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**Tests for purchasing power parity between China
and selected countries in Asia, Africa, and South
America, and estimation of transaction costs**

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Research Objectives

- 1. To test the **extent of goods market integration** through **PPP** relationships between China and other 73 trading partners in Asia, Africa and Latin America.
- 2. To estimate the **transaction costs** in goods markets from **thresholds**, using only exchange rate and price data.
- 3. To identify the key **factors** that contribute to the reduction of **transaction costs** and, hence, formulate policies and strategies to promote economic cooperation and integration.

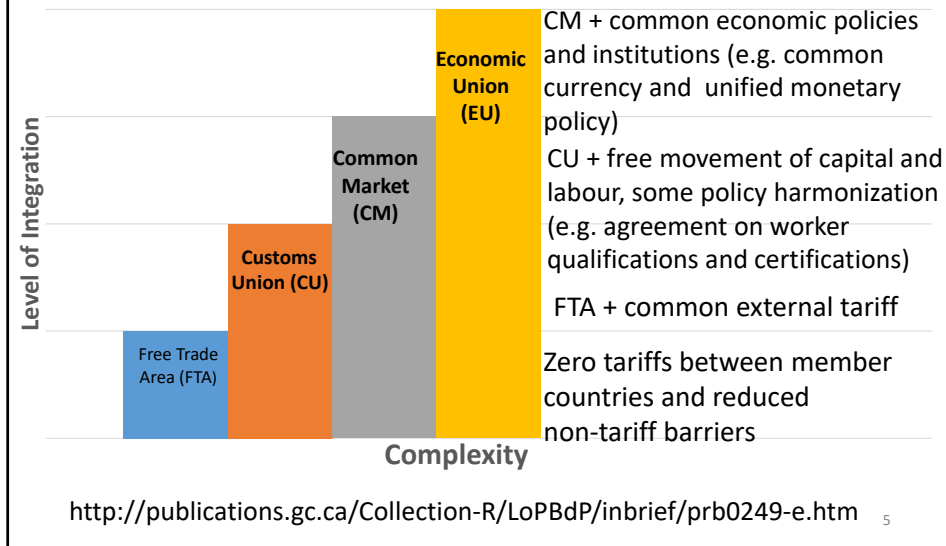
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Additive Stages of Economic Integration

- There are different stages of Economic integration:
- A. Free trade area: Zero tariffs between member countries and reduced non-tariff barriers
- B. Customs union: FTA + common external tariff
- C. Common Market: CU + free movement of capital and labour, some policy harmonization. (e. g. agreement on worker qualifications and certifications)
- D. Economic Union: CM + common economic policies and institutions (e. g. common currency and unified monetary policy)

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Additive Stages of Economic Integration



Testing for the Level of Economic Integration

→ **What level of Economic Integration?**

→ **What criteria for Economic Integration?**

Free Trade Area and Customs Union

Purchasing Power Parity (PPP) suggests that **without transportation costs, customs tariffs and other trade barriers and non-tariff barriers, competition** will force the price of identical traded goods and services as expressed in the **same currency** to be **equalized** across countries.

→ Price equalization across countries implies goods arbitrage and goods market integration

→ testing for **PPP** is a test for **price convergence** and **goods market integration**.

Empirical Testing (Criteria) for Appropriate Stage of Integration

Common Market (CM):

Test for: product price convergence + factor price (e. g. wages and interest rate) convergence

Economic Union (CU)

Test for: product price convergence + factor price convergence + income convergence + unemployment, fiscal deficit, money supply...all variables convergence

→ Higher degree of Economic Integration, more economic variables are needed to converge.

→ All in all, Economic Integration: should be **from one stage to another stage: Step by Step**

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Objective of Study: Free Trade

- Lowest level of Economic Integration: **Free Trade**
- Testing for **Purchasing Power Parity (PPP)** is a test for price convergence and **goods market integration**
- According to the **PPP** theory, nominal exchange rate between two currencies should be adjusted to equalize the purchasing power of a unit of currency of one country in the other country
 - If there is evidence of **cointegration** among **nominal exchange rate, prices** of China and other countries, **trade arbitrages** will result in **price convergence** and **goods market integration**
 - i.e., **real exchange rate** is stationary

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Purchasing Power Parity (PPP)

- The validity of **PPP** is important for policymakers because:
 - first, PPP functions as a **prediction model** for exchange rates, which helps estimate the **degree of misalignment** of nominal exchange rates and judge whether the currencies are **over- or under-valued**;
 - second, the **quality of policy advice**, if based on the exchange rate theories that employ some notion of PPP, may depend upon whether **PPP** is effective;

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Purchasing Power Parity (PPP)

- third, estimates of **PPP exchange rates** are used to determine exchange rate parities
- Fourth, the PPP theory reflects the degree of **goods market integration** among countries. PPP can be used to build an economic foundation of goods market integration.
- Hence, the validity of PPP is a prerequisite for the formation of a potential common market or economic union to attain closer economic integration in the future.


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Purchasing Power Parity (PPP)

- If PPP and goods market integration between China and its trading partners are **accepted**, the next step would involve strengthening economic cooperation by formulating policies to integrate financial and labour markets, potentially leading to the formation of a common market or an economic union.
- However, if PPP is **rejected**, there may be barriers that prevent goods market integration. Then, policies to curtail those barriers to trade shall be needed, such as adjusting taxes, existing tariff and nontariff barriers, and other protectionist policies in order to achieve goods market integration before establishing closer economic integration.

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Non-linear adjustment process toward PPP

- Traditional PPP  Assume there are no transport costs, customs tariffs and other trade barriers
- In reality, there are transaction costs and trade barriers.
- **Goods arbitrages** will be undertaken when the profits from arbitrages due to the (absolute values of) price differences are **larger** than the transaction costs.
- Good arbitrages would stop when the price differences **within a neutral band** are lower than the transaction costs.
- The data generation process of real exchange rates is then **nonlinear**.
- Indeed, investigation of **non-linearity** and **asymmetries** in real exchange rates, especially in developing countries has been recently growing rapidly

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Three-regime TAR Process

- The **transaction costs theory** of PPP is empirically justified by the **threshold** cointegration method. The threshold models can also help estimate the **transaction costs**.
- We briefly introduce this methodology and its relevance to PPP theory.
- After that, we present the results of the threshold cointegration tests and the estimates of transaction costs in the threshold models.

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Three-regime TAR Process

- We Investigate evidence **PPP** between China and its trading partners in Asia, Africa and Latin America in a **3-regime threshold** co-integration model
 - **Advantages:** allowing for the existence of a **neutral band** in accordance with the **transaction costs theory** and the estimation of the **transaction costs** from the **threshold values** so as to be appropriate for testing
 - We adopt the **residual-based 3-regime TAR** (threshold autoregressive) model of **Maki and Kitasaka (2015)** for PPP testing

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Three-regime TAR Process

- General long-run equilibrium model for **PPP**

$$e_t = \beta_0 + \beta_1 P_t + \beta_2 P_t^* + u_t, \quad t = 1 \dots T \quad (1)$$

where:

e_t is the natural log of nominal exchange rate expressed as units of foreign currency per unit of RMB

P_t and P_t^* are the natural log of price level of a foreign country and China, respectively

β_0 , β_1 and β_2 are parameters

u_t is an **equilibrium error** representing the deviations from PPP

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Three-regime TAR Process

- Based on (1) we specify (2) by setting $\beta_2 = -1$ and rearranging the terms as follows:

$$e_t + P_t^* = \beta_0 + \beta_1 P_t + u_t, \quad t = 1 \dots T \quad (2)$$

where

$e_t + P_t^*$ Thus, $e_t + P_t^*$ = costs of goods and services sold in China expressed in terms of a foreign currency

- $+P_t^*$ and P_t can be compared since they are expressed in terms of the same foreign currency unit.
- **PPP** exists if there is evidence of **cointegration** between $e_t + P_t^*$ and P_t .
- The **residual-based** test for **cointegration** is a test for **stationarity** of u_t which is known as **real exchange rate**.

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Three-regime TAR Process

Based on 3-regime TAR error-correcting process for **real exchange rate, u_t** we obtain (3) as follows

$$\Delta u_t = (\rho_1 u_{t-1}) I\{u_{t-1} \leq \lambda_1\} + (\rho_2 u_{t-1}) I\{u_{t-1} > \lambda_2\} + \sum_j^p \alpha_j \Delta u_{t-j} + \varepsilon_t \quad (3)$$

where

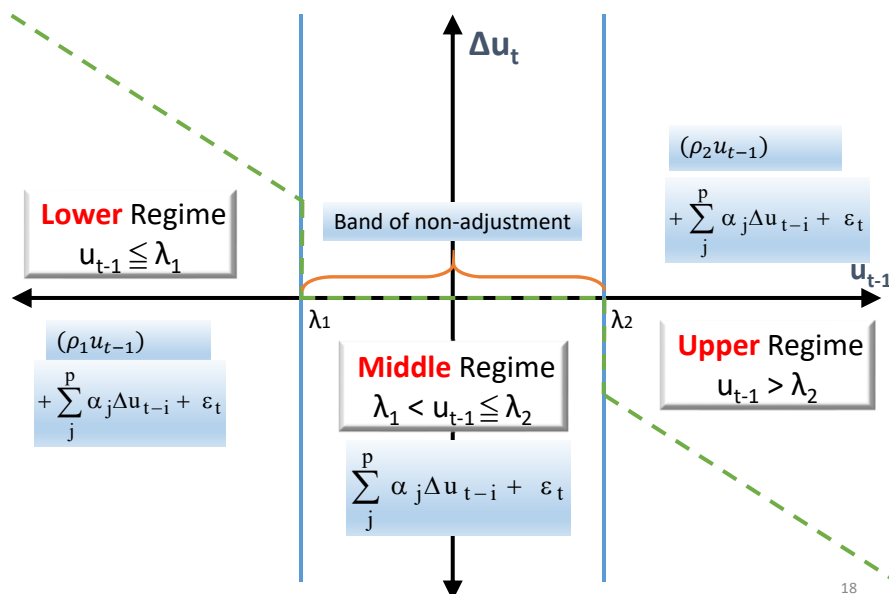
μ_1 and μ_2 are the regime-specific intercepts

λ_1 and λ_2 are thresholds

The equilibrium error in equation (3) is adjusted toward the zero equilibrium

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Impact of the transaction costs on the 3-regime TAR Error Correction (Real Exchange Rate) process



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Estimates of transaction costs

- The **magnitudes of the thresholds (λ_1 and λ_2)** represent the **proportional transaction costs** that delineate different regimes
- We can use data on **price and exchange rate series** to estimate the **transaction costs** under the threshold models.
- The values of thresholds can reflect the **non-observable** as well as observable costs such as cultural and languages differences
- This is an efficient, low-cost estimation method
- **Neutral or threshold band ($\lambda_1 \leq u_{t-1} < \lambda_2$)** exists in the middle regime
 - within which deviations from PPP are too small to induce profitable arbitrage

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Wald-type and t-type tests

- Null hypothesis (H_0) of no linear cointegration and the alternative hypothesis (H_1) of threshold cointegration for equation (3):

$$H_0: \rho_1 = \rho_2 = 0 \quad \text{and} \quad H_1: \rho_1 < 0 \quad \text{and} \quad \rho_2 < 0 \quad (4)$$
- The hypotheses are tested using the **supremum** of the **Wald statistics** (Maki and Kitasaka, 2015)

$$\text{Sup } WT^B(\lambda) = \text{Sup}_{\lambda \in [\lambda_{\min}, \lambda_{\max}]} W_T^B(\lambda) \quad (5)$$
- The parameter space of threshold $[\lambda_{\min}, \lambda_{\max}]$ is selected such that at least $(100 \times 2 \gamma)\%$ of the sample in the middle regime.

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Wald-type and t-type tests

- Also, null hypothesis (H_0) of no linear cointegration and the alternative hypothesis (H_2) of partial threshold cointegration:

$$H_2: \rho_1 = 0 \text{ and } \rho_2 < 0 \quad \text{and} \quad H_2: \rho_1 < 0 \text{ and } \rho_2 = 0 \quad (6)$$
- The hypotheses are tested using the infimum of the t statistics (Maki and Kitasaka, 2015)

$$\text{Inf } tT^B(\lambda) = \text{Inf}_{\lambda \in [\lambda_{\min}, \lambda_{\max}]} t_T^B(\lambda) \text{max} \quad (7)$$
- **Advantage: Asymptotic distributions** dependent upon deterministic terms and the number of regressors in equation (2), and the value of γ in the grid space
- **Wald** type tests have **higher power** than the t-type counterparts

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Data

1. 73 countries from Asia, Africa and Latin America
2. 73 consumer price indices
2. 73 Spot exchange rates per USD and RMB per USD; transformed into 73 spot exchange rates per RMB in order to detect PPP between China and other countries.
 - Monthly data from (Jan 1996 for Asia, Jan 2000 for Africa, Jan 2022 for Latin America) to Dec 2020
 - Source
 - IMF International Financial Statistics

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Empirical results

- **Unit root tests:** All are I(1)
- **Cointegration tests:** evidence of cointegration in the PPP relationship for pairs of China and **17 Asian, 14 African and 10 Latin American** countries using Supremum of Wald statistics

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Threshold cointegration results

Asian Countries	sup $W_T^B(\lambda)$	inf $t_T^B(\lambda)$	Lag	MR (%)
Bangladesh	4.490	-1.443	19	0
Brunei	5.265	-1.631	15	0
Cambodia	27.498***	-3.370**	16	74.00
Georgia	6.703	-1.354	19	0
India	18.928**	-1.776	13	72.67
Indonesia	78.689***	-4.318***	15	61.00
Iran	22.203**	-0.675	15	48.81
Iraq	25.644**	-1.940	20	32.87
Japan	4.043	-0.982	12	0
Kazakhstan	10.025	-2.193	19	0

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Threshold cointegration results

Korea	23.255***	-1.431	20	46.67
Kyrgyzstan	32.675***	-3.844***	20	48.67
Laos	37.501**	-2.673**	18	72.00
Malaysia	26.364***	-2.616**	9	61.33
Maldives	39.403***	-2.385*	18	72.00
Mongolia	3.838	-1.260	13	0
Nepal	15.159*	-2.510*	12	77.33
Pakistan	17.990**	-2.808**	19	33.33
Philippines	17.826**	-2.571**	13	67.33

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Threshold cointegration results

Russia	7.965	-1.472	1	0
Singapore	24.320***	-2.380*	20	75.67
Sri Lanka	2.461	-1.108	16	0
Thailand	24.875***	-2.768**	8	67.67
Ukraine	27.867***	-1.518	19	56.67
Vietnam	26.525***	-1.749	17	57.33

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Threshold cointegration results

African Countries	sup $W_T^B(\lambda)$	inf $t_T^B(\lambda)$	Lag	MR (%)
Algeria	10.941	-0.927	13	0
Angola	5.726	-1.204	19	0
Benin	10.478	-2.127	18	0
Botswana	8.299	-2.106	12	0
Burundi	22.250***	-2.508*	14	50.79
Cameroon	8.104	-1.990	19	0
Central African	9.349	-2.047	18	0
Chad	7.983	-1.978	18	0
Congo	12.194	-1.853	18	0
Côte d'Ivoire	12.360	-2.388	17	0 ²⁷

Threshold cointegration results

Egypt	26.662***	-2.548**	9	80.16
Equatorial Guinea	10.486	-2.316	19	0
Ethiopia	18.444***	-2.885**	20	44.84
Gabon	7.958	-1.997	18	0
Ghana	23.225***	-1.160	6	55.95
Guinea-Bissau	6.691	-1.793	12	0
Kenya	12.133	-2.001	16	0
LIBERIA	19.097**	-2.328	11	79.36
Libya	65.553***	-1.470	14	60.52
Madagascar	20.559**	-3.466***	18	74.21
Mali	12.585	-2.229	19	0

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Threshold cointegration results

Morocco	9.757	-2.080	17	0
Mozambique	16.792*	-2.617**	17	76.59
Namibia	33.573***	-3.575***	20	42.86
Nigeria	6.352	-1.168	15	0
Rwanda	6.499	-1.682	16	0
Senegal	10.656	-2.201	19	0
Sierra Leone	46.760***	-5.937***	18	71.83
South Africa	47.073***	-4.284***	20	54.37
Sudan	36.569***	-3.261***	18	77.38
Tanzania	15.552*	-2.375*	12	75.79
Uganda	15.025*	-2.912**	15	68.65
Zambia	9.665	-2.003	5	0

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Threshold cointegration results

LAC Countries	$\sup W_T^B(\lambda)$	$\inf t_T^B(\lambda)$	Lag	MR (%)
Argentina	24.036***	-1.933	8	53.95
Bolivia	14.948*	-2.668**	16	73.68
Brazil	9.859	-1.754	20	0
Chile	16.346*	-2.838**	20	53.51
Colombia	10.804	-2.282	14	0
Costa Rica	9.028	-1.988	18	0
Dominica	30.271***	-3.081***	19	75.88
Ecuador	25.303***	-1.779	18	64.47
EL Salvador	6.122	-1.552	13	0

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Threshold cointegration results

Guyana	16.282*	-1.918	20	66.67
Jamaica	18.550**	-1.136	20	78.51
Mexico	10.387	-2.208	0	0
Peru	15.239*	-2.797**	9	46.05
Suriname	85.679***	-3.189***	0	71.49
Trinidad and Tobago	19.928**	-2.152	16	70.18
Uruguay	7.264	-1.024	15	0

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Weak and strong form of PPP

- **Weak** form of PPP refers to cointegration among nominal exchange rate and prices between two countries.
- **Strong** form of PPP further requires $\beta_1 = 1$.
- Some factors may lead to **rejection of the strong form**:
 - **measurement errors** in observed prices,
 - variations in **price index weights** across countries,
 - data being not reliable due to **price and foreign exchange controls**, especially in less developed countries.
 - Differences in the **composition of baskets of goods** included in national price indexes such as CPI
 - the presence of **non-traded** goods and services.
- These factors can hinder the equal transmission of price shocks from one market to another, circumvent the equi-proportionate pass-through of price shocks from one market to another.

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Weak and strong form of PPP

Asian Countries	$\hat{\beta}_1$	FM Wald($\beta_1 = 1$)
Cambodia	0.956 (0.020)	4.623**
India	0.957 (0.019)	4.989**
Indonesia	1.083 (0.039)	4.427**
Iran	1.059 (0.046)	1.739
Iraq	1.179 (0.064)	11.623***
Kyrgyzstan	1.040 (0.034)	1.373
Laos	0.914 (0.023)	13.616***
Malaysia	1.863 (0.067)	164.951***
Maldives	1.325 (0.023)	185.397***
Nepal	0.959 (0.018)	4.797**

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Asian Countries	$\hat{\beta}_1$	FM Wald($\beta_1 = 1$)
Pakistan	1.133 (0.016)	65.216***
Philippines	1.154 (0.041)	13.777***
Singapore	1.328 (0.054)	37.055***
Thailand	1.228 (0.073)	9.824***
Ukraine	1.219 (0.032)	45.772***
Vietnam	0.944 (0.012)	19.731***

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African Countries	$\hat{\beta}_1$	FM Wald($\beta_1 = 1$)
Burundi	0.961 (0.017)	4.916**
Egypt	1.063 (0.030)	3.289*
Ethiopia	0.900 (0.014)	45.186***
Ghana	1.270 (0.036)	55.676***
Liberia	1.002 (0.017)	0.027
Libya	0.524 (0.0420)	127.783**
Madagascar	1.093 (0.025)	16.153***
Mozambique	1.200 (0.045)	19.148***
Namibia	1.372 (0.076)	23.732***
Sierra Leone	1.359 (0.027)	166.760***

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South Africa	1.577 (0.071)	64.712***
Sudan	0.894 (0.032)	10.387***
Tanzania	1.250 (0.017)	203.778*
Uganda	1.232 (0.027)	73.229***
South Africa	1.577 (0.071)	64.712***
Sudan	0.894 (0.032)	10.387***
Tanzania	1.250 (0.017)	203.778*
Uganda	1.232 (0.027)	73.229***

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LAC Countries	$\hat{\beta}_1$	FM Wald($\beta_1 = 1$)
Argentina	1.422 (0.020)	427.831***
Bolivia	0.647 (0.021)	256.739**
Chile	1.557 (0.080)	48.062***
Dominica	1.275 (0.139)	3.890**
Ecuador	1.262 (0.037)	49.391***
Guyana	1.193 (0.028)	45.573***
Jamaica	1.156 (0.040)	14.728***
Peru	1.373 (0.035)	109.554***
Suriname	1.050 (0.019)	6.478**
Trinidad and Tobago	0.772 (0.014)	234.426***

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Symmetric vs. Asymmetric Adjustments

- These findings of **asymmetric** adjustment:
- heterogeneous conditions in goods markets, such as:
 - variations in **physical** characteristics (weight and stowage) of traded goods,
 - **market sizes**, and
 - **trade restrictions** across countries

Symmetric vs. Asymmetric Adjustments

Asian Countries	$\hat{\rho}_1$	$\hat{\rho}_2$	$F(\rho_1 = \rho_2)$
Cambodia	-0.116 (0.034)	-0.136 (0.032)	0.0200
India	-0.042 (0.025)	-0.175 (0.041)	8.724***
Indonesia	-0.068 (0.015)	-0.163 (0.020)	14.318***
Iran	-0.142 (0.032)	-0.011 (0.041)	6.819***
Iraq	-0.246 (0.063)	-0.176 (0.091)	2.387
Kyrgyzstan	-0.054 (0.010)	-0.034 (0.009)	3.679*
Laos	-0.123 (0.056)	-0.197 (0.034)	1.301
Malaysia	-0.073 (0.030)	-0.148 (0.031)	3.140*
Maldives	-0.207 (0.037)	-0.086 (0.036)	4.699**
Nepal	-0.081 (0.032)	-0.088 (0.027)	0.031

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Pakistan	-0.071 (0.025)	-0.096 (0.025)	0.629
Philippines	-0.109 (0.031)	-0.065 (0.026)	1.259
Singapore	-0.117 (0.049)	-0.161 (0.038)	0.487
Thailand	-0.083 (0.030)	-0.145 (0.034)	1.951
Ukraine	-0.031 (0.020)	-0.152 (0.029)	12.990***
Vietnam	-0.147 (0.030)	-0.040 (0.022)	7.463***

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African Countries	$\hat{\rho}_1$	$\hat{\rho}_2$	$F(\rho_1 = \rho_2)$
Burundi	-0.220 (0.087)	-0.109 (0.036)	1.107
Egypt	-0.310 (0.066)	-0.099 (0.039)	8.421***
Ethiopia	-0.067 (0.023)	-0.131 (0.033)	3.327*
Ghana	-0.005 (0.011)	-0.074 (0.015)	10.254***
Liberia	-0.123 (0.053)	-0.158 (0.039)	0.231
Libya	-0.180 (0.032)	-0.019 (0.014)	21.226***
Madagascar	-0.143 (0.041)	-0.218 (0.054)	1.877
Mozambique	-0.074 (0.028)	-0.097 (0.026)	0.390
Namibia	-0.076 (0.021)	-0.069 (0.013)	0.097
Sierra Leone	-0.064 (0.010)	-0.075 (0.012)	1.033

South Africa	-0.117 (0.023)	-0.074 (0.017)	2.241
Sudan	-0.175 (0.053)	-0.294 (0.052)	3.082*
Tanzania	-0.097 (0.042)	-0.113 (0.033)	0.053
Uganda	-0.083 (0.028)	-0.117 (0.040)	0.565
South Africa	-0.117 (0.023)	-0.074 (0.017)	2.241
Sudan	-0.175 (0.053)	-0.294 (0.052)	3.082*
Tanzania	-0.097 (0.042)	-0.113 (0.033)	0.053
Uganda	-0.083 (0.028)	-0.117 (0.040)	0.565

LAC Countries	$\hat{\rho}_1$	$\hat{\rho}_2$	F($\rho_1 = \rho_2$)
Argentina	-0.061 (0.031)	-0.161 (0.035)	4.818**
Bolivia	-0.094 (0.035)	-0.104 (0.035)	0.044
Chile	-0.089 (0.026)	-0.105 (0.037)	0.135
Dominica	-0.069 (0.022)	-0.131 (0.024)	10.971***
Ecuador	-0.112 (0.024)	-0.040 (0.022)	4.532**
Guyana	-0.081 (0.020)	-0.076 (0.039)	0.017
Jamaica	-0.073 (0.047)	-0.127 (0.041)	1.133
Peru	-0.143 (0.044)	-0.112 (0.040)	0.326
Suriname	-0.299 (0.093)	-0.091 (0.016)	4.016**
Trinidad and Tobago	-0.168 (0.039)	-0.059 (0.031)	5.799**

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Estimates of transaction costs

Asia	$\hat{\lambda}_1$	Asia	$\hat{\lambda}_2$	Asia	$ \hat{\lambda}_1 + \hat{\lambda}_2 $
Iraq	-0.0120	Iraq	0.0205	Iraq	0.0325
Pakistan	-0.0201	Vietnam	0.0285	Pakistan	0.0622
Vietnam	-0.0465	Pakistan	0.0420	Vietnam	0.0750
Maldives	-0.0522	Singapore	0.0475	Maldives	0.1177
Malaysia	-0.0543	Cambodia	0.0483	Singapore	0.1178
Philippines	-0.0606	Kyrgyzstan	0.0549	Cambodia	0.1217
Thailand	-0.0687	Maldives	0.0655	Malaysia	0.1470
Singapore	-0.0703	India	0.0740	Nepal	0.1553
Cambodia	-0.0734	Nepal	0.0759	India	0.1560

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Nepal	-0.0794	Malaysia	0.0927	Philippines	0.1676
India	-0.0820	Thailand	0.1069	Thailand	0.1756
Laos	-0.0830	Philippines	0.1070	Kyrgyzstan	0.2008
Indonesia	-0.1062	Iran	0.1655	Laos	0.2846
Ukraine	-0.1351	Laos	0.2016	Indonesia	0.3138
Kyrgyzstan	-0.1459	Indonesia	0.2076	Ukraine	0.4210
Iran	-0.4482	Ukraine	0.2859	Iran	0.6138
Average	-0.0774		0.1069		0.1844

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Estimates of Thresholds

- Among **Asian** countries, Iran exhibits the largest value of $|\hat{\lambda}_1|$.
- When **Iran's** price level (p_t) in Iranian rial is higher than China's price level (e_t+p_t) by approximately **44.8%**, China exports goods to Iran. Similarly, Ukraine has the largest value of $|\hat{\lambda}_2|$.
- When China's price level in **Ukrainian** Hryvnia (e_t+p_t) is higher than Ukraine's price level (p_t) by around **28.6%**, China imports goods from Ukraine.

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Africa	$\hat{\lambda}_1$	Africa	$\hat{\lambda}_2$	Africa	$ \hat{\lambda}_1 + \hat{\lambda}_2 $
Ethiopia	-0.0336	Ethiopia	0.0495	Ethiopia	0.0831
Tanzania	-0.0613	Namibia	0.0578	Tanzania	0.1547
Uganda	-0.0773	South Africa	0.0728	Burundi	0.1754
Burundi	-0.0904	Burundi	0.0850	Uganda	0.1824
Liberia	-0.1009	Libya	0.0862	Liberia	0.2115
Madagascar	-0.1092	Tanzania	0.0934	Libya	0.2179
Ghana	-0.1103	Uganda	0.1051	Madagascar	0.2410
Sierra Leone	-0.1317	Liberia	0.1106	Sierra Leone	0.2491
Libya	-0.1317	Sierra Leone	0.1174	South Africa	0.2603
Egypt	-0.1525	Madagascar	0.1318	Namibia	0.2834
South Africa	-0.1875	Egypt	0.2364	Ghana	0.3640
Mozambique	-0.1884	Mozambique	0.2520	Egypt	0.3889
Namibia	-0.2256	Ghana	0.2537	Mozambique	0.4404
Sudan	-0.2763	Sudan	0.3844	Sudan	0.6607
Average	-0.1418		0.1454		0.2795

Estimates of Thresholds

- In **Africa**, **Sudan** has the highest values of both $|\hat{\lambda}_1|$ and $|\hat{\lambda}_2|$.
- China exports goods to **Sudan** when Sudan's price level (p_t) exceeds China's price level in Sudanese pound ($e_t + p_t$) by about **27.6%**.
- Conversely, China **imports** goods from **Sudan** when China's price level in Sudanese pound ($e_t + p_t$) is higher than Sudan's price level (p_t) by approximately **38.4%**.

LAC	$\hat{\lambda}_1$	LAC	$\hat{\lambda}_2$	LAC	$ \hat{\lambda}_1 + \hat{\lambda}_2 $
Peru	-0.0270	Peru	0.0263	Peru	0.0533
Guyana	-0.039	Trinidad and Tobago	0.0324	Trinidad and Tobago	0.0738
Trinidad and Tobago	-0.0413	Ecuador	0.0546	Guyana	0.097
Bolivia	-0.0521	Guyana	0.0581	Bolivia	0.1086
Ecuador	-0.0602	Bolivia	0.0565	Ecuador	0.1148
Argentina	-0.0655	Jamaica	0.0601	Jamaica	0.1319
Jamaica	-0.0717	Chile	0.0622	Chile	0.1658
Suriname	-0.0981	Suriname	0.0693	Suriname	0.1674
Chile	-0.1036	Dominica	0.1101	Argentina	0.2360
Dominica	-0.1730	Argentina	0.1755	Dominica	0.2831
Average	-0.0732		0.0705		0.1432

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Estimates of Thresholds

- Within **LAC**, **Dominica** exhibits the largest value of $|\hat{\lambda}_1|$, and the second largest value of $|\hat{\lambda}_2|$.
- China exports goods to **Dominica** when Dominica's price level (p_t) surpasses China's price level in Eastern Caribbean dollar (e_t+p_t) by about **17.3%**.
- China imports goods from Dominica when China's price level in Eastern Caribbean dollar (e_t+p_t) is higher than Dominica's price level (p_t) by around **11.01%**.

Estimates of Thresholds

- The estimates of thresholds demonstrate reasonable asymmetry, indicating that **transaction costs** of goods to be arbitrated in one direction may **differ** from those in the opposite direction.
- This **asymmetry** in thresholds may be attributed to factors such as
 - price-to-weight ratios,
 - price-to-volume ratios of traded products,
 - trade barriers,
 - market sizes,
 - price-setting powers and market structures
- Therefore, imposing symmetric thresholds may lead to **incorrect** estimations of neutral band sizes.

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Estimates of Thresholds

- The **total** proportional transaction costs, measured by the **sum** of $|\hat{\lambda}_1|$ and $|\hat{\lambda}_2|$ are the highest for Iran among **Asian** countries, amounting to **0.6638**.
- **Iran** has the widest neutral band implied by the thresholds in Asia.
- Kyrgyzstan, Laos, and Indonesia exhibit neutral bands that are greater than 20% of prices in their currencies. On average, the width of the neutral band in Asia is approximately 0.1976.

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Estimates of Thresholds

- In **Africa**, **Sudan** has the highest value of $|\hat{\lambda}_1|+|\hat{\lambda}_2|$, reaching around **0.66**.
- Seven African countries (Liberia, Libya, Madagascar, Sierra Leone, South Africa, Namibia, Ghana, Egypt, and Mozambique) have neutral bands that exceed 20% of prices in their respective currencies.
- The average width of the neutral band in **Africa** is the largest compared to Asia and LAC, amounting to 0.2795.
- In **LAC**, the average width of the neutral band is approximately **0.1432**, the smallest among the three regions. **Argentina** and **Dominica** exhibit neutral bands that are greater than 20% of prices in their respective currencies.

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Estimates of Thresholds

- To enhance goods market integration and efficiency in goods arbitrage between China and its trading partners in Asia, Africa, and LAC, particularly those with **significant thresholds** and **wide neutral bands**, measures to curtail transaction costs should be taken.
- This could involve investments in advanced **transportation and logistics** infrastructure, increasing **economic freedom**, and further **reducing tariff and non-tariff barriers to trade**, which help strengthen the degree of goods market integration and efficiency in goods arbitrage between China and its trading partners

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Regression models of transaction costs

- We attempt to estimate the causes of **thresholds (total proportional transaction costs)** across the countries under study.
- Transactions costs as a form of 'iceberg' **shipping costs** may be **proportional** to the **distance** shipped. **Longer** distance from China would lead to **higher proportional** transaction costs.
- **Economic freedom** may help reduction of transaction costs, thereby producing a **negative** relationship between transaction costs and economic freedom
- **Corrupt** activities may increase transaction costs implying a **positive** relationship between them
- **Trade openness** also benefits firms, by giving producers access to bigger markets, encouraging market competition, reducing monopoly power and transaction costs. Transaction costs can be kept at a low level in the era of **globalization**.
- Trade openness and globalization then have a **negative** relation with transaction costs.

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Regression models of transaction costs

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	0.1889	-0.4938	0.6930	1.1428	1.0600	0.1189
Distance	0.0031	0.0857	0.0699	0.0668	0.0649	0.0904
Distance*DLAC		-0.0200	-0.0179	-0.0174	-0.0186	-0.0223
Economic Freedom			-0.2593	-0.3171	-0.3435	-0.2797
Corruption				-0.0458	-0.0308	-0.0085
Trade Openness					0.0347	-0.0443
Globalization						0.1600
R ²	0.0002	0.1861	0.2933	0.2801	0.2836	0.3139
Adjusted R ²	-0.0260	0.1421	0.2327	0.1929	0.1717	0.1811

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Regression models of transaction costs

- The coefficients of **Distance** (with slope dummy of LAC) and **Economic Freedom** are statistically significant, with the largest adjusted R^2 in Model 3, where every increase of 1% in distance from China leads to an increase in total proportional transaction costs of about 0.07% for Asian and African countries, and about 0.052% for LACs.
- Moreover, an increase in 1% economic freedom score brings about a decrease in transaction costs of 0.26%, implying that economic freedom is the most important factor for transaction costs.
- The coefficients of **Corruption**, **Trade Openness** and **Globalization** are all statistically insignificant.

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Reference

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Thank You

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