Volume 37, issue 3, September 2013 ISSN 0939-3625

ECONOMIC SYSTEMS

CONTENTS

Symposium: Institutions, Economic Growth and International Trade
Guest Editors: Jun Zhang and Ali M.Kutan

Articles

Economic Systems 37 (2013) 462–472

Contents lists available at SciVerse ScienceDirect

Economic Systems

journal homepage: www.elsevier.com/locate/ecosys

Remittances and economic growth: A study of Guyana ☆

Ronald Ravinesh Kumar *

School of Economics, Faculty of Business & Economics, University of the South Pacific, Suva, Fiji

A R T I C L E I N F O

Article history:
Received 11 September 2012
Received in revised form 5 December 2012
Accepted 18 January 2013

JEL classification:
C22
F24
F43
O54

Keywords:
Remittances
Financial deepening
Aid
Growth
Guyana

A B S T R A C T

Using an augmented Solow framework and an ARDL bounds test for cointegration, we explore the short- and long-run effects of remittances, aid and financial deepening on growth in Guyana using annual data for the period 1982–2010. The results show that remittances have a positive and significant effect both in the short and the long run. Aid has a negative effect in the long run and financial deepening is not statistically significant. The Granger-causality test reveals that capital stock, aid and financial deepening cause remittances inflow in Guyana.

1. Introduction

The economic growth of Guyana vis-à-vis the remittances inflow has not received enough attention despite the fact that the remittances inflow to Guyana has been increasing at a steady pace. Over the years, remittances in Guyana have increased from an average of $US3.6 million (0.8 percent of Gross Domestic Product or GDP) in the 1982–1990 period to US189.3 million (14.1 percent of GDP) in the 2001–2010 period (World Bank, 2012). In 2010, the remittances inflow to Guyana recorded US$309

☆ Disclaimer: The views expressed in the article are solely those of the author and do not necessarily represent the views of the author's affiliated institutions.

* Tel.: +679 32 32769; fax: +679 32 32522.
E-mail addresses: kumar_RN@usp.ac.fj, ronaldkmr15@gmail.com.

0939-3625/$ – see front matter
http://dx.doi.org/10.1016/j.ecosys.2013.01.001

Table 1
Selected indicators of Guyana's economic system.

Land Area ('000 km^2)	196.9
Population in thousands (2010)	754.5
Per capita GDP, current 2000 US$ (2006–2010)	2502.3
Per capita aid current US$ (2006–2011)	211.6
Annual GDP growth (%) (2006–2010)	4.4
Annual inflation, consumer prices index percent (2007–2010)	6.4
External debt stocks as a percent of GDP (2006–2010)	48.6
Current account balance as a percent of GDP (2006–2010)	−8.8

Source: World Bank (2012).
Figures for interval years are averages computed by the authors.

million (13.7 percent of GDP) and was ranked 16th in the World in relative terms. Nevertheless, these inflows are understated because a significant amount of remittances flow through informal channels. The major remittance markets are USA (68%), U.K. (11%), and Canada (10%), among others (Roberts, 2006; World Bank, 2012). A summary of Guyana's economic profile is given in Table 1.

As noted in Fig. 1, although there is a slight increase in domestic credit between 1982 and 2003, it has remained below 65 percent of GDP. Moreover, there has been some volatility in aid inflows (ODA as a percent of GDP) over the sample period. On the other hand, the remittances inflow has increased significantly since early 2000. It is also noted that the remittances inflow has been relatively stable, indicating some resilience from economic shocks.

The role of remittances in economic growth has been studied vastly. However, in the case of Guyana, the subject is not well explored. Subsequently, in this paper, we advance our study by exploring the nexus between remittances, financial deepening and official development assistance (ODA) vis-à-vis growth. We hypothesize that the remittances inflow has a plausible positive effect on growth in Guyana given its history of migration and the recent surge in remittances. However, we give equal importance to the role of financial deepening measured by domestic credit to private sectors and aid in the development process. However, their respective impacts will depend on the degree of financial depth and aid management and deployment strategies over the years, respectively. The structure of the article is as follows. Section 2 provides a brief literature survey on selected variables. Section 3 discusses the method and data. Section 4 provides regression and Granger-causality test results. Conclusions with some limitations are presented in Section 5.

2. Remittances, aid and financial deepening

Remittance inflows are often defined as private income sent back to the remaining family unit in the home country from one or more family members living and working abroad (Chami et al., 2006). At a global level, remittances have surpassed the official development assistance (ODA) of developing

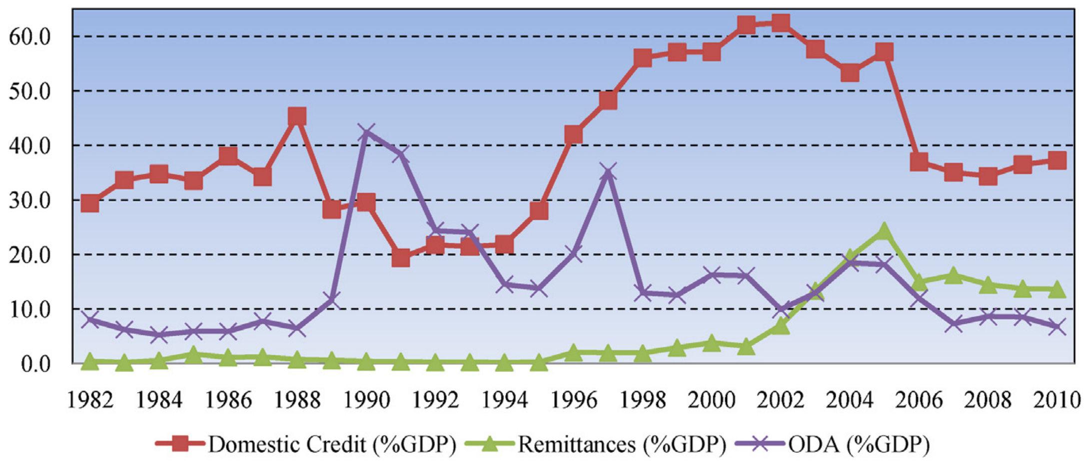

Fig. 1. Financial deepening, ODA & remittances in Guyana.

countries and remittances flowing to developing countries have increased from US$22 billion (1985–1990) to US$325 billion (2010) (Mohapatra et al., 2011).

Remittances have a welfare enhancing effect, particularly when supporting consumption, capital investment, education and human capital development, entrepreneurship, and poverty reduction efforts (Buch and Kuckulenz, 2010; Rao and Hassan, 2012a). However, given the high remittance transfer costs through formal channels (such as banking services), in most cases remitters prefer to send money via informal channels which often include postal mail, visiting migrants or migrant's relatives and friends, and informal money transfer services (IFTs) (Coxhead and Linh, 2010; Hernández-Coss, 2005). The formal channels used by remitters often include Western Union money transfers, bank drafts, and automated teller machines (ATM). It has also been argued that the job stability of the remitter and the economic performance of the remittance-sending country have a significant influence on remittance flows to a receiving country (Maldonado et al., 2011).

The motivation of foreign aid has generally been modeled in terms of donor self-interest and recipient needs, and improving growth and international income distribution (Maizels and Nissanke, 1984; McKinlay and Little, 1979; Trumbull and Wall, 1994). It has been noted that per capita income growth rates of previous years have some influence on aid granting decisions of donors. For example, Sobhee and Nath (2007a) show that high-income countries, such as Botswana and Mauritius, have not benefitted as much from external assistance as low-income countries like Mozambique and Bangladesh. Moreover, many countries have benefitted from project-specific assistance on education, health or human capital formation in their early stages of development because of a relatively larger size of grants at the initial stages of development (Sobhee and Nath, 2007b).

Various scholars have argued that aid has a positive contributory power toward growth and the magnitude of the impact depends on the recipient country's policy, aid management and accountability, and geopolitical factors (Burnside and Dollar, 2000; Collier and Dollar, 2002). It has also been argued that aid mismanagement, which results mostly when donors give complete control to the recipient country, gives way to corruption, poverty and bureaucracy (Angeles and Neanidis, 2009; Ayodele et al., 2005). On the other hand, some scholars have counter-argued that foreign aid can be harmful or ineffective when donors direct the use of aid to implement their own projects and programs (Banerjee and Rondinelli, 2003; Dalgaard, 2008; Durbarry et al., 1998; Gomanee et al., 2005; Hansen and Tarp, 2000, 2001).

The role of financial sectors is often measured by their ability to expedite growth and development. The dynamics of financial systems is often characterized by their ability to produce information about possible investments ex ante, to mobilize and pool savings and allocate capital, to monitor investments and exert corporate governance after providing finance, to facilitate the trading, diversification and management of risk, and to ease the exchange of goods and services (Beck et al., 2000; Greenwood and Jovanovic, 1990; McKinnon, 1973; Levine, 1997). Moreover, greater accessibility of financial services to more individuals spreads out risk, which in turn boosts investment activity in both physical and human capital, thus supporting output growth. However, the efficiency of financial services is compromised with suboptimal outcomes in financing and investment activities when there are high degrees of asymmetric information, externalities in financial markets, and imperfect or weak competition resulting in undesirable consequences like bank runs, fraud or credit constraints (Stiglitz and Weiss, 1991, 1992). Hence, in order to ensure successful financial liberalization and foster the efficient operation of financial markets, institutional factors such as legal infrastructure, bankruptcy code, accounting norms, disclosure rules and prudential regulations are very important (Aivazian, 1998).

Three indicators are often used to assess financial deepening. These include bank credit to private sectors as a percent of GDP, turnover rate of stock market or ratio of shares traded to GDP, and the extent of shareholder and creditor protection as part of the legal or regulatory characteristics of the financial system. It is argued that greater financial depth measured by the ratio of financial asset to income is associated with higher levels of productivity and thus per capita income (King and Levine, 1993a,b; Levine and Zervos, 1998). Moreover, the nexus between financial development and growth has been researched widely. For instance, in a recent study, Hassan et al. (2011) find that there has been a positive association between finance and economic growth for developing countries but contradictory results for high-income countries. The consensus of various other studies is that there is a positive correlation between financial development and economic growth despite mixed views on the direction of causality between the two (Khan and Senhadji, 2003; Odhiambo, 2010; Savvides, 1995).

Although the banking sector provides a number of services such as ATM, credit card, funds transfer, check payment, funds deposit, balance enquiry, utility bills, and statement of account, remittances, draft, pay order, phone banking, and mobile banking, the actual link of these services with remittance transfers and development goals remains scant.

Very few studies have looked at the impact of remittance inflows on growth in Guyana. In a study by Agarwal and Horowitz (2002) using household level data, the authors conclude that remittances to Guyana are predominantly motivated by altruism. There are some broader regional level studies that include Guyana. For instance, Diego (2009) finds that the financial sector in Guyana has a very low participation in the remittances market relative to all other Latin American countries. Using a dataset for remittances covering about 100 developing countries including Guyana, Giuliano and Ruiz-Arranz (2009) find that remittances boost growth in countries with less developed financial systems by providing an alternative way to finance investment and help overcome liquidity. Similarly, using a panel of 66 developing countries, including Guyana, over the period 1991–2005, Bettin and Zazzaro (2009) show that an efficient banking system complements the positive effect of remittances on GDP growth. Mundaca (2009) uses panel data estimation on selected countries in Latin America and the Caribbean (including Guyana) and discovers that remittances and financial development have a positive and significant effect on growth. However, the study finds a relatively high contribution from remittances (0.47%), which seems a little too ambitious. Further, remittance flows not only relax liquidity constraints and guarantee access to credit, but can also contribute to funding growth-enhancing projects when mediated by an efficient banking system. This is confirmed in a study by Aggarwal et al. (2011) using data on remittance flows for 109 developing countries including Guyana over the period 1975–2007, which reveals the existence of a positive and significant link between remittances and financial sector development.

In summary, the above literature highlights the multi-pronged effect that remittances, aid and financial deepening have on economic growth. However, the nexus between these variables remains controversial primarily due to the methods and approaches that are used in analyzing their plausible effects. Our study presents a method adapted from Rao (2010) and the technique developed by Pesaran et al. (2001) to estimate the plausible effects of remittances besides financial deepening and ODA.

3. Method and data

3.1. Method

The method is simple in its construction. Similar to Rao (2010), Rao and Takirua (2010) and Rao and Hassan (2012a,b), we use the conventional Cobb-Douglas type production function within the augmented Solow framework (Solow, 1956). The per worker output (y_t) equation is defined as:

$$y_t = A_t k_t^{\alpha}, \quad \alpha \in (0,1) \tag{1}$$

where A = stock of technology and k = capital per worker, and α is the profit share. The Solow model assumes that the evolution of technology is given by

$$A_t = A_0 e^{gT} \tag{2}$$

where A_0 is the initial stock of knowledge and T is time.

It is also plausible to assume for our purpose that:

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

where

y = output per worker in Guyanese dollars deflated at 2010 prices;
k = capital per worker in Guyanese dollars deflated at 2010 prices;
REM = workers' remittances as a percent of GDP;
ODA = net official development aid as a percent of GDP;

FIN = domestic credit to private sectors as a percent of GDP, which is a proxy for financial deepening; and
T = trend or time.

The effect of *REM*, *ODA* and *FIN* on total factor productivity (TFP) can be captured with *REM*, *ODA* and *FIN* entering as shift variables into the production function (Rao, 2010). Subsequently,

$$A_t = A_0 e^{gT} REM_t^{\beta} ODA_t^{\lambda} FIN_t^{\gamma} \tag{4}$$

and

$$y_t = (A_o e^{gT} REM_t^{\beta} ODA_t^{\lambda} FIN_t^{\gamma}) k_t^{a} \tag{5}$$

The above can be formulated as:

$$\Delta Ly^* = g + \beta \Delta LREM + \lambda \Delta LODA + \gamma \Delta LFIN \tag{6}$$

where the term ΔL denotes the partial differential of logs of respective variables and the intercept term, *g*, is the *TFP*, which is compactly defined.

3.2. Data

We used annual data from 1982 to 2010, sourced from the *World Development Indicators and Global Development Finance* database (World Bank, 2012). Moreover, missing data for workers' remittances (in current Guyanese dollars) from 1985 to 1991 was estimated using the average growth rate of remittances for all other years for which data was available, and then divided by the respective year's nominal GDP to obtain the ratio in percent.[1] Capital stock was built using the perpetual inventory method, where gross fixed capital formation was used as a proxy for investment.[2] All variables were duly transformed into log form before carrying out the regression analysis.

3.3. ARDL approach

The auto-regressive distributed lag (ARDL) bounds testing procedure is used because it is relatively simple and recommended for small sample sizes (Pesaran et al., 2001). We carry out the unit root test in order to determine whether the variables used in the study are at most integrated of order one (I(1)), i.e. the variables are at most stationary in their first differences. Moreover, performing the unit root test helps us to conduct a robust causality assessment. Subsequently, we used the ADF and Phillips–Perron tests to examine the time series properties of the variables and compute the unit root statistics. The test statistics show that all variables are stationary at most in their first differences (Table 2).

The ARDL equation is specified as follows[3]:

$$\begin{aligned}\Delta Ly_t = {} & \beta_{10} + \beta_{11} Ly_{t-1} + \beta_{12} Lk_{t-1} + \beta_{13} LREM_{t-1} + \beta_{14} LODA_{t-1} + \beta_{15} LFIN_{t-1} + \beta_{16} TREND \\ & + \sum_{i=1}^{p} \alpha_{11i} \Delta Ly_{t-i} + \sum_{i=0}^{p} \alpha_{12i} \Delta Lk_{t-i} + \sum_{i=0}^{p} \alpha_{13i} \Delta LREM_{t-i} + \sum_{i=0}^{p} \alpha_{14i} \Delta LODA_{t-i} \\ & + \sum_{i=0}^{p} \alpha_{15i} \Delta LFIN_{t-i} + \varepsilon_{1t}\end{aligned} \tag{7}$$

---

[1] The missing data for remittances was therefore approximated using the average growth formula: $REM_t = \exp^{(In^{(REM_{t-1})} + \hat{g}_{REM})}$ where $\hat{g}_{REM}$ is the average growth rate of remittances for available data.

[2] Capital stock, K_t, is defined as $K_t = (1 - \delta)K_{t-1} + I_t$, where δ is the depreciation rate and I_t is investment in constant Guyanese dollars deflated at 2010 prices. Labor stock is estimated from the employment to population ratio. We used $\delta = 0.35$ and initial K_0 is set as 1.2 times the 1981 GDP deflated at 2010 prices.

Table 2
Results of unit root tests.

Variables in log form	ADF		Phillips and Perron	
	Level	First difference	Level	First difference
Ly_t	−4.29	−3.39**	−2.58	−3.35**
Lk_t	−1.05	−4.59***	−1.26	−3.04**
$LREM_t$	−0.76	−5.01***	−0.78	−5.02***
$LODA_t$	−2.41	−4.92***	−1.99	−4.84***
$LFIN_t$	−1.59	−5.49***	−1.76	−5.52***

The ADF critical values are based on McKinnon. The optimal lag is chosen on the basis of the Akaike Information Criterion (AIC). The null hypothesis for both ADF and Phillips–Perron tests in a series has a unit root (non-stationary).
** The rejection of the null hypothesis of unit root at 5% level of significance.
*** The rejection of the null hypothesis of unit root at 1% level of significance.

Table 3
Results of bound tests.

Dependent variable		Computed F-statistic
Ly_t		5.73*
Lk_t		3.77
$LREM_t$		1.76
$LODA_t$		0.59
$LFIN_t$		2.81
Pesaran et al. (2001)		
Critical Value	Lower bound value	Upper bound value
1 per cent	4.40	5.72

Critical values are obtained from Pesaran et al. (2001), Table CI.v: Case V with unrestricted intercept and unrestricted trend, p. 301.
* Significance at 1% level.

3.4. Bounds test results

In examining the cointegration relationship, two steps are involved. First, Eq. (7) is estimated by the ordinary least squares technique. Second, the existence of a long-run relationship is traced by imposing a restriction on all estimated coefficients of lagged level variables equating to zero. Hence, in essence, the bounds test is based on the F-statistics (or Wald statistics) with the null hypothesis of no cointegration ($H_0 : \beta_{i1} = \beta_{i2} = \beta_{i3} = \beta_{i4} = \beta_{i5} = 0$) against the alternative hypothesis of the existence of long-run cointegration ($H_1 : \beta_{i1} \neq 0; \beta_{i2} \neq 0; \beta_{i3} \neq 0; \beta_{i4} \neq 0; \beta_{i5} \neq 0$). The results of the bounds tests (Table 3) confirm the presence of a long-run relationship when only real output per worker (Ly_t) is set as the dependent variable. The computed F-statistic for Ly_t is 5.73, which is statistically significant at the 1 percent level.

4. Regression and Granger-causality results

4.1. Diagnostic test results

After confirming the existence of a long-run relationship between Ly_t with Lk_t, $LREM_t$, $LODA_t$ and $LFIN_t$, the diagnostic tests were reviewed from the ARDL lag estimates.[4] These include: (a) the Lagrange multiplier test of residual serial correlation, (b) Ramsey's RESET test using the square of the fitted values for correct functional form, (c) a normality test based on a test of skewness and kurtosis of

[3] Other cointegration specifications were tested by setting Lk_t, $LREM_t$, $LODA_t$, and $LFIN_t$ as the dependent variable, respectively. To conserve space, their respective regression specifications are not shown.

Table 4
Diagnostic tests – from the ARDL approach: ARDL(1,2,0,2,0).

Test types	LM version	*p*-Value	*F* version	*p*-Value
Serial correlation	$\chi^2(1)=1.1609$	0.281	$F(1,15)=0.6739$	0.425
Functional form	$\chi^2(1)=0.1076$	0.743	$F(1,15)=0.0600$	0.810
Normality	$\chi^2(2)=0.3515$	0.839	Not applicable	
Heteroscedasticity	$\chi^2(1)=3.7705$	0.052	$F(1,25)=4.0578$	0.055

ADL lag estimates test statistics			
R-squared	0.9967	*R*-bar-squared	0.9947
S.E. of regression	0.0160	*F*-stat. *F*(10, 16)	494.36
Mean of dependent variable	13.606	S.D. of dependent variable	0.2211
Residual sum of squares	0.0041	Equation log-likelihood	80.379
Akaike Info. criterion	69.379	Schwarz Bayesian criterion	62.252
DW-statistic	2.3267		

residuals and (d) a heteroscedasticity test based on the regression of squared residuals on squared fitted values. The results show that the equation performed well as the disturbance terms are distributed normally and are serially uncorrelated with the homoscedasticity of residuals, duly confirming that the model has a correct functional form (see Table 4). Moreover, the CUSUM and CUSUM of Squares plot show that the parameters of the model are relatively stable over time (Figs. 2 and 3).

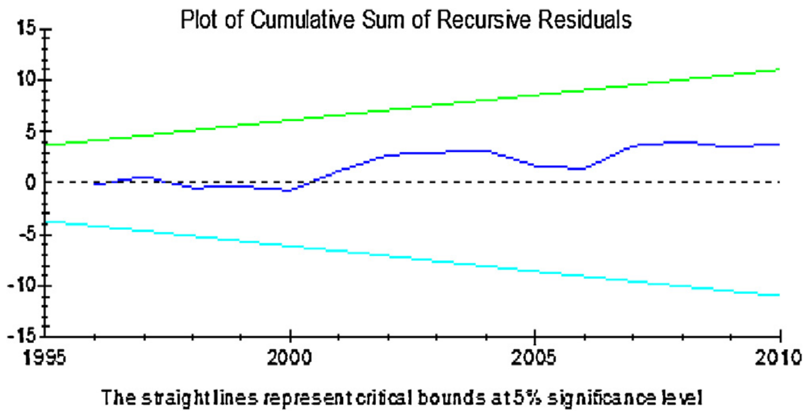

Fig. 2. Plot of cumulative sum of recursive residuals.

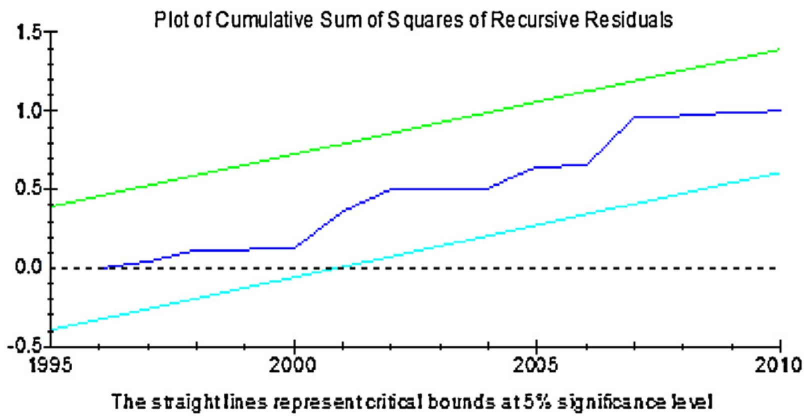

Fig. 3. Plot of cumulative sum of squares of recursive residuals.

Table 5
Estimated long-run coefficients and error correction representation: ARDL(1,2,0,2,0).

Long-run: dependent variable Ly_t				Short-run: dependent variable ΔLy_t			
Regressor	Coefficient	t-Ratio		Regressor	Coefficient	t-Ratio	
Lk_t	0.6890	10.6387	***	ΔLk_t	0.4134	4.8405	***
$LREM_t$	0.0303	3.2013	***	ΔLk_{t-1}	−0.3069	−2.9741	***
$LODA_t$	−0.0229	−1.8188	*	$\Delta LREM_t$	0.0293	3.3020	***
$LFIN_t$	−0.0192	−0.6411	n.s.	$\Delta LODA_t$	−0.0075	−0.7473	n.s.
$Constant_t$	4.2124	5.4028	***	$\Delta LODA_{t-1}$	0.0147	1.4189	n.s.
$TREND$	0.0127	7.2320	***	$\Delta LFIN_t$	−0.0187	−0.6965	n.s.
				$Constant_t$	4.0748	2.7450	**
				$TREND$	0.0123	3.3771	***
				ECT_{t-1}	−0.9673	−4.6581	***

n.s. = not significant within 1–10 percent level of significance.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

4.2. Long-run and short-run results

The long-run capital share is about 698.9 percent (Lk_t = 68.9%), which is significant at the 1 percent level. As noted, the results show that the capital share is close to two thirds, which is relatively higher than the stylized value of one third ascertained for developed countries. The results show that workers' remittances are positive and significant ($LREM_t$ = 3.00%) at the one percent level, contributing about 3 percent to GDP in the long run, while ODA is negative ($LODA_t$ = −2.30%) and significant at the 10 percent level. On the other hand, we find that financial development is not statistically significant, both in the long and short run.

In the short run (using the first difference model), the capital productivity in the current period (ΔLk_t = 41.3%) is about 41.3 percent with a lag-one negative effect. Workers' remittances are positive and significant at the one percent level, contributing about 2.9 percent ($\Delta LREM_t$ = 2.93%). On the other hand, official development aid and domestic credit to the private sector (a proxy for financial deepening) is not statistically significant in the short run.

The error correction term (ECT_{t-1} = −96.70%), which measures the speed at which prior deviations from the equilibrium are corrected, has the correct (negative) sign and is significant at the 1 percent level, duly indicating a relatively speedy convergence to long-run equilibrium (Table 5).

4.3. Granger causality test

Next, we conduct the Granger-causality test to identify the direction of causality. We use the vector autoregressive (VAR) model with variables in first difference, since they are stationary (cf. Table 2). In order to perform the Granger-causality test (Granger, 1988), the specification of the possible causal linkages between the endogenous variables, which are ΔLy, ΔLk, $\Delta LREM$, $\Delta LODA$, and $\Delta LFIN$, were tested in a VAR system. In a VAR model, a block-exogeneity causality test looks at whether lags of any variables Granger-cause any other variable in the system. Hence, the potential causality patterns are represented by the following VAR specification[5]:

$$\Delta Ly_t = \alpha_{10} + \sum_{i=1}^{p}\alpha_{11i}\Delta Ly_{t-i} + \sum_{i=0}^{p}\alpha_{12i}\Delta Lk_{t-i} + \sum_{i=0}^{p}\alpha_{13i}\Delta LREM_{t-i} + \sum_{i=0}^{p}\alpha_{14i}\Delta LODA_{t-i} + \sum_{i=0}^{p}\alpha_{15i}\Delta LFIN_{t-i} + u_{1t} \quad (8)$$

[4] The ARDL lag estimation results, which precede the long- and short-run estimation, are not included here. We only provide the diagnostic tests in order to ascertain the robustness of the estimated long- and short-run results.

Table 6
VAR(2) granger causality/block exogeneity Wald tests.

Excluded variable	Dependent variable (χ^2)				
	ΔLy	ΔLk	$\Delta LREM$	$\Delta LODA$	$\Delta LFIN$
ΔLy	–	2.8254 (0.2435)	2.3866 (0.3032)	1.4108 (0.4939)	11.278*** (0.0036)
ΔLk	9.7361*** (0.0077)	–	18.651*** (0.0001)	1.8811 (0.3904)	3.9006 (0.1422)
$\Delta LREM$	3.9072 (0.1418)	3.1254 (0.2096)	–	3.4216 (0.1807)	0.8523 (0.6530)
$\Delta LODA$	0.1029 (0.9498)	5.1430* (0.0764)	10.850*** (0.0044)	–	0.9336 (0.6270)
$\Delta LFIN$	0.1419 (0.9315)	3.6418 (0.1619)	6.6364** (0.0362)	0.2855 (0.8670)	–
All	16.557** (0.0351)	9.2869 (0.3187)	30.230*** (0.0002)	10.653 (0.2221)	18.432** (0.0182)

df = 2. *p*-Value in parenthesis.
* Refers to 10%.
** Refers to 5%.
*** Refers to 1%.

The Wald test, which follows the chi-square (χ^2) distribution, is computed to test the causal relations among ΔLy, ΔLk, $\Delta LREM$, $\Delta LODA$, and $\Delta LFIN$ based on the multivariate VAR framework. Before the Granger causality tests are conducted, the order of lag length for the unrestricted VAR has to be identified. The optimal lag is chosen on a set of statistical selection information criterions viz. Likelihood ratio (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz criterion (SC), and Hannan–Quinn information criterion (HQ). The VAR order selection criteria based on LR, FPE and HQ indicate a lag-length of 2 as ideal for the test. Moreover, the roots of the characteristic autoregressive (AR) polynomial have absolute values less than one and lie inside the unit circle, indicating that the VAR model is stationary.[6]

The Granger-causality test results (Table 6) indicate that capital stock causes output ($\chi^2 = 9.7361$) at the one percent level of significance and that there exists a weak causation from all excluded variables on output ($\chi^2 = 16.557$) at the five percent level of significance. Moreover, we also find that causation runs from ODA to capital stock ($\chi^2 = 5.1430$) at the 10 percent level of significance, which is justified when aid inflows are predominantly deployed in infrastructure development and the expansion of other physical capital. Furthermore, capital stock ($\chi^2 = 18.651$), ODA ($\chi^2 = 10.850$) and financial deepening ($\chi^2 = 6.6364$) cause remittance inflows and all excluded variables have relatively strong causation on remittance inflows. Capital stock and financial development tend to encourage remittances through investment channels and in cases where aid inflows are low, particularly in times of crisis, remittances tend to flow in relatively large amounts. Finally, it is noted that output causes financial deepening ($\chi^2 = 11.278$) at the one percent level of significance (Khan and Senhadji, 2003; Savvides, 1995).

5. Conclusions and limitations

Using the augmented Solow framework (Rao, 2010; Rao and Hassan, 2012b), bounds procedure, and Granger-causality test, we explored the plausible nexus between remittances, aid and financial deepening vis-à-vis growth in Guyana. Our study used annual data from 1982 to 2010. The results show that the remittances inflow is positive and statistically significant in both the short and the long run. Therefore, our study posits that remittances matter for countries like Guyana, which has a relatively small economy and a developing financial sector (Diego, 2009; Giuliano and Ruiz-Arranz,

[5] Other equations in the Granger-causality specifications were tested by setting ΔLk_t, $\Delta LREM_t$, $\Delta LODA_t$, and $\Delta LFIN_t$ as the dependent variable, respectively. To conserve space, their respective regression specifications are not shown.
[6] To conserve space, we did not include the optimal lag-length table and the inverse roots of AR characteristic polynomial diagram here. However, it is available upon request.

2009; Mundaca, 2009). On the other hand, the effect of aid (ODA) on growth is not significant in the short run and negative in the long run, thus calling for a more vigilant look at the aid deployment and management aspects. The effect of financial deepening is not significant in our results. This is plausible because of the low share of domestic credit (as a percent of GDP) over the sample period, which is indicative of weak financial intermediation (Diego, 2009). Subsequently, one may consider the possibility of expanding credit and linking the remittances inflow with cost-effective financial services including remittance transfer services. The Granger-causality test provides some important linkages worth noting. We find that capital stock causes output, aid causes capital stock, capital stock, aid and financial deepening cause remittances inflow, and output causes financial deepening.

However, there are some limitations to our study. Firstly, given the paucity of data on remittances, our analysis was confined to a relatively small sample size. We used a relatively high depreciation rate to compute capital stock in order to ensure that per worker capital stock exhibits diminishing returns to scale over time. Furthermore, our long-run capital share is 0.689 (68.9%), which is relatively higher than the usual stylized value of 0.33 (33.3%). A relatively high capital share is due to a couple of reasons. Firstly, when capital and labor inputs tend to grow at relatively similar rates; secondly, when economies of developing countries such as Guyana have large numbers of self-employed persons who derive income from both capital and their own labor, thus making it difficult to obtain meaningful measures of income shares; and, thirdly, because of the poor quality of data and the small sample size (Bosworth and Collins, 2008). We concur with all the aforementioned reasons in our study. Finally, we did not explore the interaction effect of remittances with financial development and its consequent impact on growth because of the small sample size resulting in multicollinearity problems. Nevertheless, we hope that our specifications based on the Solow growth model and methods of analysis to estimate the long-run growth effects of remittances, aid and financial deepening will interest others working on the sources of growth in Guyana and other developing countries.

References

Aggarwal, R., Demirguc-Kunt, A., Peria, M.S.M., 2011. Do remittances promote financial development. Journal of Development Economics 96, 255–264.

Agarwal, R., Horowitz, A.W., 2002. Are international remittances altruism or insurance? Evidence from Guyana using multiple-migrant household. World Development 30, 2033–2044.

Aivazian, V.A., 1998. Microeconomic elements and perspectives from finance theory. In: Fanelli, J.M., Medhora, R. (Eds.), Financial Reform in Developing Countries. International Development Research Centre, Canada.

Angeles, L., Neanidis, K.C., 2009. Aid effectiveness: the role of the local elite? Journal of Development Economics 90, 120–134.

Ayodele, T., Cudjoe, F., Nolutshungu, T.A., Sunwabe, C.K., 2005. African perspectives on aid: foreign assistance will not pull africa out of poverty. Economic Development Bulletin 2, 1–4.

Banerjee, S.G., Rondinelli, D.A., 2003. Does foreign aid promote privatization? Empirical evidence from developing countries?. World Development 31, 1527–1548.

Beck, T., Levine, R., Loayza, N., 2000. Finance and the sources of growth. Journal of Financial Economics 58, 261–300.

Bettin, G., Zazzaro, A., 2009. Remittances and Financial Development: Substitute or Complements in Economic Growth? Working Paper 28, Money & Finance Research Group, Germany http://dea2.univpm.it/quaderni/pdfmofir/Mofir028.pdf (Accessed 29.08.12).

Bosworth, B., Collins, S.M., 2008. Accounting for growth: comparing China and India. Journal of Economic Perspectives 22, 45–66.

Buch, M.C., Kuckulenz, A., 2010. Worker remittances and capital flows to developing countries. International Migration 48, 89–117.

Burnside, C., Dollar, D., 2000. Aid, policies, and growth. The American Economic Review 90, 847–868.

Chami, R., Cosimano, T.F., 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, DC.

Collier, P., Dollar, D., 2002. Aid allocation and poverty reduction. European Economic Review 45, 1–26.

Coxhead, I., Linh, V.H., 2010. The Effects of Global Shocks on Poverty in Vietnam. Institute of Social Economic Research, Osaka University, Japan.

Dalgaard, C.J., 2008. Donor policy rules and aid effectiveness? Journal of Economic Dynamics and Control 32, 1895–1920.

Debra, R., 2006. The Development Impact of Remittances on Caribbean Economies. The Case of Guyana, Central Bank of Guyana https://uwivet.edu/conferences/salises/documents/Roberts%20D.pdf (accessed 29.08.12).

Diego, H., 2009. Remittances and Financial Development in Latin America. School of Business and Economics – Institute of Public Economics, Humboldt-Universitat, Berlin, Germany (MA Thesis).

Durbarry R., Gemmell N., Greenaway D., New evidence on the impact of foreign aid on economic growth. CREDIT Research Paper 98/8, 1998, University of Nottingham.

Giuliano, P., Ruiz-Arranz, M., 2009. Remittances, financial development, and growth. Journal of Development Economics 90, 144–152.

Gomanee, K., Girma, S., Morrisey, O., 2005. Aid and growth in Sub-Saharan Africa: accounting for transmission mechanisms. Journal of International Development 17, 1055–1075.
Granger, C.W.J., 1988. Some recent developments in a concept of causality. Journal of Econometrics 39 (1–2) 199–211.
Greenwood, J., Jovanovic, B., 1990. Financial development, growth, and the distribution of income. Journal of Political Economy 98, 1076–1107.
Hansen, H., Tarp, F., 2001. Aid and growth regressions. Journal of Development Economics 64, 547–570.
Hansen, H., Tarp, F., 2000. Aid effectiveness disputed. Journal of International Development 12, 375–398.
Hassan, M.K., Sanchez, B., Yu, J., 2011. Financial development and economic growth: new evidence from panel data. The Quarterly Review of Economics and Finance 51, 88–104.
Hernández-Coss, R., 2005. The Canada-Vietnam Remittance Corridor – Lessons on Shifting from Informal to Formal Transfer Systems. World Bank Working Paper No. 48. World Bank.
Khan, M., Senhadji, A., 2003. Financial development and economic growth: a review and new evidence. Journal of African Economies 12, 89–110.
King, R.G., Levine, R., 1993a. Finance and growth: Schumpeter might be right. Quarterly Journal of Economics 108, 717–737.
King, R.G., Levine, R., 1993b. Finance, entrepreneurship and growth: theory and evidence. Journal of Monetary Economics 32, 513–542.
Levine, R., Zervos, S., 1998. Stock markets, banks, and economic growth. American Economic Review 88, 537–558.
Levine, R., 1997. Financial development and economic growth: views and agenda. Journal of Economic Literature 35, 688–726.
Maizels, A., Nissanke, M.K., 1984. Motivations for aid to developing countries. World Development 12, 879–900.
Maldonado, R., Bajuk, N., Hayem, M., 2011. Remittances to Latin America and the Caribbean in 2010: Stabilization after the Crisis. Multilateral Investment Fund. Inter-American Development Bank, Washington, DC http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=35788832 (accessed 06.09.12).
McKinlay, R.D., Little, R., 1979. The US aid relationship: a test of the recipient need and the donor interest model. Political Studies 27, 250–263.
McKinnon, R.I., 1973. Money and Capital in Economic Development. Brookings Institution, Washington, DC.
Mohapatra, S., Ratha, D., Silwal, A., 2011. Migration and Development Brief 17. World Bank, Washington, DC.
Mundaca, B.G., 2009. Remittances, fiancial market development, and economic growth: the case of Latin America and The Caribbean. Review of Development Economics 13, 288–303.
Odhiambo, N.M., 2010. Finance-investment-growth nexus in South Africa: an ARDL-bounds testing procedure. Economic Change and Restructuring 43, 205–219.
Pesaran, M.H., Shin, Y., Smith, R., 2001. Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics 16, 289–326.
Rao, B.B., 2010. Estimates of the steady state growth rates for selected Asian countries with an extended Solow Model. Economic Modelling 27, 46–53.
Rao, B.B., Hassan, G.H., 2012a. Are the direct and indirect growth effects of remittances significant? World Economy 35, 351–372.
Rao, B.B., Hassan, G.H., 2012b. An analysis of the determinants of the long-run growth rate of Bangladesh. Applied Economics 44, 565–580.
Rao, B.B., Takirua, T., 2010. The effects of exports, aid and remittances on output: the case of Kiribati. Applied Economics 42, 1387–1396.
Savvides, A., 1995. Economic growth in Africa. World Development 23, 449–458.
Sobhee, S.K., Nath, S., 2007a. Aid motivation and donor behavior. American Review of Political Economy 5, 1–13.
Sobhee, S.K., Nath, S., 2007b. Growth, income inequality and aid giving: looking for an aid-kuznet curve. Review of Applied Economics 3, 157–167.
Solow, R.M., 1956. A contribution to the theory of economic growth. Quarterly Journal of Economics 70, 65–94.
Stiglitz, J.E., Weiss, A., 1992. Asymmetric information in credit markets and its implication for macro-economics. Oxford Economic Papers 44, 694–724.
Stiglitz, J.E., Weiss, A., 1991. Credit rationing in market with imperfect information. American Economic Review 71, 393–410.
Trumbull, W.N., Wall, H.J., 1994. Estimating aid-allocation criteria with panel-data. Economic Journal 104, 876–882.
World Bank, 2012. World Development Indicators and Global Development Finance. World Bank, Washington, DC http://databank.worldbank.org/ddp/home.do?Step=1&id=4 (accessed 15.04.11).