications of a likely world-wide decline in remittance flows due to the ongoing global recession for the past two years, a report by Asian Development Bank (Asian Development Bank 2009) was more optimistic in regard to Pacific Island Countries (PICs)[1]. This optimism is based on the fact that remittance inflows to PICs even during the short spells of slowdown in economic growth in Australia and New Zealand, rose in 2000 and 2001, and again in 2005 and 2006. Further, it was expected that implementation of a scheme of granting temporary work-permits for unskilled labourers from PICs for fruit picking in the two advanced countries in the region, namely Australia and New Zealand, would ensure a steady source of remittance inflows to PICs (Asian Development Bank 2009).

With increased financial sector development and spread of banking facilities in PICs, including Samoa and Tonga, which are the two countries of focus for our study, a large proportion of remittances is more likely to be deposited in interest earning deposits than ever before. Remittance receipts, thus entering the system through banking channels promote financial intermediation. There are several studies available on remittances received by PICs, including the latest by Browne and Leeves (2007). These studies investigated the impact of remittances on household incomes and expenditures. The objective of this paper is to examine the nexus between remittances and economic growth in Samoa and Tonga by adopting an augmented Cobb–Douglas production function approach along the lines of a Solow growth

[1] The 14 independent Pacific island countries, which are the members of the formal inter-governmental organization, known as Pacific Islands Forum are: Cook Islands, Fiji, Kiribati, Federated States of Micronesia, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

model employed by Rao, Tamazian, Singh and Vadlamannati (2008) and Luintel, Khan, Arestis and Theodoridis (2008).

Specifically, our objective is to estimate the long-run relationship between per capita real GDP, per capita physical capital stock and remittances through co-integration tests. The paper is organized into five sections. The second section provides a brief review of literature on the linkages between remittances and growth; the third section examines recent trends in inward remittances of Samoa and Tonga; the fourth section outlines the methodology adopted to undertake the empirical study and discusses the results. The fifth and last section presents conclusions with some policy implications.

A brief literature survey

Remittances are defined as private income transfers from one or more family members living and working abroad, back to the remaining family unit in the home country (Chami *et al.* 2006). Inward remittances reduce poverty by enabling the recipient families to increase consumption (Buch and Kuckulenz 2004; Maclellan and Mares 2005; and Ratha 2007). Remittances spent on expenditures beyond daily consumption enhance productive capacities of the economy thereby contributing to economic growth. In regard to poor households, they help in developing human capital by contributing to education and healthcare needs and foster entrepreneurial development through investments in businesses, especially during economic crises and natural disasters (UN ESCAP 2010). A recent study by Browne and Leeves (2007) on Tonga shows that remittances helped households increase their incomes as well as expenditure levels and their patterns as well. Further, remittances have become an increasingly important

source of development finance, supporting the balance of payments as well as contributing to investment.

Three phases of emigrants' motivations behind steady remittances evolving over their careers have been identified by an IMF study (Browne 2006). In the first phase, remittances are meant for meeting basic consumption needs of families living in home countries; and later the expenditures extend to cover telephones, sound systems, computers and outboard motors. The second phase is for human capital investment for the next generation, which includes support for schooling in the home country and later for support for higher education abroad. The next phase focuses on future retirement needs if migrants decide to return home, including long term needs such as real estate purchases and house building as well as for business investment purposes.

Common means of sending remittances in the Pacific region are through postal mails, and visiting migrant's or migrant's relatives or friends. Brown and Ahlburg (1999) in their study on PICs, including Tonga confirm that remittances sent or contributed are largely through informal channels than through formal channels. The formal channels used by remitters in the region include Western Union money transfers, bank drafts and automated teller machines (ATM). The transaction costs involved in sending remittances to PICs through legal, banking channels have been high (Irving *et al.* 2010). Some of the market factors determining the transaction cost of remittances are (a) the number of competitors (service providers) in the market, which depends on the size of that particular remittance corridor and legal regulations; (b) the cost of remittance providers, which depends on the method and technology available to them for use; (c) the needs and preferences of customers; and (d) the extent to which consumers are aware of the various

choices of services available to them. Further, the preferences of customers are equally dependent on the availability and accessibility of existing remittance-transfer services, the selection of which are largely based on the speed, the needs at the destination, and the sender's legal status (Ratha and Riedberg 2005, Irving *et al*. 2010).

Sending remittance through the formal channels strengthens the process of financial sector development. The latter is signified by the presence of deposit accepting banking institutions and the process of financial deepening.[2] Implementation of financial sector reforms in PICs, including deregulation of interest rates and encouraging new entrants to the banking sector for allowing greater competition among the banking institutions, has facilitated a healthy shift in remittance flows from informal to formal banking arrangements (Browne 2006). As and when remittances are deposited with financial institutions, a cash economy begins to evolve; and as bank reserves accumulate, the latter tend to give out more loans. Consequently, a larger number of people would be able to have access to increased credit facilities for education, home mortgages, and small business enterprises (Browne 2006).

Remittance inflows, financial sector development and exports

In the Pacific region, Fiji, Samoa and Tonga receive substantial remittance inflows in absolute terms compared to other PICs. However, remittance inflows of Tonga, Samoa, and Kiribati account for a large proportion of their respective gross domestic products (Table 1). Samoa and Tonga, whose key indicators are given in Table 2, are the two PICs which figure in the list of top 10 remittances recipient countries in 2007 and 2008 (Table 3). In 2008,

[2]The term financial deepening here refers to rise in the ratio of broad money (currency and demand deposits plus savings and time deposits) to GDP.

remittances accounted for 26 per cent of GDP of Samoa, while Tonga was the second top most country with remittances accounting for about 38 percent of GDP.

Financial Sectors

Samoa's financial sector is small. It consists of one central bank, and four commercial banks, two of which are subsidiaries of foreign banks, with a market share of about 80% of total banking system assets. The other two banks, which are locally owned, have yet to establish themselves (Table 4). The non-bank financial institutions include a few foreign-owned insurance companies and locally owned credit unions, besides the state sponsored pension fund institution, known as Samoa National Provident Fund. Due to inadequate private sector initiatives, mainly hampered by lack of collateral, the pension funds are invested in government's treasury bills and public sector projects. There is no stock market. Further, the only financial securities issued are those of the government, comprising short-term treasury bills and long-term bonds of different maturities. There is no secondary market, in which these securities can be traded. So bondholders hold them until their maturity.

Tonga's financial sector consists of five institutions: one central bank, three commercial banks, and one state-owned development bank (Table 5). Until 1993, only two banks operated in Tonga, including a state-owned development bank established to promote rural development by investing resources obtained mainly from external borrowing. Another of the commercial banks established in 1993 was a branch of a foreign bank; the other was a locally incorporated bank. A small insurance sector completes the financial sector.

While Samoa has its own state sponsored national provident fund institution, Tonga has no such pension fund institution. In both countries, banking activities are largely confined to urban areas, where formal sector activities are concentrated. As Samoa and Tonga do not have vibrant bond and equity markets, there are no attractive financial assets other than saving and time deposits in the commercial banks for savers to invest in. Following the liberalization of their respective economies and financial sectors in particular, both countries have discontinued controls on lending and deposit rates from the mid 1990s. Further, as more rural bank branches have been opened and mobile van banking facilities introduced, the ratio of broad money, comprising narrow money and quasi money (savings and time deposits) to GDP has been on the rise (Tables 6 and 7).

Exports of Samoa and Tonga

Both Samoan and Tongan economies have a narrow export base, dominated by agricultural commodities. While Samoa exports bananas and vegetables to New Zealand, Tonga has a lucrative niche export market in Japan for its squash, besides its traditional exports of bananas and vegetables to New Zealand. Until recently and unlike Tonga, which has no significant manufacturing base, Samoa was able to attract foreign domestic investment in the production of terms of automotive harness products for the Australian automobile industry. Since 2008, the Yazaki Samoa (a harness manufacturing plant) had to scale down its production. This was due to the world-wide recession that resulted in a drop in the country's only manufactured exports. However, for both countries tourism continues to be the second-largest source of foreign exchange earnings, next to remittances.

Data, modeling, methodology and results

Our study focuses on possible linkages between expenditures out of remittances facilitated by financial sector development and GDP during this period. There is substantial body of literature on the subject on how the financial sector development plays a critical role in reallocating resources to the most productive investments, which in turn lead to higher economic growth (King and Levine 1993; Beck, Levine and Loyaza 2000; and Levine, Loayza and Beck 2000). For the study, we therefore make an assumption that as remittances received by rural and urban households increase over time, surplus funds after satisfying consumption needs are increasingly mobilized by financial sector institutions and excess reserves in the banking system are lent out to private sector for investment in activities, which are oriented towards production of agricultural exports.

Data

In the context of paucity of disaggregated data, we employ aggregated data relating to variables (Tables 6 and 7), which are reported on an annual basis by the World Bank (2008, 2009a, b). There are two indicators of financial sector development. One reflects financial deepening, which is the ratio of M2 (broad money: currency and demand and time and savings deposits) to GDP. The other is the ratio of bank credit to private sector to GDP. However, we choose the ratio of credit to private sector to GDP (PCR), as a variable representing financial sector development. The reasons for choosing PCR are as follows: In the event of a tighter monetary policy stance, central banks resort to effect increases in statutory reserve ratios and commercial banks are required to keep higher reserves with central bank. A mere rise in M2/GDP by itself would not be a sufficient indicator of financial sector development as compared to a rise in credit flows to private sector. Hence, PCR emerges to be a more

appropriate measure since it is directly related to the quantity of funds available for encouraging investment, and hence economic growth.

The Model

We hypothesize that: (i) remittances, expressed as percent of GDP positively affect economic activities; and (ii) financial sector development credit to private sector, expressed as percentage of GDP and economic activities are directly related. We start from the Cobb-Douglas production function, along the lines employed by Luintel, Khan, Arestis and Theodoridis (2008) and Rao, Tamazian, Singh and Vadlamannati (2008) with constant returns and Hicks–neutral technical progress:

$$y_t = A_t k_t^{\alpha}, \qquad 0 < \alpha < 1 \tag{1}$$

where y = per worker output;

A = stock of technology;

k = capital stock per worker.

The Solow model assumes that the evolution of technology is given by

$$A_t = A_o e^{gT} \tag{2}$$

where $A_{0=}$ the initial stock of knowledge,

g= steady state of growth; and

T= time

It is also plausible to assume for our purpose that

$$A_t = f(T, REM, FD) \tag{3}$$

where

REM= remittances as percent of GDP;

FD = indicator of financial sector development

The effect of *REM* and *FD* on total factor productivity (*TFP)* can be captured with *REM* and FD as a shift variable into the production function[3]

$$A_t = A_o e^{gT} REM_t^{\beta} FD^{\lambda}_t \qquad (4)$$

$$y_t = (A_o e^{gT} REM^{\beta}_t FD_t^{\lambda}) k_t^{\alpha} \qquad (5)$$

The capital stock utilized for the study has been estimated by a perpetual inventory method. As regards labour, we use population as a proxy, since we do not have a consistent time series on employment. Data on remittances are sourced from *World Development Indicators* issued by World Bank (2009b), whereas data on financial indicators are taken from International Financial Statistics of International Monetary Fund (2009). Appendix 1 provides information on data sources.

Bounds testing approach

The number of annual observations utilized for the study is small. Samoa and Tonga and other Pacific island countries started building their national accounts only from the early 1980s with substantial technical assistance from Asian Development Bank. Since the time series of data cover only a 28-year period (1981-2008), the bounds testing approach within an autoregressive distributed lag (ARDL) framework which was developed by Pesaran *et al.* (2001) is chosen as

[3] In the estimation procedure in order to accommodate the likely contribution of other variables which are not included and hence ignored, to total factor productivity one can include time trend to the production function.

the preferred procedure for checking the existence of cointegration of the variables employed in the study. An important advantage of the ARDL approach is that it has better small sample properties than the widely used Johansen and Juslieus (1988, 1990) procedure. Excellent expositions of ARDL bounds testing approach are available in Bahmani-Oskooee and Rehman (2005), Narayan (2005) and Narayan and Smyth (2006).

The ARDL bounds testing approach does not require pre-testing of unit roots for investigating cointegration of the variables, irrespective of their order. However, we prefer to conduct unit root tests first with a view to ensuring that they are of the same order before entering them into analysis with a view to conducting further analysis in terms of error-correction model (ECM) in first differences.

We start our analysis by examining the stationarity properties using two kinds of unit root tests – augmented Dickey–Fuller (ADF) test and Ng and Perron (2001) test. The use of the Ng and Perron (NP) test to complement the widely used ADF test is motivated by the statement that when a linear trend exists in the time series, the use of NP can substantially improve the power of the unit root test over the conventional tests. We find that all variables in respect of both Samoa and Tonga, are nonstationary in their levels and found to be stationary after first differencing [4]

[4] For want of space, the unit root results are not reproduced. However they will be made available on request.

The second step is to test for cointegration using the ARDL bounds test developed by Pesaran et al. (2001), which can be estimated by ordinary least squares (OLS)[5]. In the estimation procedure we add a trend variable (*TREND*). For econometric analysis, all variables are duly transformed into their natural logs (*L*). The technique involves estimating the following single-equation conditional error-correction model:

$$\Delta Ly_t = \beta_{10} + \beta_{11} Ly_{t-1} + \beta_{12} Lk_{t-1} + \beta_{13} LREM_{t-1} + \beta_{14} LFD_{t-1} + \beta_{15} TREND + \sum_{i=1}^{p} \alpha_{11i} \Delta Ly_{t-i} + \sum_{i=0}^{p} \alpha_{12i} \Delta Lk_{t-i} + \sum_{i=0}^{p} \alpha_{13i} \Delta LREM_{t-i} + \sum_{i=0}^{p} \alpha_{14i} \Delta LFD_{t-i} + \varepsilon_{1t} \quad (6)$$

$$\Delta Lk_t = \beta_{20} + \beta_{21} Ly_{t-1} + \beta_{22} Lk_{t-1} + \beta_{23} LREM_{t-1} + \beta_{24} LFD_{t-1} + \beta_{25} TREND + \sum_{i=0}^{p} \alpha_{21i} \Delta Ly_{t-i} + \sum_{i=1}^{p} \alpha_{22i} \Delta Lk_{t-i} + \sum_{i=0}^{p} \alpha_{23i} \Delta LREM_{t-i} + \sum_{i=0}^{p} \alpha_{24i} \Delta LFD_{t-i} + \varepsilon_{2t} \quad (7)$$

$$\Delta LREM_t = \beta_{30} + \beta_{31} Ly_{t-1} + \beta_{32} Lk_{t-1} + \beta_{33} LREM_{t-1} + \beta_{34} LFD_{t-1} + \beta_{35} TREND + \sum_{i=0}^{p} \alpha_{31i} \Delta Ly_{t-i} + \sum_{i=0}^{p} \alpha_{32i} \Delta Lk_{t-i} + \sum_{i=1}^{p} \alpha_{33i} \Delta LREM_{t-i} + \sum_{i=0}^{p} \alpha_{34i} \Delta LFD_{t-i} + \varepsilon_{3t} \quad (8)$$

$$\Delta LFD_t = \beta_{40} + \beta_{41} Ly_{t-1} + \beta_{42} Lk_{t-1} + \beta_{43} LREM_{t-1} + \beta_{44} LFD_{t-1} + \beta_{45} TREND + \sum_{i=0}^{p} \alpha_{41i} \Delta Ly_{t-i} + \sum_{i=0}^{p} \alpha_{42i} \Delta Lk_{t-i} + \sum_{i=0}^{p} \alpha_{43i} \Delta LREM_{t-i} + \sum_{i=1}^{p} \alpha_{44i} \Delta LFD_{t-i} + \varepsilon_{4t}$$

[5] Pesaran and Shin (1999) indicate that the OLS estimators of the short-run parameters are consistent and the ARDL based estimators of the long-run coefficients are super-consistent in small sample sizes. Therefore, valid inferences on the long-run parameters can be made using standard normal asymptotic theory.

(9)

There are two steps involved in the procedure for examining the long-run relationship between *Ly*, *Lk*, *LREM* and *LFD*. First, we estimate Equations (6) to (9) by ordinary least squares techniques. Second, the existence of a long-run relationship can be traced by imposing a restriction on all estimated coefficients of lagged level variables equating to zero. Hence, bounds test is based on the F-statistics (or Wald statistics) with the null hypothesis of no cointegration ($H_0 : \beta_{i1} = \beta_{i2} = \beta_{i3} = \beta_{i4} = 0$) against its alternative hypothesis of a long-run cointegration relationship ($H_1 : \beta_{i1} \neq \beta_{i2} \neq \beta_{i3} \neq \beta_{i4} \neq 0$).

Since the F-statistics used for this test have a non-standard asymptotic distribution, Pesaran *et al.* (2001) have generated two different sets of critical values for given significance levels. The first set assumes that all variable are integrated of order zero, I(0) and the second set assumes all variables are integrated of order one, I(1). If the computed F-statistic is greater than the upper critical bounds value, then the null hypothesis is rejected. In contrast, if the computed F-statistic is smaller than lower critical bounds value, it indicates no long-run relationship between variables. If the computed F-statistic lies between lower and upper bounds values, then the test becomes inconclusive.

Results and Interpretation

The results of the bounds tests for Samoa and Tonga are reported in Table 8, Panels 1 and 2, respectively. The results confirm the existence of a long run relationship amongst the variables when real output per worker (*Ly*) is set as the dependent variable. The computed F-statistics for

both Samoa and Tonga are 58.417 and 42.321 respectively, which are higher than the upper critical values provided by Pesaran, et al (2001) and Narayan (2005) at 1% significance level. Therefore, the null hypothesis of no cointegration is rejected for this equation. However, the respective computed F-statistics in the equations with other variables, as dependent variables, are found not statistically significant even at 10% significance level for these two countries.

Having confirmed the presence of a long-run relationship between per capita output and per capita capital stock, remittances and private credit, we now proceed to estimate the long run equation by using the autoregressive distributed lag model (ARDL). The estimated long-run equations for both Samoa and Tonga are based on the optimal lag lengths of 2 and 3 years respectively. The choice of optimal lengths was indicated by the Schwarz Bayesian Criterion (SBC)[6].

The long-run equations are shown as follows:

Samoa

$$\begin{aligned} Ly &= 5.449 + 0.306Lk^{*} + 0.041LREM^{**} + 0.051LFD^{*} - 0.029TREND^{**} \\ t = &\quad (13.793)\ (6.644) \qquad (13.092) \quad (11.602) \qquad (-23.999) \end{aligned} \tag{10}$$

Tonga

$$\begin{aligned} Ly &= 5.697 + 0.323Lk^{***} + 0.021LREM^{**} + 0.073LFD^{**} - 0.007TREND^{**} \\ t = &\quad (8.161)\ (9.075) \qquad (3.277) \qquad (3.156) \qquad (-3.126) \end{aligned} \tag{11}$$

[6] For conserving space, details are not reported here. However, they will be made available to the interested redaer on request.

From Equations (10) and (11), we find first the estimated coefficients of log of per capita capital stock (*Lk*), log of remittances (*LREM*) and log of financial development indicator (*LFD*) have positive signs and are found significant at 10% level or better for both countries. Second, the coefficients of log of per capita capital stock, denoting the profits share, for Samoa and Tonga are 0.306 and 0.323, respectively which are consistent with the stylized value of one third obtained elsewhere (Rao, Tamazian, and Vadlamannati 2008, Rao 2010).

Second, among the shift variables, we find that coefficients of remittances and financial development indicator are respectively for Samoa 0.041 and 0.051; and for Tonga 0.021-0.073, respectively, denoting the elasticities of output with respect to remittances and financial development indicator. That is in Samoa, 1 percent increase in REM would increase per worker output by 0.04 percent and in Tonga the corresponding increase in per capital output bt 0.02 percent. The findings of positive impact of remittances on output are consistent with the findings of empirical studies undertaken in other regions (Giuliano and Ruiz-Arranz, 2009). It also emerges that growth is directly associated with financial sector development in Tonga, which is in line with standard studies (King and Levine, 1993, Levine *et al*., 2000, Beck and Levine, 2004).

Third, and more interestingly, the time trend for Samoa and Tonga has a negative sign and is also statistically significant, indicating that technical progress in these countries has been negative, virtually offsetting the positive effects of factor accumulation. The magnitude of the coefficient of time trend is however small (-0.029 in Samoa and -0.007 in Tonga). However, it is disturbing, as the technical efficiency in Samoa and Tonga has declined with time at the rate of

2.9 and 0.7 per cent, respectively per year. The reasons behind the fall in efficiency might be due to persistent loss of skilled and trained personnel through steady migration to advanced countries, which is a well-observed phenomenon in all the South Pacific island countries.

A number of diagnostic tests such as Jacque-Bera normality test, serial correlation LM test, heteroskedasticity ARCH test, and Ramsey RESET mis-specification test were conducted. Equations (10) and (11) perform reasonably well as the disturbance terms are normally distributed and serially uncorrelated with homoskedasticity of residuals, confirming the model has a correct functional form. Besides, the CUSUM and CUSUM of Squares plot show that the parameters of the model are stable over time.[7]

The fact that econometric results show the existence of cointegration relationship among the variables, we conclude that the cointegrated variables have an error correction representation, with an error correction term (ECT) duly incorporated into the model (Engle and Granger, 1987). Accordingly, a vector error correction model (VECM) is constructed to reintroduce the information lost in the differencing process, thereby allowing for long-run equilibrium as well as short-run dynamics. The VECM for four variables (per capita output, per capita capital stock, remittances and financial development) is formulated as follows:

$$\Delta Ly_t = \alpha_1 + \alpha_{11} ECT_{t-1} + \sum_{j=1}^{p-1} \phi_{1j} \Delta Ly_{t-j} + \sum_{j=1}^{p-1} \theta_{1j} \Delta Lk_{t-j} + \sum_{j=1}^{p-1} \psi_{1j} \Delta LREM_{t-j} + \sum_{j=1}^{p-1} \delta_{1j} \Delta LFD_{t-j} + \varepsilon_{1t} \quad (12)$$

[7] The CUSUM and CUSUM of Squares plots are not reported in order to conserve space. However, the results are available upon request.

$$\Delta Lk_t = \alpha_2 + \alpha_{21} ECT_{t-1} + \sum_{j=1}^{p-1} \phi_{2j} \Delta Ly_{t-j} + \sum_{j=1}^{p-1} \theta_{2j} \Delta Lk_{t-j} + \sum_{j=1}^{p-1} \psi_{2j} \Delta LREM_{t-j} + \sum_{j=1}^{p-1} \delta_{2j} \Delta LFD_{t-j} + \varepsilon_{2t} \quad (13)$$

$$\Delta LREM_t = \alpha_3 + \alpha_{31} ECT_{t-1} + \sum_{j=1}^{p-1} \phi_{3j} \Delta Ly_{t-j} + \sum_{j=1}^{p-1} \theta_{3j} \Delta Lk_{t-j} + \sum_{j=1}^{p-1} \psi_{3j} \Delta LREM_{t-j} + \sum_{j=1}^{p-1} \delta_{3j} \Delta LFD_{t-j} + \varepsilon_{3t} \quad (14)$$

$$\Delta LFD_t = \alpha_4 + \alpha_{41} ECT_{t-1} + \sum_{j=1}^{p-1} \phi_{4j} \Delta Ly_{t-j} + \sum_{j=1}^{p-1} \theta_{4j} \Delta Lk_{t-j} + \sum_{j=1}^{p-1} \psi_{4j} \Delta LREM_{t-j} + \sum_{j=1}^{p-1} \delta_{4j} \Delta LFD_{t-j} + \varepsilon_{4t} \quad (15)$$

There are two sources of causality relationships, namely, via the ECT, if $\alpha \neq 0$, or via the lagged dynamic terms. The ECT measures the long-run relationship while the coefficients on lagged difference terms reflect the short-run dynamics. The statistical significance of the coefficients associated with ECT provides evidence of an error correction mechanism that drives the variables back to their long-run relationship (Engle and Granger, 1987).

Granger causality tests: Samoa

The Granger causality test results for Samoa shown in Table 9 indicate that bi-directional causal linkages exist between per capita output and remittances, per capita output and private credit, and per capita capital stock and remittances. This suggests that the responsibility of the

policy-maker should be redirected so that it focuses on developing the domestic financial system, on attracting more remittances and on nurturing a good investment climate, so as to attract more capital input, thereby leading to better economic performance. Besides, there is unidirectional Granger causality running from private credit (FD) to both per capita capital stock and remittances, and from per capita capital stock to per capita output.

Turning to the *t*-statistic on the coefficient of the lagged error-correction term (ECT_{t-1}), the coefficient on the lagged error-correction term is significant in the per capita output equation only at 1% with a negative sign, which confirms the finding of the bounds test for long-run relationship. The error correction term for other equations is not significant when per capita capital stock, remittances or private credit is the dependent variable. The results from the Granger causality test implies that in the long run, causality runs interactively through the error correction term from per capita capital stock, remittances and private credit to per capita output.

Granger Causality Results: Tonga

The results of the Granger causality tests for Tonga are reported in Table 10. The results indicate that in the long run the causality runs in only one direction. The linkage is only from per capita capital stock, remittances and financial development indicator to per capita output, since ECT which measures the speed of adjustment back to the long-run equilibrium level is statistically significant only in the equation with per capita output. The speed of adjustment is at 67.05 percent a year.

When examining the short-run causal relationship between these variables, we find evidence of unidirectional causality running from per capita capital stock and remittances to per capita output as well as from per capita capital stock to remittances. On the other hand, it is evident that there exists a bi-directional causality between per capita capital stock and financial development, remittances and financial development, and per capita output and financial development. The results confirm that both per capita capital stock and remittances have a significant effect on per capita output in the short-run and the effect on per capita output can be enhanced via the efficiency of domestic financial system.

Conclusions and policy implications

Samoa and Tonga are two small Pacific island countries, which are heavily dependent on remittances. This paper adopted an augmented Solow model approach for examining the nexus between remittance and economic growth in Samoa and Tonga during the past 28–year period (1981-2008). The findings are that inward remittances lead to growth in economic activities, by adding to the liquidity in the banking system, which in turn adds to rise in credit to private sector.

The findings of positive impact of remittances on output are consistent with the findings of empirical studies undertaken in other regions (Giuliano and Ruiz-Arranz, 2009). It also emerges that growth is directly associated with financial sector development in Samoa and Tonga, which is in line with the findings of various studies (King and Levine, 1993, Levine *et al*., 2000, Beck and Levine, 2004).

The policy implications are:

- since financial sector development is key to growth, appropriate incentive measures are needed to encourage the remittance recipient families to deposit them in financial institutions;
- incentive measures should include higher interest rates for remittance deposits than for domestic currency deposits on the lines offered by the South Asian countries for attracting deposits from their non-resident nationals; and
- governments in consultation with financial institutions should review the current structure of fees and other charges on inward remittances at both ends with a view to removing any hurdles that may constrain remittance flow through the formal channels.

References

Asian Development Bank (2009) *Navigating the Global Storm*, Asian Development Bank, Manila.

Bahmani-Oskooee, M. and Rehman, H. (2005) 'Stability of the money demand function in Asian developing countries', *Applied Economics*, Vol. 37, pp. 773-792.

Beck, T. and Levine, R. (2004) Legal institutions and financial development, NBER Working Paper No. W10417.

Beck, T., Levine, R. and Loayza, N. (2000) 'Finance and the sources of growth', *Journal of Financial Economics,* Vol. 58, pp. 261-300.

Brown, R. and Ahlburg, A.D. (1999) 'Remittance in the Pacific', *International Journal of Social Economics*, Vol. 26, pp. 325-344.

Browne, C. (2006) 'Remittances and migration', in C. Browne (ed.)*, Pacific Island Economies*, International Monetary Fund, Washington, D.C.

Browne, R. and Leeves, G. (2007) Impacts of international migration and remittances on source country household incomes in Small Island States: Fiji and Tonga, *Discussion Paper No. 347.* School of Economics, University of Queensland, Brisbane.

Buch, M. C. and Kuckulenz, A. (2004) Worker remittances and capital flows to developing countries, *Discussion Paper No. 04-31*, Center for European Economic Research (ZEW).

Central Bank of Samoa (2008) *Annual Report 2008*, Central Bank of Samoa, Apia.

Chami, R., Cosimano, T.F. and Gapen, M.T. (2006) 'Beware of emigrants bearing gifts: optimal fiscal and monetary policy in the presence of remittances', *IMF Working Paper WP/06/61.* International Monetary Fund, Washington, D.C.

Engle, R. and Granger, C. (1987) 'Co-integration and error correction: representation, estimation and testing', *Econometrica*, Vol. 55, pp. 251-276.

Giuliano, P. and Ruiz-Arranz, M. (2009) 'Remittances, financial development, and growth', *Journal of Development Economics*, Vol. 90, pp. 144-152.

International Monetary Fund (IMF) (2009) *International Financial Statistics*, CD ROM December 2009, International Monetary Fund, Washington, D.C.

Irving, J., Mohapatra, S. and Ratha, D. (2010) *Migrant Remittance Flows: Findings from a Global Survey of Central Banks*, World Bank Working Paper No: 194/2010, International Monetary Fund, Washington, D.C.

Johansen, S. (1988) 'Statistical analysis of cointegrating vectors', *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231-254.

Johansen, S and Juselius, K. (1990). 'Maximum likelihood estimation and inference on cointegration with applications to the demand for money', *Oxford Bulletin of Economics and Statistics,* Vol. 52, pp. 169-210

King, R.G. and Levine, R. (1993) 'Finance and growth: Schumpeter might be right', *The Quarterly Journal of Economics*, Vol. 108, pp. 717-737.

Levine, R., Loayza, N. and Beck, T. (2000) 'Financial intermediation and growth: causality and causes', *Journal of Monetary Economics*, Vol. 46, pp. 31-77.

Luintel, K.B. and Khan, M. (1999) 'A quantitative reassessment of the finance-growth nexus: evidence from a multivariate VAR', *Journal of Development Economics,* Vol. 60, pp. 381-405.

Maclellan, N. and Mares, P. (2005) Remittances and labour mobility in the Pacific - A working paper on seasonal work programs in Australia for Pacific Islanders, Swinburne Institute for Social Research, Melbourne.

Narayan, P.K. (2005) 'The saving and investment nexus for China: evidence from cointegration tests', *Applied Economics*, Vol. 37, pp. 1979-1990.

Narayan, P.K. and Smyth, R. (2006) 'The residential demand for electricity in Australia: an application of the bounds testing approach to cointegration', *Energy Policy*, Vol. 33, pp. 467-474.

National Reserve Bank of Tonga (2008) *Annual Report 2008*. NRBT, Nukulofa.

Ng, S. and Perron, P. (2001) 'Lag length selection and the construction of unit root tests with good size and power', *Econometrica*, Vol. 69, pp. 1519-1554.

Pesaran, M.H. and Shin, Y. (1999) 'An autoregressive distributed lag modelling approach to cointegration analysis', in S. Strom (ed.), *Econometrics and Economic Theory in the 20th Century*, Cambridge University Press, Cambridge.

Pesaran, M.H., Shin, Y. and Smith, R. (2001) 'Bounds testing approaches to the analysis of level relationships', *Journal of Applied Econometrics*, Vol. 16, pp. 289-326.

Rao, B., Tamazian, A., Singh, R. and Vadlamannati, K.C. (2008) 'Financial developments and the rate of growth of output: An alternative approach', *MPRA Paper* No. 8605. http://mpra.ub.uni-muenchen.de/8605/ (accessed: June 28, 2010).

Rao, B. (2010) 'Estimates of the steady state growth rates for selected Asian countries with an extended Solow Model', *Economic Modelling*, Vol. 27, No. 1, pp. 46-53.

Ratha, D. (2007) *Leveraging Remittances for Development*. Migration policy Institute, World Bank, Washington D.C.

Ratha, D. and Riedberg, J. (2005) *On Reducing Remittance Costs*. World Bank, Washington D.C.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) (2007) *Economic and Social Survey*, *2007*, UNESCAP, Bangkok.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) (2010) *Economic and Social Survey*, *2010*, UNESCAP, Bangkok.

World Bank (2008) *World Development Indicators 2008 CD ROM*, World Bank, Washington D.C.

World Bank (2009a) *Migration and Remittance Data*, World Bank, Washington D.C. h*ttp://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTDECPROSPECTS/0,,contentMDK:21352016~pagePK:64165401~piPK:64165026~theSitePK:476883,00.html (accessed on 29 December, 2009).*

World Bank (2009b) *WDI Online Word Development Indicators*, World Bank, Washington D.C. *http://ddptxt.worldbank.org/ext/DDPQQ/member.do?method=getMembers&userid=1&queryId=6 (accessed on 28 December, 2009)*

Table 1. Remittances in US$ Million and in Percentages of GDP: 1970-2008[a]

	Fiji	Kiribati	Papua New Guinea	Samoa	Solomon Islands	Tonga	Vanuatu
1970-1974 (average)	n.a.	n.a.	n.a.	n.a.	n.a.	2 (7.5)	n.a.
1975-1979 (average)	4 (0.5)	2 (4.5)	10 (0.6)	10 (13.2)	n.a.	6 (16.4)	n.a.
1980-1984 (average)	8 (0.7)	2 (6.9)	5 (0.2)	19 (19)	n.a.	10 (16.5)	8 (7.0)
1985-1989 (average)	26 (2.2)	4 (15.8)	9 (0.3)	34 (33.8)	n.a.	19 (22.5)	8 (6.0)
1990-1994 (average)	24 (1.6)	6 (19.3)	17 (0.4)	37 (28.1)	n.a.	21 (15.4)	12.2 (6.4)
1995-1999 (average)	30 (1.5)	7 (15.2)	13 (0.3)	44 (19.6)	2 (0.6)	61 (37.7)	22 (8.3)
2000 -2004 (average)	73 (3.6)	7 (13.3)	11 (0.3)	54 (18.9)	4 (1.6)	61 (37.7)	22 (8.3)
2005	184 (6.2)	7 (11.4)	13 (0.3)	110 (25.9)	7 (2.4)	66 (30.6)	5.1 (1.4)
2006	165 (5.2)	7 (11.3)	13 (0.2)	108 (24.0)	20 (6)	72 (30.5)	5.0 (1.2)
2007	165 (4.8)	7 (9.0)	13 (0.2)	120 (22.9)	20 (5.1)	100 (39.6)	5.5 (1.1)
2008	175 (4.7)	9 (10.7)	13 (0.2)	135 (24.0)	20 (4.8)	100 (36.9)	7.0 (1.2)

[a] Figures in parentheses denote percentages to GDP.
Source: World Bank (2008, 2009a)

Table 2. Selected Key Indicators: Samoa and Tonga

Indicator	**Samoa**	**Tonga**
Land Area (Sq.km.'000)	2.8	0.72
Population (2008: '000)	178.8	104
Per Capita GDP (US$) Current Prices (2008)	2,926	2,548
Aid Per Capita in US$ (2006)	254	296
Aid as percentage of GDP (2008)	5.0	12.0
Annual Average Growth Rate in percent (2001-2008)	3.8	1.4
Annual Average Inflation in percent (2001-2008)	6.4	9.0
Overall Budget Balance as percent of GDP (2001-2007)	-0.7	0.4
Current Account Balance as percent of GDP (2004-2007)	-7.4	-6.6

Source: World Bank (2009b), ADB (2009), UNESCAP (2007)

Table 3: Top ten remittance recipients of 2008 (as percentage of GDP)

Country	Remittance	
	As percentage of GDP	In US$ (millions)
Tajikistan	50	2,544
Tonga	38	100
Moldova	31	1,897
Kyrgyz Rep.	28	1,232
Lesotho	27	443
Samoa	26	135
Lebanon	25	7,180
Guyana	24	278
Nepal	22	2,727
Honduras	20	2,824

Source: World Bank (2008, 2009a & 2009b)

Table 4. Samoa's Financial System Structure: 2008

	Assets (Millions in Domestic currency)	Percent in Total Assets	Number of Institutions	Percent of 2008 GDP
Commercial Banks	751.1	49.8	4	65.1
Central Bank of Samoa	184.0	12.2	1	15.9
Development Bank	129.7	8.6	1	11.2
Insurance companies	63,3	4.2	2	5.5
Pension funds (NPF)	346.9	23.0	1	30.1
Samoa Housing Corpn.	21.1	1.4	1	1.8
Total	1508.3	100		129.6

Source: Central Bank of Samoa (2008)

Table 5: Tonga: Financial System Structure: 2008

	Assets (Millions of pa'anga)	Percent in Total Assets	Percent of GDP	Number of Institutions
Commercial banks	200.4	81.6	72.3	3
State-owned development bank	45.1	18.4	16.3	1
Insurance companies	n.a.	n.a.	n.a.	6
Total	245.5	100.0	88.6	10

Source: National Reserve Bank of Tonga (2008)

Table 6. Samoa - Growth Rate, Remittances and Financial Indicators

Variables	GDP Growth Rate (%)	Remittances (% of GDP)	Exports of goods and services (% of GDP)	Money & quasi money ((% of GDP)	Private sector credit (% of GDP)
1981-1985 (average)	1.9	21.6	n.d.	26.1	10.9
1986-1990 (average)	0.8	35.5	n.d.	35.5	16.9
1991-1995 (average)	1.1	26.3	29.1	36.5	21.9
1996-2000 (average)	4.0	19.3	34.8	32.9	25.4
2001	7.1	18.8	34.6	35.8	32.0
2002	4.4	17.1	32.9	36.3	33.1
2003	4.8	14.0	26.8	37.9	33.3
2004	4.8	22.8	26.3	37.6	33.5
2005	5.4	25.2	26.7	38.2	37.3
2006	1.1	24.1	28.2	41.4	43.1
2007	6.4	22.0	30.7	40.8	39.8
2008	-3.4	25.8	33.5	44.5	43.7

Source: Authors' calculations; and World Bank (2009a and 2009b)

Table 7. Tonga: Growth Rate, Remittances and Financial Indicators

Variables	GDP Growth Rate (%)	Remittances (% of GDP)	Exports of goods and services (% of GDP)	Money & quasi money (% of GDP)	Private sector credit (% of GDP)
1981-1985 (average)	3.4	21.1	25.8	28.5	19.3
1986-1990 (average)	0.3	21.8	27.8	31.5	31.6
1991-1995 (average)	3.7	16.8	21.2	31.0	34.2
1996-2000 (average)	1.8	25.7	14.0	36.8	50.2
2001	3.1	39.0	11.0	45.6	53.9
2002	1.7	44.3	18.0	44.7	56.4
2003	3.1	32.6	19.0	44.5	56.8
2004	1.1	34.0	21.0	47.5	51.5
2005	-3.3	30.6	20.0	52.6	64.1
2006	4.4	30.5	16.0	52.0	59.2
2007	-0.3	39.4	16.6	53.8	65.1
2008	1.2	37.7	17.1	50.7	64.9

Source: Authors' calculations; and World Bank (2009a and 2009b)

Table 8. Results of Bound Tests in Samoa and Tonga

Dependent Variable			Computed F-statistic	
Panel 1: Samoa				
Ly			58.417***	
Lk			2.639	
LREM			1.269	
LFD			2.270	
Panel 2: Tonga				
Ly			42.321***	
Lk			2.253	
LREM			2.542	
LFD			2.642	
	Pesaran, et al. (2001)[a]		**Narayan (2005)[b]**	
Critical Value	Lower bound value	Upper bound value	Lower bound value	Upper bound value
1 per cent	3.74	5.06	4.768	6.670
5 per cent	2.86	4.01	3.354	4.774
10 per cent	2.45	3.52	2.752	3.994

[a] Critical values are obtained from Pesaran et al. (2001), Table CI(iii) Case III: Unrestricted intercept and no trend, p. 300.
[b] Critical values are obtained from Narayan (2005), Table case III: unrestricted intercept and no trend, p. 10. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

Table 9. Samoa: Granger Causality Tests

Dependent Variable	F-statistics				ECT (t-statistics)
	ΔLy	**ΔLk**	**ΔLREM**	**ΔLFD**	
ΔLy	-	7.263**	25.321***	35.571***	-0.2566*** (-5.224)
ΔLk	1.999	-	6.829**	3.411*	-0.0026 (-0.177)
ΔLREM	9.089***	8.379***	-	6.338**	-0.2434 (-1.025)
ΔLFD	4.441*	1.219	1.477	-	-0.3761 (-1.202)

Note: *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively. Figures in parentheses are t-statistics.

Table 10. Tonga: Granger Causality Tests

Dependent Variable	F-statistics				ECT (t-statistics)
	ΔLy	**ΔLk**	**ΔLREM**	**ΔLFD**	
ΔLy	-	15.247***	6.558***	4.311*	-0.6705 (4.357)
ΔLk	1.283	-	0.031	4.457*	-0.7609 (-0.791)
ΔLREM	1.317	4.549**	-	3.808*	-0.0926 (-0.051)
ΔLFD	7.131***	3.771*	3.654*	-	-0.5423 (-0.819)

Note: *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively. Figures in parentheses are t-statistics.