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THE ROLE OF EXCHANGE RATE IN REMITTANCE INFLOWS Evidence from Indonesia

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Abstract

This paper attempts to analyze the economic importance of the exchange rate in Indonesia based on the question of whether the exchange rate determines the remittance inflows. Estimation of quarterly time series data for 2005(1)-2018(4) presents that remittance inflows and exchange rate are co-integrated and bi-directional Granger-causality. The results of ARDL present that remittance inflows are pro-cyclical both in the short- and the long-run, implying that remittance inflows are motivated by altruism or family arrangement. However, the home currency depreciation induces overseas workers to send more money. Asymmetrically, when the home currency appreciates, the overseas workers do not reduce their remit. Given the huge flows of remittance to Indonesia, the impact of remittances on the supply of foreign exchange should be a major concern for monetary authority. To stabilize the exchange rate and to maintain sufficient international reserve, improving the competitiveness of migrant workers should be an integral part of the macroeconomic policy.

1. Introduction

International migration from emerging countries to developed countries has grown in importance during the last decade. As having the largest worker population in South-East Asia, Indonesia is not an exception. At the end of 2018, the total number of Indonesian migrant workers who were working overseas officially registered by the Ministry of Man Power and Transmigration was reported to be 3.65 million, or 2.8 per cent of the Indonesian workforce. The number is far higher (more than 9 million or 3 per cent of Indonesia's labour force) if undocumented migrants are included (World Bank, 2017).

The resulting remittance inflows to Indonesia reached US$ 11.2 billion (equivalent to 1 per cent of Indonesia's total GDP), experienced double-digit growth in 2018 at around 24.7 per cent (World Bank, 2019). The remittance flows are the third-largest source, behind Official Development Aids and Foreign Direct Investment, of external funding as private capital flows, have declined in recent years. They exceed total government spending on social assistance programs – at 89 trillion Rupiah in 2016. Overall, the remittance inflow contributed to Indonesia's balance of payment in the amount of 27 per cent of all services, income, and current transfer value.

Given the rapid growth in the movement of people across international boundaries, remittance inflows continue to be an important issue for researchers and policymakers. For policy maker's point of view, migrant workers make a major contribution to the lives of many ordinary workers and their families. From a researcher's point of view, the rapid growth in remittance inflows is interesting to assess the validity of altruism or family arrangement motives when confronted with the selfish reasons motives. Hence, the behaviour of remittance inflows is necessary to be examined to know the stability and cyclicality patterns.

An emerging body of researches is devoted to analyzing the stability of remittance inflows (Ratha, 2003; Buch and Kuckulenz, 2004; IMF, 2005). Those studies found that remittances are a stable source of external finance seems to have become received wisdom. However, beyond the stability, empirical works of literature in developed and emerging countries concerning the cyclicality of remittances provide differing results (Sayan, 2004, 2006; Chami *et al.*, 2005; Lueth and Ruiz-Arranz, 2007; and Neagu and Schiff, 2009). Given the wide range of empirical results, there appears to be no clear consensus among research works on this issue.

Despite such a growing significance, there is a paucity of pieces of literature that analyze the impact of exchange rates in remittance inflows. Exchange rate as a determinant of remittance inflows has been studied intensively (see for example Bouhga-Hagbe, 2004; Chamon *et al.*, 2005; Gupta, 2005; Barua *et al.*, 2007; Lin, 2011; Olubiyi and Kehinde, 2015; and Pant and Budha, 2016). In general, their findings are inconclusive and need to be re-assessed. The change in exchange rates as motivation for migrant workers to send their money in the case of Indonesia is relevant. Based on the experience of heavy depreciation in 1997 and 2008, Indonesia consistently conducts prudent macroeconomic policy to face possible depreciation in the medium term so it would be suboptimal to cut back international reserve to make more room for speculative attacks. Therefore, implementing pro-rebalancing monetary measures, such as stabilizing the exchange rate, is likely to require an increase in the size of capital inflow from remittances.

This paper addresses the cyclicality and the role of the exchange rate on worker remittances in the context of Indonesia. We contribute to the literature in several ways. First, we analyze at the single country-level instead of a large number of countries and a wide time-frame. Some of the conventional wisdom on the stability of remittances is based on aggregate (global) data even though policymakers are typically concerned with the behaviour of these flows at their country-level (Neagu and Schiff, 2009). Second, along with cyclicality concerning output, this study identifies asymmetry of the exchange rate which is recognized as the nonlinear autoregressive distributed lag model. To the best of our knowledge, this is the first study to assess remittances in Indonesia. The rest of this paper is organized as follows. The next section describes the review of previous literature. The methodological framework and the data are delivered in the proceeding section; the penultimate section discusses empirical results, and the last section concludes and points to some directions for future research. Finally, some policy implications for Indonesia are also drawn.

2. Literature Review

While the literature on the relationship between remittance inflows and output is rich, on the relationship between remittance inflows and exchange rate is limited. Economic literature offers two strands linking remittances and exchange rate. The first channel is based on the effect of remittance flows on exchange rates, i.e. remittance led to exchange rate hypotheses. How it is admitted fact on all the hands that increase in remittances leads to a balance of payments improvement through a substantial reduction in current account deficit and then increase GDP growth. Eventually, the shift in foreign currency supply affects exchange rate appreciation (Obstfeld and Rogoff, 1996).

However, the impact of remittance flows on the exchange rate is ambiguous. In the first round, the enormity of the remittance flow may cause significant nominal exchange rate appreciation. It may further lower the external trade competitiveness of the country by increasing the relative price of non-tradable to tradable (Acosta *et al.,* 2009). This, in turn, lowers the long-run growth of the developing countries (Rodrik, 2008). In a less diversified tradable sector with weak institutional supports, it reduces the diversification of the exported items (Obstfeld and Rogoff, 1996).

In the consecutive round, the increase in international remittances induces aggregate demand in the destination country. Because the aggregate supply is inelastic, this, in turn, drives up the domestic price level. Furthermore, the increase in inflation rate along with lower export revenues and then followed by lower economic growth cause the nominal exchange rate depreciation. Thus, the remittance flow carries the "Dutch disease" effect on the home country, appreciating at first but depreciating overtime. This situation is similar to the J-curve idea in the opposite direction. Reichart (1981) termed this situation as 'Migrant Syndrome'.

The second channel is in the opposite direction, i.e. exchange rates led to remittance hypotheses. According to the neoclassical theory, the remittance flows depend on the consumer's income, the relative price of the goods/services at the destination country compared to the host country, the prices of related goods/services (substitutes and complements), transportation cost, distance, neighbouring country, qualitative factors in the country of origin or at the destination, and other demand shifters.

Regarding the price of the goods/services consumed by migrant workers at the destination country, the exchange rate is a crucial determinant of migrant workers to remit their money. By definition, the exchange rate is the ratio of currency between the receiving country and the country of origin. The change in the exchange rate, as a component of the cost of living, will affect the currency value of the origin country. Any appreciation in origin currency (or depreciation currency in the destination country) may encourage migrant workers to remit more money to the home country.

The role of the exchange rate in the decision to remit depends on the monetary system. In the fixed exchange rate regime, exchange rate volatility was eliminated or reduced and this encourages international capital inflow such as remittances (Calvo and Reinhart 2002). In the flexible exchange rate system, the monetary authorities adjust interest rates based on economic circumstances. Under flexible rates, the authorities can flirt with monetary variables to stabilize employment and output. Moreover, the exchange rate can adjust to counteract current account imbalances. Because of the absence of a transparent target for the exchange rate, the public is unsure of policymakers' commitments to maintaining stable prices. The implication of this is that flexibility may not attract more remittances (Olubiyi and Kehinde, 2015).

In the pegged exchange rate system, the nominal exchange rate becomes exogenous and, thus, has an impact on remittance inflows, whereas the reverse is less likely. The exchange rate through the 'substitution' and 'wealth' effects could influence the level of remittance (Bouhga-Hagbe, 2004). In a situation of currency depreciation, the goods in the home country become less expensive and, thus, migrants do not need to send back as much money as before for purchasing a given amount of goods by their families. This enables migrants to substitute some goods in the home country for some more expensive goods in the country of residence. This is termed as a substitution effect.

On the other hand, a devaluation or depreciation of the home country's exchange rate enables its migrant citizens to accumulate more wealth, which provides incentives to send back more money to buy even more goods, including building a residence and investing in real estate, in the home country. This is the 'wealth effect' of the exchange rate devaluation or depreciation. Moreover, the migrants may also send back future planned remittances by taking advances or loans to take benefit of the favourable exchange rate (Chamon *et al.*, 2005).

The role of the exchange rate in the decision to remit might be also associated with the purpose of remittance usage. If remittances are used for investment purposes and exchange rate changes are anticipated, depreciation will create an additional cost of investment, thereby attenuating the inflow. In this case, there is an adverse impact on remittances. However, if it is unanticipated, remittances will be impacted positively (Golberg, 2008). Meanwhile, if remittances are altruistic, depreciation is expected to lower remittances while appreciation raises it, ceteris paribus.

Several country-specific studies have been conducted for analyzing the impact of exchange rate on remittance inflows in the case of developing countries. Lin (2011) establishes that an appreciation of the Tongan currency results at the same proportion decrease in the growth of remittances to households compared to a 5 percentage-point decline in the growth of remittances to non-profitable organizations. Chamon *et al.* (2005) found that growth in remittance inflows in Samoa is significantly affected by the changes in the real exchange rate. Barua *et al.* (2007) also illustrated that depreciation of domestic currency appears to be

positively correlated with the flow of workers' remittances in Bangladesh. Gupta (2005) found an insignificant impact of exchange rate on remittance inflows in India.

Dakila and Claveria (2007) analyze the impact of different measures of exchange rates on remittance inflows to the Philippines. The results confirmed that a depreciation of the peso vis-à-vis a basket of currencies of major destination countries for Filipino workers increases the remittances. But, the impact of nominal peso-dollar rate to the remittance inflows to the Philippines is found insignificant. Vargas-Silva (2007) examines the relationship between remittances, exchange rates and money demand in Mexico and finds the existence of a bidirectional relationship between remittances and the exchange rate. More recently, Pant and Budha (2016) conclude that depreciation of Nepalese currency has a positive impact on remittance inflows.

In the case of Indonesia, the related study is rare. Ratha (2007) documents evidence of high remittance flows to Indonesia during the financial crisis in 1998. As a result, Indonesia experiences a Dutch disease (Javaid, 2009). Nizar (2014) found that the growth of remittance inflows have a positive impact on real exchange rates of rupiah. The increase in remittance inflows causes the real exchange rate of the rupiah has strengthened in a fairly long period. Therefore, it is not surprising that remittance inflows appreciate the exchange rate and adversely affect competitiveness whereas, the exchange rates negatively affect exports (Khurshid *et al.*, 2018).

3. Research Method

The brief literature review above suggests the potential for some interesting hypotheses about potential linkages among labours migration, worker remittances, and other macroeconomic variables, such as GDP and exchange rates. Unfortunately, there is not a clear consensus about the direction of the causal link, which means the findings are country-specific. The cyclical properties of remittances depend on the countries studied, the periods examined, and the techniques employed.

While there has been an increased emphasis on examining the sensitivity of exchange rate fluctuation on the remittances sent to developing countries, the literature about Indonesia is yet to fill this gap. In what follows, we examine the remittance flows to Indonesia to determine if this is indeed also the case for Indonesia. The purpose of this section is to develop an analytical framework within which these can be clearly stated as a set of formal propositions.

The exchange rate is a crucial determinant of migrant workers sending their income to the home country. By definition, the exchange rate is the ratio of currency between the receiving country and the country of origin. The change in the exchange rate will affect the currency value of the origin country. Any change in the exchange rate will lead to an appreciation or depreciation of origin currency. In short, any appreciation in origin currency (or depreciation currency in the home country) may encourage more people to work abroad and to remit their income. This idea is similar to wage differential in the standard microeconomic analysis dealing with the supply of labour.

As stated previously, remittances may be motivated by altruism or family arrangement. The two motives imply the cyclicality. The altruism motive proposes that remittances are

expected to be counter-cyclical. Another one posits that remittances are mostly driven by selfish reasons. In this case, remittances should be procyclical. In short, the test of cyclicality requires GDP as an explanatory variable to check the behaviour of remittances. Since labour migrant and worker remittances are closely inter-related, we use the remittance-labour migrant ratio to avoid endogeneity.

Eventually, we can construct the remittances (*REM*) model that is a function of the exchange rate (*ER*) and *GDP*:

$$\text{Log (REM)} = f \left(\text{Log (ER)}, \text{Log (Q)} \right) \tag{1}$$

More operationally, equation (1) could be transformed into a linear relationship among those variables by implementing disturbance component (ε):

$$\text{Log (REM)} = \alpha + \beta \, \text{Log (ER)} + \gamma \, \text{Log (Q)} + \varepsilon \tag{2}$$

Equation (2) is then transformed into the restricted ARDL (auto-regressive distributed lag) model to accommodate some adjustments. The use of the ARDL model is justified by the fact that it makes possible to easily assess REM both in the short-run and in the long-run. The short-term relationships can be evaluated from the first-difference variable, while the long-term relationships can be investigated from the lagged variable. Another advantage of this specification is the consistency and efficiency of estimates in the presence of endogenous regressors.

Moreover, bearing in mind that standard unit root tests are susceptible to misleading results, Pesaran and Shin (1999) show that ARDL models yield consistent estimates of the coefficients irrespective of whether the underlying regressors are *I(1)* or *I(0)*, thus providing robustness to the results. The model takes the unrestricted form as follows:

$$
\begin{aligned}
\Delta \, \text{Log (REM)}_t = {}& \alpha + \Sigma \, \beta_i \, \Delta \, \text{Log (REM)}_{t\text{-}i} + \Sigma \, \gamma_j \, \Delta \, \text{Log (ER)}_{t\text{-}j} \\
& + \Sigma \, \delta_k \, \Delta \, \text{Log (Q)}_{t\text{-}k} + \phi_1 \, \text{Log (ER)}_{t\text{-}1} \\
& + \phi_2 \, \text{Log (Q)}_{t\text{-}1} + \varphi \, \text{Log (REM)}_{t\text{-}1} + \in_t
\end{aligned}
\tag{3}
$$

where Δ is difference operator and φ is coefficient of partial adjustment, $0 \leq \varphi \leq 1$.

In model (3), long term effect between variables is the same size either in a reduction or in increase case. In contrast, when effects of increase or reduction are not the same (in other words, when we have asymmetric effects in the increase and decrease of variables), we need to use a model developed by Shin (2014). In nonlinear autoregressive distributed lag developed by Shin (2014), short term and long term effect are calculated asymmetrically.

To study the asymmetric effect, exchange rate and GDP variables need to be divided into two groups including positive changes and negative changes, which is defined further as follows:

$$
\begin{aligned}
\Delta \, \text{Log (REM)}_t = {}& \alpha + \Sigma \, \beta_i \, \Delta \, \text{Log (REM)}_{t\text{-}i} + \Sigma \, \gamma_{1j} \, \Delta^+ \text{Log (ER)}_{t\text{-}j} \\
& + \Sigma \, \gamma_{2j} \, \Delta^- \text{Log (ER)}_{t\text{-}j} + \Sigma \, \delta_k \, \Delta \, \text{Log (Q)}_{t\text{-}k} \\
& + \phi_1 \, \text{Log (ER)}_{t\text{-}1} + \phi_2 \, \text{Log (Q)}_{t\text{-}1} + \varphi \, \text{Log (REM)}_{t\text{-}1} + \xi_t
\end{aligned}
\tag{4}
$$

The Wald test is computed to test the null hypothesis, $H_0: \phi_1 = \phi_2 = \varphi = 0$ against the alternative hypothesis, $H_a: \phi_1 \neq \phi_2 \neq \varphi \neq 0$. If the Wald test value falls outside the upper bound, the null hypothesis of no co-integration is rejected. In other words, Log (REM), Log

(ER), and Log (Q) are said to be co-integrated. However, no conclusive inference can be made for the Wald test value falls inside the critical bounds, unless the order of integration of the variables is known. If the Wald test value falls below the lower bound, the null hypothesis of no co-integration cannot be rejected.

Assuming that the bounds test leads to the conclusion of cointegration, we can meaningfully estimate the long-run equilibrium relationship between the variables as (2) as well as the usual ECM:

$$\Delta \text{Log (REM)}_t = \alpha + \Sigma \ \beta_i \ \Delta \text{Log (REM)}_{t-i} + \Sigma \ \gamma_{1j} \ \Delta^+ \text{Log (ER)}_{t-j}$$
$$+ \Sigma \ \gamma_{2j} \ \Delta^- \text{Log (ER)}_{t-j} + \Sigma \ \delta_k \ \Delta \text{Log (Q)}_{t-k} + \lambda \ \text{ECT}_{t-1} + \mu_t \qquad (5)$$

where ECT $= \varepsilon$ in (2)

Generally, both in the short-run and the long-run, the coefficients of the exchange rate and output could be positive or negative. The coefficient of the lagged dependent variable is expected to be positive and measures the speed of adjustment towards the equilibrium in the long-run. Therefore, long term coefficient is obtained by positive and negative changes by -$\Sigma\gamma_{1j}/\varphi$ and -$\Sigma\gamma_{2k}/\varphi$. long term symmetric effect are tested by Wald test when -$\Sigma\gamma_{1j}/\varphi = $ -$\Sigma\gamma_{2k}/\varphi$. These coefficients show long term influence ability. Short term adjustment of the dependent variable with a positive and negative difference of independent variable is obtained by $\Sigma\gamma_{1j}$ and $\Sigma\gamma_{2k}$. For short term symmetric test, Wald test is used when $\Sigma\gamma_{1j} = \Sigma\gamma_{2k}$.

We employ the following indicators: worker remittances, GDP, and exchange rate. The worker remittances are defined as the sum of three series covering workers' remittances, migrants' transfers, and compensation of employees. The worker remittances are expressed in million US dollar in the current prices. The national output is measured by GDP in 2000 constant price in the local currency. The exchange rate is the price of the US dollar against domestic currency (Rupiah) at the middle rate. The sample periods were chosen for this study extend from 2005(Q1) to 2018(Q4) because of data availability in particular overseas workers. The total raw observation is 56 sample points. The data are derived from the balance of payment published electronically by the Central Bank of Indonesia.

4. Result and Discussion

Table 1 presents the basic statistics covering the mean, median, and extreme (maximum and minimum) values for all variables of interest. Each the median value is not too far from the respective mean (in particular domestic output). The closeness of the median to the mean value preliminary indicates that all of the variables of interest are normally distributed.

Furthermore, the range (distance from minimum to maximum) values vary, in particular remittance inflows. The range values of the exchange rate and domestic output are relatively almost the same (0.55 and 0.77). They are consistent with the configuration of standard deviation. The standard deviation and coefficients of variation (CV) of remittance inflows are highest compared to two other variables. Regardless of the symmetric behaviour in nature, the statistical evaluation above confirms that both domestic income and exchange rate have low volatility.

Table 1: Statistic Descriptive

	LOG (REM)	LOG (ER)	LOG (Q)
Mean	6.1486	9.2885	14.4417
Median	6.0603	9.1932	14.4725
Maximum	6.6788	9.6111	14.8029
Minimum	5.7039	9.0592	14.0308
Std. Dev.	0.2900	0.1813	0.2236
CV	0.0472	0.0195	0.0155

Figure 1 delivers the dynamics of the two main variables of interest. Brief visual inspection onto Figure 1 seems that remittance inflows are more stable than the other. After overseas workers moratorium in mid-2005, the remittance per labour migrant grew consistently in the proceeding years. On the other hand, the bilateral exchange rate fluctuated especially depreciated in 2008 in line with the global financial crisis and again sharply decreased at the end of 2015 under 'mini-crisis' (Abimanyu, 2016).

To quantify the relationship between remittance flows and exchange rate, one can calculate the coefficient of correlation. However, if the two series are integrated of order one (i.e. both contain a unit root), the distribution of the sample correlation is a semi-ellipse (see e.g. Banerjee *et al.*, 1993). One may compute the correlation but it will not tell you anything because all values between -1 and 1 are 'almost equally likely'.

Figure 1: Remittance and Exchange Rate
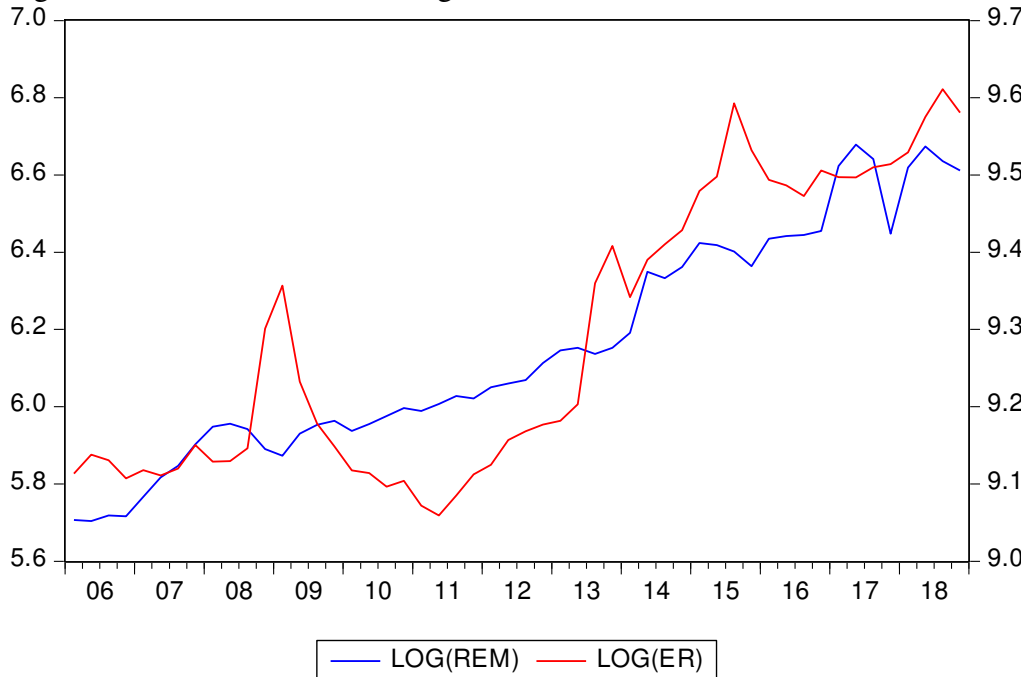
To evaluate further the synchronous fluctuation patterns among remittance inflows, exchange rate, and output, we de-trend the three series by regressing them on a constant and linear trend. Then we compute the correlation among the three de-trended series (i.e. the residuals). It is noticeable that overall there are synchronous fluctuation patterns between remittance inflows and exchange rate. As presented in Table 2, the unsynchronous pattern is found for

remittance inflows and domestic income (-0.35) as well as exchange rate and domestic income (-0.40). All of the pairwise coefficients correlation is statistically significant.

The pairwise correlation between de-trended series of Log (REM) and de-trended series of Log (ER) is 0.15 from 2005 to 2008, 0.52 in 2009-18 period, and 0.50 in the whole period respectively. Based on those figures, we can say that the dynamics of remittance inflows is strongly associated with the fluctuation of the exchange rate in the post-global financial crisis but the relationship is probably unstable for the whole period. From Table 2, we can also preliminary infer that the remittance inflows are countercyclical to the domestic income growth. The latter will be re-examined using econometric models as specified in the previous section.

Table 2: Correlation Matrix among the De-Trended Variables

	LOG (REM)	LOG (ER)	LOG (Q)
LOG (REM)	1.0000	0.4961	-0.3510
LOG (ER)	0.4961	1.0000	-0.3966
LOG (Q)	-0.3510	-0.3966	1.0000

Those findings are still incomplete because correlations do not provide information about causality links between variables of interest. As presented in Table 3, we conduct standard Granger causality test with 2 lags. The 2-lags test is suggested by LR, FPE, AIC, SC, and HQ criteria. The results of Granger causality tests show that there exists a long run bi-directional causality from remittance inflows to exchange rate. The said is not false for the reverse as found by Bayangos and Jansen (2005) and Vargas-Silva (2007) in the case of Phillippine and Mexico respectively.

The bi-directional causality is also found between remittance inflows and home income. These results suggest that remittance inflows factor is growing in significance in the exchange rate complex. As stated before, the depreciation of the domestic currency has raised the remittance inflows. The remittance inflows then increase the quantity of foreign currency supplied and then the exchange rate appreciates. This is a plausible result since modern international migration depends heavily on the differences in financial systems, migration patterns, the quality of institutions, inflation (Glytsos and Katseli, 1986), socio-demographic factors (Russell, 1986), and the economic development of the home countries.

Table 3: Causality Test

Pairwise Granger Causality Tests			
Null Hypothesis:	Obs	F-Stat	Prob.
LOG(REM) does not Granger Cause LOG(ER)	54	3.3950	0.0416
LOG(ER) does not Granger Cause LOG(REM)		2.9388	0.0623
LOG(Q) does not Granger Cause LOG(REM)	54	5.6765	0.0061
LOG(REM) does not Granger Cause LOG(Q)		4.3089	0.0189
LOG(Q) does not Granger Cause LOG(ER)	54	4.0033	0.0245
LOG(ER) does not Granger Cause LOG(Q)		1.8616	0.1663

To prove our hypothesis, we estimate the ARDL model first as equation (3). The OLS estimation results. unfortunately. show that the coefficients of $\beta_i \Delta$ Log $(REM)_{t-i}$ for whole 2 consecutive lags are statistically insignificant. Therefore, we remove them. The same results are obtained for $\gamma_j \Delta$ Log $(ER)_{t-j}$ and $\delta_k \Delta$ Log $(Q)_{t-k}$ especially for lag 2. Then, we reestimate (3) using only 1 lag for all of three specification models (Table 4). The coefficients of lagged dependent variables are highly significant. These preliminary perform the presence of co-integration. To ensure the presence of co-integration, then we test the possibility of co-integration by implementing the bound test.

The result is presented in Table 5. The Wald test (F and χ^2 statistic) is computed to test the null hypothesis, H_0: $\phi_1 = \phi_2 = \varphi = 0$ against the alternative hypothesis, H_a: $\phi_1 \neq \phi_2 \neq \varphi \neq 0$. The result of the Wald test values falls outside the upper bound in the lower (0.025) probability value. It means that the null hypothesis of no co-integration is rejected suggesting the presence of co-integrating relation. In other words, the remittance inflows, exchange rates, and home income are said to be co-integrated.

Table 4: Estimation Results

Dep. Variable:	(1)		(2)		(3)	
Δ LOG (REM)	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-9.3172	0.0003	-10.5853	0.0000	-10.1078	0.0002
Δ LOG (ER)	0.0498	0.7831	-	-	-	-
Δ LOG (ER)$^+$	-	-	-0.3708	0.1249	-0.3270	0.2058
Δ LOG (ER)$^-$	-	-	0.9129	0.0204	0.8993	0.0237
LOG (ER(-1))	0.2000	0.0625	0.3215	0.0054	0.3105	0.0087
Δ LOG (Q)	0.5558	0.1149	0.5608	0.0932	-	-
Δ LOG (Q)$^+$	-	-	-	-	0.2696	0.6888
Δ LOG (Q)$^-$	-	-	-	-	1.0358	0.3073
LOG Q(-1)	0.4919	0.0004	0.4987	0.0002	0.4744	0.0009
LOG REM(-1)	-0.4763	0.0004	-0.5568	0.0000	-0.5344	0.0002
R^2	0.2563		0.3497		0.3535	
Adj. R^2	0.1755		0.2630		0.2506	
S.E.E	0.0562		0.0532		0.0536	
F	3.1708	0.0153	4.0328	0.0026	3.4366	0.0051
DW	1.6525		1.8972		1.8700	
Correlogram Q(2)	2.5332	0.2820	2.7920	0.2480	2.6381	0.2670
Normality Test	3.9591	0.1381	4.3368	0.1144	4.0978	0.1289
B-G Serial	1.5305	0.2277	1.4476	0.2464	1.3006	0.2831
Correlation Test	3.3822	0.1843	3.2804	0.1939	3.0327	0.2195
B-P-G Hetero-	2.0981	0.0827	2.0190	0.0827	1.6566	0.1450
skedasticity Test	9.6567	0.0856	11.0293	0.0875	10.8461	0.1455
Reset(1)	1.7138	0.0934	1.1456	0.2581	0.8450	0.4028
	2.9371	0.0934	1.3125	0.2581	0.7140	0.4028

Table 5: Bound Cointegration Test

Model	Test	Value	df	Prob.	Conclusion
(1)	F-stat	5.2796	(3, 46)	0.0033	Co-integrated
	χ2-stat	15.8388	3	0.0012	
(2)	F-stat	7.1625	(3, 45)	0.0005	Co-integrated
	χ2-stat	21.4876	3	0.0001	
(3)	F-stat	5.6120	(3, 44)	0.0024	Co-integrated
	χ2-stat	16.8361	3	0.0008	

The conclusion is made based on a 2.5% critical value (Pesaran *et al.* (2001)

In the short-run, the change in exchange rates has no effect to induce the remittance inflows (Model 1). It implies that free capital movement required by the free-floating exchange rate regime implies that exchange rates fluctuation is strongly affected by the occasional reversal of capital inflows. Therefore, considering the short-run exchange rate market is not relevant for migrant workers to send their money to the home country. This result confirms to some researchers that found exchange rates have a limited effect on remittance inflows as offered by Dakila and Claveria (2007).

However, when we split up into depreciation and appreciation (Model 2), the impact of depreciation home currency for migrant labour to send their money to the home country becomes significant. In other words, migrant labour asymmetrically responds to the change in home currency. In this case, migrant workers would increase their financial support for families to maintain consumption level. Ir seems that remitters could be risk aversive, trusting the home country in times of economic hardship and preferring to spend less (or save more) their gains then sending them home.

In the long-run, the exchange rate depreciation encourages remittance inflows. This is verified by the coefficient of lagged Log (ER) which is statistically significant at 1 per cent confidence level mainly in Model 2. In such a case, the capability of migrant workers to remit their money plays an important role in stabilizing the exchange rate fluctuation in the long-run. It seems that exchange rates stabilization in the future requires the adequacy and quality of overseas labour in the current period. This confirms to most empirical studies as surveyed by IMF (2005).

The coefficient of Log (Q) presents cyclicality. Both in the short- and long-run confirm that remittance inflows are procyclical indicated by the positive sign of the corresponding variables. The short-run impact of GDP on remittance inflows is statistically significant at a 10 per cent confidence level mainly in Model 2. Again, when we split up into recessions and booms in model 3, the conclusion is different. The remitters typically do not care about the current status of economic condition in sending their money. The a-cyclical implies that the income effect is less than the substitution effect as found in exchange rates.

The estimation of the lagged dependent variable gives significant coefficients. The associated coefficient displays persistence. The remittance inflows persistence can be considered as a measure of the degree of dependence of current remittance inflows behaviour on its past developments. The coefficient of lagged dependent variables is quite the same, ranging from 0.4 to 0.6, suggesting that a change in the remittance inflows between quarter *t-1* and *t* drives up the remittance inflows process in *t* only 0.4 to 0.6 per cent partial adjustments to respond

to the tolerated levels. Consequently, the remittance inflows tend to be less persistent than to respond to exchange rate fluctuation in the short-run.

Tabel 6 further recheck the validity of ARDL when confronted with the ECM. The magnitude of lagged ECM, ranging from 0.47 to 0.54, is close to the coefficient of lagged dependent variable in the ARDL model. The coefficient of lagged ECM for three models specification is statistically significant representing that all variables in the model are co-integrated as found in the bound co-integration test.

Using the coefficient of lagged ECM, we can estimate the long-run coefficient of regression as displayed in Table 7 for Model (2). In general, the obtained long-run coefficient of regression in ECM is consistent with the result of ARDL. The long-run coefficient of regression is slightly higher than the short-run. However, it does not alter the initial conclusion: asymmetric behaviour concerning the change in exchange rate exists and remittance inflows are characterized pro-cyclical.

Table 6: Error Correction Terms

Variable	Model (1)		Model (2)		Model (3)	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
ECM(-1)	-0.4737	0.0003	-0.5487	0.0000	-0.5206	0.0002

Table 7: Long Run Coefficient of Regression

|	LOG (ER)$^{+}$	LOG (ER)$^{-}$	LOG (Q)
Coeff.	-0.6585	1.5932	0.9573
t-stat	-2.8180	4.9058	2.9946

Processed from Table 4 and 6

5. Robustness Test

Furthermore, the significance of the lagged dependent variable in ARDL models indicates that our estimated remittance inflows model is well specified. Thereafter, it is necessary to check for the stability of the remittance inflows function. This is because of the importance of the stability of the remittance inflows function for an effective monetary policy. This, therefore, makes it necessary to test whether the estimated remittance inflows equation has shifted over time as an important part of this empirical study. Since Models (1) dan (2) give a better estimate, we check the robustness only on the two models.

As a robustness measure for empirical results, we use the cumulative sum (CUSUM) tests for the stability of the model. The plots of the CUSUM in Figure 2 fall within the 95 per cent confidence bands, which verify the stability of estimated parameters only in all cases. Another robustness approach including a dummy variable for the global financial crisis and 'mini-crisis' in the models as a control variable for external shocks does not affect the sign and significance of our estimators, indicating all model encompasses to the others. In principle, they support the presence of significant effects of the exchange rate and domestic income on the remittance inflows.

Figure 2: CUSUM Robustness Test

(1)   (2)
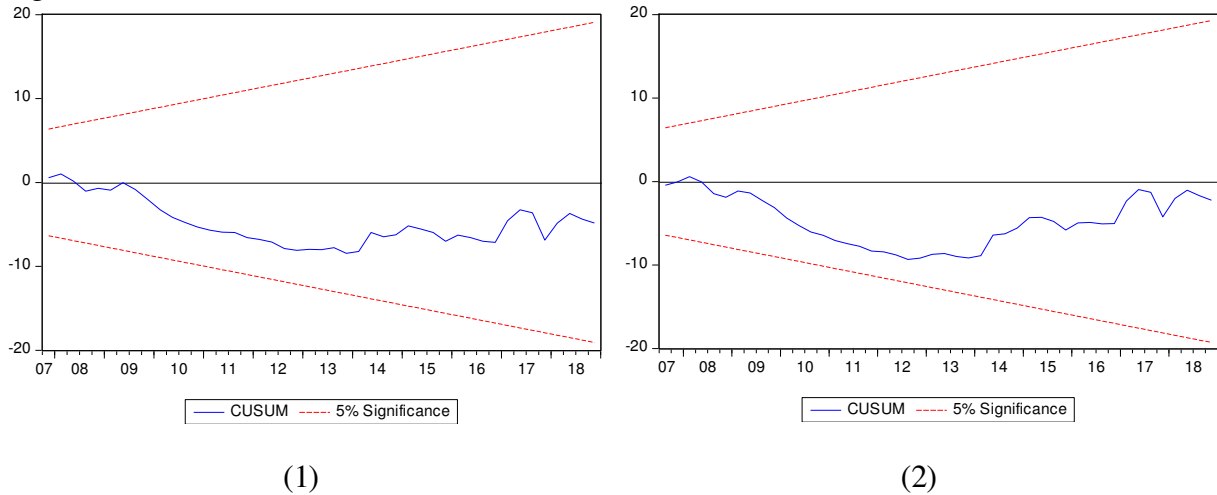
Concluding Remarks

Migration and remittances are special for Indonesia for at least two reasons. First, this is because Indonesia is recognized as having the second-largest migrant worker population in South-East Asia, second to the Philippines. Second, in line with the recent intense migration flows from Indonesia to advanced countries, the transfers of funds by migrants back to the country of origin have become increasingly significant. The government even calls the labour migrant as "Foreign Currency Hero".

This paper attempts to analyze the economic importance of the exchange rate in Indonesia based on the question of whether the exchange rate determines the remittance inflows. Estimation of quarterly time series data for 2005(1)-2018(4) presents that remittance inflows and exchange rate are co-integrated and bi-directional Granger-causality. The results of ARDL present that remittance inflows are pro-cyclical both in the short- and the long-run, implying that remittance inflows are motivated by altruism or family arrangement.

However, the home currency depreciation induces overseas workers to send more money. This is unsurprised concerning the altruistic reasons, i.e. migrants' desire to enhance the welfare of relatives still living in the country of origin. Asymmetrically, when the home currency appreciates, the overseas workers do not reduce their remit. Given the huge flows of remittance to Indonesia, the impact of remittances on the supply of foreign exchange should be a major concern for monetary authority. To stabilize the exchange rate and to maintain sufficient international reserve, improving the competitiveness of migrant workers should be an integral part of the macroeconomic policy.

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