
Linking remittances with financial development and ICT: a study of the Philippines

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Abstract: The Philippines is the fourth largest recipient of remittances in the world with booming information and communications (ICT) services. In this study, we therefore explore the short-run and long-run nexus between remittance inflows, remittances interaction with financial development and ICT, trade openness and overseas development assistance (ODA) vis-à-vis income for the period 1976 to 2010 using ARDL bounds approach. The results show remittances and remittances interaction with ICT have positive effects on income. However, aid and remittances interaction with financial development have negative effects whereas trade openness is not statistically significant. Subsequently, encouraging remittance inflows through labour mobility, minimising transfer cost, harnessing benefits from mobile network operations, and reviewing remittance transfer fees via banking systems are would be ideal for scaling up ICT, and ensuring greater financial inclusion and sustainability of remittance inflows. Assessing aid-for-trade initiatives and building necessary infrastructure and institutions are equally crucial for long term development of the economy.

Keywords: openness; ODA; financial development; remittances; technology; bounds test; Philippines.

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1 Introduction

The Philippines is classified as a middle income country and a member of the Association of South East Asian Nations (ASEAN). It is one of the countries within East Asia and the Pacific that has a relatively large service sector and is the third largest source of migrant workers all over the world. The economy's service sector which employs a significant proportion of labour force, accounts for more than 50% of its GDP (World Bank, 2011a, 2011b, 2011c; Yi, 2012).

Although the economy has a fairly open regime for foreign market access, its service trade openness is well below the regional average. The country scores 14 out of 100 in the overall general agreement of trade in services (GATS) commitment index (Yi, 2012) and its trade in services (TIS) as a share of total trade is around 18% (World Bank, 2011c).

Nevertheless, the successful operation of GATS mode IV has opened up work-related migration opportunities for the Filipinos at a greater scale. Remittances from the Overseas Filipino Workers (OFWs) have been relatively high, both in absolute and relative to GDP terms, surpassing the net inflow of foreign direct investment (FDI) and official development assistance (ODA). Besides noting the stable flow of remittances in the country in spite of the recent financial crisis, remittances has been a significant contributor to positive current account balances and the economy's consumption level. Remittances increased by 5.8% in 2009 and by a further 8.1% in 2010. In 2010, about \$21.4 billion was recorded as remittances from official channels, which comprised 10.7% of GDP. Further, at a global level, the Philippines are ranked as the fourth largest recipient of remittances after India, China and Mexico (Yi, 2012; World Bank, 2011c).

The ICT sector is booming in the Philippines. Although the loan growth remains relatively stagnant in the Philippines, banks and mobile network operators are able to expand business operation and create greater efficiency as they compete for remittance from the OFWs (Yi, 2012). The country has a comparative advantage in ICT and travel services; although the latter has short lived gains and comparative disadvantages are evident in insurance and financial services.

Moreover, the economy's productivity growth is hampered by inadequate supply of infrastructure, high cost of doing business particularly due to high energy costs, occasional power outages, shortage of skilled workers for domestic sectors, and a weak tourism sector, which is highly sensitive to the global shocks and internal economic environment. Against these backdrops and noting the ICT is booming, which continues to provide business process outsourcing (BPO) firms with the critical inputs for efficient services (Yi, 2012), we explore the linkage effects with remittances and financial development.

The paper therefore looks at the critical role played by remittances in the broader context of economic growth and development. Although there are a number of studies that theoretically acknowledge the permeating role of financial development and ICT inclusion, the interactive role of remittances with financial development and ICT have not gained much empirical interest and attention. Subsequently, this study works toward modestly filling the vacuum. We conduct a macro level analysis using the augmented Solow (1956) approach, with insights from the some of the prominent pioneers of growth theory (Schumpeter, 1933; Domar, 1952, 1961; Harrod, 1959; Acemoglu, 2009; Rao, 2010), and the ARDL bounds procedure to determine the contributory powers of trade

openness, development aid, remittance inflows, remittance interaction with technology, and remittance interaction with financial development vis-à-vis per worker income.

The remainder of the paper is set out as follows. Firstly, a brief literature survey is provided. Secondly, trends relating to the variables used in the study are discussed. Thirdly, the data, method and model are discussed followed by the analysis. Finally, conclusion follows.

2 A brief literature survey

The aim of this section is to provide some recent studies done in light of the impacts of remittances, financial sector development, aid inflows, technology development, and trade openness on growth.

2.1 Remittances

Remittance inflows refer to private income sent from one or more family members living and working abroad back to the remaining family unit in the home country (Chami et al., 2006). There are both micro and macro level impacts of remittances. For instances, at a micro-level, when remittance inflows are consistent and received by relatively poor groups in the society, there is improvement in consumption levels and some cases where there are surplus funds invested in small capital projects and enterprises, there is a plausible welfare enhancing effect on the household (Maclellan and Mares, 2005; Ratha, 2007; Buch and Kuckulenz, 2010). Further, remittances are also used to support household education, healthcare needs, and when saved as 'buffer cash', it acts as a collateral in times of economic crisis, national disasters and other unexpected events (Browne and Leeves, 2007; UNESCAP, 2010).

Remittances are sent in various ways. The common means of sending remittances are through postal mails and visiting migrant's or migrant's relatives or friends. Brown and Ahlburg (1999) in their study on Pacific Island Countries (PICs) confirm that a large amount of remittances are sent through informal channels than the formal channels. This is mostly the case for many developing countries where infrastructure development is a concern. The formal channels used by the remitters often include Western Union money transfers, bank drafts and automated teller machines (ATM). The transaction costs involved in sending remittances to small and developing countries through legal, banking channels have been high (Irving et al., 2010). Some of the market factors determining the transaction cost of remittances are: the number of competitors (service providers) in the market, which depends on the size of that particular remittance corridor and legal regulations; the cost of remittance providers, which depends on the method and technology available to them for use; the needs and preferences of customers; and 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; (Irving et al., 2010; Ratha and Riedberg, 2005).

In a study by Giuliano and Ruiz-Arranz (2009) which considered some 100 developing countries and found that remittances boost growth in countries with less developed financial systems by providing an alternative way to finance investment and

support in overcoming liquidity constraints. Kumar (2011a) empirically explored the nexus between the remittances, financial development and trade openness linkages to growth in Pakistan. He found that while remittances have a positive long run effect, financial sector development had a marginal negative effect in the short run and no significant effect in the long run. Moreover, comparing capital inflows (ODA, FDI, and remittances) in Vanuatu, which is a small and least developed country, Kumar (2011b) found that only remittances stood out to have a positive and significant effect on per worker income. Similarly, Kumar et al. (2011) found that remittances are relatively effective than tourism in Vanuatu. It has also been noted that for some developing countries like Fiji, Samoa and Tonga, remittance incomes do support economic growth (Jayaraman et al., 2011a, 2011b).

2.2 Financial development, ICT and remittances

A substantial body of literature exists in support of the role of financial development as critical contributor to economic growth. Financial systems promote investment and growth by acting as intermediaries and by reducing costs through economies of scale. Financial institutions provide loans; expedite and exploit new and existing business opportunities; mobilise savings; and diversify risks through pooling funds for investment thus creating liquidity in the economy and subsequently influencing aggregate demand and overall economic activities (King and Levine, 1993; Beck et al., 2000; Levine et al., 2000). A number of indicators have been used to measure the importance and relative ease with which banks provide funds. These include: ratio of broad money; ratio of asset of deposit money of banks to assets of the central bank and deposit money of banks; reserve ratio; and ratio of credit to private to GDP (Creane et al., 2004).

In a study of Turkey, Kar et al. (2008) found that trade liberalisation, financial development, and the interaction between the two had positively contributed to economic growth in the long term. In some recent studies, the role of remittances, aid, and FDI have been underscored as instrumental to growth for small and developing countries particularly on the agreement that sound financial infrastructure, and effective banking and financial services are efficiently linked with financial flows (Jalil and Ma, 2008; Lal et al., 2009; Atif et al. 2010; Muhammad and Umer, 2010; Odhiambo, 2010; Anwar et al., 2011; Hassan et al., 2011; Kumar 2011a, 2011b).

The information and communications technology (ICT) services have the potential to develop the economy through increasing labour productivity, provide technology-dependent industries (such as manufacturing and services) to operate cost effectively and efficiently, and ensure that consumers have greater choice and information through easy access to information on various products and services (Porter, 2001; Jalava and Pohjola, 2008; Katz, 2009; Kuppusamy et al., 2009; Venturini, 2009)

For countries which are sea-locked, geographically remote, and isolated from large business centres, availability of efficient technology provides a global virtual platform for communication and trade within and across various sectors (Horscroft, 2010). Therefore when ICT services grow as a result of increase in greater connections largely spurred by cables and other technological devices, efficient and cost-effective communication links are established which facilitate various economic activities besides tourism (Buhalis and Law, 2008). There is also a notable causal positive link between broadband infrastructure and growth particularly in the presence of a critical mass infrastructure (Koutroumpis, 2009). It has also been acknowledged that ICT services supports banking and financial

services. For example, when ICT services are linked with tourism and remittance transfer services via the financial system, efficiency gains are realised through greater remittance inflows, effective and greater degree of financial services and tourism development. Subsequently, in scaling-up ICT, emphasis needs to be on financial inclusion mobile network technology (Merritt, 2010).

2.3 Overseas development assistance

The motivation of foreign aid has generally been modelled in terms of donor self-interest and recipient need, and improving growth and international income distribution (Rosenstein-Rodan, 1961; Elderman and Chenery, 1977; McKinlay and Little, 1979; Maizels and Nissanke, 1984; Trumbull and Wall, 1994; Boone, 1996; Llavador and Roemer, 2001). The per capita income growth rate of previous years has some influence on the aid granting decisions by the donors. For example, Sobhee and Nath (2007a) showed that high income countries such as Botswana and Mauritius have not benefited much from external assistance as had low income countries like Mozambique and Bangladesh. Moreover, many countries do benefit from project-specific assistance on education, health or human capital formation in their early stages of development since grants are relatively larger (Sobhee and Nath, 2007b).

On the other hand, some scholars have also argued that foreign aid can be harmful or ineffective when donors direct the use of aid to implement their own projects and programmes (Banerjee and Rondinelli, 2003; Dalgaard, 2008). It has been argued that where aid is mismanaged by the recipient countries as a consequent of donor giving the complete control to the recipient country, corruption, poverty and bureaucracy are the likely outcomes in the main (Angeles and Neanidis, 2009). Further, positive effects of aid (or ODA) on growth for many developing countries are largely influenced by the degree of stability in aid inflows (Chauvet and Guillaumont, 2004, 2009). Agénor and Aizenman (2010) asserted that where aid inflows are erratic and pro-cyclic in nature, output gaps and poverty traps are likely to emerge.

Quazi (2005) concludes that where aid is used to fund non-productive investments, its contribution to growth and development is virtually impossible. Some studies are quite neutral in stating that aid has basically no effect on growth (Rajan and Subramanian, 2008). Similarly, Neanidis and Varvarigos (2009) argue that aid can be harmful for recipient countries growth rate in cases where aid inflows are volatile. In similar vein, some other studies (Rao, 2010; Werker et al., 2009; Shleifer, 2009; Kumar, 2011b) contend that aid does not have any significant effect on growth for the recipient countries which are relatively small in terms of population size and have weak economic institutions.

However, for countries where foreign aid was identified to have positive effect on growth, much of the merit was given to the efficient apparatus through which aid was channelled: in productive investment; and in reducing (increasing) taxes (subsidies) thus increasing the aggregate demand and general output level (Feyzioglu et al., 1998) whilst contributing to equal distribution of income at some stage in the development process (Sobhee and Nath, 2007b). In a recent work examining aid effect, Shafiullah (2011) considered some 94 least developed countries and found that aid was effective and does have the potential to reduce inequality.

Hadjimichael et al. (1995) analysed 31 sub-Saharan African countries and concluded that while poor economic performance of SSA results from policy differences, there is a

positive impact of aid on growth. Durbarry et al. (1998) analysed 58 developing countries and concluded that greater foreign aid inflows do have a beneficial impact on growth. Hansen and Tarp (2000, 2001) in their studies show existence of a strong, unconditional non-linear impact of aid on growth.

Moreover, inappropriate technology and institutional destruction are impediments of aid effectiveness and results in the aid-Laffer effect; and in cases of voluminous aid inflows, they overwhelm management capacity, undermine revenue collection, and breed corruption and negative institutions (Lensink and White, 2001; Heller and Gupta, 2002). Collier and Dollar (2002) combining diminishing returns and conditional effects of aid introduced aid squared term besides the multiplicative aid-policy variable to solve the problem of an optimal aid allocation. Some scholars argue that while economic vulnerability may increase the marginal impact of aid on growth, the shocks resulting from climatic or terms of trade changes duly linked to aid should not be overlooked in order to thoroughly assess the macroeconomic vulnerability and aids effect on growth (Chauvet and Guillaumont, 2004).

Gomanee et al. (2005) show a different perspective by implementing a threshold regression. Their results showed no evidence of diminishing returns but evidence of a non-linear impact of aid on GNP, thus arguing that aid stimulates growth positively and significantly only if the ratio of ODA to GNP is above 2% level. Wagner (2008) looked at some 61 countries using a semi-parametric econometric method, and also found that aid benefits are governed by a certain threshold beyond which aid becomes detrimental to growth. Wagner further noted that aid is more responsive to growth where vulnerability is high thus highlighting that aid-growth relationship is a complex dynamic process to comprehend. Shleifer (2009) and Rao (2007) are somewhat sceptical of aid having any significant effect on growth for particularly developing countries. For instances, Takahashi (2009) showed the indirect effects of Japanese aid channelled in agriculture development in the South Sulawesi province in the eastern part of Indonesia. Takahashi show that agricultural sector expansion in the South Sulawesi (Eastern Indonesia) drives the development in other regions in eastern Indonesia and has the largest spill over effects compared to other economically important region such as Eastern Java and Kalimantan.

Recent studies also agree that aid inflows to a recipient country are largely affected by the recipient countries government performance, income level and the donors own (self) interest (Chong and Gradstein, 2008; Harrigan and Wang, 2010). Subsequently, in order for aid allocation and distribution to have the required impact on growth, aid-recipient country need to meet certain prerequisites such as: incorporating grants in their budgetary decision-making; reviewing aid apparatus carefully; and having an effective governance system and good institutions to measure aid deployment in the economy (Sobhee and Nath, 2010; Heckelman and Knack, 2009; Rajan and Subramanian, 2007; Burnside and Dollar, 2000).

2.4 Trade openness

From international trade theory perspective, exports and imports are important when considering trade openness. This is because according to the theory of comparative advantage, international trade would lead to a more efficient use of a country's resources as countries will import those goods and services that are costly to produce at home and export the goods and services which they can efficiently produce (Frankel and Rose, 2000). Accordingly, Rose (2004) lists seven indicators of trade policy which are:

openness measured by the ratio of trade (imports and exports) as a percent of GDP, and imports as a percent of GDP; trade flows adjusted for country-characteristics; tariffs; non-tariff barriers; informal or qualitative measures; composite indices; and measures based on price outcomes.

Yanikkaya (2003) highlighted that East Asian countries employed export-promotion policies and hence consistently outperformed other countries. Dowrick and Golley (2004) in a cross country analysis found that specialisation in primary exports was harmful for growth and that since 1980s the beneficiaries of trade were mostly richer economies and not supposedly less developed economies. Furthermore, the dynamic benefit of trade is largely a result of productivity growth and less from contributions coming from investment growth. Winters et al. (2004) argued that trade liberalisation, if managed properly, can be an important component of a pro-poor development strategy. Wacziarg and Welch (2008) showed that trade liberalisation has resulted in higher growth for many countries, and those which experienced negative or no effect were mainly due to political instability, unfavourable macroeconomic policies, or high protection barriers. Freund and Bolaky (2008) examined the relationship between trade openness and per-capita income using a cross-country data from 126 countries. They found that trade leads to a higher standard of living in flexible economies (defined as economies with ease of firm entry), but not in rigid economies.

3 Trends and patterns

Philippines average growth rate of GDP was 4.9% while inflation averaged to 5.5% (Table 1). The population has been growing at an annual average rate of 1.8% since 2005. Annual population was close to 86 million in 2005 and by 2010, it increased to 89 million. This has been also reflected in the population density which increased from 290 people per square kilometre of land area in 2005 to 313 people in 2010. There has been growth in per capita income from USD 1,205 (2005) to USD 2,140 (2010). The unemployment rate has been close to 8% of the total labour force. Furthermore, a little more than a third of the population resides in rural areas indicating the plausible pressure on urban resources. The fiscal balance of the central government as a percent of GDP has been negative, averaging around -2.1% (2005 to 2010). However, the external balance as a percent of GDP has improved from -5.6% (2005) to -1.8% (2010) and the current account balance (as a percent of GDP) has increased from 1.9% (2005) to 4.3% (2010).

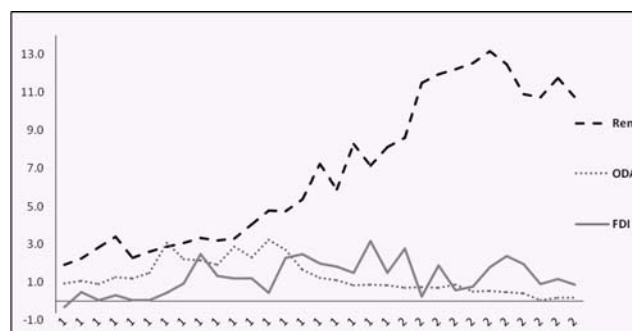
Philippines have experienced a decline in the share of agriculture and manufacturing shares. Agriculture value added (as a percent of GDP) has declined from 28% (1961 to 1970) to 12% (2010) while manufacturing value added hovers around 20% of GDP (Table 2). However, there has been a remarkable growth in the services value added (as a percent of GDP) from 4.7% (1961 to 1970) to 5.5% (2001 to 2010). Services value added as a share of GDP has increased from 42% (1960) to 55% (2010). Similarly, trade as a percent of GDP has increased dramatically from 35% (1961 to 1970) to 71% (2010). Interestingly, similar to growth in overall trade, TIS component rose as well. While trade (as a percent of GDP) declined (-18.2%) in 2009, growth in TIS was positive (8.6%). Moreover, TIS as a percent of total trade has grown from 11.0% (2006) to 18.1% (2010); and remittance inflows increased significantly compared to the official development aid (ODA) and net inflow of FDI (Figure 1).

Table 1 Philippines: selected key indicators*

Indicators	2005	2006	2007	2008	2009	2010	Average
Age dependency ratio (% of working-age)	68.1	67.4	66.6	65.8	65.0	64.1	66.2
Aid per capita in US\$	6.6	6.5	6.9	0.5	3.4	3.4	4.6
Central government debt (% GDP) [†]	62.0	n.a.	n.a.	n.a.	n.a.	n.a.	62.0
Current account balance (% GDP)	1.9	4.4	4.8	2.1	5.6	4.5	4.3
External balance (as a percent of GDP)	-5.6	-1.8	-0.1	-2.5	-1.1	-1.8	-2.1
Fiscal balance of central govt. (% GDP)	-2.8	-1.3	-1.4	-1.2	-3.8	n.a.	-2.1
Growth rate of GDP (%)	4.8	5.2	6.6	4.2	1.1	7.6	4.9
Inflation (% CPI)	7.6	6.2	2.8	9.3	3.2	3.8	5.5
Labour force, total (millions)	34.7	35.1	35.8	36.7	37.6	n.a.	36.0
Land area ('000 sq. km)	298.2	298.2	298.2	298.2	298.2	298.2	298.2
Per capita GDP (US\$) current prices	1,204.8	1,402.8	1,684.8	1,925.2	1,835.6	2,140.1	1,698.9
Population (millions)	85.5	87.1	88.7	90.2	91.7	93.3	89.4
Population density (people per sq. km)	286.9	292.2	297.3	302.4	307.6	312.8	299.9
Population growth (%)	1.9	1.8	1.7	1.7	1.7	1.7	1.8
Poverty headcount ratio at national poverty line (% of population)	n.a.	26.4	n.a.	n.a.	26.5	n.a.	26.5
Rural population (% population)	37.3	36.6	35.8	35.1	34.3	33.6	35.5
Unemployment (% labour force)	7.7	8.0	7.4	7.3	7.5	n.a.	7.6

Note: [†]2005 figure is estimated as average from 2000 to 2004, and in 2004, the debt was 73.9% of GDP

Source: World Bank (2011c)

Figure 1 Remittances, ODA and FDI as a percent of GDP for Philippines

Source: World Development Indicators and World Development Finance (World Bank, 2011c).

Table 2 Philippines: sector and trade profile from 1961 to 2010^a

Year ^b	Agriculture % GDP	Manufacturing % GDP	Services % GDP	Trade in services (TIS) % GDP	Trade % GDP	TIS ratio (% trade)
1961 to 1970	27.7 [4.3]	24.3 [5.8]	41.1 [4.7]	n.a.	35.2 [6.0]	n.a.
1971 to 1980	29.0 [4.1]	25.8 [6.2]	35.4 [5.1]	8.5 [19.9]	46.1 [17.8]	17.9
1981 to 1990	23.5 [1.2]	24.9 [1.1]	40.1 [3.1]	10.4 [5.5]	51.8 [4.7]	20.3
1991 to 2000	19.1 [2.1]	23.6 [2.6]	47.8 [3.3]	18.7 [5.4]	84.7 [11.5]	22.0
2001 to 2005	14.7 [3.0]	23.9 [3.3]	51.5 [4.6]	15.3 [-7.1]	99.5 [4.2]	15.3
2006	12.4 [3.6]	23.6 [4.1]	54.1 [6.0]	10.4 [20.5]	94.9 [14.0]	11.0
2007	12.5 [4.7]	22.7 [3.6]	54.5 [7.6]	11.6 [30.4]	86.6 [10.9]	13.4
2008	13.2 [3.2]	22.8 [4.3]	53.9 [4.0]	10.5 [5.6]	76.3 [2.3]	13.8
2009	13.1 [-0.7]	21.3 [-4.8]	55.2 [3.4]	11.8 [8.6]	65.6 [-18.2]	18.0
2010	12.3 [-0.2]	21.4 [11.2]	55.1 [7.2]	12.9 [25.8]	71.4 [25.5]	18.1

Notes: ^a figures in [] denote the growth rates, n.a. – not available
^b interval year values are averaged.

Source: World Development Indicators and World Development Finance (World Bank, 2011c).

4 Data, method and results

The study covers a 34-year period (1976 to 2010). In this paper, we look at the effects from remittances, remittances interaction with technology, and remittances interaction with financial development, aid inflows and trade openness on per worker income in Philippines. All variables used in the analysis are duly transformed into log form (summarised in Table 3).

Using the conventional Cobb-Douglas production function, with the Hicks-neutral technical progress, the per worker output (y_t) is defined as:

$$y_t = A_t k_t^\alpha, \quad 0 < \alpha < 1 \quad (1)$$

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:

$$A_t = A_0 e^{gT} \quad (2)$$

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

It is also plausible to assume for our purpose that:

$$A_t = f(TRD_t, ODA_t, REM_t, REMICT_t, REMBANK_t) \quad (3)$$

The effect of TRD_t , ODA_t , REM_t , $REMICT_t$, and $REMBANK_t$ on total factor productivity (TFP) can be captured when these variables enter as shift variables into the production function. The capital stock has been built up by a perpetual inventory method.¹ Labour is proxied by annual labour stock data. All data used in the analyses are sourced from *World Development Indicators and Global Development Finance* database issued by the World Bank (2011c).

Table 3 Summary of data used in the analysis with definitions*

Year	Output per worker	Capital per worker	Trade (% GDP)	Remittances (% GDP)	ODA (% GDP)	Private sector credit (% GDP)	Telephone lines per 100 people	Remittance interaction with technology	Remittance interaction with financial development
	Ly_t	Lk_t	$LTRD_t$	$LREM_t$	$LODA_t$	$LBANK_t$	$LICT_t$	$REMICT_t$	$REMBANK_t$
1976 to 1980	7.47	7.86	3.85	0.65	-0.01	3.36	-0.19	-0.10	2.19
1981 to 1990	7.42	8.38	3.94	1.06	0.52	3.09	-0.04	-0.04	3.26
1991 to 2000	7.42	8.63	4.42	1.83	0.29	3.51	0.74	1.47	6.49
2001 to 2005	7.53	8.80	4.61	2.51	-0.42	3.50	1.41	3.52	8.78
2006	7.63	8.86	4.55	2.52	-0.77	3.36	1.43	3.60	8.47
2007	7.67	8.88	4.46	2.39	-0.90	3.36	1.49	3.57	8.04
2008	7.70	8.91	4.33	2.37	-3.60	3.37	1.51	3.58	8.00
2009	7.69	8.92	4.18	2.46	-1.69	3.37	1.50	3.69	8.31
2010	7.75	8.95	4.27	2.37	-1.83	3.39	1.56	3.70	8.04

Note: *figures displayed are transformed into log form; interval years represent averages calculated by the author.

Source: World Development Indicators and World Development Finance (World Bank, 2011c)

The ARDL bounds testing approach under autoregressive distributed lag (ARDL) procedure developed by Pesaran et al. (2001) is deployed. This approach is suitable where the sample size is small. In this procedure, pre-testing of unit roots is not required and it is possible to investigate cointegration of the levels of the variables irrespective of their orders. However, we compute the unit root tests to ensure that all variables are at most integrated of order one for the application of Bounds procedure. The results are confirmed in Table 4.²

Table 4 Results of unit root tests

Variables in log form	ADF		Phillips and Perron	
	Level	First difference	Level	First difference
Ly_t	-0.263	-3.972**	-0.593	-3.125**
Lk_t	-2.112	-5.552***	-2.710	-3.586 [†] **
$LTRD_t$	-0.082	-4.390**	-0.434	-4.422***
$LREM_t$	-1.350	-7.540***	-2.212	-7.540***
$LODA_t$	-2.538	-8.799***	-2.306	-9.340***
$LICT$	-0.104	-1.659*	0.941	-2.443**
$BANK$	-2.148	-2.714**	-1.839	-3.637***
$REMICT_t$	-1.646 [‡]	-3.386**	-1.885	-3.416**
$REMBANK_t$	-1.618	-6.855**	-1.635	-6.855***

Notes: The ADF critical values are based on Mckinnon. The optimal lag is chosen on the basis of Akaike Information Criterion (AIC). [†] and [‡] indicates unit root tests conducted using spectral OLS-detrended option, and lag-length = 0, respectively. The null hypothesis for both ADF and Phillips-Perron tests is a series has a unit root (non-stationary). ***, **, and * – denotes the rejection of the null hypothesis of unit root at 1%, 5% and 10% level of significance respectively.

The next step is to examine the existence of a long run relationship between per worker output, (Ly_t) capital per worker (Lk_t), and the shift variables (trade openness ($LTRD_t$), development assistance ($LODA_t$), remittances ($LREM_t$), remittances interaction with ICT ($REMICT_t$), and remittances interacted with financial development ($REMBANK_t$)) using the bounds test procedure to establish cointegration. The ARDL specification is given as follows:

$$\begin{aligned}
 \Delta Ly_t = & \beta_{10} + \beta_{11}Ly_{t-1} + \beta_{12}Lk_{t-1} + \beta_{13}LTRD_{t-1} + \beta_{14}LODA_{t-1} + \beta_{15}LREM_{t-1} \\
 & + \beta_{16}REMICT_{t-1} + \beta_{17}REMBANK_{t-1} + \sum_{i=1}^p \alpha_{11i}\Delta Ly_{t-i} + \sum_{i=0}^p \alpha_{12i}\Delta Lk_{t-i} \\
 & + \sum_{i=0}^p \alpha_{13i}\Delta TRD_{t-i} + \sum_{i=0}^p \alpha_{14i}\Delta LREM_{t-i} + \sum_{i=0}^p \alpha_{15i}\Delta LODA_{t-i} \\
 & + \sum_{i=0}^p \alpha_{16i}\Delta REMICT_{t-i} + \sum_{i=0}^p \alpha_{17i}\Delta REMBANK_{t-i} + \varepsilon_{1t}
 \end{aligned} \tag{4}$$

There are two steps in examining the cointegration relationship. First, equation (4) is estimated by ordinary least square technique.³ 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, bounds test is based on the F-statistics (or Wald statistics) with the null hypothesis of no cointegration: $H_{NULL}: \beta_{11} = \beta_{12} = \beta_{13} = \beta_{14} = \beta_{15} = \beta_{16} = \beta_{17} = 0$, against its alternative hypothesis of a long-run cointegration relationship: $H_{ALT}: \beta_{11} \neq 0; \beta_{12} \neq 0; \beta_{13} \neq 0; \beta_{14} \neq 0; \beta_{15} \neq 0; \beta_{16} \neq 0; \beta_{17} \neq 0$. The results of the bounds test are reported in Table 5, confirming the presence of a long run relationship amongst the variables when only real output per worker (Ly_t) is set as the dependent variable. The computed F-statistics for Ly_t is 4.14, which is significant at 5% level.

Table 5 Results of bound tests

<i>Dependent variable</i>	<i>Computed F-statistic</i>	
Ly_t	4.14**	
Lk_t	2.11	
$LTRD_t$	1.42	
$LODA_t$	2.72	
$LREM_t$	2.75	
$REMICT_t$	2.27	
$REMBANK_t$	2.25	
<i>Pesaran et al. (2001)^a</i>		
<i>Critical value</i>	<i>Lower bound value</i>	<i>Upper bound value</i>
5%	2.87	4.00
10%	2.53	3.59

Notes: ^a Critical values are obtained from Pesaran et al. (2001), Table CI.v: case V with unrestricted intercept and unrestricted trend, (p.300); **indicates significance at 5% level.

Once the existence of a long-run relationship is confirmed, the next step is to estimate the long and short run equations. The results are presented in Table 6. During this process, key diagnostic tests are reviewed from the initial ARDL (autoregressive distributed lag) model, which is reported in the lower panel of Table 6. These includes: Lagrange multiplier test of residual serial correlation; Ramsey’s RESET test using the square of the fitted values for correct functional form; (normality test based on a test of skewness and kurtosis of residuals; and heteroscedasticity test based on the regression of squared residuals on squared fitted values. The results showed the equation performed well as the disturbance terms are normally distributed and serially uncorrelated with homoscedasticity of residuals thus confirming the models have correct functional forms. The CUSUM and CUSUM of Squares plot (CUSUMQ), measures the stability of the parameters in the model, confirmed that parameters are stable over time (Figures 2 and 3).

Figure 2 Cumulative sum of squares (CUSUM)

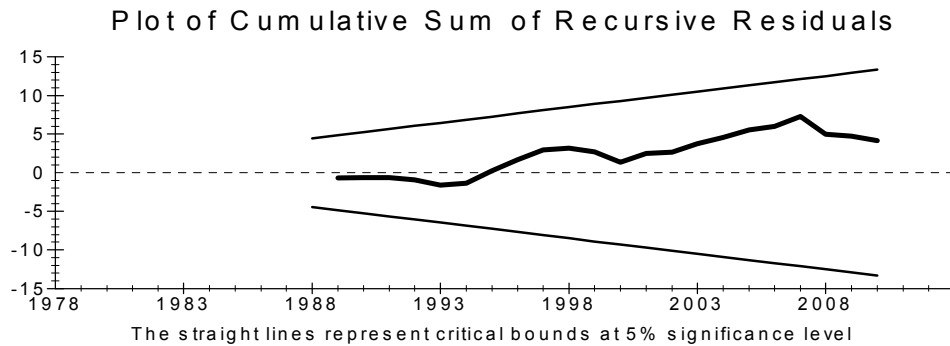
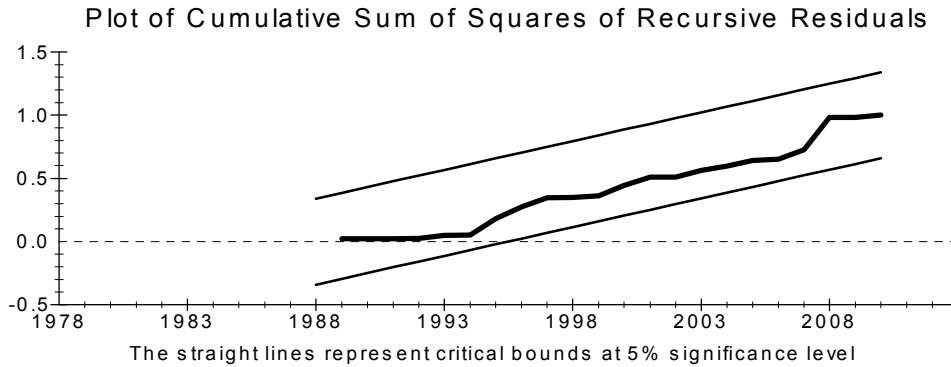


Figure 3 Cumulative sum of squares of recursive residuals (CUSUMQ)

4.1 Results

In the long run [see Table 6(a)], the capital share ($Lk_t = 0.53\%$) is about 0.53 which is mostly the case for many developing countries (Bosworth and Collins, 2008). Further, besides capital productivity, Philippines economic growth is predominantly driven: by remittances ($LREM_t = 0.22\%$) and marginally by remittance interaction with ICT (technology) development ($REMICT_t = 0.06\%$). However, ODA ($LODA_t = -0.02\%$) and remittances interaction with financial development ($REMBANK_t = -0.08\%$) have a marginal negative contributions. Notably, trade openness elasticity is ($LTRD_t = -0.09\%$) negative, however not statistically significant.

In the short run [see Table 6(b)], growth in capital stock ($\Delta Lk_t = 3.28\%$) contributed about 3.28% to growth in per worker income, thus signifying the importance of growth driven by capital accumulation and productivity (Table 6). On the other hand, growth in trade openness (measured by the ratio of trade to GDP in percentage) is positive ($\Delta LTRD_t = 0.08\%$), however not statistically significant in the short run.⁴ Further, growth in remittance inflows in the current period ($\Delta LREM_t = 0.16\%$) is significant (at 1% level) and contributes about 0.16% towards growth in income.

Overseas development assistance (ODA) ($\Delta LODA_t = -0.02\%$) is negative and statistically significant in the short run, indicating ineffective deployment of aid particularly in efforts to generate employment and income. Exploring the interactive terms, remittance-technology interaction has a positive effect in the short run ($\Delta REMICT_t = 0.04\%$) while remittance-financial development interaction has a negative effect ($\Delta REMBANK_t = -0.06\%$). The latter is plausibly a result of high transaction costs when remittances are sent via formal banking channels. Moreover, high remittance transfer costs consequently discourage remittance flow through formal system and financial innovation within the purview of remittance industry (such micro-savings, micro-loans, insurance services, etc.) and thus constrain financial deepening. On the other hand, greater preference and confidence in mobile technology (ICT services) as a convenient remittance transfer and storage medium, particularly when mobile technology offers greater opportunities in terms of cost-effective efficient money transfer, bill payments, among other options, would ideally place ICT services in the centre of ICT viz. financial innovation (Yi, 2012).

The error-correct-term ($ECT_{t-1} = -0.69\%$), which is a measure of reconciling short-run with long-run equilibrium has a correct (negative) sign and is statistically significant (at 1% level), indicating a relatively speedy convergence towards long-run equilibrium income.

Table 6 Dependent variable: Ly_t and ARDL (1, 1, 2, 2, 2, 2, 1, 2)

(a)				(b)			
Long-run coefficients				Short-run coefficients			
Regressor	Coefficient	t-ratio		Regressor	Coefficient	t-ratio	
Lk_t	0.5322	5.8098	***	ΔLk_t	3.2782	5.3069	***
$LTRD_t$	-0.0890	-1.4906	NS	$\Delta LTRD_t$	0.0813	1.1164	NS
$LODA_t$	-0.0214	-1.7967	*	$\Delta LODA_t$	-0.0148	-1.8141	*
$LREM_t$	0.2243	2.5699	**	$\Delta LREM_t$	0.1551	3.3690	***
$REMICT_t$	0.0549	3.6739	***	$\Delta REMICT_t$	0.0380	3.0123	***
$REMBANK_t$	-0.0842	-3.8656	***	$\Delta REMBANK_t$	-0.0582	-4.8163	***
C_t	3.1693	3.9507	***	C_t	2.1904	3.0760	***
				ECT_{t-1}	-0.6911	-4.9600	***
				\bar{R}^2		0.726	
				DW-statistics		1.213	
Diagnostic tests from ARDL specification							
	LM version	p-value		F version	p-value		
Serial correlation	$\chi^2(1) = 7.408$	0.006		F(1, 22) = 6.368	0.019†		
Functional form	$\chi^2(1) = 1.290$	0.256		F(1, 22) = 0.895	0.354		
Normality	$\chi^2(2) = 0.627$	0.731		Not applicable			
Heteroscedasticity	$\chi^2(1) = 0.259$	0.611		F(1, 31) = 0.245	0.624		

Notes: *** – significant at 1% level, ** – significant at 5% level and * – significant at 10% level; NS – not statistically significant. † Acceptance of null hypothesis at 5% but not at 1% level of significance.

Table 7 Granger causality test results – F-statistics and ECT from bounds test

Variables	F-statistics							ECT_{t-1} (t-statistics)
	ΔLy_t	ΔLk_t	$\Delta LTRD_t$	$\Delta LREM_t$	$\Delta LODA_t$	$\Delta REMICT_t$	$\Delta REMBANK_t$	
ΔLy_t	-	8.5086***	0.3706	0.1664	6.0150**	0.0001	0.1541	-0.691 (-4.96)***
ΔLk_t	2.7562*	-	0.0522	0.0019	0.1996	0.3321	0.0005	-0.135 (-16.09)***
$\Delta LTRD_t$	3.3583*	0.09751	-	0.0547	0.2107	1.1862	0.2752	-0.467 (-4.47)***
$\Delta LREM_t$	0.0241	0.4146	1.1925	-	1.2212	3.7234*	1.0711	-0.314 (-3.67)***
$\Delta LODA_t$	1.8065	0.0001	6.8957**	0.7102	-	0.2970	0.7955	-1.368 (-6.44)***
$\Delta REMICT_t$	0.0447	0.0898	0.7279	0.3392	0.2204	-	0.6062	-0.303 (-3.89)***
$\Delta REMBANK_t$	0.0516	1.0682	1.5125	0.0568	0.2507	2.0454	-	-0.352 (-3.15)***

Furthermore, the Granger causality test (Table 7) shows a uni-directional causations running from: per worker income to per worker capital ($\Delta Ly_t \rightarrow \Delta Lk_t$) and aid inflows ($\Delta Ly_t \rightarrow \Delta LODA_t$); from trade openness to per worker income ($\Delta LTRD_t \rightarrow \Delta Ly_t$), from remittances to remittances interaction with technology ($\Delta LREM_t \rightarrow \Delta LREMICT_t$); and from aid inflow to trade openness ($\Delta LODA_t \rightarrow \Delta LTRD_t$). The results therefore gives impetus to the following: growth in income affects the growth in per worker capital stock (capital productivity); economic growth affects the growth in aid inflows; growth in aid influences trade intensity which in turn affects economic growth; and growth in remittances influences the growth in technology interaction with remittances.

5 Conclusions

The paper showed short-run and long-run nexus between ODA, remittances, trade openness, remittances respective interactions with ICT services and financial development vis-à-vis per worker income. It is shown that remittances and remittances interaction with technology have positive effects both in short run and long run. However, remittances interaction with financial development has a marginal negative effect. Trade openness is not statistically significant. Further, it is also shown that aid (ODA) has a negative effect, both in short and long run. From the above analysis, the following points are put forward for development policy discourse:

- Remittance inflows remain a significant contributor to long run and short run growth of Philippines besides accounting the predominant capital productivity effects. Therefore, formalising remittances, expediting existing and new bilateral TIS deals with particular focus on short-term migration schemes under mode IV of General Agreement on TIS which covers temporary movement of natural persons (TMNP). Expediting labour mobility through sound immigration policies and bi-lateral trade deals will contribute towards a sustainable inflow of remittance inflow for Philippines. Subsequently, forward looking strategy need to prioritise labour mobility agreements both within and outside the ASEAN region and solidify existing regional trade agreements.
- Capitalising and linking ICT (technology) services with remittance transfers in a more innovative and cost-effective way would scale up technology as well as ensure ease of remittance transfers from OFWs. Therefore, investing in research and development in order to scale-up technology is vital. Further, ensuring that accessibility, availability and affordability of ICT services in urban and rural (remote) areas are critical. In this regard, the role of mobile network (wireless) services should be given due attention as they have potential for reaching greater mass of population.
- Financial and banking services need to be made effective, particularly when it comes to remittance inflows. It is incumbent on financial service providers to capture remittances, and create financial products that will benefit the poor (examples: micro-loans, micro-savings, micro-insurance schemes). Making the financial services cost effective and integrating its services with better and appropriate technology would support these activities at a greater scale.

- Philippines have a solid record of receiving large amount of remittances from OFWs working abroad. Therefore ensuring that financial services (including deposit facilities linked to remittances) are available at an affordable rate across the rural-urban regions would support domestic consumption and investment, particularly when remittances are easily available and channelled to productive ventures.
- ODA has supported some major infrastructural development in Philippines and therefore it is important that aid continues to be effectively channelled to productive projects that support financial and ICT growth in parallel with development and maintenance of the basic (existing) infrastructure (including road and transportation) which duly facilitate cost effective remittance transfers. From a global perspective, donor relationship need to be maintained and strengthened, and good governance and management practises should not be compromised with corrupt practises. Subsequently aid deployment should not overlook the importance of broad-based growth objectives.
- The need for sound legal and regulatory framework is mandatory for effective and efficient inflow of remittances. Moreover, it is vital to ensure that possibilities and attributes of money whitening or laundering activities are tracked down and discouraged, however, being cautious that tracking system do not discourage remittance transfers from honest and hardworking Filipinos abroad.
- All in all, there is need to nurture good economic institutions which supports growth of financial services, ICT, and remittance industry whilst upholding law and order, protection of human rights and welfare of OFWs, discouraging illegal migration and corruptive practises and having policies in place to create the necessary 'homely environment' for the OFW who (decide to) return home.

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Notes

- 1 We use the perpetual inventory method to compute the capital stock with depreciation rate of 2% and initial capital stock is estimated at 1.2 times 1976 real GDP.
- 2 The procedure requires that all variables are at most integrated to order one, I (1). We also use the stationary variables determined through unit root test to conduct the Granger causality test.
- 3 Similar formulation is done in other cases where ΔLk_t , $\Delta LTRD_t$, $\Delta LREM_t$, $\Delta LODA_t$, $\Delta REMICT_t$ and $\Delta REMBANK_t$ is set as dependent variable to estimate the F-statistics. Note that: $REMICT_t = LREM_t \times LICT_t$, where $LICT_t$ is natural log of the number of telephone lines per 100 populations; and $REMBANK_t = LREM_t \times LFIN_t$, where $LFIN_t$ is natural log of domestic credit to private sector as a percent of GDP.
- 4 We also used net exports as a percent of GDP and imports as a percent of GDP to measure the effect of trade openness. The results show similar coefficients. We opt to use trade as a share of GDP since it improves the overall results from other endogenised variables.