Trade Balance and Exchange Rate: The J-Curve of Kyrgyzstan

by

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Abstract

This study explores the relationship between real effective exchange rate and trade balance in the Kyrgyz Republic and investigates the J-curve phenomenon in overall and bilateral trade between Kyrgyzstan and its key trading partners: Kazakhstan, Russia, Uzbekistan, and Turkiye. This research uses quarterly data for the period 2001–2022. Export and import flows (including bilateral), real domestic GDP, real effective exchange rate, and real bilateral exchange rates are incorporated in the models. An ARDL bounds testing approach to cointegration developed by Pesaran et al. (2001) was used to analyze the long-run relationship between variables. The short run impacts and associated J-curve effect are investigated. No J-curve phenomena is detected.

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Introduction

The "J-Curve," a process through which currency depreciation lead to temporary losses in a country's trade balance before the projected improvement finally comes in, is one of the most popular - and widely studied - phenomena in the international finance. This theory contends that currency swings might be detrimental to exporters in the short-term, before rigidities such as set trade contracts are removed. Therefore, knowing this mechanism has significant ramifications.

This notion, introduced by Magee (1973), was remodeled by Bahmani-Oskooee (1985) to incorporate a innovative empirical test. Rose and Yellen (1989) established the most recent statistical concept of a "J-Curve," which combines short-term and long-term coefficients with opposing sign. More recent developments in time series technique, like as cointegration, have been utilized to uncover evidence of any J-curve phenomenon for country pairs. The theory has never been verified clearly, and many countries see no effect. Bahmani-Oskooee and Ratha (2004) and Bahmani-Oskooee and Hegerty (2010) undertook reviews of this large literature.

The goal of this study is threefold. First, it investigates if a long-run link exists between trade balance, real exchange rate, and domestic GDP. Second, the article examines the long- and short-term elasticities of trade balance in relation to the exchange rate and real gross domestic product (GDP). To achieve these goals, the simplified form of the Rose and Yellen (1989) trade balance model is used, followed by the autoregressive distributed lag (ARDL) bounds testing technique to cointegration pioneered by Pesaran et al. (2001). Third, check if there is a J-curve in bilateral trade.

Literature Review

The relationship between the exchange rate and trade balance has been widely studied in the literature (Eichengreen, 1981; Bahmani-Oskooee, 1985; Brissimis & Leventakis, 1989; Rose & Yellen, 1989; Bahmani-Oskooee & Ratha, 2004; Bahmani-Oskooee et al., 2006; Bahmani-Oskooee et al., 2016). The primary issue that scholars are attempting to deal with is the degree to which currency depreciations and appreciations impact countries' trade balances. Existing research has empirically examined the link between exchange rates and trade balances in the context of the Marshall-Lerner (ML) condition and the J-curve hypothesis. Marshall and Lerner based their proposition on Marshall's concept of the price elasticity of demand, that claims that if the sum of the demand elasticities of exports and imports exceeded one, a devaluation of the domestic currency would ultimately improve the trade balance (Branson, 1972; Bahmani-Oskooee, 1985).

However, research have demonstrated that domestic currency devaluation may have an immediate negative impact on the trade balance due to the time gap between current and new contracts. According to Magee (1973), the trade balance deteriorates immediately after a devaluation because of an adjustment phase between devaluation and changes in behavior of consumer, importer, and exporter. When the domestic currency depreciates, importers as well as exporters will have already signed contracts at already fixed quantities and prices, making demand inelastic. As a result, when the domestic currency depreciates, imports become pricey in the domestic currency, but export prices remain same in terms of the domestic currency. Because of the devaluation of the domestic currency, the trade balance deteriorates, which is known as the exchange rate pass-through (Magee, 1973; Bahmani-Oskooee & Ratha, 2004; Madura, 2011). Imports will grow in price over time, and demand will fall, but exports will become comparably cheaper, and demand for exports will probably rise. The short- and long-term effects of devaluation will result in a skewed J-curve on the trade balance (Magee, 1973; Dixit & Norman, 1980). This theory is known as the J-curve.

Even though the researchers have used a wide range of empirical approaches, previous studies did not take into account the dynamics of exchange rate policies and tended to use ordinary least square (OLS) method to assess the effect of a devaluation on the trade balance. However, because of possible autocorrelation and data non-stationarity, OLS algorithm may produce inaccurate results (Wooldridge, 2010). Considerable progress has been made in empirical modeling to evaluate the impact of currency devaluation on the trade balance since then.

Since Rose and Yellen (1989), various dynamic modeling approaches have been used to investigate the impact of currency devaluation on trade balances to avoid misleading estimate difficulties caused by the non-stationarity of the data. Rose and Yellen (1989) used cointegration and error correction models to analyze the impact of devaluation on bilateral trade balances between the United States and six of its main trading partners. However, their data revealed that the exchange rate had no impact on the bilateral balance of trade between the United States and these six specific trading partners, rejecting the J-curve theory's postulations. Brissimis and Leventakis (1989) generated conclusions using a similar empirical technique that revealed the creation of a skewed J-curve in Greece's trade balance.

Researchers have examined the connection between the exchange rate and the trade balance in comparable and unlike country situations using several modern empirical approaches. However, the findings of these research were mixed. For example, studies by Narayan and Narayan (2004), Bahmani-Oskooee and Kovyryalova (2008), and Bahmani-Oskooee and Fariditavana (2016) discovered evidence indicating the existence of a J-curve. However, the findings of Arora, Bahmani-Oskooee, and Goswami (2003), Bahmani-Oskooee and Ratha (2004), and Bahmani-Oskooee et al. (2006) were conflicting.

It has additionally been proposed that these opposing views are dependent on bilateral agreements on trade. According to Bahmani-Oskooee and Brooks (1999), the contradictory results may be related to an examination of the link between exchange rates and trade balance at an aggregate level rather than at a bilateral trade level between countries. However, analyzing the link between exchange rates and trade balances at the country level may still be inaccurate since the effect of devaluation may differ at the industry level. For example, devaluation in currency rates may have a different impact on the bilateral trade balance of the car business than it does on the agriculture. Bahmani-Oskooee and Hegerty (2011) examined the link between the Mexican and US currency rates and bilateral trade balances at various industry levels and discovered evidence supporting the J-curve hypothesis in certain industries but not in others.

Halicioglu (2008a) investigated the existence of the J-curve pattern in Turkiye from 1980 to 2005. The short-run J-curve effect was validated by the findings of the bounds testing cointegration technique. Halicioglu (2008b) reviewed Turkish bilateral trade balance trends with her 13 trading partners from 1985 to 2005. In the short term, the results did not support the J-curve effect; nevertheless, in the long run, actual devaluation of the domestic currency had a positive effect on Turkish trade balance with some countries.

Keho (2021a) discovered that domestic income had a negative influence on the trade balance of Cote d'Ivoire. Furthermore, the findings suggest a negative long-run connection between the real effective exchange rate and the trade balance, as would be predicted if a real devaluation of the domestic currency encourages exports while suppressing imports.

Overall, the data points to the J-curve not being an empirical regularity. The J-curve phenomenon is more prevalent in some countries than others. With a few exceptions, the data confirms the existence of a positive stable long-run link between the trade balance and the currency rate.

Model specification and Methodology

The goal is to determine how the real effective exchange rate affects the trade balance and to determine whether real currency depreciation and appreciation have the same impact. The empirical model is described in accordance with Rose and Yellen (1989) long-run (cointegrating) form as follows:

$$\ln TB_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln YF_t + \beta_3 \ln REER_t + \mu_t$$

where TB is the trade balance on goods defined as the ratio of exports to imports; Y is domestic real GDP used as a proxy for domestic income; YF is world real GDP used as a proxy for foreign income; $REER$ is the real effective exchange rate; μ_t is an error term assumed to be a white-noise process.

In terms of the predicted sign of each coefficient, the estimates of β_1 and β_2 might be positive or negative depending on whether money is spent on local or international items. If rising levels of domestic income boost demand for imports, the coefficient β_1 is negative. Similarly, the coefficient β_2 is positive, indicating that greater levels of foreign income enhance the rest of the world's demand for local goods. Finally, it is projected that a real depreciation of the real exchange rate will enhance the trade balance. The coefficient β_3 is ambiguous. The J-curve hypotheses suggests that a real devaluation of the local currency deteriorates the trade balance in the short-term and enhances it in the long term. Our major focus in this thesis is studying the influence of exchange rate on trade balance, that is, if a depreciation of the real effective exchange rate will enhance trade balance.

The key steps in the analysis are as follows. First, the best specification of the model should be found. Then we use the Phillips and Perron unit root test (PP, 1988) and the Kwiatkowski et al. test (KPSS, 1992) to determine the order of integration of the series. In the second stage, the results of the unit root tests will be used to see if there is a long-term relationship between the variables. We use the Autoregressive Distributed Lag (ARDL) bounds testing technique to cointegration established by Pesaran et al. (2001) for this purpose. This method has been shown to work effectively in small samples regardless of whether the explanatory variables are stationary or integrated of order one.

Data

The analysis includes annual data from 1993 till 2022, and quarterly data from 2001 through 2022 (quarterly data from 1993 to 2000 are not available). The variables include trade balance, defined as the ratio of exports to imports, domestic real GDP in constant US dollars as a proxy for domestic income, world real GDP in constant US dollars as a proxy for foreign income, and real effective exchange rate[1]. Data on world annual real GDP were obtained from the World Bank's World Development Indicators database. The National Bank of the Kyrgyz Republic provided data on the trade balance, domestic real GDP, and the real effective exchange rate. The real effective exchange rate variable is such that a rise (reduction) represents a genuine appreciation (depreciation) of the domestic currency. For the empirical analysis, all variables were converted into natural logarithms. From a statistical standpoint, the logarithmic transformation reduces oscillations in individual variables, increasing the possibility of stationarity after initial differencing. From an economic standpoint, the logarithmic transformation allows the initial differences of the variables to be understood as growth rates and elasticity coefficients.

Table 1 shows the correlation matrix of the variables. There is a strong positive relationship between domestic and world GDP. For this reason, the proxy for the foreign income was dropped.

[1] Real effective exchange rate index is geometric weighted average of real bilateral exchange rates indices of major trading partner countries in the basket being examined. For the period t it is calculated in the following way:

$$\mathrm{REER_t} = \mathrm{RBER_{1t}^{W1t}} * \mathrm{RBER_{2t}^{W2t}} * \ldots * \mathrm{RBER_{nt}^{Wnt}}$$

where:
$\mathrm{RBER_{1t}}$ is the real bilateral exchange rate index of country i for the period t is calculated with formula (example, to the US dollar):

$$\mathrm{RBER_{USt}} = 100 * (\mathrm{ER_{USt}}/\mathrm{ER_{US0}}) * (\mathrm{CPI_{KYRt}}/\mathrm{CPI_{USt}})$$

where:
$\mathrm{ER_{USt}}$ is the geometric average of nominal exchange rate of som (units of US dollars per 1 som) in period t;
$\mathrm{ER_{US0}}$ is the corresponding geometric average of nominal exchange rates for the basis period 0;
$\mathrm{CPI_{KYRt}}$ and $\mathrm{CPI_{USt}}$ are the changes in CPI index in the Kyrgyz Republic and USA correspondingly for the period t relative to the base period 0;
Wnt is the corresponding weight of partner country in the external trade of the Kyrgyz Republic is calculated with the above mentioned formula for nominal effective exchange rate index.

Table 1. Correlation

	GDP_World	GDP_KG	GDP_KZ	GDP_RU	GDP_UZ	GDP_TR	REER	TB
GDP_World	1	.	.	.	.	.	.	.
GDP_KG	.98	1	.	.	.	.	.	.
GDP_KZ	.97	.98	1	.	.	.	.	.
GDP_RU	.95	.96	.99	1	.	.	.	.
GDP_UZ	.98	.99	.98	.94	1	.	.	.
GDP_TR	.99	.98	.97	.93	.99	1	.	.
REER	.15	.28	.29	.28	.31	.24	1	.
TB	-.81	-.82	-.85	-.85	-.83	-.83	-.37	1

Source: Author's calculations

KG – Kyrgyzstan

KZ – Kazakhstan

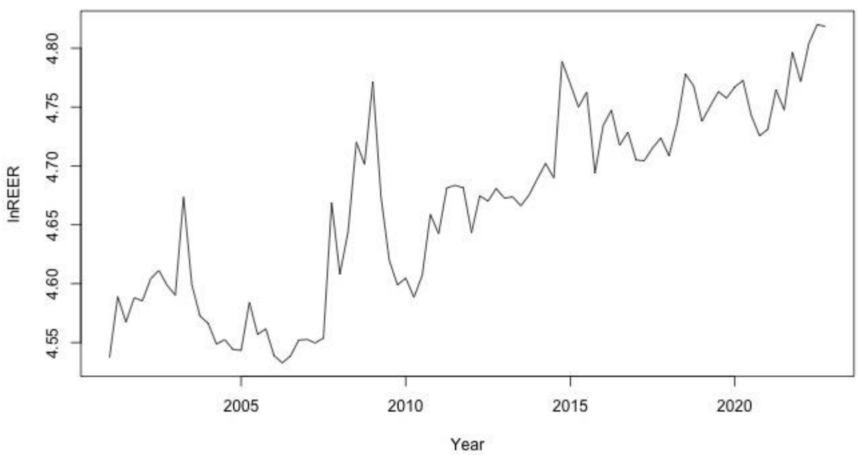
RU – Russia

UZ – Uzbekistan

TR – Turkyie

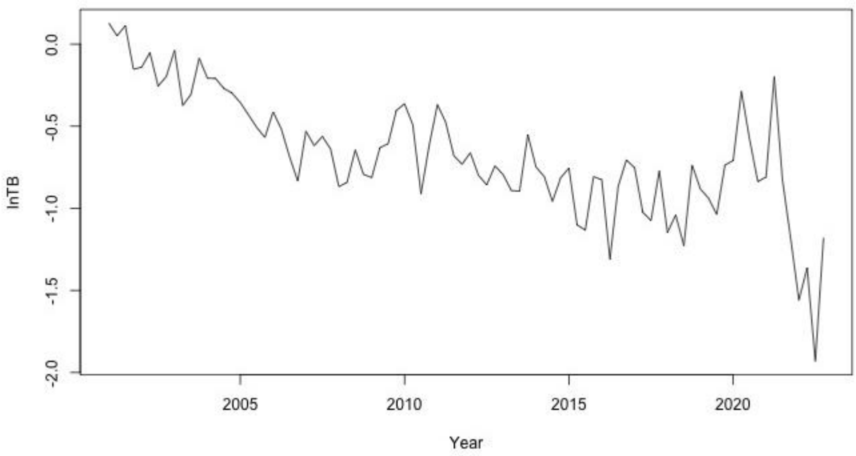
In order to make analysis more precise I decided to switch from annual to quarterly data (the real-world GDP was unavailable in quarterly terms).

Figure 1. Trade balance in log



Source: The author

Figure 2. Real effective exchange rate in log



Source: The author

Figures 1-2 show the trends of trade balance and real effective exchange rate in their natural logarithm. Both variables exhibit large fluctuations.

Results and Discussion

The empirical analysis begins with finding the best ARDL specification. Lag length on each variable was selected using the Akaike information criterion (AIC) with maximum lag set to 8[2]. The best model was found to be ARDL(1, 0, 4) , where 1 is the number of lags of trade balance, 0 – real effective exchange rate, and 4 – domestic GDP. Then we should test for the order of integration of the variables using the PP unit root test of Phillips and Perron (1988) and the KPSS test of Kwiatkowski et al. (1992). It is required to ensure that there are no variables which are integrated of order 2. The PP test examines the null hypothesis of a unit root, whereas the KPSS approach tests the null hypothesis of stationarity. Table 2 displays the results of the PP and KPSS tests. According to the results of PP test all variables are stationary at their levels while KPSS test show that variables are stationary at the first difference. Based on this finding, the next stage in empirical inquiry will be to see if there is a long-run relationship between the variables.

Table 2. Results of unit root tests

Series	**Level**		**First difference**	
	PP	**KPSS**	**PP**	**KPSS**
lnTB	-38.605	1.484	-	0.055
lnREER	-27.999	1.983	-	0.029
lnGDP_KG	-44.763	2.151	-	0.267

TB, GDP_KG and REER denote trade balance, real domestic GDP, and real effective exchange rate, respectively.

The ARDL bounds test is used to evaluate the presence of a long-run relationship between the variables. Table 3 shows the outcomes of the Wald bounds-test for no cointegration Pesaran et al. (2001). At 5% and 10% level of significance the F-statistic value is greater than the upper bound critical value. This shows that there is a cointegrating link between the real

[2] From Jeffery Wooldridge's Introductory Econometrics: A Modern Approach with quarterly data, the number of lags from 1 to 8 lags is appropriate.

effective exchange rate, domestic GDP, and trade balance. To crosscheck results, we should also perform a "Bounds t-test for no cointegration". The bounds t-test rejects the null hypothesis of no integration with p-value = 0.003. Based on the results, there is a long-run relationship between the variables.

Table 3. Results of the bounds test for cointegration

Model	TB = f (REER, GDP_KG)			
ARDL	ARDL (1, 0, 4)			
Test Statistic	**Value**	**Level of Significance**	**I(0)**	**I(1)**
F-statistic	6.783	1%	5.166	6.338
		5%	3.791	4.807
t-statistic	-4.497	1%	-3.425	-4.097
		5%	-2.860	-3.507

TB, GDP_KG and REER denote trade balance, real domestic GDP, and real effective exchange rate, respectively. Critical values are from Pesaran et al.(2001).

Because of the cointegration between variables, we estimate the long-run coefficients of the explanatory variables by using the ARDL model.

Table 4. Long-run coefficients of trade balance function

Term	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	4.9116447	4.2571424	1.1537422	0.25222129
REER	-0.6811153	1.0951114	-0.6219599	0.53582970
GDP_KG	-0.3345202	0.1576958	-2.1213000	0.03715697

Source: Author's calculations

The results in Table 4 show that only domestic GDP is significant. This means that a growth in domestic GDP leads to a long-term worsening in trade balance. According to the estimated long-run coefficients, a 1% rise in domestic GDP results in a 0.335% worsening of the trade balance. This study lends credence to the "demand as a driver" theory, which holds that gains in local output generate higher imports. According to Keho (2019), domestic output has a key influence in explaining aggregate import demand for goods and services in Cote d'Ivoire. Furthermore, the results demonstrate that the coefficient of the real effective exchange rate to be insignificant.

Table 5. Short-run dynamic of trade balance

Term	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	2.2532128	2.0487897	1.0997775	0.2749006
REER	-0.3124611	0.5112175	-0.6112097	0.5428847
GDP_KG	-0.1973970	0.2180754	-0.9051778	0.3682318

Source: Author's calculations

Table 5 outlines the regression results on the short-run effects of domestic GDP and real effective exchange rate on the trade balance. Both variables are insignificant, but patterns remain the same.

J-curve implies the effect of real devaluation of the exchange rate on trade balance to be negative in the short-run and to be positive in the long-run. Thus, the J-curve phenomenon is not supported in the context of the Kyrgyz Republic.

Table 6. ARDL model

```
Time series regression with "ts" data:
Start = 2002(1), End = 2022(4)

Call:
dynlm::dynlm(formula = full_formula, data = data, start = start,
    end = end)

Residuals:
     Min       1Q   Median       3Q      Max
-0.54099 -0.07135  0.01538  0.09704  0.62886

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)     2.2532     2.0488   1.100  0.27490
L(TB, 1)        0.5413     0.1020   5.306 1.07e-06 ***
REER           -0.3125     0.5112  -0.611  0.54288
GDP_KG         -0.1974     0.2181  -0.905  0.36823
L(GDP_KG, 1)   -0.3211     0.1331  -2.412  0.01827 *
L(GDP_KG, 2)    0.4006     0.1339   2.993  0.00372 **
L(GDP_KG, 3)   -0.5538     0.1322  -4.188 7.49e-05 ***
L(GDP_KG, 4)    0.5182     0.2081   2.491  0.01494 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2006 on 76 degrees of freedom
Multiple R-squared:  0.6623,    Adjusted R-squared:  0.6312
F-statistic: 21.29 on 7 and 76 DF,  p-value: 1.344e-15
```

Source: Author's calculations

Table 7. Results of unit root tests

Series	Level		First difference	
	PP	KPSS	PP	KPSS
lnTB_KZ	-21.634	0.398	-	-
lnRBER_KZ	-11.186	1.745	-69.938	0.081
lnTB_RU	-15.161	1.064	-115.080	0.433
lnRBER_RU	-13.050	0.535	-93.098	0.102
lnTB_TR	-45.369	0.633	-86.678	0.108
lnRBER_TR	-6.432	1.439	-73.084	0.190
lnTB_UZ	-35.654	0.745	-79.366	0.087
lnRBER_UZ	-13.010	1.910	-47.257	0.189

TB, RBER denote trade balance and real bilateral exchange rate, respectively (KZ for Kazakhstan, RU for Russia, TR for Turkiye, UZ for Uzbekistan)

Table 7 shows that just bilateral trade balance with Kazakhstan is stationary in levels while other variables are stationary in first differences.

Table 8. Results of the bounds test for cointegration for Kazakhstan

Model **ARDL**	TB_KZ = f (RBER_KZ, GDP_KG) ARDL (1, 0, 5)			
Test Statistic	**Value**	**Level of Significance**	**I(0)**	**I(1)**
F-statistic	8.025	1%	5.166	6.338
		5%	3.791	4.807
t-statistic	-4.737	1%	-3.425	-4.097
		5%	-2.860	-3.507

Source: Author's calculations

Table 9. Results of the bounds test for cointegration for Russia

Model	TB_RU = f (RBER_RU, GDP_KG)			
ARDL	ARDL (3, 2, 1)			
Test Statistic	**Value**	**Level of Significance**	**I(0)**	**I(1)**
F-statistic	2.660	1%	5.166	6.338
		5%	3.791	4.807
t-statistic	-1.757	1%	-3.425	-4.097
		5%	-2.860	-3.507

Table 10. Results of the bounds test for cointegration for Turkiye

Model	TB_TR = f (RBER_TR, GDP_KG)			
ARDL	ARDL (4, 8, 3)			
Test Statistic	**Value**	**Level of Significance**	**I(0)**	**I(1)**
F-statistic	9.730	1%	5.166	6.338
		5%	3.791	4.807
t-statistic	-4.297	1%	-3.425	-4.097
		5%	-2.860	-3.507

Table 11. Results of the bounds test for cointegration for Uzbekistan

Model	TB_UZ = f (RBER_UZ, GDP_KG, trend)			
ARDL	ARDL (8, 2, 3)			
Test Statistic	**Value**	**Level of Significance**	**I(0)**	**I(1)**
F-statistic	5.901	1%	6.388	7.401
		5%	4.882	5.826
t-statistic	-4.187	1%	-3.971	-4.503
		5%	-3.411	-3.932

Tables 8-11 show the results of the bound test for cointegration. There might be a cointegration between variables for Kazakhstan and Uzbekistan at 1% at 5 % levels of significance. However, there is no cointegration in data for Russia. Thus, the short- and long-run coefficients were estimated just for three countries. ARDL model for Uzbekistan is the only model where trend is significant, but there is possible cointegration just at 5% significance level.

Results of the estimated ARDL model with short-run and long-run coefficients for Kazakhstan, Turkiye, and Uzbekistan presented in Tables A1-A9 in Appendix. There is no country with long-run significantly positive coefficients. Thus, there is no J-curve phenomenon with main trading partners.

Conclusion

This study looked at the influence of Kyrgyzstan's real effective exchange rate on the country's trade balance from 2001 to 2022. The bounds testing approach to cointegration was used in the study, along with additional efficient estimating approach. The findings suggest that there is a long-run link between the real exchange rate, real domestic GDP, and trade balance. However, there is no J-curve phenomenon in total or bilateral trade. The paper has found no J-curve phenomena in bilateral trade.

The policy implications of this conclusion include that governmental efforts should be focused on import substitution strategies, so that items that can be produced locally are not imported. This import substitution method can aid in the creation of long-term jobs and the growth of the industrial manufacturing sector.

This study is not without flaws. The analysis did not consider the possibility of asymmetric impacts of the actual exchange rate on trade balance. The idea of exchange rate appreciations and depreciations impacting trade balance in diverse ways has lately piqued the curiosity of economists. This is due to adjustment costs, pricing rigidities, and quantity constraints.

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Appendix

Table A1: Long-run coefficients of trade balance function for Kazakhstan

Term	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	6.9466179	2.3316399	2.979284	0.0039061028
RBER_KZ	-2.3483286	0.6135518	-3.827433	0.0002686226
GDP_KG	0.5290935	0.1681381	3.146779	0.0023788547

Table A2: Short-run dynamic of trade balance for Kazakhstan

Term	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	3.37724489	1.3448550	2.5112334	0.014213257
RBER_KZ	-1.14168950	0.4040015	-2.8259536	0.006057375
GDP_KG	-0.05619513	0.4128539	-0.1361138	0.892100911

Table A3: ARDL model for Kazakhstan

```
Time series regression with "ts" data:
Start = 2002(2), End = 2022(4)

Call:
dynlm::dynlm(formula = full_formula, data = data, start = start
    end = end)

Residuals:
     Min       1Q   Median       3Q      Max
-0.96331 -0.17701  0.02622  0.17284  0.73802

Coefficients:
              Estimate Std. Error t value   Pr(>|t|)
(Intercept)    3.37724    1.34486   2.511    0.01421 *
L(TB_KZ, 1)    0.51383    0.10263   5.007 0.00000364 ***
RBER_KZ       -1.14169    0.40400  -2.826    0.00606 **
GDP_KG        -0.05620    0.41285  -0.136    0.89210
L(GDP_KG, 1)   0.15549    0.41665   0.373    0.71007
L(GDP_KG, 2)  -0.04473    0.18999  -0.235    0.81451
L(GDP_KG, 3)   0.39277    0.19025   2.065    0.04247 *
L(GDP_KG, 4)   0.03821    0.43587   0.088    0.93037
L(GDP_KG, 5)  -0.22832    0.41445  -0.551    0.58336
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2855 on 74 degrees of freedom
Multiple R-squared:  0.6111,    Adjusted R-squared:  0.569
F-statistic: 14.53 on 8 and 74 DF,  p-value: 0.000000000001583
```

Table A4: Long-run coefficients of trade balance function for Turkiye

Term	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-1.653178	1.8878131	-0.8757105	0.3845675831917
RBER_TR	-2.232036	0.5508876	-4.0517078	0.0001440067018
GDP_KG	1.567445	0.2843322	5.5127233	0.0000007282483

Table A5: Short-run dynamic of trade balance for Turkiye

Term	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-1.1602741	1.4094799	-0.8231931	0.4135534
RBER_TR	0.3353058	0.8836691	0.3794472	0.7056524
GDP_KG	0.4463692	0.3302440	1.3516342	0.1814033

Table A6: ARDL model for Turkiye

```
Time series regression with "ts" data:
Start = 2003(1), End = 2022(4)

Call:
dynlm::dynlm(formula = full_formula, data = data, start = start
    end = end)

Residuals:
     Min       1Q   Median       3Q      Max
-0.80369 -0.21410 -0.03318  0.26066  0.98969

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)    -1.160274   1.409480  -0.823   0.4136
L(TB_TR, 1)    -0.032617   0.121389  -0.269   0.7891
L(TB_TR, 2)     0.003631   0.114101   0.032   0.9747
L(TB_TR, 3)     0.123336   0.111916   1.102   0.2747
L(TB_TR, 4)     0.203805   0.106746   1.909   0.0609 .
RBER_TR         0.335306   0.883669   0.379   0.7057
L(RBER_TR, 1) -1.250359   1.178483  -1.061   0.2928
L(RBER_TR, 2)  0.053816   1.111968   0.048   0.9616
L(RBER_TR, 3)  1.219542   1.098907   1.110   0.2714
L(RBER_TR, 4) -1.231544   1.095355  -1.124   0.2652
L(RBER_TR, 5) -1.181250   1.098214  -1.076   0.2863
L(RBER_TR, 6) -0.925778   1.144207  -0.809   0.4216
L(RBER_TR, 7)  2.042366   1.136077   1.798   0.0771 .
L(RBER_TR, 8) -0.628642   0.759915  -0.827   0.4113
GDP_KG          0.446369   0.330244   1.352   0.1814
L(GDP_KG, 1)    0.538755   0.330973   1.628   0.1086
L(GDP_KG, 2)    0.687548   0.338647   2.030   0.0466 *
L(GDP_KG, 3)   -0.572570   0.322419  -1.776   0.0807 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4179 on 62 degrees of freedom
Multiple R-squared:  0.7187,    Adjusted R-squared:  0.6416
F-statistic: 9.319 on 17 and 62 DF,  p-value: 0.00000000002181
```

Table A7: Long-run coefficients of trade balance function for Uzbekistan

Term	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-10.70077465	2.42448723	-4.413624	0.00004061485283764
trend(TB_UZ)	-0.08239988	0.03537194	-2.329527	0.02305018514797018
RBER_UZ	-1.11590839	0.32096128	-3.476769	0.00092501406072915
GDP_KG	2.38440363	0.30785671	7.745173	0.00000000009960181

Table A8: Short-run dynamic of trade balance for Uzbekistan

Term	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-9.55074285	3.21083626	-2.974534	0.004155733
trend(TB_UZ)	-0.07354422	0.03576465	-2.056338	0.043897761
RBER_UZ	-1.78523119	0.86293768	-2.068783	0.042675658
GDP_KG	0.88729855	0.31045627	2.858047	0.005770765

Table A9: ARDL model for Uzbekistan

```
Time series regression with "ts" data:
Start = 2003(1), End = 2022(4)

Call:
dynlm::dynlm(formula = full_formula, data = data, start = start,
    end = end)

Residuals:
     Min       1Q   Median       3Q      Max 
-0.84606 -0.17384 -0.00738  0.23511  1.05002 

Coefficients:
               Estimate Std. Error t value Pr(>|t|)    
(Intercept)    -9.55074    3.21084  -2.975 0.004156 ** 
trend(TB_UZ)   -0.07354    0.03576  -2.056 0.043898 *  
L(TB_UZ, 1)     0.44193    0.11560   3.823 0.000305 ***
L(TB_UZ, 2)    -0.08728    0.12106  -0.721 0.473618    
L(TB_UZ, 3)     0.18002    0.11386   1.581 0.118891    
L(TB_UZ, 4)     0.08232    0.11148   0.738 0.463026    
L(TB_UZ, 5)    -0.20578    0.10540  -1.952 0.055331 .  
L(TB_UZ, 6)    -0.25591    0.10444  -2.450 0.017060 *  
L(TB_UZ, 7)    -0.15519    0.10364  -1.497 0.139275    
L(TB_UZ, 8)     0.10736    0.09438   1.138 0.259624    
RBER_UZ        -1.78523    0.86294  -2.069 0.042676 *  
L(RBER_UZ, 1)  3.66318    1.39344   2.629 0.010750 *  
L(RBER_UZ, 2) -2.87393    0.86540  -3.321 0.001496 ** 
GDP_KG          0.88730    0.31046   2.858 0.005771 ** 
L(GDP_KG, 1)    0.17509    0.33827   0.518 0.606534    
L(GDP_KG, 2)    0.63626    0.32850   1.937 0.057250 .  
L(GDP_KG, 3)    0.42949    0.31016   1.385 0.171021    
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.4102 on 63 degrees of freedom
Multiple R-squared:  0.7771,	Adjusted R-squared:  0.7205 
F-statistic: 13.73 on 16 and 63 DF,  p-value: 0.000000000000007445
```