

# SHORT AND LONG-TERM ANALYSIS OF FOREIGN EXCHANGE RATES BASED ON INCOME LEVELS

*by* Harunurrasyid<sup>1</sup> , Mardalena<sup>21</sup>, Imam Asngari<sup>3</sup> , Siti Rohima<sup>4</sup> , Sri  
Andaiyani

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## SHORT AND LONG-TERM ANALYSIS OF FOREIGN EXCHANGE RATES BASED ON INCOME LEVELS

Harunurrahyid<sup>1</sup>, Mardalena<sup>21</sup>, Imam Asngari<sup>3</sup>, Siti Rohima<sup>4</sup>, Sri Andaiyani<sup>5</sup>  
<sup>1,2,3,4,5</sup> Faculty of Economics, Universitas Sriwijaya, Indonesia

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**Abstract.** This study aimed to determine the effect of foreign exchange demand and supply on exchange rates in four groups of countries based on per capita income levels from 1989-2018 using ARDL panel method. The results showed remittances have a significant effect on exchange rates in panel A (low income countries), panel B (lower middle income countries), panel D (high income countries), but not on panel C (upper middle income countries). Export and import variables have a significant effect on panels B, C, and D, and are not significant on panel A. Meanwhile inflation variables have a significant effect on all types of panels.

**Keywords:** Remittance, Export, Import, Inflation, ARDL Panel.

**JEL Codes:** F10, F14, F19

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### 1. Introduction

Exchange rate stability is an economic's important indicator that has a strategic role. Exchange rate movements are like a double-edged sword because when there is a depreciation of the domestic currency, the exporter will be benefited from the relative price of export products when it's becoming cheaper. Otherwise, domestic currency depreciation disserves importers and foreign debtors because of increasing import costs and foreign debt repayment burdens. Depreciation also increases inflationary pressures, in case inflation increases significantly it will have a negative impact on the economy as a whole. In the end, the impact of depreciation is affected by the ratio of its positive or negative effects. However, the opposite will happen to the appreciation of the domestic currency.

The World Bank classifies all countries in the world into various categories. One of the criteria for classification that is carried out by the World Bank is based on the level of per capita income. Per capita income is the average income of the population in a country in one year (Sukirno, 1995). In 2018 the World

<sup>1</sup> Corresponding author email address: [mardalena@fe.unsri.ac.id](mailto:mardalena@fe.unsri.ac.id)



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Bank classified countries based on per capita income level into four categories, including: (1) countries with high per capita income which is  $> \$ 12,375$  (2) countries with income per capita upper middle income which is between  $\$ 3,996 - \$ 12,375$  (3) countries with income per capita middle to low income which is between  $\$ 1,026 - \$ 3,995$  (4) countries with low income per capita that is  $\leq \$ 1,025$ .

The lowest exchange rates in the world against the U.S. dollar. Iran's rial is the currency with the lowest value against the U.S. dollar, where the exchange rate of US\$1 equals 40,864 Iranian rials, then Vietnamese currency of Vietnam also has a low value, which in 2018 US\$1 equals 22,604 dong. Meanwhile, the Indonesian rupiah is also classified as having a low value against the US dollar, where in 2018 the exchange rate of US\$1 is equivalent to 14,237 rupiahs.

The highest exchange rates in the world against the U.S. dollar. Kuwait's dinar currency is the highest exchange rate against the U.S. dollar, which in 2018 US\$1 equals 0.30 Kuwaiti dinars. Oman's currency, the Omani rial, also has a high exchange rate against the U.S. dollar, of which US\$1 is equivalent to 0.38 Omani riyals. Meanwhile, the common currency of most European countries, the euro, has a fairly high exchange rate against the U.S. dollar, whereas the exchange rate of US\$1 is equal to 0.85 euros.

As a country that adheres to an open economic system, of course, international transactions using foreign exchange are inevitable. If in a country the demand for foreign exchange exceeds its supply the country's currency will depreciate, otherwise, when the supply of foreign exchange exceeds its demand the country's currency will appreciate, therefore demand and supply of foreign exchange are suspected as the cause of fluctuations in exchange rates in countries with lower middle per capita income.

The demand and supply of foreign exchange that is described are very interesting to examine further, therefore in this study will test one of the components that affect foreign exchange demand, namely imports and inflation against the exchange rate, because inflation can cause investors to flee their capital abroad and also make imports increase which will increase foreign exchange demand too as previously explained, so inflation and imports here have potential to depreciate domestic exchange rates. Then this research will also test the impact of one of the components that affect foreign exchange supply, namely remittances and exports, as previously explained that labor and export remittances will increase foreign exchange reserves and increase foreign exchange offerings, which is ultimately likely to appreciate domestic exchange rates.

## 2. LITERATURE STUDIES

### 2.1 Foreign Exchange Demand and Supply Theory

Foreign exchange (forex) or foreign currency serves as a means of payment to finance international economic transactions and also has an official exchange rate record at the central bank. Currencies that are often used as a means of payment in international financial economic transactions are called hard currencies, which are currencies originating from developed countries and relatively stable in value and sometimes experience appreciation or increase in value compared to currencies from other countries (Wijatmoko, 2009).



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According to Asri Alfathir (2016: 14) at least, there are 3 main factors that affect foreign exchange demand. (1) import payment factors. The increased activity in imports of goods and services causes demand for foreign currency to increase, so the exchange rate will tend to weaken. (2) capital outflow factor. The greater outflow of capital can increase the demand for foreign exchange and in its continuation will weaken the exchange rate. Capital outflows include the payment of debts (both private and government) to foreign parties and the placement of domestic resident funds abroad. (3) Speculation activities. The more foreign exchange speculation activities carried out by speculators, will increase the demand for foreign exchange thus weakening the local currency exchange rate against foreign currencies.

According to Akter (2021) There are five most important factors in affecting the exchange rate, namely inflation, differences in interest rates, differences in income levels, government control, and changes in expectations. These factors drive demand and supply and create exchange rates at a new equilibrium, but there are other factors such as political stability, term of trade, and market valuations that play an important role in determining currency demand and changes in foreign exchange rates.

While according to Krugman (2009: 136) it is a factor that affects foreign exchange offerings, among them; (1) The receipt of exports of goods and services, the more exports are carried out, the more foreign exchange will be received, so that foreign exchange offers will increase. (2) Capital inflows, the more capital entering the country will increase domestic foreign exchange offerings, capital inflows can be in the form of foreign direct investment, grant funds, foreign aid, receivable payments and others. (3) remittances of foreign workers and tourists, money sent by workers working abroad into the country will increase foreign exchange reserves and increase foreign exchange offers, as well as when foreign tourists vacation domestically, it will increase foreign exchange offers in the country because the tourist will exchange his foreign exchange for domestic currency.

Various empirical studies attempt to examine the relationship or effect of foreign exchange demand and supply on a country's exchange rate. One of the studies conducted by Afolabi O. Adejumo (2019), tested the impact of remittances of immigrants from Nigeria on the Nigerian currency exchange rate as well as testing whether remittance inflows indicated the onset of Dutch disease. Using time-series data from 1981-2014 and Dynamic Ordinary Least Squares (DOLS) analysis techniques. The study found that remittance inflows depreciated the naira exchange rate, but there were no indications dutch disease was found. Further research under the title of factors that affect the rupiah exchange rate against the US Dollar was conducted by Samsul Arifin (2016). They sought to test the effect of inflation, interest rates, index degrees of economic openness, and exchange rate volatility on the rupiah exchange rate. Their research showed similar results, where rising inflation rates, interest rates, economic openness, and exchange rate volatility caused the rupiah to weaken or depreciate against the U.S. dollar.

Another empirical study conducted by (Darmanto, 2019) examines the effect of foreign exchange reserves and remittances of Indonesian Migrant Workers on the rupiah exchange rate in the period 2008 – 2017 through the Ordinary Least Square analysis technique and concludes that remittances by Indonesian Migrant Workers have the greatest influence compared to foreign exchange reserves. Foreign exchange reserves are negatively related, while remittances are positively related to the rupiah exchange rate.

Another study conducted by Foday and Sheriff (2021) tested remittances, inflation, foreign exchange reserves, and the money supply to the effective exchange rate in the Gambia using Fully Modified OLS and Dynamic OLS techniques with data period 2009 to 2019 which revealed the results that remittances cause currency appreciation in Gambia, inflation is positively related to the effective exchange rate, foreign



exchange reserves have no effect on the effective exchange rate and the money supply causes depreciation of the effective exchange rate in Gambia.

Another study conducted by Zeeshan Khan, Shahid Ali (2016) tested the effect of remittances, inflation, and trade provisions (TOT) on exchange rates in Pakistan. Their research found a long- and short-term relationship between remittances, inflation, and trade provisions to Pakistan's real exchange rate. Remittances and trade provisions have a negative relationship which means making the exchange rate appreciate, while inflation has a positive relationship which means that the increase in inflation depreciates the real exchange rate in Pakistan. The research entitled exchange rate fluctuations in Tanzania conducted by Ntui (2013), from the study it is known that national debt, political stability, interest rates, and economic growth significantly affect fluctuations in the Shilling exchange rate. Meanwhile, export, inflation and import variables had no significant effect on the movement of Tanzania's Shilling exchange rate.

A study conducted by Mongardini & Rayner (2009) for 29 sub-Saharan African countries showed somewhat different results. Remittances have no significant effect on the real exchange rate in the long run. In contrast to the influence of aid that causes depreciation of the real exchange rate in the long run. Another study by Catalina Amuedo-Dorantes (2004), using data from several countries (panel), namely data on 13 Latin American and Caribbean countries in the period 1978 - 1998, this study also produced the same discovery that increased remittances led to an appreciation of real exchange rates. The last study was conducted by Bourdet Falck (2006) for the case of Cape Verde. Using data from 1980 to 2000 they tested the effect of remittances on real exchange rate balance. The result obtained that the increase in remittance receipts led to the appreciation of the real exchange rate.

### 3. RESEARCH METHODOLOGY

The study used some countries in the world to be reduced into four categories based on the world bank's rules in 2018. Only a few countries were included in the study, the list of these countries can be seen in table 2.

**Table 2**  
**List of Countries of Research Objects**

Low Income	Lower Middle Income	Upper Middle Income	High Income
1		1	1
Benin	Bangladesh	Botswana	Australia
Burkina Faso	Bolivia	Brazil	Iceland
Ethiopia	Cameroon	China	Israel
Guinea	Egypt, Arab Rep.	Colombia	Japan
Madagascar	Eswatini	Costa Rica	Korea, Rep.
Mali	India	Dominican Republic	Norway
Mozambique	Indonesia	Guatemala	Sweden
Niger	Lao PDR	Jamaica	Switzerland
Sierra Leone	Morocco	Malaysia	Trinidad and Tobago
	Nigeria	Maldives	United Kingdom





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Pakistan	Mexico
Papua New Guinea	Paraguay
Philippines	South Africa
Senegal	Sri Lanka
Tunisia	Thailand

Source : World Bank In 2018

Variables used are affected variables as dependent variables and independent variables as influencing variables. Meanwhile, for the period of time this study is using annual data from 1989 to 2018. The dependent variable in this study is the exchange rate of countries' analysis of the U.S. dollar. And then, the independent variables in this study are labor remittances, exports, imports, and inflation. The data used in this study is secondary data. Secondary data in this study in the form of panel data (combined between time series and cross-section) from 1989-2018. Data on exchange rates, remittances, exports, imports, and inflation, were obtained from the World Bank and IMF websites.

The analytical technique used to solve problems in this study is a quantitative analysis. Using a panel data regression model. Common models for investigating the long-term effects of remittances, exports, imports, and inflation on exchange rates are as follows:

$$LNEXRT_{it} = \beta_1 + \beta_2 LNREM_{it} + \beta_3 LNEXP_{it} + \beta_4 LNIMP_{it} + \beta_5 INF_{it} + \varepsilon_{it} \quad (1)$$

Where LNEXRT is the exchange rate of a country in the form of ln (against the US dollar), i is the object state, t is the year of analysis, LNREM is the remittance of labor in the form of ln, LNEXP is export in the form of ln, LNIMP is imported in the form of ln, INF is inflation in the form of percent, and is the error term. Traditional estimation methods in equations (1) do not allow us to solve the complex problem of exchange rate dynamics, therefore this study used the ARDL panel method to examine the dynamic relationship between remittances, exports, imports, and inflation to exchange rates.

This method is interesting for several reasons. First, it allows us to control heterogeneity in the relationships between variables in different countries by incorporating individual-specific effects. Second, it allows us to control endogeneity. Third, this model facilitates the estimation of long-term and short-term impacts between free variables to Njangang-bound variables, at all (2018). According to Pesaran, Shin, & Smith (1999) the basic model of ARDL (p;q) is as follows:

$$y_{it} = \sum_{j=1}^p \lambda_{ij} y_{it-j} + \sum_{j=0}^q \delta'_{ij} x_{it-j} + v_i + \varepsilon_{it} \quad (2)$$

Where i = 1,2,..., N are the countries of analysis, t = 1,2,..., N is the year of analysis, j is the amount of lags, is the exchange rate, is remittance, export, import, and inflation, is the special fixed effect of



countries. To consider the long-term coefficient and the adjustment coefficient, the equation parameter (2) is changed as follows:

$$\Delta y_{it} = \phi_i(y_{it-1} - \theta'_i x_{i,t}) + \sum_{j=1}^{p-1} \lambda_{i,j}^* \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{i,j}^* \Delta x_{i,t-j} + v_i + \varepsilon_{it} \quad (3)$$

Where it represents a long-term relationship or equilibrium between and. Meanwhile and represents short-term coefficients relating to exchange rates with past values and other determinants. The error correction coefficient is represented by a symbol that measures the speed of exchange rate adjustment to its long-term equilibrium following changes in remittances, exports, imports, and inflation. A long-term relationship between independent variables and exchange rates exists if  $< 0$ . As a result, significant and negative values that signify the existence of cointegration between and

## 4. RESULTS AND DISCUSSIONS

### 1. Descriptive Statistics and Matrix Correlation

Descriptive statistics of variable data and matrix correlations between variables in this study can be seen in tables 3 and 4.

**Table 3**  
**Descriptive Statistics**

Country	Variabel	Mean	Median	Maximum	Minimum
Panel A : Low Income	LNEXR	5.7931	6.2677	9.1147	-0.2945
	LNREM	17.867	18.125	21.309	10.206
	LNEXP	20.707	20.625	22.755	17.170
	LNIMP	21.021	20.921	23.719	18.516
	INF	9.6920	5.6569	110.90	-27.787
Panel B : Lower Middle Income	LNEXR	3.8400	3.7136	9.5636	-0.1522
	LNREM	20.406	21.042	25.090	12.899
	LNEXP	22.985	22.936	27.009	18.268
	LNIMP	23.138	23.075	27.189	19.172
	INF	8.0048	5.9057	125.27	-3.2066
Panel C : Upper Middle Income	LNEXR	3.2415	2.5494	8.7678	-13.611
	LNREM	20.282	20.660	24.518	14.078
	LNEXP	23.673	23.363	28.606	18.827
	LNIMP	23.723	23.570	28.566	18.758
	INF	30.202	6.2159	2947.7	-1.6854
Panel D : High Income	LNEXR	2.3047	1.8407	7.2453	-0.6936
	LNREM	20.365	20.580	22.687	14.993
	LNEXP	25.214	25.520	27.559	21.328



LNIMP	25.147	25.402	27.646	21.073
INF	3.1959	2.2923	20.758	-1.3528

Source : Eviews Estimated Result, 2020

Table 3 displays descriptive statistics for four types of panels with data in the form of natural logarithms (ln). The mean value for the exchange rate variable (LNEXR) on panel A is 5.7931, panel B is 3.8400, panel C is 3.2415, and panel D is 2.3047. The highest average values for export variables (LNEXP) and imports (LNIMP) are in panel D, which are 25,214 and 25,147, respectively. The remittance variable (LNREM) in panel B has the highest average value of 20,406, while inflation variables (INF) has the highest average value, namely in panel C, which is 30,202.

Table 4  
 Matrix Correlation

Country	Variable	LNEXR	LNREM	LNEXP	LNIMP	INF
Panel A : Low Income	LNEXR	1.0000				
	LNREM	-0.0604	1.0000			
	LNEXP	-0.1815	0.6452	1.0000		
	LNIMP	-0.0881	0.5878	0.8691	1.0000	
	INF	-0.1611	-0.4364	-0.1972	-0.2625	1.0000
Panel B : Lower Middle Income	LNEXR	1.0000				
	LNREM	-0.0292	1.0000			
	LNEXP	0.0668	0.8211	1.0000		
	LNIMP	0.0714	0.8693	0.9872	1.0000	
	INF	0.0847	-0.1999	-0.1282	-0.1384	1.0000
Panel C : Upper Middle Income	LNEXR	1.0000				
	LNREM	0.0325	1.0000			
	LNEXP	-0.2233	0.6971	1.0000		
	LNIMP	-0.2146	0.7435	0.9941	1.0000	
	INF	-0.4098	0.0046	0.0262	0.0111	1.0000
Panel D : High Income	LNEXR	1.0000				
	LNREM	-0.0004	1.0000			
	LNEXP	-0.0604	0.8836	1.0000		
	LNIMP	-0.0556	0.8898	0.9941	1.0000	
	INF	0.0197	-0.3618	-0.5202	-0.5048	1.0000

Source : Eviews Estimated Results, 2020

Table 4 displays the matrix correlation between all variables for the four panel types with data in the form of natural logarithms (ln). In Panel A all free variables have a negative correlation to variables bound by exchange rates, in panel B remittance variables have a negative correlation to exchange rates while export, import, and inflation variables have a positive correlation to exchange rates. Meanwhile, for panel C the remittance variable has a positive correlation to the exchange rate, while the export, import, and inflation variables have a negative correlation, in panel D the inflation variable has a positive





correlation to the exchange rate, and the variables of remittance, export, and import have a negative correlation to the exchange rate.

## 2. Stationary Test

The root test of the panel unit is performed to test the stationarity of the data before the ARDL panel model is estimated. The results of the stationarity test can be seen in Table 5.

**Table 5**  
**Test Panel Unit Root**

Level Stationarity Test								
Variable	Individual Intercept			Individual Intercept dan Trend				
	LLC	IPS	ADF-Fisher	PP-Fisher	LLC	IPS	ADF-Fisher	PP-Fisher
Panel A : Low Income								
LNEXR	0.00000.0106		0.0218	0.0002	0.0038	0.0455	0.0734	0.0032
LNREM	0.76730.9878		0.9740	0.9951	0.1519	0.4318	0.6228	0.8797
LNEXP	0.90961.0000		1.0000	1.0000	0.0084	0.1739	0.1463	0.4804
LNIMP	0.93531.0000		1.0000	1.0000	0.1004	0.3590	0.5627	0.7283
INF	0.00000.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Panel B : Lower Middle Income								
LNEXR	0.00390.2966		0.3505	0.0091	0.2334	0.5930	0.5581	0.9378
LNREM	0.00150.8359		0.5234	0.1051	0.5266	0.8135	0.7462	0.9397
LNEXP	0.12700.9984		0.9999	0.9978	0.9344	0.7895	0.9198	0.9838
LNIMP	0.57960.9998		1.0000	0.9988	0.8238	0.6071	0.8217	0.9597
INF	0.00000.0000		0.0000	0.0000	0.0000	0.0001	0.0002	0.0000
Panel C : Upper Middle Income								
LNEXR	0.00000.0016		0.0037	0.0000	0.0045	0.0333	0.0070	0.0000
LNREM	0.00100.3258		0.4134	0.0002	0.3360	0.3612	0.2905	0.1092
LNEXP	0.00000.8586		0.9657	0.0062	0.3447	0.5940	0.7531	0.8568
LNIMP	0.00040.8630		0.9773	0.0523	0.4001	0.4426	0.7034	0.8650
INF	0.00000.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Panel D : High Income								
LNEXR	0.00010.0010		0.0025	0.0152	0.0076	0.0764	0.1935	0.9653
LNREM	0.00920.6348		0.5885	0.0046	0.1914	0.7679	0.8773	0.9425
LNEXP	0.08990.9800		0.9967	0.5533	0.5750	0.8740	0.9647	0.9956



<b>LNIMP</b>	0.08860.9825	0.9988	0.9355	0.2224	0.3642	0.5008	0.8920
<b>INF</b>	0.00000.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Source : Eviews Estimated Results, 2020

Table 5 shows the results of root tests of level panel units using the Methods <sup>1</sup> Levin, Lin & Chu (LLC), Im Pesaran & Shin (IPS), Augmented Dickey Fuller-Fisher, Phillips Perron-Fisher. Based on the ADF-Fisher test on **panel A** the variable exchange rate and inflation have been stationary at the level I (0) while the variable remittance, export, and import is stationary at the first difference I (1). Panel B variables stationary inflation at level levels and variables of the exchange rate, remittance, export, and stationery imports at first difference. Meanwhile, panels C and D variables of exchange rate and inflation have been stationary at level levels, while variable remittances, exports, and imports are stationary at first difference. It can be inferred from these results that estimates using the ARDL method can be done because variable stationarity has been mixed at the level and first difference for all types of panels.

### 3. Long-Term ARDL Panel Model Estimates

Autoregressive Distributed Lag (ARDL) can be used to look at both short- and short-term effects <sup>6</sup> in this research model. The results of the ARDL panel model estimate in the long term can be seen in table 6.

**Table 6**  
**Long-Term ARDL Panel Model Estimates**

<sup>10</sup> Panel A : Low Income				Panel B : Lower Middle Income		
Variable	Coefficient	t-Statistic	Prob.*	Coefficient	t-Statistic	Prob.*
<b>LNREM</b>	-0.2904	-1.9232	0.0568	-0.4006	-12.2573	0.0000
<b>LNEXP</b>	0.4046	1.2342	0.2195	-0.8432	-6.8584	0.0000
<b>LNIMP</b>	0.2019	0.6654	0.5071	1.2413	11.5022	0.0000
<b>INF</b>	0.1408	5.0508	0.0000	0.0585	5.5598	0.0000
<sup>10</sup> Panel C : Upper Middle Income				Panel D : High Income		
Variable	Coefficient	t-Statistic	Prob.*	<sup>1</sup> Coefficient	t-Statistic	Prob.*
<b>LNREM</b>	0.07819	0.91563	0.3606	-0.0681	-2.6203	0.0095
<b>LNEXP</b>	-1.33358	-3.06226	0.0024	-1.4250	-3.4579	0.0007
<b>LNIMP</b>	1.05931	2.50473	0.0128	1.2941	3.0711	0.0025
<b>INF</b>	0.00797	4.38437	0.0000	-0.0499	-6.5358	0.0000



Source: *Views Estimated Results, 2020*

Table 6 shows that in panel A the remittance variable has a significant and negative effect on the exchange rate with a probability of 0.0568 and a coefficient of -0.2904, meaning that an increase in remittances of 1 percent will make the exchange rate appreciate by 0.29 percent. Inflation variables have a significant and positive influence with a probability of 0.0000 and a coefficient of 0.1408, meaning that if inflation increases by 1 percent then the exchange rate will depreciate by 0.14 percent. Meanwhile, export and import variables have no significant effect on the exchange rate where the probability of each variable is 0.2195 and 0.5071.

Panel B of remittance and export variables has a significant and negative effect on the exchange rate with the same probability of 0.0000 and the coefficients of -0.4006 and -0.8432 respectively, this result shows that when there is a 1 percent increase in remittances, the exchange rate will appreciate by 0.40 percent and when exports increase by 1 percent then the exchange rate will appreciate by 0.84 percent. Meanwhile, import and inflation variables have a significant and positive influence on the exchange rate with the same probability of 0.0000 and coefficients of 1.2941 and 0.0585 respectively, this result shows that when there is an increase in imports by 1 percent then the exchange rate will depreciate by 1.29 percent and when inflation increases by 1 percent then the exchange rate will depreciate by 0.06 percent.

Panel C of remittance variables does not have a significant effect on the exchange rate, where the probability of the variable is 0.3606 with a coefficient of 0.07819. Export variables have a negative and significant influence with a variable probability of 0.0024 and coefficient of -1.33358, this result means that when exports increase by 1 percent, the exchange rate will appreciate by 1.33 percent. Meanwhile, import and inflation variables both have a positive and significant influence on the exchange rate, where the probability of variables of 0.0128 and 0.0000 with coefficients of 1.05931 and 0.00797, respectively, indicates that when there is an increase in imports by 1 percent then the exchange rate will depreciate by 1.06 percent and when there is an increase in inflation of 1 percent eating the exchange rate will depreciate by 0.008 percent.

Panel D of remittance, export, and inflation variables has a negative and significant influence on the exchange rate, where the probability of the variable remittance is 0.0095 with a coefficient of -0.0681, the probability of export variables by 0.0007 with a coefficient of -1.4250 and the probability of inflation variables of 0.0000 with a coefficient of -0.0499. These results show that when there is an increase in remittances by 1 percent then the exchange rate will appreciate by 0.07 percent, when exports increase by 1 percent then the exchange rate will appreciate by 1.42 percent and when inflation increases by 1 percent then the exchange rate will appreciate by 0.05 percent. Meanwhile, import variables have a positive and significant influence on the exchange rate, where the probability of variables is 0.0025 with a coefficient of 1.2941, meaning that when imports increase by 1 percent, the exchange rate will depreciate by 1.29 percent.

#### 4. Cointegration Test

The cointegration test is performed to evaluate whether the variables in the model have long-term equilibrium. The results of the cointegration test with the Kao method can be seen in Table 7.

Table 7  
Kao Cointegration Test Results



Panel A : Low Income			Panel B : Lower Middle Income		
ADF	t-Statistic	Prob.	ADF	t-Statistic	Prob.
	-4.5405	0.0000		-3.7366	0.0001
Residual variance	0.0296			0.0195	
HAC variance	0.0653			0.0334	
Panel C : Upper Middle Income			Panel D : High Income		
ADF	t-Statistic	Prob.	ADF	t-Statistic	Prob.
	-7.8011	0.0000		-3.4691	0.0003
Residual variance	0.0900			0.0054	
HAC variance	0.1700			0.0074	

Source : Eviews Estimated Results, 2020

Kao's cointegration test results in Table 7 show that there has been cointegration across all types of panels, evidenced by significant ADF probability at a significance level of 1%, so it can be concluded that there is a short-term relationship toward long-term balance in each type of the panel in the study.

## 5. Short-Term ARDL Panel Model Estimates

Once it is known that there is a cointegration in the Kao test that has been done before, then rarely perform a short-term analysis toward a long-term balance which can be seen in Table 8.

Table 8  
Short-Term ARDL Panel Model Estimate Results

Variable	Panel A : Lower Income	Panel B : Lower Middle Income	Panel C : Upper Middle Income	Panel D : High Income
C	-0.04(-1.10)	0.19(1.67)	0.66(6.72)	0.65(2.02)
$\Delta \text{EXR}_{t-1}$	0.07(0.76)	0.04(0.36)	0.20(3.48)	0.00(0.05)
$\Delta \text{EXR}_{t-2}$	-0.05(-0.40)	-0.01(-0.07)		
$\Delta \text{EXR}_{t-3}$		-0.13(-1.00)		
$\Delta \text{REM}$	-0.03(-0.99)	-0.03(-0.76)	-0.04(-0.94)	-0.04(-0.52)
$\Delta \text{REM}_{t-1}$	-0.05(-1.47)	-0.03(-0.73)	-0.03(-1.35)	-0.00(-0.03)
$\Delta \text{REM}_{t-2}$	-0.02(-0.48)	-0.09(-1.64)		
$\Delta \text{REM}_{t-3}$		-0.06(-1.08)		
$\Delta \text{EXP}$	-0.18(-3.26)	0.00(0.02)	-0.03(-0.27)	-0.13(-1.11)
$\Delta \text{EXP}_{t-1}$	-0.04(-1.47)	0.01(0.12)	0.06(0.94)	0.01(0.08)
$\Delta \text{EXP}_{t-2}$	0.05(1.28)	0.15(1.88)	-	-



<sup>1</sup> $\Delta \text{EXP}_{t-3}$		0.08(0.69)		
$\Delta \text{IMP}$	-0.21(-2.69)	-0.28(-1.92)	-0.30(-5.12)	-0.35(-2.67)
$\Delta \text{IMP}_{t-1}$	-0.09(-1.05)	0.04(0.52)	-0.01(-0.24)	-0.02(-0.24)
<sup>1</sup> $\Delta \text{IMP}_{t-2}$	-0.04(-0.83)	-0.26(-2.73)		
$\Delta \text{IMP}_{t-3}$		-0.20(-1.46)		
$\Delta \text{INF}$	0.00(0.35)	0.00(0.12)	0.00(2.85)	0.02(3.78)
$\Delta \text{INF}_{t-1}$	-0.00(-0.65)	-0.00(-1.59)	-0.00(-2.55)	0.00(0.43)
<sup>1</sup> $\Delta \text{INF}_{t-2}$	0.00(0.53)	-0.00(-0.26)		
$\Delta \text{INF}_{t-3}$		-0.00(-1.85)		
$\text{ECT}_{t-1}$	-0.0665(-4.61)	-0.0850(-2.16)	-0.0726(-6.37)	-0.0887(-1.69)

Source : Eviews Estimated Results, 2020

Notes : ( ) t-test

The coefficients of variables in the short term in table 8 vary, as in export variables in panel A which have a coefficient of -0.18, but that is not our focus, our focus is on ECT variables, which ECT variables must have negative and significant coefficients. In panel A the ECT variable has been significant with a coefficient of -0.0665 meaning that when a shock occurs it takes about 23.9 days to be adjusted again. In panel B the ECT variable has been significant with a coefficient of -0.0850 meaning that when a shock occurs it takes about 30.6 days to be readjusted.

Panel C of the ECT variable has also been significant with a coefficient of -0.0726 meaning that when a shock occurs it takes about 26.1 days to be readjusted. Meanwhile, in panel D the ECT variable has also been significant with a coefficient of -0.0887 meaning that when a shock occurs it takes about 31.9 days to be readjusted. The results of these four panels can be concluded that panel A (low-income countries) have more adjustment speed than other panels when there is a shock.

### 4.3 DISCUSSION

Labor remittances have a negative and significant effect <sup>10</sup> which means that increasing remittances will make the exchange rate appreciate in 3 types of panels, panel A (low-income countries), Panel B (countries with lower middle incomes), and panel D (countries with high incomes). This is not surprising because according to World Bank data in 2018, incoming remittances flowing to low-income countries only reached 3.6 percent of GDP, and remittances that went to countries with lower middle incomes reached 4.5 percent of the total GDP of those countries. Remittances that enter countries with high earned only 0.28 percent of GDP, but when viewed from the amount of money that comes in it reaches US\$ 153 billion.

<sup>8</sup> The results of this study are in accordance with the theory of foreign exchange demand and supply, at the time when remittances enter in the form of foreign exchange, especially as the U.S. dollar increases, it will increase foreign exchange supply and local currency permits in the country and will increase the country's <sup>6</sup> foreign exchange reserves, which will eventually make the local exchange rate appreciate. The findings are also in line with research conducted by Catalina Amuedo-Dorantes (2004) where increased





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remittance inflows were able to appreciate exchange rates in 13 Latin American and Caribbean countries during the period 1978-1998. Different results were found on panel C (countries with upper-middle incomes), where remittances had no significant effect on exchange rates, but these results were also in line with the results of Mungar Dini & Rayner (2009), where remittances had no significant effect on exchange rates in Sub-Saharan African countries.

Exports have a significant and negative effect on three types of panels, there are on panel B (countries with lower middle income), panel C (countries with upper-middle incomes), and panel D (countries with high incomes), which affect means the increase in exports will make the exchange rate appreciate. The results of this finding are in line with the theory of foreign exchange demand and supply, when exports increase, there will be a lot of foreign exchange from export payments that enter the exporting country and will increase the country's foreign exchange reserves that will eventually appreciate the local exchange rate.

Exports are indeed a mainstay for countries with high incomes, this can be seen from world bank data, where in 2018 the export value of high-income countries reached US\$ 5.99 trillion or 24.5 percent of GDP and the export value of countries with high income reached US\$ 17.58 trillion or 32.4 percent of GDP. Meanwhile, the export value of countries with lower middle incomes amounted to US\$ 1.53 trillion, although not as large as previous countries, the value of these exports has a considerable proportion of the GDP of these countries, which is 23 percent.

The findings are in line with research conducted by Hazizah, et al (2017) which said that exports have a negative and significant influence on the rupiah exchange rate per US dollar. While the export variable does not significantly affect the exchange rate in panel A (low-income countries), this is likely due to the accumulation of export value of low-income countries is still quite small compared to other panels, where according to world bank data in 2018, the export value of low-income countries is only US \$ 92.56 billion and only 15.7 percent of the GDP of these countries. Even the export value of countries with low incomes experienced a deficit that is quite far compared to the value of imports, which amounted to US \$ 81.19 billion. This result is also in line with research conducted by Ntui (2013), which stated that more and more exporting countries do not affect exchange rate movements.

Import variables have a positive and significant influence on the exchange rate, this influence occurs in the same 3 types of panels as export variables, namely on panel B (countries with lower middle income), panel C (countries with upper-middle incomes), and panel D (countries with high incomes). This positive and significant influence can be interpreted as an increase in imports will make the exchange rate depreciate. The findings are also in line with the theory of foreign exchange demand and supply, where when imports increase it will take a lot of foreign exchange to finance the import, consequently domestic foreign exchange demand will increase and will reduce foreign exchange reserves, which will eventually suppress or depreciate the local currency.

The value of imports in 3 types of panels that have significant results is quite large, especially on the panel of countries with lower-middle incomes, where in 2018 the import value of these countries reached US\$ 1.87 trillion or 27.8 percent of GDP, this value is much greater than the value of exports of only US\$ 1.53 trillion. While on the panel of countries with upper-middle incomes the value of imports in 2018 reached US\$ 5.62 trillion or 23 percent of GDP and on the panel of countries with high incomes, the value of imports in 2018 reached US\$ 16.93 trillion or 31.2 percent of GDP.



The findings are in line with research conducted by Hazizah et al (2017) where an increase in the number of imports will make the rupiah exchange rate per US dollar depreciate. Meanwhile, different conditions occur in the panel of low-income countries, where imports have no significant effect on the exchange rates in those countries. In fact, if viewed from the data released by the world bank in 2018, the import value of countries with low incomes reached US \$ 173.75 billion or 29.5 percent of GDP, this is likely because countries with low incomes are identical to underdeveloped countries with political situations and inflation that are usually quite high, so these conditions are the ones that affect exchange rate fluctuations here. The findings are also in line with research conducted by (Ntui (2013), where the increase in imports has no significant effect on the Tanzanian exchange rate.

Inflation variables have a positive and significant influence in the sense that rising inflation will depreciate the exchange rate on a panel of countries with low incomes, lower-middle incomes, and high incomes. This result is in line with purchasing power parity theory that when domestic inflation is higher than inflation abroad, then the price of domestic goods will tend to be more expensive than the price of goods abroad, this condition will make the price of export goods less competitive and will encourage imported goods to be more. If something like this happens then of course it will have an impact on the decline in foreign exchange reserves and will make the local exchange rate depreciate. The findings are also in line with research conducted by Zeeshan Khan, Shahid Ali (2016), where increased inflation will make Pakistan's exchange rate depreciate.

Based on data obtained from the world bank of several countries in 3 types of panels, it did experience quite high inflation, as happened in Sierra Leone on panel A, where inflation in 1990 reached 111 percent. Furthermore, inflation occurred in Laos in panel B, where inflation reached 125 percent in 1999. Then more severe inflation occurred in the country of Brazil on panel C, where Brazil experienced hyperinflation from 1989-1994 with the highest inflation occurring in 1990 which reached 2948 percent.

Meanwhile, different results occur in the panel of high-income countries, where inflation has a negative and significant effect on exchange rates, which means that an increase in inflation will make the exchange rate in those countries appreciate. This is likely because the countries on the panel are developed countries and inflation in those countries is relatively low and controlled compared to the countries on the other panel. So that when inflation increases it will increase productivity and increase the number of goods exported abroad and in the end will appreciate the exchange rate. The findings are also in line with research conducted by Rajakaruna (2017), where inflation has a negative influence on the exchange rate, which means increased inflation will make the Sri Lanka exchange rate appreciate against the US dollar.

## 5. CONCLUSION

Remittances has a negative and significant affect on exchange rates on panel A (low-income countries), panel B (countries with lower incomes), and panel D (high-income countries). Meanwhile, on panel C (countries with upper-middle incomes) the effect of remittances is not significant. Exports have a negative and significant effect on exchange rates on panel B, panel C, and panel D. Meanwhile on panel A exports' affect are not significant. Imports have a positive and significant influence on exchange rates on panel B, panel C, and panel D. Meanwhile on panel A imports do not have a significant effect. Inflation has a positive and significant effect on exchange rates on panel A, panel B, and panel C. Meanwhile on panel D inflation has a negative and significant effect on the exchange rate.



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