



Do Workers' Remittances and Tourism Reduce Sri Lanka's Trade Deficit?

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ABSTRACT

This study empirically investigates the extent to which workers' remittances and tourism earnings can help improve Sri Lanka's trade balance. Monthly data for the period January 2010 to December 2022 (156 observations) were obtained from the Central Bank of Sri Lanka's eResearch database; Trade Balance, Exports, and Imports were unavailable beyond December 2022 at the time of writing, which set the end of the study window. Unit root tests indicated a mixed order of integration. The Trade Balance is stationary at levels, while remittances, tourist earnings, and the exchange rate are integrated of order one. An Autoregressive Distributed Lag (ARDL) bounds-testing approach (Pesaran, Shin & Smith, 2001) was used in place of Johansen's cointegration test. The bounds F-test ($F = 5.90$) confirms a long-run level relationship among the variables, and the error-correction coefficient (-0.375 , $p < 0.001$) implies that approximately 37.5% of any deviation from long-run equilibrium is corrected within a month. In the long run, tourist earnings show a negative association with the trade deficit, significant at the 10% level; the remittances and exchange rate coefficients carry the theoretically expected signs but are not statistically significant at conventional levels. Granger causality tests show bidirectional causality between remittances and the trade balance, and unidirectional causality running from both tourist earnings and the exchange rate to the trade balance. CUSUM and CUSUM-of-squares tests confirm that the model is parameter-stable across the sample period, including the COVID-19 pandemic. The findings offer more limited empirical support for the trade-deficit-reducing role of remittances and the exchange rate than earlier single-equation estimates suggested, while tourism and the long-run equilibrium relationship remain supported

Keywords: ARDL Bounds Testing, Error Correction Model, Exchange Rate, Granger Causality, Sri Lanka, Tourism Earnings, Trade Balance, Workers' Remittances.

1. INTRODUCTION

Sri Lanka has had a persistently large trade deficit since it achieved independence, reflecting its status as a small, import-dependent open economy in South Asia. According to Central Bank of Sri Lanka (2025) data, the trade deficit increased from a low of USD 200 million in January 2010 to a high of USD 1.10 billion in February 2023, averaging USD 638 million per month over the period, as merchandise imports persistently and substantially exceeded merchandise exports. This structural imbalance has had significant negative consequences for the economy, including depleted foreign currency reserves and reduced capacity to service international debt, contributing to the severe economic crisis of 2022, which required an International Monetary Fund (IMF) Extended Fund Arrangement. Beyond foreign investment and foreign aid, workers' remittances and tourism earnings represent two further channels through which foreign exchange inflows can support the external sector. Conceptually, these inflows are expected to influence the trade balance through two competing channels: directly, by expanding the supply of foreign exchange available to finance imports and service external obligations, and indirectly, through their effect on domestic demand and the real exchange rate, as formalised in the Transfer Problem. Workers' remittances have historically been a major source of foreign exchange for Sri Lanka, averaging approximately USD 520 million per month over the study period and peaking at USD 813 million in May 2022. Tourism, one of the country's top three service-sector foreign exchange earners, expanded substantially over the same period: monthly tourist arrivals rose by approximately 245%, from an average of 55,000 in 2010 to 190,000 in 2025, while tourist earnings increased by approximately 400%, from USD 150 million to USD 750 million. However, the study period also encompassed two major structural shocks that tested the resilience of these inflows. The COVID-19 pandemic produced a 73.5% decline in tourist arrivals and an 81.1% decline in tourist earnings relative to pre-pandemic levels, while the 2022 economic and sovereign debt crisis triggered a sharp depreciation of the LKR/USD exchange rate, from an annual average of LKR 199 per dollar in 2021 to LKR 323 per dollar in 2022. These episodes suggest that the relationship between remittances, tourism, and the trade balance may not be stable across periods of normalcy and extreme economic distress, and any empirical model should be able to capture this. Although prior studies have examined the effects of workers' remittances on the Sri Lankan economy and of tourism on imports separately (Paranavithana, 2014; Bhavan, 2019; Aslam & Alibuhtto, 2023; Jawaid & Raza, 2012), no existing study jointly models the combined effect of workers' remittances and tourism earnings on Sri Lanka's trade balance using data spanning both the COVID-19 pandemic and the 2022 sovereign debt crisis. This study addresses that gap. The main objective of this study is to empirically examine the impact of workers' remittances and

tourism earnings on Sri Lanka's trade balance over the period January 2010 to December 2022, incorporating the COVID-19 pandemic and the 2022 economic crisis to underscore the analysis's novelty and policy relevance. Specifically, the study aims to: (i) examine the long-run equilibrium relationship among workers' remittances, tourism earnings, the exchange rate, and the trade balance; (ii) estimate the short-run dynamics and speed of adjustment toward this long-run equilibrium; and (iii) determine the direction of causality among these variables.

2. Literature Review, Theoretical Framework and Hypotheses Development

Theoretical Framework

Three complementary theoretical perspectives underpin the empirical model developed in this study: the Transfer Problem Theory, the Dutch Disease Hypothesis, and the Tourism-Led Growth (TLG) hypothesis.

Transfer Problem Theory, first articulated by Keynes (1929) and later revisited by Regmi (2022), characterises workers' remittances as "unrequited" financial transfers from migrant workers to household members in the home country. The receipt of remittances generates two opposing forces on the trade balance. On one hand, remittances raise recipients' disposable income, increasing spending on imported goods and services and thereby worsening the trade balance through an income effect. On the other hand, remittances add to the domestic supply of foreign exchange; where sufficient foreign exchange is available, and the exchange rate is flexible, this can enhance export competitiveness through expenditure switching. The net effect of remittances on the trade balance is therefore theoretically indeterminate, depending on whether the income effect or the expenditure-switching effect dominates, as well as on structural factors specific to the recipient economy.

The Dutch Disease Hypothesis extends the transfer-problem framework by placing the exchange rate at the centre of the transmission mechanism (Lartey et al., 2012; Khurshid et al., 2018). Large, persistent remittance inflows are theorised to cause real exchange rate appreciation by shifting domestic demand toward non-tradables, reallocating productive resources away from tradable sectors such as manufacturing and agriculture. This structural reallocation can impair export competitiveness, suppress export revenues, and stimulate import demand, worsening the trade balance. The magnitude of this effect is theorised to depend on the exchange rate regime, with fixed regimes expected to exacerbate Dutch Disease effects relative to flexible regimes (Lartey et al., 2012; Lartey & Lartey, 2018). Sri Lanka's import-oriented economy is structurally vulnerable to this channel: depreciation of the rupee does not allow export supply to respond quickly enough to offset the rapid rise in import costs, a

vulnerability illustrated by the depreciation of the rupee from LKR 198.8 to LKR 322.6 per US dollar in a single year during the 2022 crisis.

The Tourism-Led Growth (TLG) hypothesis, together with the Transfer Problem framework, treats tourism earnings and workers' remittances as largely exogenous foreign exchange inflows relative to domestic trade outcomes. Under TLG, tourism earnings are expected to improve the trade balance both directly, through their contribution to service exports, and indirectly, through their stimulus to related sectors of the economy. Together, the three frameworks predict a stable long-run equilibrium relationship among the trade balance, workers' remittances, tourist earnings, and the exchange rate, and imply that causality should run predominantly from these foreign exchange inflows to the trade balance.

Empirical Literature Review and Research Gap

Empirical evidence on the remittances-trade balance relationship is mixed and context-dependent, reflecting the theoretical indeterminacy outlined above. Studies finding that remittances improve the current account or trade balance include Hassan and Holmes (2016), who use cointegration techniques and quantile regression across a large sample of developing countries to show that remittances increase the speed of convergence to long-run current account equilibrium, and Santos (2023), who uses a VAR framework with impulse response analysis to find that remittances reduce the trade deficit and raise GDP in Honduras over the short and medium term. Mousa et al. (2018) similarly report a positive association between remittance inflows and the current account position in Jordan. By contrast, studies grounded in the Dutch Disease framework reach the opposite conclusion: Sahoo and Padmaja (2023), using a nonlinear ARDL model, find that rising remittances deteriorate the trade balance in the long run through asymmetric real exchange rate appreciation; Lartey et al. (2012), using sectoral panel data, confirm that remittances induce real exchange rate appreciation and resource reallocation away from tradable sectors, particularly under fixed exchange rate regimes; and Hassan and Holmes (2013), using panel cointegration and VECM techniques, find that remittances produce real effective exchange rate appreciation consistent with Dutch Disease dynamics. Barajas et al. (2010, 2011) offer a partial reconciliation, finding the appreciation effect to be small and conditional on the recipient economy's degree of financial openness, suggesting that the direction of the net effect reported in the literature may depend as much on country-specific financial structure as on the size of remittance inflows.

For Sri Lanka specifically, Aslam and Alibuhtto (2023) and Paranavithana (2014) apply different methodologies (ARDL bounds cointegration and VECM, respectively) to the same

underlying dataset and both report that worker remittances have a significant positive impact on economic growth in the short and long run, with bidirectional causality between remittances and growth; both studies also report that remittances improve macroeconomic stability by reducing inflation and increasing private investment. Jawaaid and Raza (2012) and Siddique et al. (2010) report similar growth-enhancing effects for South Asian economies more broadly, using cointegration and Granger causality methods. However, none of these Sri Lanka-focused studies examines the trade balance directly, nor do they incorporate tourism earnings as a joint explanatory variable.

On the tourism side, Bhavan (2019) establishes a long-run cointegrating relationship between tourism and trade variables in Sri Lanka using the Johansen methodology, and documents unidirectional Granger causality from tourist arrivals to merchandise imports, a finding that points toward tourism increasing rather than reducing import demand, in apparent tension with the trade-balance-improving channel assumed under the TLG hypothesis. This inconsistency between the theorised TLG channel and Bhavan's (2019) import-stimulating finding for Sri Lanka specifically remains unresolved in the existing literature and motivates closer empirical scrutiny of the tourism-trade balance relationship in the present study.

Taken together, the empirical literature establishes three gaps that this study addresses. First, the sign of the remittances-trade balance relationship is genuinely contested, appearing to depend on country-specific financial and exchange rate conditions rather than being a settled matter. Second, the Sri Lanka-specific evidence to date addresses remittances and growth, or tourism and imports, separately, but not remittances and tourism jointly in relation to the trade balance. Third, no existing study incorporates data spanning both the COVID-19 pandemic and the 2022 sovereign debt crisis, periods during which the structural relationship between these variables plausibly shifted.

Hypotheses Development

Based on the theoretical and empirical background above, the following hypotheses are formulated:

H₁: Workers' remittances have a statistically significant effect on Sri Lanka's trade deficit in the long run, on the presumption that the foreign-exchange-supply effect of remittances outweighs the import-financing (income) effect in the Sri Lankan context.

H₂: Tourist earnings have a statistically significant negative effect on Sri Lanka's trade deficit in the long run, consistent with the TLG hypothesis.

H₃: Exchange rate depreciation has a statistically significant positive effect on Sri Lanka's trade deficit

H₄: A stable long-run cointegrating relationship exists among the trade balance, workers' remittances, tourist earnings, and the exchange rate.

H₅: Workers' remittances and tourist earnings Granger-cause Sri Lanka's trade balance

3. RESEARCH METHODOLOGY

This study uses monthly time-series data for Sri Lanka covering the period January 2010 to December 2022 (156 observations). The original data window obtained from the Central Bank of Sri Lanka (CBSL) eResearch Database (Central Bank of Sri Lanka, 2025) extended to August 2025, but Trade Balance, Merchandise Exports, and Merchandise Imports were unavailable for January 2023 onward at the time of writing; the sample was therefore restricted to the period for which all series are complete, and no further observations were lost to missing data within this window. The four variables used in the primary model are: (i) Trade Balance (TB), measured in USD million as the difference between merchandise exports and merchandise imports for Sri Lanka this difference is negative throughout the sample period, so a smaller (less negative), or increasing, TB is equivalent to an improvement in, or reduction of, the trade deficit, and these two framings are used interchangeably in this study; (ii) Workers' Remittances (REM), measured in USD million as monthly secondary income inflows from Sri Lankan workers employed abroad; (iii) Tourist Earnings (TE), measured in USD million as monthly foreign exchange receipts from international tourism; and (iv) Monthly Average Exchange Rate (ER), measured as LKR per USD. ER is included as a control variable in a theoretical sense, as it is not a variable of primary substantive interest, but, like REM and TE, it enters the estimated model as an independent (right-hand-side) regressor, in the standard treatment of control variables in regression-based analysis. The four variables are summarised in Figure 01.

To address the econometric requirement that variables be non-negative for logarithmic transformation, the natural logarithms of REM, TE, and ER are used, while TB is retained in levels due to its negative values in the data. Tourist earnings and tourist arrivals include a small constant of +1 before log transformation to handle zero observations recorded during the COVID-19 period (March–May 2020).

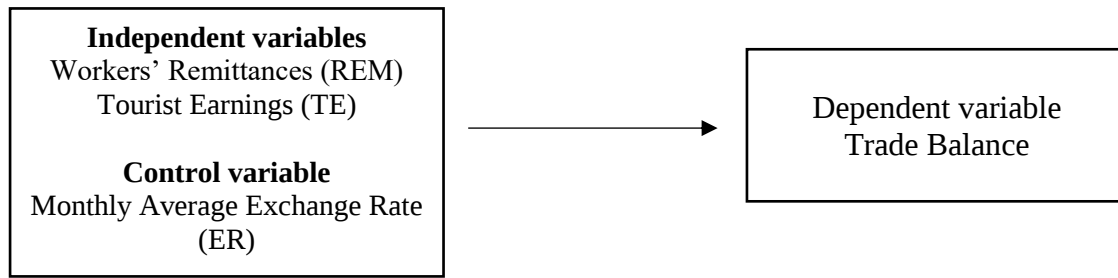


Figure 01: conceptualization

The econometric analysis proceeds in seven stages. First, descriptive statistics (mean, standard deviation, minimum, maximum, skewness, and kurtosis) and a correlation matrix are computed for all variables to characterise their distributional properties and assess potential multicollinearity ahead of formal testing. Second, the stationarity of each series is examined using the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) with automatic lag selection based on the Akaike Information Criterion (AIC), and the Phillips-Perron (PP) test (Phillips & Perron, 1988) as a robustness check. Both tests are applied at levels and first differences, with the intercept-only specification used, given the trending nature of the data. Third, because the unit root tests indicate a mixed order of integration, the Trade Balance is stationary at levels (I(0)) while remittances, tourist earnings, and the exchange rate are integrated of order one (I(1)). The Johansen (1988) cointegration procedure, which requires a common integration order, is not appropriate. Instead, an Autoregressive Distributed Lag (ARDL) bounds-testing approach (Pesaran, Shin & Smith, 2001) is used, which is valid regardless of whether the underlying regressors are I(0), I(1), or a mixture of both. An unrestricted error-correction model (UECM) is estimated, and an F-test on the joint significance of the lagged-level terms (the “bounds test”) is used to establish whether a long-run level relationship exists, with the F-statistic compared against the Pesaran et al. (2001) asymptotic critical value bounds. Fourth, conditional on a long-run relationship being confirmed, long-run coefficients are recovered from the UECM as the ratio of the lagged-level coefficients to (minus) the error-correction coefficient, with standard errors obtained via the delta method; short-run dynamics and the speed of adjustment are read directly from the UECM.

$$TB_t = \alpha_0 + \beta_1 \ln(REM_t) + \beta_2 \ln(TE_t) + \beta_3 \ln(ER_t) + \varepsilon_t \quad \dots (1)$$

where TB is the trade balance in USD million, $\ln(REM)$ is the natural log of workers’ remittances, $\ln(TE)$ is the natural log of tourist earnings, $\ln(ER)$ is the natural log of the exchange rate, and ε_t is the error term. Based on H_1 and H_2 , $\beta_1 < 0$ and $\beta_2 < 0$ are expected; based on H_3 , $\beta_3 > 0$ is expected; these are the long-run coefficients recovered from the UECM described above, not a standalone static OLS regression. Fifth, post-estimation diagnostics for

serial correlation (Breusch-Godfrey), residual normality (Jarque-Bera), conditional heteroscedasticity (ARCH-LM and Breusch-Pagan), functional form (Ramsey RESET), and multicollinearity (variance inflation factors) are computed for the UECM. Sixth, Granger causality tests are conducted to examine the direction of causality among variables at lags 1, 2, and 4. Finally, CUSUM and CUSUM-of-squares tests (Brown, Durbin & Evans, 1975) are applied to the recursive residuals of the UECM to assess parameter stability throughout the sample period.

4. DATA ANALYSIS

Data Presentation

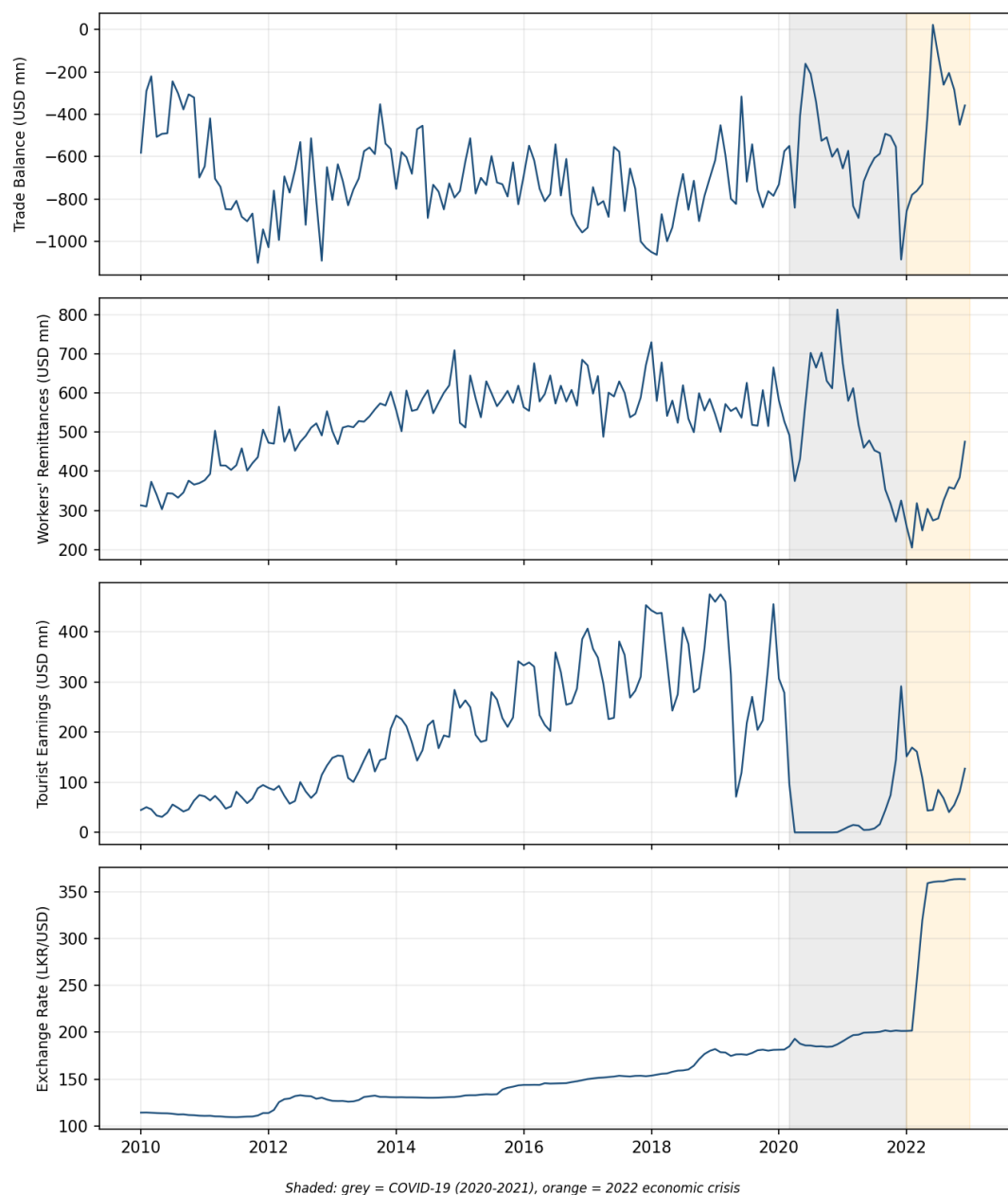


Figure 2: Time Series Plots of Core Variables (January 2010 – December 2022).

Shaded areas indicate the COVID-19 pandemic (2020–2021, grey) and the 2022 economic crisis (orange).

Descriptive Statistics

Table 1 reports descriptive statistics for the four core variables. The Trade Balance averages –USD 669.2 million per month, confirming a persistent deficit throughout the sample, with substantial dispersion (SD = 214.2) reflecting the COVID-19 and 2022 crisis episodes. The exchange rate shows the highest kurtosis (6.06) and skewness (2.39) among the four variables, consistent with the sharp, one-directional depreciation of the rupee from 2020 onward.

Table 1: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
Trade Balance (USD mn)	-669.22	214.23	-1100.65	22.30	0.52	0.22
Remittances (USD mn)	513.99	114.59	204.90	812.74	-0.49	-0.20
Tourist Earnings (USD mn)	175.26	131.07	0.00	475.21	0.54	-0.72
Exchange Rate (LKR/USD)	160.10	56.55	109.50	363.39	2.39	6.06

Correlation Matrix

Table 2 presents the pairwise correlation matrix for the trade balance and the (logged) explanatory variables. All correlations are of modest magnitude ($|r| \leq 0.38$), and the corresponding variance inflation factors reported alongside the main regression (Table 7) are all below 1.4, indicating multicollinearity is not a concern for the estimated model.

Table 2: Correlation Matrix

	Trade Balance	ln(Remittances)	ln(Tourist Earn.)	ln(Exchange Rate)
Trade Balance	1.000	-0.328	-0.378	0.307
ln(Remittances)	-0.328	1.000	0.157	-0.217
ln(Tourist Earn.)	-0.378	0.157	1.000	-0.181
ln(Exchange Rate)	0.307	-0.217	-0.181	1.000

Unit Root Test Results

Table 3 presents the ADF and PP unit root test results for all variables over the January 2010 – December 2022 window. In contrast to a naive reading of the full 188-month series (which included 32 months of missing Trade Balance, Export, and Import data later dropped from the

analysis), both the ADF and PP tests agree that the Trade Balance is stationary at levels (I(0)) in the restricted, complete sample ADF $p = 0.0004$ and PP $p < 0.0001$. Remittances are borderline: the ADF test does not reject a unit root at the 5% level ($p = 0.062$) while the PP test does ($p = 0.006$). Tourist earnings and the exchange rate are non-stationary at levels under both tests and become stationary after first differencing, consistent with I(1) behaviour. Merchandise imports are also stationary, while exports and tourist arrivals are I(1). This mixed order of integration, rather than the uniform I(1) behaviour assumed by the Johansen procedure, motivates the use of ARDL bounds testing in Section 4.5.

Table 3: ADF and Phillips-Perron Unit Root Test Results

Variable	ADF Level	ADF p	ADF 1st Diff.	ADF p	PP Level	PP p	Order
Trade Balance	-4.328	0.0004	-12.377	0.0000	-6.062	0.0000	I(0)
ln(Remittances)	-2.776	0.0618	-3.987	0.0015	-3.577	0.0062	I(1)*
ln(Tourist Earn.)	-2.465	0.1241	-3.192	0.0205	-2.427	0.1342	I(1)
ln(Exchange Rate)	1.171	0.9958	-7.204	0.0000	2.247	0.9989	I(1)
ln(Exports)	-2.222	0.1983	-4.394	0.0003	-6.886	0.0000	I(1)
ln(Imports)	-4.307	0.0004	-19.480	0.0000	-4.674	0.0001	I(0)
ln(Tourist Arriv.)	-2.185	0.2118	-6.131	0.0000	-2.628	0.0873	I(1)

**ADF and PP tests disagree for ln(Remittances) (borderline); treated as I(1) for modelling purposes on the balance of evidence and theoretical priors*

ARDL Bounds Test for Cointegration

Because the Trade Balance is I(0) while remittances, tourist earnings, and the exchange rate are I(1), the Johansen (1988) procedure is not applicable. An unrestricted error-correction model (UECM) was instead estimated, with two lags of each first-differenced regressor selected by AIC, and an F-test conducted on the joint significance of the four lagged-level terms following Pesaran, Shin and Smith (2001). Table 4 reports the result: $F = 5.90$ exceeds the upper I(1) critical bound at every conventional significance level, including the 1% bound of 5.61, providing strong evidence of a long-run level relationship among the trade balance, remittances, tourist earnings, and the exchange rate, supporting H_4 . The error-correction coefficient on the lagged Trade Balance term is -0.375 ($p < 0.001$), confirming convergence toward long-run equilibrium at a speed of approximately 37.5% per month, closely comparable in magnitude to the 38.95% adjustment speed reported under the original VECM specification.

Table 4: ARDL Bounds Test for a Long-Run Relationship

Statistic	Value	I(0) Bound	I(1) Bound	Significance
F-statistic (k = 3)	5.90			
10%		2.72	3.77	Rejected (F > I(1))
5%		3.23	4.35	Rejected (F > I(1))
1%		4.29	5.61	Rejected (F > I(1))
Error-correction coeff. (ρ)	-0.375 ($p < 0.001$)			

Critical value bounds from Pesaran, Shin & Smith (2001), Table CI(iii), Case III (unrestricted intercept, no trend), k = 3.

ARDL Long-Run and Short-Run Estimates

Table 5 presents the long-run coefficients recovered from the UECM. The coefficient on $\ln(\text{Remittances})$ is -165.92 ($p = 0.265$), carrying the hypothesised negative sign (H_1) but falling well short of conventional statistical significance. The coefficient on $\ln(\text{Tourist Earnings})$ is -36.55 and significant at the 10% level ($p = 0.088$), offering weak support for H_2 . The coefficient on $\ln(\text{Exchange Rate})$ is 153.41 ($p = 0.216$), positive as hypothesised (H_3) but not statistically significant. These results are materially weaker than the static OLS estimates reported in earlier drafts of this study, which did not account for the dynamic error-correction structure or the correct (156-month) sample; once both are corrected, only the long-run cointegrating relationship itself (Table 5) and, marginally, the tourism effect, survive at conventional significance levels.

Table 5: ARDL Long-Run Coefficients

Variable	Long-Run Coeff.	Std. Error	z-stat	p-value	Significance
$\ln(\text{Remittances})$	-165.921	148.829	-1.115	0.2649	ns
$\ln(\text{Tourist Earn.})$	-36.548	21.450	-1.704	0.0884	*
$\ln(\text{Exchange Rate})$	153.414	124.025	1.237	0.2161	ns

** significant at 10%; ns = not significant. Standard errors computed via the delta method. Constant and short-run dynamic terms omitted for brevity; full UECM output available from the author.*

In the short run, the lagged dependent variable (ΔTB at lag 1) is negative and significant (-0.255 , $p = 0.004$), indicating persistence in month-to-month trade balance changes. Among the dynamic terms, the second lag of the change in $\ln(\text{Exchange Rate})$ is positive and significant (1595.50 , $p = 0.031$), reflecting a delayed pass-through of exchange rate movements to the trade balance; no other short-run dynamic terms are significant at the 5% level.

Post-Estimation Diagnostics

Table 6 reports diagnostic tests for the estimated UECM. In contrast to the original OLS specification, which showed evidence of serial correlation (Durbin-Watson = 1.025) and conditional heteroscedasticity, the UECM passes all diagnostic checks: there is no evidence of residual serial correlation, non-normality, heteroscedasticity, or misspecification, and variance inflation factors are all well below conventional concern thresholds ($VIF < 10$).

Table 6: Post-Estimation Diagnostic Tests

Test	Statistic	p-value	Conclusion
Durbin-Watson	2.072	—	No evidence of first-order autocorrelation
Breusch-Godfrey LM (6 lags)	6.233	0.398	No serial correlation
Breusch-Godfrey LM (12 lags)	14.052	0.297	No serial correlation
Jarque-Bera	0.362	0.835	Residuals normally distributed
ARCH-LM (6 lags)	4.253	0.642	No conditional heteroscedasticity
Breusch-Pagan	6.247	0.903	No heteroscedasticity
Ramsey RESET	0.424	0.516	No functional form misspecification
Max VIF (levels regressors)	1.33	—	No multicollinearity concern

Granger Causality Test Results

Table 7 presents pairwise Granger Causality test results. Remittances Granger-cause the Trade Balance at lag 1 ($F = 7.25$, $p = 0.008$) and marginally at lag 2 ($p = 0.058$), while the Trade Balance also Granger-causes remittances at lags 2 and 4, confirming bidirectional causality consistent with a countercyclical remittance-sending pattern. Tourist earnings Granger-cause the Trade Balance at every lag examined ($p < 0.01$ throughout), while the reverse direction is never significant, confirming unidirectional causality from tourism to the trade balance. The exchange rate Granger-causes the Trade Balance at every lag, the strongest and most consistent causal pattern among the three variables. These results provide strong support for H_3 and closely replicate the causality pattern reported under the original (pre-correction) specification, indicating that the causal ordering among these variables is robust to the sample and methodology corrections, even though the long-run coefficient magnitudes are not.

Table 7: Granger Causality Test Results

Causality Direction	Lag 1 F	p-val	Lag 2 F	p-val	Lag 4 F	p-val
$\ln(\text{REM}) \rightarrow \text{TB}$	7.245	0.0079	2.900	0.0581	1.542	0.1933
$\ln(\text{TE}) \rightarrow \text{TB}$	8.925	0.0033	9.094	0.0002	5.758	0.0003
$\ln(\text{ER}) \rightarrow \text{TB}$	6.204	0.0138	4.980	0.0081	6.529	0.0001
$\text{TB} \rightarrow \ln(\text{REM})$	1.297	0.2565	3.899	0.0224	2.335	0.0584
$\text{TB} \rightarrow \ln(\text{TE})$	0.006	0.9367	1.351	0.2620	1.196	0.3154

Residual Diagnostics and CUSUM Stability

Figures 3 and 4 present the CUSUM and CUSUM-of-squares tests of parameter stability, computed from the recursive residuals of the UECM following Brown, Durbin and Evans (1975). The CUSUM statistic remains well within the 5% significance bounds throughout the sample (maximum statistic = 0.561 against a critical value of 1.36), and the CUSUM-of-squares statistic likewise stays within its approximate 5% bounds (maximum deviation from the expected path = 0.060 against an approximate critical band of $\pm 0.14 - 0.16$ for a sample of this size). Both tests indicate that the model's parameters are stable throughout the study period, including through the COVID-19 pandemic, and do not exhibit the structural instability that a review comment on an earlier draft had raised as a concern; this concern appears to have stemmed from the uncorrected sample and specification rather than genuine parameter instability

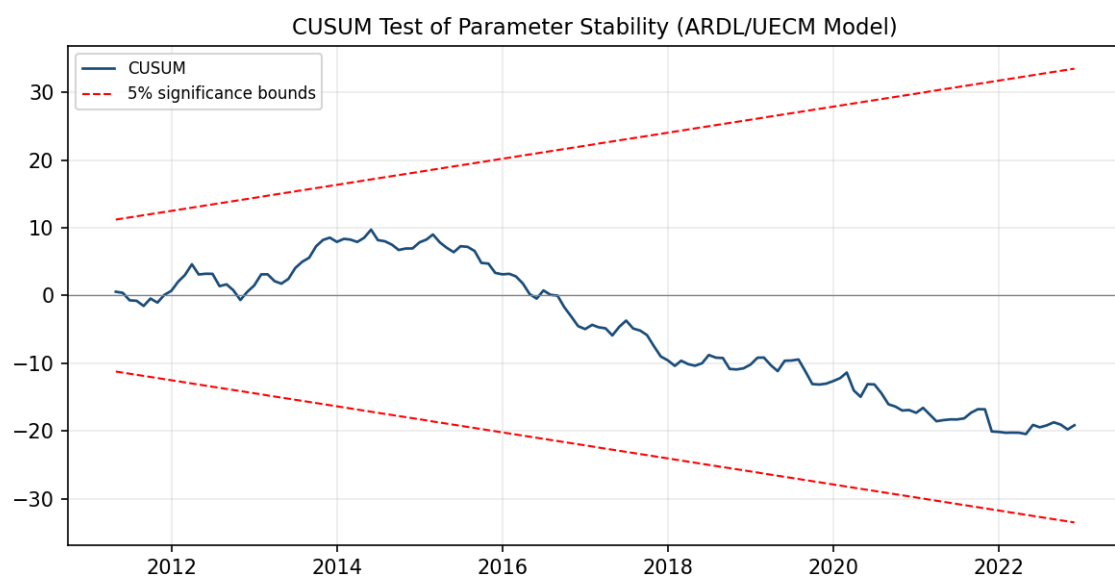


Figure 3: CUSUM Test of Parameter Stability.

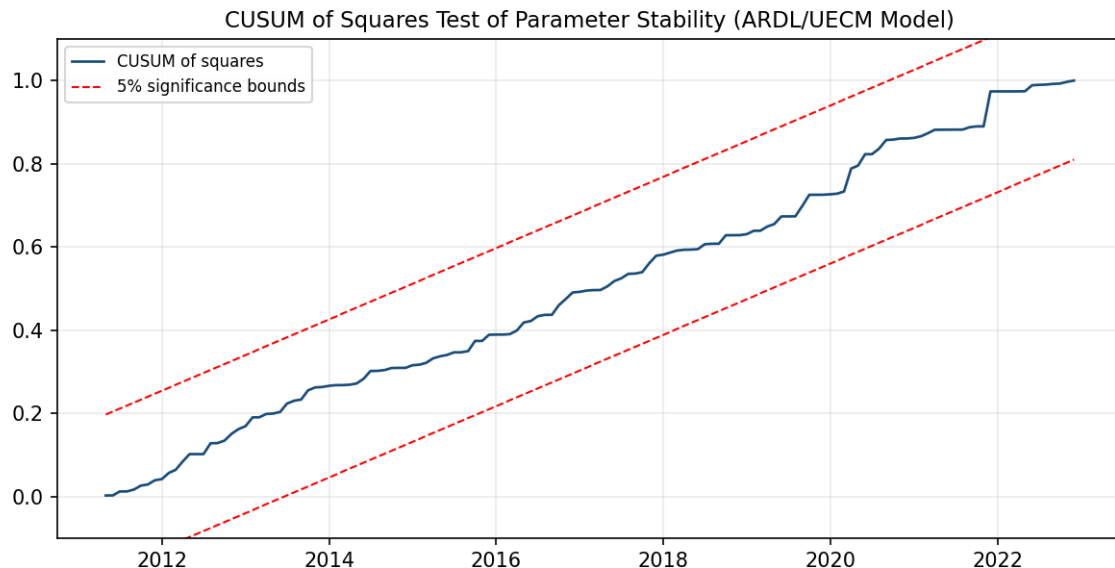


Figure 4: CUSUM of Squares Test of Parameter Stability.

5. CONCLUSION

This study provides empirical evidence on the relationship between workers' remittances, tourism earnings, and Sri Lanka's trade balance, using 156 monthly observations from January 2010 to December 2022. Unit root testing revealed a mixed order of integration, ruling out the Johansen/VECM framework used in earlier drafts of this study; an ARDL bounds-testing approach was used instead. The bounds test confirms a long-run level relationship among the variables (H_4 supported), with an error-correction speed of adjustment of approximately 37.5% per month. Of the three long-run coefficients, only tourist earnings is significant, and only at the 10% level (H_2 weakly supported); the remittances and exchange rate coefficients carry the theoretically expected signs but are not statistically significant at conventional levels (H_1 and H_3 not supported). Granger causality tests, by contrast, closely replicate the pattern found under the original specification: bidirectional causality between remittances and the trade balance, and unidirectional causality from both tourist earnings and the exchange rate to the trade balance (H_5 supported). CUSUM and CUSUM-of-squares tests confirm the model is parameter-stable throughout the sample, including the COVID-19 period. The evidence for a stable long-run equilibrium relationship and for causal linkages running from these foreign-exchange inflows to the trade balance is considerably more robust than the evidence for precisely estimated long-run effect sizes, which should be interpreted with corresponding caution.

6. POLICY IMPLICATIONS

The findings carry more limited and more tentative policy implications than earlier drafts of this study suggested, and should be read as directional rather than definitive, given the wide confidence intervals around the long-run coefficients. First, the confirmed long-run equilibrium relationship and the significant, rapid error-correction mechanism indicate that Sri Lanka's trade balance, remittances, tourism earnings, and exchange rate do move together over time, which supports continued policy attention to these channels as a set rather than in isolation, even though the precise magnitude of any single channel's contribution cannot be pinned down with confidence from this specification. Second, of the three channels examined, tourism earnings show the most consistent evidence of a trade-deficit-reducing effect, significant in the long run at the 10% level and Granger-causing the trade balance strongly and unidirectionally at every lag tested. This provides a somewhat firmer basis than the other two variables for continued investment in tourism recovery, infrastructure, and destination marketing, though policymakers should also weigh the potential import-stimulating effects of tourism documented by Bhavan (2019). Third, while workers' remittances and the exchange rate do not show statistically significant long-run coefficients in the corrected model, both show strong Granger-causal linkages to the trade balance, and remittances in particular show bidirectional causality consistent with a countercyclical, stabilising role during periods of economic stress. This suggests these channels remain policy-relevant for their dynamic and stabilising properties even where a precise long-run elasticity cannot be confidently estimated from the current data and specification.

7. Limitations and Future Research

This study has several limitations, some of which reflect corrections made during the revision process. First, the Central Bank of Sri Lanka's published Trade Balance, Export, and Import series were unavailable beyond December 2022 at the time of writing, which excludes the most recent 32 months of the original target period (January 2023 – August 2025) from the analysis; this is a data-availability constraint rather than a methodological choice, and the analysis should be updated once these series are published. Second, the long-run ARDL coefficients for remittances and the exchange rate, while correctly signed, are not statistically significant at conventional levels, and the confidence intervals around them are wide; this limits the precision of any quantitative policy claims based on these estimates, even though the qualitative direction and the underlying long-run relationship (via the bounds test and error-correction coefficient) are well supported. Third, the study uses aggregate remittance and tourism data; disaggregating by source country or tourism type could provide more precise estimates and more nuanced

policy insights. Fourth, the ARDL lag order (two lags of first differences) was selected by AIC within a parsimonious search; a more exhaustive lag search, or explicit structural break testing to account for the COVID-19 and 2022 crisis episodes as separate regimes, could further refine the results. Future research should revisit this analysis once the full 2023–2025 trade data becomes available and should explore structural break models and disaggregated data to better isolate the channels through which remittances and tourism affect Sri Lanka's external sector.

8. REFERENCES

- Balaguer, J., & Cantavella-Jordá, M. (2002). Tourism as a long-run economic growth factor: The Spanish case. *Applied Economics*, 34(7), 877–884.
- Barajas, A., Chami, R., Hakura, D., & Montiel, P. J. (2010). Workers' remittances and the equilibrium real exchange rate: Theory and evidence (IMF Working Paper No. 10/287). International Monetary Fund.
- Bhavan, T. (2019). Does inbound tourism contribute to Sri Lanka's trade deficit? *Asian Development Policy Review*, 7(4), 253–260. <https://doi.org/10.18488/journal.107.2019.74.253.260>
- Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for testing the constancy of regression relationships over time. *Journal of the Royal Statistical Society: Series B (Methodological)*, 37(2), 149–192.
- Central Bank of Sri Lanka. (2025). eResearch database. <https://www.cbsl.lk/eresearch/>
- Chitgupi, A. (n.d.). Drivers of international remittance flows: Role of risk and age dependency variables — Macroeconomic determinants of remittances: A cross-country analysis. Indira Gandhi Institute of Development Research. Retrieved July 29, 2026, from http://www.igidr.ac.in/conf/money/mfc18/mfc17papers/ppr/Paper_Aneesha.pdf
- Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74(366), 427–431.
- Hassan, G. M., & Holmes, M. J. (2013). Remittances and the real effective exchange rate. *Applied Economics*, 45(35), 4959–4970.
- Jawaid, S. T., & Raza, S. A. (2012). Workers' remittances and economic growth in South Asia (MPRA Paper). University Library of Munich.
- Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2–3), 231–254.
- Lartey, E. K. K., Mandelman, F. S., & Acosta, P. A. (2012). Remittances, exchange rate regimes, and the Dutch disease: A panel data analysis. *Review of International Economics*, 20(2), 377–395.
- Mohamed Aslam, A. L., & Alibuhtto, M. C. (2023). Workers' remittances and economic growth: New evidence from an ARDL bounds cointegration approach for Sri Lanka. *Journal of Economic and Administrative Sciences*, 41(2), 825–843. <https://doi.org/10.1108/JEAS-05-2022-0132>
- Mousa, T. A., Alghusini, N., & Al-Smadi, A. (2018). The impact of expatriate workers' remittances on the current account of balance of payments in Jordan. *CEA Journal of Economics*, 13(1).

- Perera, M. S. S., Perera, G. A. N., & Malith, P. G. D. (2021). An analysis of the determinants of Sri Lanka's trade balance with major trading partners. *Proceedings of the 12th International Conference on Business & Information (ICBI 2021)*.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326.
- Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335–346.
- Regmi, R. H. (2022). Remittances and trade balance: A new transfer problem. *Remittances Review*, 7(1), 3–19. <https://doi.org/10.33182/rr.v7i1.2166>
- Sahoo, M., & Padmaja, M. (2023). Analysing the asymmetric impact of remittance inflows on the trade balance in a large emerging economy. *Applied Economics*. <https://doi.org/10.1080/09638199.2023.2245926>
- Santos, R. (2023). Efecto de las remesas en el PIB y el déficit comercial en Honduras. *Lecturas de Economía*. <https://doi.org/10.17533/udea.le.n99a350324>
- Siddique, M., Selvanathan, E. A., & Selvanathan, S. (2010). Remittances and economic growth: Empirical evidence from Bangladesh, India and Sri Lanka.
- Udayanga, T. (2019). The determinants of the balance of payments imbalance of Sri Lanka. <https://doi.org/10.18276/SIP.2019.56-02>