Role of remittances in India's economic growth

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Abstract: India has been among the top ten remittance recipient countries in the world since the 1970s. In the context of the ongoing worldwide recession and uncertain export prospects, mobilisation of foreign exchange earnings has assumed greater importance. Given the intensification of financial sector development together with relatively stable capital inflows (FDI and ODA) and the efforts towards formalising the channels of remittance inflows, we find that remittances and the interaction between remittances and financial sector development have had a positive and significant effect on growth over the last four decades (1970–2009). In the light of these findings, it is proposed that the proactive policy measures in India should continue for encouraging remittance inflows for long-term growth and development.

Keywords: remittances; financial sector development, bounds test; economic growth; India.

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1   Introduction

India has been among the world's top ten remittance recipient countries since the 1970s. In absolute terms, India's inward remittances have been the highest in 2009. Official statistics show India received US $49.3 billion which formed 3.8% of GDP, compared to China's US $47.6 billion, which is around 1% of its GDP. Before the onset of the ongoing global economic crisis in 2008, high oil prices led to severe balance of payments problems for South Asian countries, including India. Although their exports to industrialised counties declined, slowdown in imports helped them contain trade and current account deficits. Added to the woes of the global economic crisis, Dubai's financial problems in late 2009 also caused concerns to all the remittance recipient countries in South Asia and India, in particular. However, the concerns were short lived, since the resilience of remittances, as in the past, continued to remain strong (UNESCAP, 2010; Gupta, 2010).

Further, there have been a number of supportive elements which contributed to the utilisation of remittance inflows for promoting economic growth. These included improved financial sector development and intensive efforts towards formalising the channels of remittance inflows through banking system rather than informal channels.

Noting the above developments, the objective of this paper is to examine the nexus between remittances, capital inflows, financial sector development and exports and economic growth in India. By adopting an augmented Solow model (Luintel et al., 2008; Rao et al., 2008), the study estimates the long-run relationship among these variables taking into account the impact of interaction between remittances and financial development.

The rest of the paper is organised into five sections. Section 2 provides a brief review of literature on the linkages between remittances and growth; Section 3 examines the trends in inward remittances against other capital inflows of India; Section 4 outlines the methodology adopted to undertake the empirical study and discusses the results. Section 5 presents conclusions with some policy implications.

2   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; 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 (UNESCAP, 2010).

In a panel data study, Ekanayake and Halkides (2008) find that remittances and foreign direct investment have positive effect on economic growth. Further, increase in the use of official channels to send money abroad such as wire transfers has also helped central banks in improving its remittance data management while the subsequent growth in remittance market has also created greater prospects in financial activities such as opening up of new personal loans and savings account (Jha et al., 2009; Jayaraman et al., 2009, 2010). As noted by Ratha et al. (2010), the continuous growth in remittances to Asian countries has been largely a result of the growth in the number of nationals living abroad and therefore, the degree of migration diversification over time tends to make remittances flows more resilient.

In the specific context of India, remittances have been found to be influenced by the growth in migration, the migrants' earnings and the economic environment in the source country (Gupta, 2010, 2005). Tax exemption on interest income earned on remittances has been a major attraction to the non-resident Indians (NRIs). The tax exemption was announced in the 1980s for improving the foreign reserves position, which was then in dire situation. With the tax exemption, NRIs were encouraged to open their deposit accounts in any recognised major foreign currencies, either as current, savings or long-term fixed deposits, in any commercial bank in India.

In the early 2000s, as the foreign reserves position improved, the central government considered a budget proposal, imposing a tax on interest income earned on foreign currency deposits of NRIs, which was received with great disappointment among the overseas Indians. Consequently, the budget proposal was withdrawn. Thus, the most important incentive of tax exemption is still continuing and most of the success in raising resources from the overseas Indians on a very basis is attributed to tax exemption, as a major incentive.

Secondly, central bank restrictions on limits of overseas remittances for NRIs, including the ten-year lock-in were eventually removed by early 1990s. Sending or remitting money to India for investment purpose is not difficult anymore. Further, NRIs can use cash out on the property they acquire in India and have also been offered an incentive to make investments in Indian real estate. Furthermore, Indians living abroad are allowed to remit money from the sale of immovable property. Among other strategies, some of the incentives targeting migrants and their remittances include provision of special access for migrants' children to public educational institutions; generous duty-free import limits for items of personal convenience; eligibility for special lotteries for prime plots in public housing schemes at attractive prices.

Aside from offering attractive interest rates, which are normally fixed at a rate higher than the London inter-bank offered rate (LIBOR), many commercial banks have launched remittance products with foreign tie-ups. With the help of money exchange service providers, one can send money directly into any bank account and make PayPal transfers. Most of these service providers offer round-the-clock customer support and mobile alerts. Further, overseas remittance services have been overtaken by online remittances.

A study by Reserve Bank of India (RBI) (2010) has shown that about 61% of the remittances in India are used for family maintenance while close to 27% are used for in productive investment and savings, the latter comprising about 20%. A large amount of remittances came from North America (38%), Gulf countries (27%) and Europe (18%).

Remittance inflows to India and other developing countries were affected by high transaction costs in the past. Some of the market factors determining the transaction cost of remittances include:

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

d   the extent to which consumers are aware of the various choices of services available to them.

Further, 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). Therefore, reduction in transaction costs overtime through greater competition among service providers and cheaper communication services have contributed to further growth in the volume of remittance inflows. As noted by RBI (2010) about 63% of remittances sent to India are via SWIFT and electronic wires, 22% by draft and checks, 10% by direct transfers, debit/credit cards, money orders among other means.

3   Trends in remittance inflows

Foreign direct investment and remittance inflows to developing countries have been growing since 1990 (Figure 1). The rising trend was temporarily reversed in 2009. While remittance inflows in 2009 declined by 7% from its previous year, foreign direct investment decreased by 45%, and official development assistance by 15%. On average, from 1990–2009, remittances grew at 12% per year, while foreign direct investment, portfolio equity and private non-guaranteed external debt, and official development assistance by 14%, 16% and 3% respectively.

Table 1 provides details of remittance flows to developing countries during 1970–2009. During the past ten years, India, China, Mexico, Philippines, France and Bangladesh registered high growth in remittance inflows (Table 2). While India, China, Mexico and France received large amounts in absolute terms, Philippines and Bangladesh have gained remittance prominence in relative terms. India received the highest amount of remittances in absolute terms ($49.3 billion) in 2009 which is about 3.8% of GDP ranked at world number four (Table 3). In terms of remittances as a percentage of GDP, Philippines recorded the highest (12.3%), closely followed by Bangladesh and Nigeria.

Table 1   Remittance outlook for developing countries

	1970–1980	1981–1990	1991–2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010*	2011*
Remittances in USD billions														
Developing countries	5.6	22.0	58.6	93.1	112.6	140.4	164.4	198.9	235.4	289.4	337.8	306.5	335.0	359.0
East Asia and Pacific	0.4	2.5	9.7	21.0	27.0	32.3	40.0	50.3	57.4	71.1	85.5	85.0	94.0	103.0
Europe and Central Asia	0.9	2.1	8.0	10.3	10.7	11.6	16.0	23.3	28.4	39.3	45.8	35.4	48.0	52.0
Latin America and Caribbean	0.5	3.3	13.0	24.4	28.2	36.8	43.4	50.1	59.2	63.3	64.6	56.9	60.0	64.0
Middle-East and North Africa	2.0	7.0	13.5	15.3	15.9	20.5	23.2	25.1	26.5	32.1	35.9	33.5	33.0	34.0
South Asia	1.4	5.7	11.1	19.2	24.1	30.4	28.7	33.9	42.5	54.0	71.6	74.9	79.0	83.0
Sub-Saharan Africa	0.4	1.5	3.3	4.7	5.1	6.0	8.0	9.4	12.7	18.6	21.4	20.8	22.0	23.0
Low-income countries	0.3	1.5	3.8	4.5	6.1	7.0	8.1	10.1	13.0	16.6	22.0	22.5	35.0	37.0
Middle-income countries	5.3	20.6	54.7	90.4	104.9	130.4	151.2	182.1	213.7	261.9	302.9	283.9	301.0	322.0
World	13.3	44.9	103.1	149.5	169.2	204.2	237.0	274.9	317.9	385.0	443.2	415.3	437.0	465.0
Growth rate (%)														
Developing countries		136.8	98.0	46.3	19.0	22.1	15.7	19.1	16.8	20.6	15.5	–9.7	8.9	6.9
East Asia and Pacific		171.4	137.3	77.0	25.2	17.8	21.5	22.9	13.3	21.3	18.4	–0.6	10.1	9.1
Europe and Central Asia		91.3	131.9	25.3	3.9	7.9	32.2	37.4	19.9	32.6	15.3	–25.8	30.4	8.0
Latin America and Caribbean		190.5	137.9	63.5	14.1	26.7	16.5	14.6	16.6	6.6	2.1	–12.8	5.3	6.5
Middle-East and North Africa		125.5	66.2	12.5	3.9	25.0	12.6	7.7	5.4	19.5	11.2	–6.9	–1.6	3.0
South Asia		141.0	66.0	54.9	23.0	23.0	–5.7	16.7	22.6	24.0	28.1	4.4	5.4	4.9
Sub-Saharan Africa		125.1	80.6	34.3	8.2	16.6	29.7	16.0	29.6	38.3	13.9	–2.5	5.5	4.4
Low-income countries		160.9	96.8	16.7	29.1	14.0	14.9	21.7	25.5	24.3	28.1	2.6	44.0	5.6
Middle-income countries		135.6	97.8	50.1	15.0	21.8	14.8	18.6	16.0	20.3	14.5	–6.5	5.8	6.7
World		121.7	83.1	37.2	12.4	18.8	14.9	14.8	19.2	14.1		–6.5	5.1	6.2

Note: *Indicates World Bank projected figures.

Source: World Bank (2009b), Migration and Development Brief 12 (2010) and authors own calculation based on absolute figures

Table 2   Remittances in US$ billion and in percentages of GDP: 1970–2009[a]

Year	India	China	Mexico	Philippines	France	Bangladesh	Spain	Germany	Nigeria	Belgium
1971–1980	0.75	0.57	0.61	0.49	1.25	0.14	1.68	0.65	0.01	0.87
	(0.57)	(0.33)	(0.33)	(1.91)	(0.25)	(0.97)	(1.10)	(0.11)	(0.03)	(0.94)
1981–1990	2.46	0.32	1.91	1.05	2.17	0.62	1.61	2.93	0.01	1.44
	(1.02)	(0.13)	(1.04)	(2.92)	(0.27)	(2.77)	(0.65)	(0.28)	(0.03)	(1.09)
1991–2000	7.44	2.15	5.04	4.63	6.57	1.33	3.34	4.35	0.94	4.45
	(1.96)	(0.24)	(1.26)	(6.62)	(0.47)	(3.37)	(0.57)	(0.21)	(2.89)	(1.82)
2001	14.27	7.04	10.15	8.77	9.19	2.10	5.09	3.93	1.17	3.93
	(2.99)	(0.53)	(1.63)	(12.31)	(0.69)	(4.48)	(0.84)	(0.21)	(2.43)	(1.70)
2002	15.74	10.96	11.03	9.74	10.36	2.86	5.58	4.68	1.21	4.67
	(3.10)	(0.75)	(1.70)	(12.67)	(0.71)	(6.01)	(0.81)	(0.23)	(2.05)	(1.86)
2003	21.00	15.06	16.56	10.24	11.31	3.19	6.57	5.78	1.06	5.99
	(3.50)	(0.92)	(2.36)	(12.86)	(0.63)	(6.15)	(0.74)	(0.24)	(1.57)	(1.93)
2004	18.75	20.19	19.86	11.47	12.28	3.58	7.53	6.58	2.27	6.86
	(2.60)	(1.05)	(2.61)	(13.20)	(0.60)	(6.34)	(0.72)	(0.24)	(2.59)	(1.90)
2005	22.13	24.10	23.06	13.57	11.95	4.31	7.96	6.93	3.33	7.24
	(2.64)	(1.07)	(2.72)	(13.73)	(0.56)	(7.15)	(0.70)	(0.25)	(2.97)	(1.92)
2006	28.33	27.95	26.88	15.25	13.03	5.43	8.89	7.57	5.44	7.49
	(2.99)	(1.03)	(2.82)	(12.98)	(0.58)	(8.77)	(0.72)	(0.26)	(3.70)	(1.88)
2007	37.22	38.79	27.14	16.30	14.44	6.56	10.74	9.90	9.22	9.10
	(3.02)	(1.11)	(2.65)	(11.32)	(0.56)	(9.59)	(0.75)	(0.30)	(5.56)	(1.99)
2008	49.94	48.52	26.30	18.64	16.41	8.94	11.81	10.91	9.98	10.26
	(4.11)	(1.07)	(2.41)	(11.13)	(0.58)	(11.24)	(0.74)	(0.30)	(4.82)	(2.03)
2009	49.26	47.55	22.15	19.77	15.55	10.52	9.90	10.88	9.58	10.36
	(3.76)	(0.95)	(2.53)	(12.32)	(0.59)	(11.77)	(0.68)	(0.33)	(5.67)	(2.21)

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

Figure 1 Remittances and capital flows to developing countries in USD billions (see online version for colours)
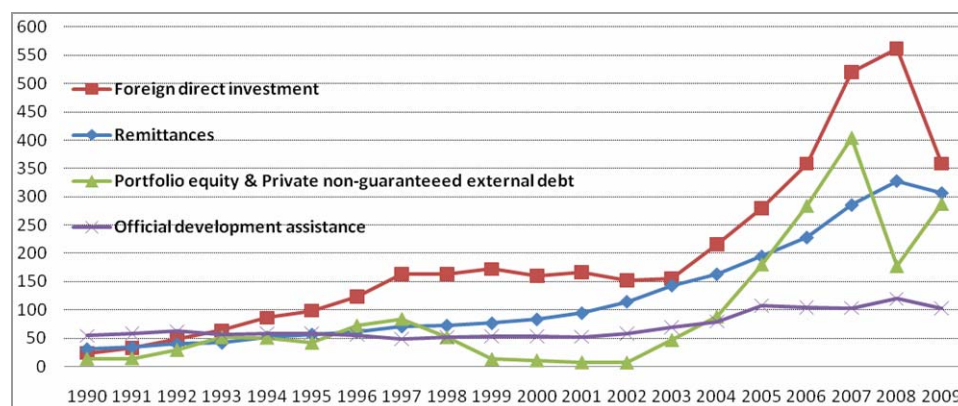
Table 3 Top ten remittance recipients of 2009

Country	Remittances	
	Percentage of GDP	*US$ (billions)*
Philippines	12.3	19.8
Bangladesh	11.8	10.5
Nigeria	5.8	9.6
India	3.8	49.3
Mexico	2.5	22.2
Belgium	2.2	10.4
China	1.0	47.6
Spain	0.7	9.9
France	0.6	15.6
Germany	0.3	10.9

Source: World Bank (2009a, 2009b)

3.1 Financial sector

There is a growing body of literature on how financial sector development plays a critical role in reallocating resources to the most productive investments, which in turn lead to higher economic growth. It has been documented that as remittances received by rural and urban households increase over time, surplus funds after satisfying consumption needs are increasingly mobilised by financial sector institutions. Consequently, additions to reserves in the banking system are lent out to private sector for investment in

activities, which are oriented towards production of agricultural exports (King and Levine, 1993; Beck et al., 2000; Levine et al., 2000).

India's financial sector consists of three main categories of banking institutions. These are: the public sector banks; private sector banks; and banks owned by foreign interests. The public sector banks include nationalised and state banking group (Table 4). There are seven banks in the State Bank Group and 20 nationalised banks. The financial system is primarily dominated by banks. However, the non-bank finance institutions play a crucial role in providing enhanced equity and risk based products. India's non-bank financial institutions (NBFIs) are diverse in size and functionality. The major intermediaries are the development finance institutions (DFIs), insurance companies, non-bank financial companies (NBFCs), primary deals (PDs) and capital market intermediaries such as mutual funds.

In recent macro-economic analysis, two indicators of financial sector development are widely used. One reflects financial deepening, which is the ratio of M2 (broad money defined as currency, demand, time and savings deposits) to GDP. The other is the availability of funds to private sector for investment, which is the ratio of bank credit to private sector to GDP. Table 5 shows the trends in the ratio of broad money (M2) to GDP during the period under study. Rising from an average of 20% during 1961–1970, it has increased steadily over time to reach an average of 44% during 1990–2000. It grew relatively faster thereafter, parking around 75% in 2009. In regard to private sector credit, the growth was equally impressive though not as spectacular as the growth of M2 as percentage of GDP. From a low figure of 10%, the ratio rose steadily, closing around 50% of GDP in 2009.

Table 4   India: financial system structure: 2009

Types of banks	Assets in millions of rupees	Percent in total assets	Number of institutions	Total assets (% of GDP)
Public sector banks[†]	37,667,160	71.9	27	60.4
Private sector banks	10,274,650	19.6	22	16.5
Foreign banks	4,471,490	8.5	32	7.2
Total	*52,413,300*	*100.0*	*81*	*84.1*

Note: [†]Public sector banks include nationalised banks and State Bank Group.

    Source: Reserve Bank of India

4   Data, modelling, methodology and results

Our empirical study focuses on the likely linkages between economic growth and remittances, facilitated by financial sector development during this period. Further, the study also takes into account the roles of two important capital inflows in India's economic growth ever since its independence. They are foreign direct investment and overseas development assistance (bilateral and multilateral) popularly known as foreign aid. In the context of paucity of disaggregated data, we employ aggregated data (Table 5), which are reported on an annual basis by the World Bank (2008, 2009a, 2009b).

Table 5 India: data on growth rates, remittances and financial indicators

Variables	GDP growth rate (%)	Remittances (REM % of GDP)	Exports of goods and services (XP % of GDP)	Money and quasi money (M2 % of GDP)	Private sector credit (FD % of GDP)	Foreign direct investment (FDI % GDP)	Official development assistance (ODA % GDP)
1961–1970	6.5	0.2	4.1	19.9	10.1	n.a.	2.26
1971–1980	3.1	0.6	5.5	26.1	18.5	0.01	1.13
1981–1990	5.6	1.0	6.1	37.2	28.1	0.05	0.74
1991–2000	5.5	2.0	10.6	44.0	24.6	0.46	0.58
2001	5.2	3.0	12.8	55.0	29.1	1.15	0.37
2002	3.8	3.1	14.5	59.0	32.8	1.11	0.35
2003	8.4	3.5	14.8	60.4	32.1	0.72	0.12
2004	8.3	2.6	17.6	59.0	35.6	0.80	0.11
2005	9.3	2.6	19.2	59.9	39.3	0.91	0.23
2006	9.4	3.0	21.3	61.6	43.3	2.14	0.15
2007	9.6	3.0	20.6	65.0	45.2	2.02	0.11
2008	5.1	4.1	23.5	70.0	49.0	3.40	0.18
2009	7.7	3.8	25.4	74.6	49.2	2.51	0.18

Notes: interval years denote averages; n.a. = not available

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

Between the two ratios, which are used as indicators of financial development, we choose the ratio of credit to private sector to GDP, since it has been increasingly recognised as a superior measure. The reasoning behind the choice is as follows: in the event of any rise in statutory reserve ratio, as part of monetary policy measures by RBI, commercial banks are required to keep higher reserves with central bank. Therefore, a mere rise in the ratio of M2/GDP by itself would not be a sufficient indicator. Availability of credit to private sector has been considered as a more appropriate measure, as it is directly related to the quantity of investment funds and hence to economic growth. Besides the financial sector variable, we also take into account one more variable, namely exports as a ratio of GDP for assessing its impact on growth in combination with remittances under the assumption that private sector credit would facilitate growth in export oriented investment activities.

4.1   The model

We hypothesise that:

1   remittances, expressed as percent of GDP positively affect economic activities

2   financial development (represented by domestic credit to private sector) expressed as percent of GDP, and output are directly related

3   interaction between financial sector development and remittances has a positive impact on output

4   exports (expressed as a percent of GDP) result in positive contribution to output

5   FDI and ODA have a positive influence on output.

We start from the Cobb-Douglas production function, along the lines employed by Luintel et al. (2008) and Rao et al. (2008) with constant returns and Hicks – neutral technical progress:

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

where

y per worker output

A stock of technology

k capital per worker

t time period.

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

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

where

A_o initial stock of knowledge

T time.

It is also plausible to assume for our purpose, as suggested by Rao et al. (2008) that

$$A_t = f\left(T, REM_t, FD_t, XP_t, FDI_t, ODA_t\right) \tag{3}$$

where

REM   workers' remittances as percent of GDP

FD   private sector credit by banks as percent of GDP

XP   exports of goods and services as percent of GDP

FDI   foreign direct investment as percent of GDP

ODA   overseas development assistance as percent of GDP.

The effects of REM_t, FD_t, XP_t, FDI_t, and ODA_t on total factor productivity (TFP) can be captured with the five shift variables into the production function[1]:

$$A_t = A_o e^{gT} REM_t^{\beta} FD_t^{\lambda} XP_t^{\delta} FDI_t^{\theta} ODA_t^{\pi} \tag{4}$$

$$y_t = \left(A_o e^{gT} REM_t^{\beta} FD_t^{\lambda} XP_t^{\delta} FDI_t^{\theta} ODA_t^{\pi}\right) k_t^{\alpha} \tag{5}$$

Data on remittances, financial indicators, FDI and ODA are sourced from *World Development Indicators* issued by World Bank (2009b). We employ the capital and labour stock data compiled and updated by Professor Barry Bosworth.[2]

4.2   Bounds testing approach

We resort to bounds testing approach under autoregressive distributed lag (ARDL) procedure developed by Pesaran et al. (2001). 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 procedure does not require pre-testing of unit roots for investigating co-integration 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 for conducting further analysis in terms of error-correction model (ECM) in first differences, if the variables are of I(1).

The next step is to test for co-integration using the ARDL bounds test developed by Pesaran et al. (2001), which can be estimated by ordinary least squares (OLS).[3] In the estimation procedure we add 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 ECM:

$$\Delta Ly_t = \beta_{10} + \beta_{11}Ly_{t-1} + \beta_{12}Lk_{t-1} + \beta_{13}LREM_{t-1} + \beta_{14}LFDI_{t-1} + \beta_{15}LODA_{t-1}$$

$$+ \beta_{16}LFD_{t-1} + \beta_{17}LXP_{t-1} + \beta_{18}LREMLFD_{t-1} + \beta_{19}TREND + \sum_{i=1}^{p}\alpha_{11i}\Delta Ly_{t-i}$$

$$+ \sum_{i=0}^{p}\alpha_{12i}\Delta Lk_{t-i} + \sum_{i=0}^{p}\alpha_{13i}\Delta LREM_{t-i} + \sum_{i=0}^{p}\alpha_{14i}\Delta LFDI_{t-i} + \sum_{i=0}^{p}\alpha_{15i}\Delta LODA_{t-i} \qquad (6)$$

$$+ \sum_{i=0}^{p}\alpha_{16i}\Delta LFD_{t-i} + \sum_{i=0}^{p}\alpha_{17i}\Delta LXP_{t-i} + \sum_{i=0}^{p}\alpha_{18i}\Delta LREMLFD_{t-i} + \varepsilon_{1t}$$

$$\Delta Lk_t = \beta_{20} + \beta_{21}Ly_{t-1} + \beta_{22}Lk_{t-1} + \beta_{23}LREM_{t-1} + \beta_{24}LFDI_{t-1} + \beta_{25}LODA_{t-1}$$

$$+ \beta_{26}LFD_{t-1} + \beta_{27}LXP_{t-1} + \beta_{28}LREMLFD_{t-1} + \beta_{29}TREND + \sum_{i=1}^{p}\alpha_{21i}\Delta Ly_{t-i}$$

$$+ \sum_{i=0}^{p}\alpha_{22i}\Delta Lk_{t-i} + \sum_{i=0}^{p}\alpha_{23i}\Delta LREM_{t-i} + \sum_{i=0}^{p}\alpha_{24i}\Delta LFDI_{t-i} + \sum_{i=0}^{p}\alpha_{25i}\Delta LODA_{t-i} \qquad (7)$$

$$+ \sum_{i=0}^{p}\alpha_{26i}\Delta LFD_{t-i} + \sum_{i=0}^{p}\alpha_{27i}\Delta LXP_{t-i} + \sum_{i=0}^{p}\alpha_{28i}\Delta LREMLFD_{t-i} + \varepsilon_{2t}$$

$$\Delta LREM_t = \beta_{30} + \beta_{31}Ly_{t-1} + \beta_{32}Lk_{t-1} + \beta_{33}LREM_{t-1} + \beta_{34}LFDI_{t-1} + \beta_{35}LODA_{t-1}$$

$$+ \beta_{36}LFD_{t-1} + \beta_{37}LXP_{t-1} + \beta_{38}LREMLFD_{t-1} + \beta_{39}TREND + \sum_{i=1}^{p}\alpha_{31i}\Delta Ly_{t-i}$$

$$+ \sum_{i=0}^{p}\alpha_{32i}\Delta Lk_{t-i} + \sum_{i=0}^{p}\alpha_{33i}\Delta LREM_{t-i} + \sum_{i=0}^{p}\alpha_{34i}\Delta LFDI_{t-i} + \sum_{i=0}^{p}\alpha_{35i}\Delta LODA_{t-i} \qquad (8)$$

$$+ \sum_{i=0}^{p}\alpha_{36i}\Delta LFD_{t-i} + \sum_{i=0}^{p}\alpha_{37i}\Delta LXP_{t-i} + \sum_{i=0}^{p}\alpha_{38i}\Delta LREMLFD_{t-i} + \varepsilon_{3t}$$

$$\Delta LFDI_t = \beta_{40} + \beta_{41}Ly_{t-1} + \beta_{42}Lk_{t-1} + \beta_{43}LREM_{t-1} + \beta_{44}LFDI_{t-1} + \beta_{45}LODA_{t-1}$$

$$+ \beta_{46}LFD_{t-1} + \beta_{47}LXP_{t-1} + \beta_{48}LREMLFD_{t-1} + \beta_{49}TREND + \sum_{i=1}^{p}\alpha_{41i}\Delta Ly_{t-i}$$

$$+ \sum_{i=0}^{p}\alpha_{42i}\Delta Lk_{t-i} + \sum_{i=0}^{p}\alpha_{43i}\Delta LREM_{t-i} + \sum_{i=0}^{p}\alpha_{44i}\Delta LFDI_{t-i} + \sum_{i=0}^{p}\alpha_{45i}\Delta LODA_{t-i} \qquad (9)$$

$$+ \sum_{i=0}^{p}\alpha_{46i}\Delta LFD_{t-i} + \sum_{i=0}^{p}\alpha_{47i}\Delta LXP_{t-i} + \sum_{i=0}^{p}\alpha_{48i}\Delta LREMLFD_{t-i} + \varepsilon_{4t}$$

$$\Delta LODA_t = \beta_{50} + \beta_{51}Ly_{t-1} + \beta_{52}Lk_{t-1} + \beta_{53}LREM_{t-1} + \beta_{54}LFDI_{t-1} + \beta_{55}LODA_{t-1}$$

$$+\beta_{56}LFD_{t-1} + \beta_{57}LXP_{t-1} + \beta_{58}LREMLFD_{t-1} + \beta_{59}TREND + \sum_{i=1}^{p}\alpha_{51i}\Delta Ly_{t-i}$$

$$+\sum_{i=0}^{p}\alpha_{52i}\Delta Lk_{t-i} + \sum_{i=0}^{p}\alpha_{53i}\Delta LREM_{t-i} + \sum_{i=0}^{p}\alpha_{54i}\Delta LFDI_{t-i} + \sum_{i=0}^{p}\alpha_{55i}\Delta LODA_{t-i}$$

$$+\sum_{i=0}^{p}\alpha_{56i}\Delta LFD_{t-i} + \sum_{i=0}^{p}\alpha_{57i}\Delta LXP_{t-i} + \sum_{i=0}^{p}\alpha_{58i}\Delta LREMLFD_{t-i} + \varepsilon_{5t}$$

(10)

$$\Delta LFD_t = \beta_{60} + \beta_{61}Ly_{t-1} + \beta_{62}Lk_{t-1} + \beta_{63}LREM_{t-1} + \beta_{64}LFDI_{t-1} + \beta_{65}LODA_{t-1}$$

$$+\beta_{66}LFD_{t-1} + \beta_{67}LXP_{t-1} + \beta_{68}LREMLFD_{t-1} + \beta_{69}TREND + \sum_{i=1}^{p}\alpha_{61i}\Delta Ly_{t-i}$$

$$+\sum_{i=0}^{p}\alpha_{62i}\Delta Lk_{t-i} + \sum_{i=0}^{p}\alpha_{63i}\Delta LREM_{t-i} + \sum_{i=0}^{p}\alpha_{64i}\Delta LFDI_{t-i} + \sum_{i=0}^{p}\alpha_{65i}\Delta LODA_{t-i}$$

$$+\sum_{i=0}^{p}\alpha_{66i}\Delta LFD_{t-i} + \sum_{i=0}^{p}\alpha_{67i}\Delta LXP_{t-i} + \sum_{i=0}^{p}\alpha_{68i}\Delta LREMLFD_{t-i} + \varepsilon_{6t}$$

(11)

$$\Delta LXP_t = \beta_{70} + \beta_{71}Ly_{t-1} + \beta_{72}Lk_{t-1} + \beta_{73}LREM_{t-1} + \beta_{74}LFDI_{t-1} + \beta_{75}LODA_{t-1}$$

$$+\beta_{76}LFD_{t-1} + \beta_{77}LXP_{t-1} + \beta_{78}LREMLFD_{t-1} + \beta_{79}TREND$$

$$+\sum_{i=1}^{p}\alpha_{71i}\Delta Ly_{t-i} + \sum_{i=0}^{p}\alpha_{72i}\Delta Lk_{t-i} + \sum_{i=0}^{p}\alpha_{73i}\Delta LREM_{t-i} + \sum_{i=0}^{p}\alpha_{74i}\Delta LFDI_{t-i}$$

(12)

$$+\sum_{i=0}^{p}\alpha_{75i}\Delta LODA_{t-i} \sum_{i=0}^{p}\alpha_{76i}\Delta LFD_{t-i} + \sum_{i=0}^{p}\alpha_{77i}\Delta LXP_{t-i}$$

$$+\sum_{i=0}^{p}\alpha_{78i}\Delta LREMLFD_{t-i} + \varepsilon_{7t}$$

$$\Delta LREMLFD_t = \beta_{80} + \beta_{81}Ly_{t-1} + \beta_{82}Lk_{t-1} + \beta_{83}LREM_{t-1} + \beta_{84}LFDI_{t-1}$$

$$+\beta_{85}LODA_{t-1} + \beta_{86}LFD_{t-1} + \beta_{87}LXP_{t-1} + \beta_{88}LREMLFD_{t-1}$$

$$+\beta_{89}TREND + \sum_{i=1}^{p}\alpha_{81i}\Delta Ly_{t-i} + \sum_{i=0}^{p}\alpha_{82i}\Delta Lk_{t-i}$$

(13)

$$+\sum_{i=0}^{p}\alpha_{83i}\Delta LREM_{t-i} + \sum_{i=0}^{p}\alpha_{84i}\Delta LFDI_{t-i} + \sum_{i=0}^{p}\alpha_{85i}\Delta LODA_{t-i}$$

$$\sum_{i=0}^{p}\alpha_{86i}\Delta LFD_{t-i} + \sum_{i=0}^{p}\alpha_{87i}\Delta LXP_{t-i} + \sum_{i=0}^{p}\alpha_{88i}\Delta LREMLFD_{t-i} + \varepsilon_{8t}$$

There are two steps involved in the procedure for examining the long-run relationship between Ly_t, Lk_t, $LREM_t$, LFD_t, LXP_t, $LFDI_t$, $LODA_t$ and the interaction term between remittances and financial development ($LREMLFD_t$). First, we estimate equation (6) to equation (13) by OLS 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 co-integration (H_0: $\beta_{i1} = \beta_{i2} = \beta_{i3} = \beta_{i4} = \beta_{i5} = \beta_{i6} = \beta_{i7} = \beta_{i8} = 0$) against its alternative hypothesis of a long-run co-integration relationship (H_1: $\beta_{i1} \neq \beta_{i2} \neq \beta_{i3} \neq \beta_{i4} \neq \beta_{i5} \neq \beta_{i6} \neq \beta_{i7} \neq \beta_{i8} \neq 0$).

Since the F-statistics used for this test has 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.

4.3   Results and interpretation

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 are non-stationary in levels and stationary in their first differences.[4]

Table 6   Results of bound tests

Dependent variable	Computed F-statistic		
Ly	21.777***		
Lk	1.738		
LREM	1.622		
LFDI	0.709		
LODA	1.017		
LFD	1.888		
LXP	0.514		
LREMLFD	1.143		
Critical value	*Pesaran et al. (2001)*[a]		*Narayan (2005)*[b]	
	Lower bound value	*Upper bound value*	*Lower bound value*	*Upper bound value*
1%	2.96	4.26	4.104	6.151
5%	2.32	3.50	2.875	4.445
10%	2.03	3.13	2.384	3.728

Notes: [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.1988.
       *, ** and ***indicate significance at 10%, 5% and 1% levels, respectively.

The results of the bounds test are reported in Table 6. The results confirm the existence of a long-run relationship amongst the variables when real output per worker (Ly_t) is set as the dependent variable. The computed F-statistics 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 co-integration 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% level of significance.

Having confirmed the presence of a long-run relationship between per capita output and per capita capital stock, remittances and private credit and exports, we now proceed to estimate the long-run equation by using the ARDL. The long-run equations are shown as follows:

$$Ly = 3.489 + 0.411Lk* + 0.421LREM** + 0.036FDI** + 0.037ODA** + 0.193LFD***$$
$$t = (2.796)\ (2.011)\quad\quad (3.344)\quad\quad\quad (3.898)\quad\quad\quad (3.292)\quad\quad\quad (4.202)$$
$$+0.141LXP*** + 0.137LREMLFD** + 0.019TREND**$$
$$\quad (8.507)\quad\quad\quad (3.514)\quad\quad\quad\quad (3.019)$$

$$(14)$$

It is found that the coefficients of all the explanatory variables have positive signs and are statistically significant at 10% significance level or better. The coefficient of log of per capita capital stock denotes the measure of profits share, which is 0.411.[5] The coefficients of $LREM_t$, $LFDI_t$, $LODA_t$, LFD_t and LXP_t, are 0.421, 0.036, 0.037, 0.193 and 0.141, respectively. In comparison, it is found that the magnitude of the coefficient of remittances is higher than those of both FDI and foreign aid. Furthermore, we note that the interaction term, *LREMLFD*, representing the interaction between remittances and financial sector development is also statistically significant. This confirms the existence of effective operation of domestic financial sector in channelling remittance inflows into the banking system to finance the productive investment projects for stimulating real output.

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. Equation (14) performed 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.[6]

4.4 Granger causality tests

Since it is established that there is co-integration between the variables which are of order I(1), we proceed to examine the short-run dynamic causal relationship of the variables in their first difference by using Granger causality tests. The results are reported in Table 7. The results suggest the existence of a unidirectional relationship in the long-run, which runs only from per capita capital stock, remittances and financial development, exports and the interaction term to per capita output, as error-correction term (ECT_{t-1}) has a correct sign and is statistically significant at 1% level in the equation with per capita output as dependent variable. In contrast, ECT_{t-1} in other equations are not statistically significant which duly confirms the existence of only one co-integration vector, as was shown by bounds test approach.

Table 7   Granger causality tests

Variable	F-statistics								ECT (t-statistics)
	ΔLy	ΔLk	ΔLREM	ΔLFDI	ΔLODA	ΔLFD	ΔLXP	ΔLREMLFD	
ΔLy	-	8.123***	1.970*	2.276*	5.820***	6.515***	8.058***	2.618**	-0.8005* (-2.684)
ΔLk	7.053***	-	3.580*	3.710**	1.842	0.531	2.291	4.101**	-0.1709 (-1.557)
ΔLREM	3.124*	2.518*	-	7.101***	0.249	2.990*	0.242	4.455*	-0.0567 (-0.031)
ΔLFDI	1.560	4.378**	0.660	-	0.668	3.234*	0.337	6.208**	-0.5853 (-0.653)
ΔLODA	0.422	3.184*	1.704	2.267	-	4.071**	1.169	4.175**	-0.8993 (-0.438)
ΔLFD	0.877	0.631	0.580	0.843	0.246	-	1.161	1.791	-0.2186 (-0.441)
ΔLXP	3.157*	1.270	0.281	3.949*	0.188	0.106	-	0.325	-0.3682 (-0.468)
ΔLREMLFD	0.454	0.511	0.613	0.064	0.022	0.061	0.302	-	-0.4710 (-0.031)

Notes: *Significance at the 10% level; **significance at the 5% level; ***significance at the 1% level

Looking at the short-run causality linkages, it is of interest to observe that financial sector development significantly influences the output, via remittances, FDI and overseas development assistance in the short-run. Hence, financial sector development emerges as a crucial determinant in the growth process. Besides, there is bi-directional linkage between real output and per capita capital stock, per capita capital stock and remittances; per capita capital stock and FDI; exports and real output, and per capita capital stock and remittances.

5 Summary and conclusions

Adopting an augmented Solow model, this paper employed the bounds testing procedure to empirically investigate the plausible existence of a long-term relationship between remittances and FDI and overseas development assistance and economic growth in India during the past four decades. The study utilised the relevant variables, namely per capita output, per capita stock, remittances as percent of GDP, foreign direct investment as percent of GDP, overseas development assistance as percent of GDP, bank credit to private sector as percent of GDP representing financial sector development and exports as percent of GDP as well as the interaction between remittances and private sector credit. The study findings showed that there was only one co-integrating vector, establishing the existence of a long-term relationship between these variables.

The long-term relationship was flowing only in one direction, which is from the explanatory variables – per capita capital stock, remittances, FDI, ODA, bank credit to private sector representing financial sector development and exports as well as the interaction between remittances and financial sector development. All the explanatory variables have the expected positive signs and their estimated coefficients are significant.

The result thus confirms a positive impact of remittances on output, similar to the results obtained in other recent country studies (Giuliano and Ruiz-Arranz, 2009). Further, the findings also establish the hypothesis that a well-developed financial system promotes the country's economic output (King and Levine, 1993; Levine et al., 2000; Beck and Levine, 2004).

Therefore, with inward remittances having an augmenting effect on economic growth, policy measures in India should continue to be supportive of remittance inflows. Policy implications indicate that attention should be given towards

1 further improving the financial infrastructure

2 providing incentive for greater remittance inflows through formal channels by offering higher interest rates on non-residents' deposits

3 lessening the cost of remittance transfer at both sending and receiving ends.

Furthermore, any disincentives such as a tax on inward remittances will only create dead weight loss, be counterproductive and may even reverse the positive momentum of current remittances inflows.

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Notes

1 For accommodating the likely contribution of other variables which are not included, one can include time trend in the production function.

2 We are grateful to Professor Barry Bosworth of Brookings Institution, Washington, DC, for making available the data on India's capital and labour stock.

3 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.

4 For conserving space, the unit root test results are not reproduced. However, they will be made available on request.

5 Our capital share ratio is about 0.411, slightly higher than the stylised value of one third. However, our estimated capital share for India is close to what Bosworth and Collins (2008, p.62), which is 0.40.

6 The CUSUM and CUSUM of squares plots are not reported here in order to conserve space. However, the results will be made available upon request.