Remittances and Economic Growth in Vietnam: An ARDL Bounds Testing Approach*

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Abstract. This paper investigates the relationship between remittances and economic growth in Vietnam during the period 1996–2012. To do that, we applied an autoregressive distributed lag (ARDL) bounds testing approach to co-integration; in addition, an error correction model derived from the ARDL model was used to examine short-run dynamics among variables. We provide empirical evidence that remittances have significant positive effects on economic growth in both the short and long run.

Аннотация. Целью данной работы является исследование взаимосвязи денежных переводов с экономическим ростом во Вьетнаме в период с 1996 по 2012 гг. Основным методом исследования является выявление коинтеграции всплесков авторегрессии распределенного лага (ARDL). В дополнение используется метод коррекции ошибок (ECM), основанный на модели ARDL, с целью выявления связи между переменными в краткосрочном периоде. В заключение мы приведем эмпирические свидетельства значимой и положительной взаимосвязи денежных переводов с экономическим ростом как в долгосрочном, так и в краткосрочном периоде.

Key words: Vietnam, remittances, economic growth, ARLD.

1. INTRODUCTION

From 1996 to 2012, along with impressive development of the economy, Vietnam experienced a boom in remittance inflows, which led the country to become one of the largest remittance-receiving countries in the world. Moreover, remittances have been one of the largest sources of external private finance for the country, and in comparison with other financial flows such as foreign direct investment (FDI) and official development assistance (ODA), they have been more stable and predictable. Remittances therefore have played an important role in the Vietnamese economy in the context of a persistent trade deficit, excessive government expenditure, a considerable funding gap and fluctuations in FDI and ODA flows as ratios of GDP. In some years, the share of remittances in GDP was larger than that of FDI in GDP. Indeed, between 2002 and 2012, the remittances to GDP ratio far exceeded the ratio of ODA to GDP (Appendix Figure 1). However, there is no consensus on the impact of remittances on economic growth in Vietnam.

Hence, we conducted research to investigate the impact of remittances on economic growth in Vietnam in the 1996–2012 period, in order to examine the roles of remittances in the Vietnamese economy. The study has two main findings. Firstly, remittances are positively and significantly correlated with economic growth in the country in both the short and long run. Secondly, remittances have *de facto* been a substitute for financial services in spurring economic growth. These results contribute to literature on the relationship between remittances and economic growth in recipient countries and provide more evidence on whether remittances and financial development act like substitutes or are complementary in promoting GDP growth.

The rest of the paper is organized as follows. Section 2 provides literature on the impact of remittances on economic growth in recipient countries. Section 3 discusses methodology to be applied in the study. Section 4 presents empirical results. The last Section concludes the study.

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2. LITERATURE REVIEW

The relationship between remittances and economic growth has shown mixed results and has been a controversial issue both among academics and policy makers. By using a data set of 83 countries in the 1970–1998 period, Chami, Fullenkamp and Jahjah (2003) run panel regressions of real GDP per capita growth rate on both workers' remittances as a share of GDP and annual change in this ratio[1]. This study shows significant negative effects of remittances on economic growth. Furthermore, in order to account for endogeneity problem, an instrumental variable method is employed. This method also finds that annual changes in remittances negatively influence economic growth in remittance-receiving countries.

Moreover, another study by Chami, Barajas, Cosimano, Fullenkamp, Gapen and Montiel (2008) uses data of 108 countries over the 1970–2004 period, and the instrumental variable method. The study indicates that it is not always clear that the direct impact of workers' remittances on economic growth is positive. Additionally, by using interaction between workers' remittances and financial depth[2], the study finds evidence that a greater remittances to GDP ratio together with higher development of the financial system may be connected to lower economic growth rates since coefficients on interaction terms in most regressions tend to be negative and significant.

A study by the International Monetary Fund (IMF) (2005) uses the total remittances variable, which is the sum of workers' remittances, employee compensations and migrant transfers; and similar to Chami *et al*. (2003, 2008), the IMF study also applies the instrumental variable method; in particular, two instruments for remittances are "distance from the migrants' home to the main destination country, and a dummy measuring whether the home and main destination country shared a common language"[3]. Using data of 101 countries in the period 1970–2003, the study finds that total remittances do not have a statistically significant impact on economic growth.

Another study by Giuliano and Ruiz–Arranz (2005) collects the data of 73 countries over the period 1975–2002, then calculates the five-year average for all variables to eliminate business cycles. These researchers find that there is no significant impact of remittances on economic growth. However, applying a similar method with the study in 2005, in another study in 2009, using data of 100 developing countries, they show that remittances promote economic growth in countries with less developed financial systems since significant negative coefficients on interaction terms are found.

Together with generally negative outcomes above, a series of studies also find a positive impact of remittances on economic growth in recipient countries. Some studies show a positive correlation between remittances and financial development, thus promoting economic growth. Using data of 109 developing countries in the period 1975–2007, a study conducted by Aggarwal, Demirgüç-Kunt and Martínez Pería (2011) indicates that remittances have positive impacts on ratios of bank deposits to GDP and banking credit to the private sector to GDP. In other words, remittances are positively correlated with financial development in the recipient countries.

Like the study carried by the IMF (2005), using total remittances, by applying the ordinary least squares (OLS), Faini (2006) conducts a regression on a data set of 68 countries from 1980 to 2004 and shows that the impact of remittances on economic growth is statistically significant positive. Nevertheless, by conducting the instrumental variable method, the study finds positive but insignificant effect of remittances on economic growth. A study by Catrinescu, Leon-Ledesma, Piracha and Quillin (2006) covers 114 countries in the 1991–2003 period and finds a positive correlation between total remittances and economic growth. In addition, a study by the World Bank (WB) (2006) provides more empirical evidence to support those above-mentioned studies. The WB study uses a data set of 67 countries between 1991 and 2005 and indicates that remittances have a positive effect on economic growth in recipient countries.

By dividing Latin American and Caribbean countries into lower and upper income countries, Ramirez and Sharma (2008) apply Fully-Modified OLS methodology and indicate that remittances positively and significantly affect economic growth in those countries. However, the effect of remittances is higher in upper income countries because remittance-recipient households in such countries have more opportunities to use remittances for profitable investments. Another study conducted by Fayissa and Nsiah (2010) for 18 Latin American countries in the period 1980–2005 illustrates a positive and significant impact of remittances on economic growth since remittances are utilized for investment in the context of the less developed financial system. In addition, remittances also help ease liquidity constraints in those countries.

[1] Other independent variables are ratio of investment to GDP, inflation rate, net private capital flows to GDP ratio and regional dummies.
[2] M2 to GDP ratio represents financial depth in the recipient countries
[3] Chami *et al.,* 2008

Furthermore, according to Mohamed and Sidiropoulos (2010) in their study for seven Middle East and North Africa countries, the level of development of the financial system and the quality of institution are critical factors for the positive correlation between remittances and economic growth. Moreover, they also argue that high institutional quality helps remittances to be used more efficiently and remittances help to overcome liquidity constraints, thus promoting economic growth in recipient countries.

Supporting positive views of the effect of remittances on economic growth, some studies have been conducted to show the relationship between remittances and economic growth in Pakistan. Javid, Arif and Qayyum (2012) report positive and significant effect of remittances on economic growth by empirically testing data from 1973 to 2010 with the ARDL approach. Waheed and Aleem (2008) use co-integration and the error correction model to test impact of remittances on economic growth in the long and short run, respectively from 1981 to 2006. The study indicates that remittances have a significant negative influence on economic growth in the long run, but in the short run a positive and significant correlation is found. Moreover, with the same purpose as Waheed and Aleem (2008), Ahmed, Zaman and Shah (2011) use a bound testing approach and the error correction model with annual data from 1976 to 2009, and indicate that remittances significantly and positively affect economic growth in both the short and long run in Pakistan.

3. METHODOLOGY

Based on the growth literature, the hypothesized model specification is as follows:

$$lnGDP_t = f\left(lnREM_t, lnX_t\right) \tag{1}$$

where

lnGDP: Real GDP in natural logarithm;

lnREM: Remittances as a percentage of GDP in natural logarithm;

lnX: Set of control variables: (i) ratio of credit provided by the banking sector to the private sector to GDP (lnCRD), (ii) FDI to GDP ratio (lnFDI), (iii) openness as total trade (sum of exports plus imports of goods and services) to GDP ratio (lnTRADE) and (iv) interaction between remittances and financial sector development (lnREMlnCRD) are all in natural logarithms.

In order to investigate the relationship between remittances and economic growth in Vietnam, we apply the ARDL bounds testing approach to co-integration developed by Pesaran, Shin and Smith (2001). Indeed, that method has become more popular in recent studies.

Additionally, the error correction model can be made from the ARDL approach. The error correction model "integrates the short-run dynamics with the long-run equilibrium" while keeping long-run relationship information[4].

By applying the ARDL bounds testing approach to co-integration, the ARDL model for economic growth is constructed as follows:

$$\Delta lnGDP_t = \alpha_0 + \mu_1 lnGDP_{t-1} + \mu_2 lnREM_{t-1} + \mu_n lnX_{t-1} + \sum_{i=1}^{p}\rho_i \Delta lnGDP_{t-i} + \sum_{i=0}^{q}\beta_i \Delta lnREM_{t-i} + \sum_{i=0}^{m}\delta_i \Delta lnX_{t-i} + u_t \tag{2}$$

where

p, q and m are the optimal lag length

ρ_i, β_i, and δ_i are short-run dynamic coefficients of the ARDL model

$\mu_1, \mu_2, \ldots, \mu_n$ are long-run multipliers

Δ is the first difference operator

α_0 is constant term, and

u_t is white noise error.

In the first stage, Equation (2) is estimated by using the OLS method and the presence of long-run relationship among variables is detected based on an F-test (Wald-test) by setting the coefficients of one period lagged level of the independent variables equal to zero. The null hypothesis of no co-integration among variables in the Equation (2) is H_0: $\mu_1 = \mu_2 = \ldots = \mu_n = 0$ against the alternative hypothesis H_1: $\mu_1 \neq 0$, $\mu_2 \neq 0, \ldots, \mu_n \neq 0$. In

[4] Shrestha and Chowdhury, 2005

order to reject or accept H_0, the value of the F-test is compared with critical value bounds. For a small sample size between 30 and 80 observations, critical values computed by Narayan (2005) are appropriate to be used since critical values calculated by Pesaran *et al*. (2001) are applied for a large size of sample ranging from 500 to 40,000 observations[5]. For a given significance level, Pesaran *et al*. (2001), and Narayan (2005) generated two different sets of critical values. Lower critical bound values are calculated based on the assumption that all of the variables in the regression equation are I (0), while upper critical bound values are calculated based on the assumption that all of the variables in the regression equation are I (1)[6]. Therefore, "the two sets of critical values provide critical value bounds for all classification of the regressors into purely I (1), purely I (0) or mutually co-integrated"[7].

As a result, if a computed F-statistic lies outside the critical value bounds, the null hypothesis, H_0, is rejected which means there exists a long-run relationship among the variables concerned regardless of the order of integration of the variables. In contrast, if the computed F-statistic falls inside those bounds, the test is inconclusive[8].

In the ARDL model, the optimal lag lengths for independent variables can be selected based on the Akaike information criterion (AIC) or the Schwarz Bayesian criterion (SBC) by searching across $(p+1)^k$ ARDL models[9]; and smaller value of SBC or AIC is a better result. In this paper, we use SBC to decide the optimal lag lengths for ARDL model in the Equation (2). Moreover, according to Shrestha and Chowdhury (2005), as cited from Pesaran and Pesaran (1997), for quarterly data, 4 lags can be set as the maximum lag.

If a long-run relationship (co-integration) among variables is found, the next stage is to examine the long-run and short-run relationships among selected variables. To test long-run relationship among the variables based on the ARDL approach, the following equation is built up

$$lnGDP_t = \alpha_1 + \sum_{i=1}^{p} \phi_i lnGDP_{t-i} + \sum_{i=0}^{q} \eta_i lnREM_{t-i} + \sum_{i=0}^{m} \lambda_i lnX_{t-i} + \vartheta_t \quad (3)$$

Moreover, in order to examine the short-run dynamics from the ARDL model and to recheck the existence of co-integration found in the ARDL model, we also estimate the error correction model which is developed as follows:

$$\Delta lnGDP_t = \alpha_2 + \sum_{i=1}^{p} \varphi_i \Delta lnGDP_{t-i} + \sum_{i=0}^{q} \theta_i \Delta lnREM_{t-i} + \sum_{i=0}^{m} \sigma_i lnX_{t-i} + \Psi\, ECM_{t-1} + \xi_t \quad (4)$$

where the error correction term (ECM) can be expressed as in the following equation

$$ECM_t = lnGDP_t - \widehat{\alpha_1} - \sum_{i=1}^{p} \widehat{\phi_i} lnGDP_{t-i} - \sum_{i=0}^{q} \widehat{\eta_i} lnREM_{t-i} - \sum_{i=0}^{m} \widehat{\lambda_i} lnX_{t-i} \quad (5)$$

If the coefficient of the ECM in the Equation (4) is negative and significant, there is a long-run relationship among the variables; and it also represents the speed of adjustment to the equilibrium.

The sign of the coefficient on the interaction between remittances and financial depth indicates whether the level of development of the financial system influences the effect of remittances on economic growth. A negative coefficient shows that in country with less developed financial system, remittance inflows are more effective in promoting economic growth. To put it another way, remittances and level of financial depth act like substitutes. On the other hand, a positive coefficient provides evidence of complementarity between remittances and financial development[10].

More importantly, to determine the reliability of the ARDL results, the serial correlation, functional form, heteroskedasticity and normality of the ARDL model need to be checked. Additionally, the cumulative sum of recursive residuals test based on the cumulative sum of the recursive residuals is conducted. "This option plots the cumulative sum together with the 5% critical lines. The test finds parameter instability if the cumulative

[5] Narayan, 2005
[6] Giles, 2013
[7] Pesaran et al.,2001
[8] *ibid.*
[9] *ibid.,* and p — maximum lag length, k — a number of variables
[10] Giuliano and Ruiz–Arranz, 2009

Table 2. ARDL co-integration tests.

ARDL co-integration test			
Lag length	**F-statistic**		
ARDL (2,4,2,3,0,4)	4.924**		
Significance level	**Critical values***		
	Lower bounds I (0)	***Upper bounds (I1)***	
1 percent	3.783	5.300	
5 percent	2.835	4.090	
10 percent	2.397	3.543	
Diagnostic tests			
χ^2_{NORMAL}	χ^2_{SERIAL}	χ^2_{BPG}	χ^2_{WHITE}
0.5502 (0.759493)	3.212655 (0.2006)	12.62015 (0.9871)	21.43866 (0.7190)

Note: **, **, *** indicate significance at 10, 5 and 1 percent, respectively.*

Numbers in () are P-values

* Cited from Narayan, 2005

sum goes outside the area between the two critical lines"[11]. The cumulative sum of squares of recursive residuals test also needs to be done. "The cumulative sum of squares is generally within the 5% significance lines, suggesting that the residual variance is somewhat stable"[12].

4. EMPIRICAL RESULTS

We first conducted unit root tests to investigate the order of integration of the variables and check that none of them is I (2). By applying an Augmented Dickey Fuller (ADF) test, we found that all the variables are I (1) at the 1 percent significance level, and there is no evidence of I (2), which satisfies conditions for applying the ARDL model. Unit root test results and decisions on the order of integration are presented in Appendix Table 1.

The next step is to examine the presence of a long-run relationship or co-integration among the variables. To do that, using the OLS method, we estimate the Equation (2) and conduct the F-test by restricting the coefficients of one period lagged level of the independent variables equal to zero. Based on SBC, the optimal lag length for each variable in the ARDL model is chosen; it turns out that our model is in the form of ARDL (2,4,2,3,0,4)[13]. The F-statistic, the optimal lag length, and diagnostic test results are displayed in Table 2.

Table 2 shows that the computed F-statistic falls outside the critical value bounds at the 5 percent level of significance, which implies that we can reject the null hypothesis of no long-run relationship among the variables. Furthermore, our model also passes all the relevant diagnostic tests such as normality, serial correlation, heteroskedasticity and white noise. According to Pesaran *et al.* (2001), a key presumption for the ARDL model is that the errors of the Equation (2) must be serially independent, and that requirement may influence our final selection of the optimal lags for the variables in the model. Our model therefore meets the requirement of no serial correlation or does not suffer from serial correlation.

As noted above, in order to test for parameter stability of model, the "cumulative sum of recursive residuals" and "cumulative sum of squares of recursive residuals" tests are also undertaken. Results for these tests are shown in Figures 2–3.

As can be seen from Figure 2 and 3, since the cumulative sum of recursive residuals and the cumulative sum of squares of recursive residuals fall between the 5 percent significance lines, the parameters of the model are stable over time.

By employing the ARDL bounds testing, we find evidence of co-integration among the variables; we therefore conduct an estimation of the long-run relationship among the variables. To put it another way, Equation (3) is estimated to show co-integration among the variables in our model. Econometric results for the long-run model are displayed in Table 3.

In order to investigate the robustness of the short-run dynamics from the ARDL model and

[11] EViews 6 User's Guide II

[12] *ibid.*

[13] The optimal lag length of LNGDP, LNREM, LNCRD, LNFDI, LNTRADE and LNREMLNCRD are 2, 4, 2, 3, 0 and 4, respectively.

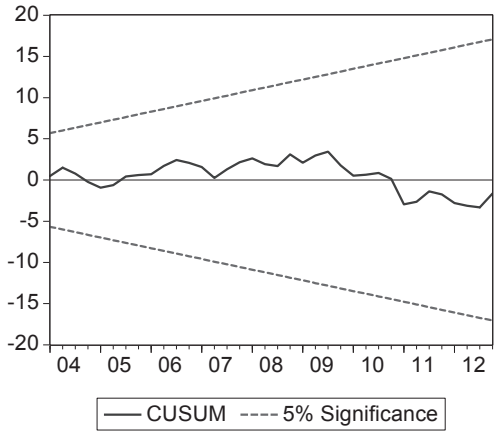

Figure 2. Plot of cumulative sum of recursive residuals.

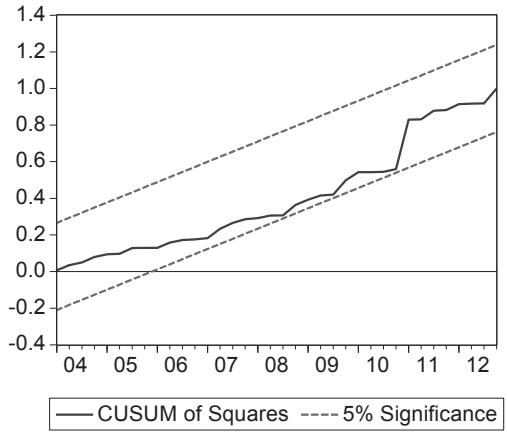

Figure 3. Plot of cumulative sum of squares of recursive residuals.

Table 3. Econometric results for the long-run model.
Dependent variable: LNGDP

Independent variables	Coefficients	Independent variables	Coefficients
LNREM	0.1145** (2.1116)	LNTRADE	0.0585*** (2.8020)
LNCRD	0.0930*** (3.1748)	LNREMLNCRD	-0.0226** (−2.2562)
LNFDI	0.0022 (0.5371)		

Note: Numbers in () are t-statistics
, **, * indicate significance at 10, 5 and 1 percent, respectively*

to recheck presence of the long-run relationship detected in the ARDL model, we proceed with the estimation of the error correction model[14], and its results are presented in Table 4. As shown in the Table, the coefficient on the error correction term, ECM (−1), is significant and negative at the 1 percent level, which confirms the existence of the long-run relationship among the variables in our model found by the F-test. In addition, it also indicates a very speedy convergence to long-run equilibrium of the model.

Tables 3 and 4 show that in Vietnam, the remittances to GDP ratio has a significant positive impact on economic growth in both the short and long run. In particular, a 10 percent increase in the ratio of remittances to GDP is associated with a 1.1 percent growth in real GDP in the short run, and leads to a 1.15 percent rise in economic growth in the long run. There are several ways to interpret our results. Firstly, only a small proportion of remittances, around 15 percent, are used for consumption. Secondly, unofficial data reports that 15 to 20 percent of remittance inflows go to bank deposits. These savings can be used for investment purposes, thus resulting in enhanced economic growth. Lastly, Hernandez-Coss (2005) points out that Overseas Vietnamese *(Viet Kieu)* send their income back to the country for investment and business purposes. Moreover, according to Sakr (2006), remittance flows to Vietnam are heavily affected by the portfolio decisions of remitters. In other words, most remittance flows to the country are devoted to investment purposes, thus promoting economic growth. In addition, by using Vietnam Household Living Standards Survey (VHLSS) 2002 and 2004, Nguyen (2008) supports the argument of Sakr (2006) and reveals that a large part of remittances are used for

[14] The error correction model is derived from the ARDL model as noted above.

Table 4. Econometric results for the error correction model.
Dependent variable: ΔLNGDP

Independent Variables	Coefficients	Independent Variables	Coefficients
ΔLNREM	0.1105** (2.5886)	ΔLNFDI	0.0103*** (2.8024)
ΔLNREM (–1)	0.0311 (0.7353)	ΔLNFDI (–1)	0.0173*** (3.4751)
ΔLNREM (–2)	0.0956** (2.3344)	ΔLNFDI (–2)	0.0068 (1.3105)
ΔLNREM (–3)	0.0285 (0.7813)	ΔLNFDI (–3)	0.0076** (2.1832)
ΔLNREM (–4)	-0.1235*** (–3.641)	ΔLNTRADE	0.0890*** (4.072)
ΔLNCRD	0.1008*** (3.835)	ΔLNREMLNCRD	-0.0212** (–2.6773)
ΔLNCRD (–1)	-0.0634* (–1.9653)	ΔLNREMLNCRD (–1)	-0.0072 (–0.9001)
ΔLNCRD (–2)	0.0588* (1.8144)	ΔLNREMLNCRD (–2)	-0.0194** (–2.4831)
ECM (–1)	-1.2592*** (–5.2811)	ΔLNREMLNCRD (–3)	-0.0079 (–1.1796)
		ΔLNREMLNCRD (–4)	0.0208*** (3.2363)
Diagnostic tests			
χ^2_{NORMAL}	χ^2_{SERIAL}	χ^2_{BPG}	χ^2_{WHITE}
0.651212 [0.722089]	0.8686 [0.7972]	10.97975 [0.9632]	16.49043 [0.7415]

Note: Numbers in () are t-statistics, and in [] are P-values
, **, * indicate significance at 10, 5 and 1 percent, respectively*

savings and investment. Indeed, in 2012, around 70 percent of remittances were allocated to business and production to help enterprises and household businesses overcome difficulties.

As can be seen, FDI, as a part of total investment, has significant positive impact on economic growth in the short run but does not have an effect in the long run. It is an interesting finding and is a puzzle.

Moreover, our findings show that the openness of the economy significantly and positively influences economic growth in both the short and long run. Since implementing the open-door policy, Vietnam has been proactive in taking part in the global market and consequently, has attained an impressive growth in trade. Joining the international market provides Vietnam many opportunities to foster its economy. The country has succeeded in accessing new markets rather than depending on existing markets.

Finally, Tables 3 and 4 state that coefficients on the interaction between remittances and financial depth are significant and negative in both the short

and long run. This finding is consistent with the literature since the Vietnamese financial system is still less developed. Moreover, this result provides evidence of substitutability between remittances and financial development, which supports findings by Giuliano and Ruiz–Arranz (2009) and other studies. By easing the liquidity constraints, remittances tend to offset the inefficiency of the financial market. Put another way, remittances have de facto been a substitute for financial services in spurring economic growth.

5. CONCLUSIONS

In order to examine the impact of remittances on economic growth in Vietnam, we applied the ARDL bounds testing approach to co-integration developed by Pesaran *et al.* (2001), using quarterly data from 1996 to 2012. The error correction model derived from the ARDL model was used to investigate short-run dynamics among the variables.

In the paper, two main results were found. Firstly, significant and positive correlation between remittances and economic growth was detected in both the short and long run. Secondly, in line with previous studies, our findings indicate that in Vietnam, like in other countries with less developed financial systems, remittances and financial development have acted as substitutes to enhance economic growth.

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Appendices

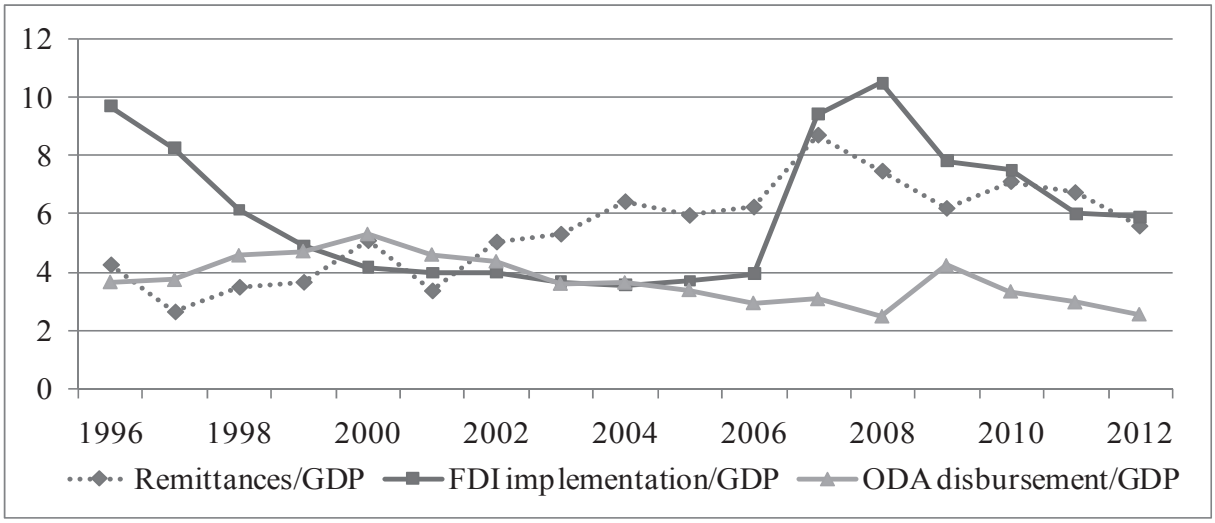

Figure 1. Remittances, FDI and ODA to Vietnam from 1996–2012 (as % of GDP).
Source: Author's calculation based on data collected from the International Monetary Fund and the World Bank

Table 2. Unit root test results and decision on the order of integration.

Variable	ADF test statistic	Decision	Variable	ADF test statistic	Decision
LNRGDP ΔLNRGDP	-0.2447 −4.5987***	I (1)	LNFDI ΔLNFDI	-1.6771 −8.4799***	I (1)
LNREM ΔLNREM	-1.6536 −10.3439***	I (1)	LNTRADE ΔLNTRADE	-1.4397 −7.3858***	I (1)
LNCRD ΔLNCRD	-1.6980 −6.0021***	I (1)	LNREMLNCRD ΔLNREMLNCRD	-1.3196 −10.3061***	I (1)

Note: *, **, *** indicate significance at 10, 5 and 1 percent, respectively.