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Palm oil trade restrictiveness index and its impact on world palm oil exports

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Electronic supplementary material

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APPENDIX A

Table S1. List of importing countries

Country	ISO3
Algeria	DZA
Australia	AUS
Bahrain	BHR
Belgium	BEL
Benin	BEN
Brazil	BRA
Cameroon	CMR
Canada	CAN
Chile	CHL
China	CHN
Colombia	COL
Cote d'Ivoire	CIV
Denmark	DNK
Ethiopia	ETH
France	FRA
Germany	DEU
Ghana	GHA
Greece	GRC
Hong Kong	HKG
India	IND
Ireland	IRL
Israel	ISR
Italy	ITA
Japan	JPN
Jordan	JOR
Kazakhstan	KAZ
South Korea	KOR
Kuwait	KWT
Lebanon	LBN
Mauritius	MUS
Mexico	MEX
Morocco	MAR
Myanmar	MMR
Nepal	NPL
Netherlands	NLD
New Zealand	NZL
Niger	NER
Nigeria	NGA
Oman	OMN
Pakistan	PAK
Peru	PER
Philippines	PHL
Qatar	QAT
Russia	RUS
Saudi Arabia	SAU
Senegal	SEN
Singapore	SGP
Spain	ESP
Sri Lanka	LKA
Sweden	SWE
Switzerland	CHE
Thailand	THA
Togo	TGO
Tunisia	TUN
Turkey	TUR
United Arab Emirates	ARE
United Kingdom	GBR
United States	USA
Vietnam	VNM

Source: Authors' own elaboration

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Table S2. Description of data

Variable	Description	Source
X	Palm oil export value based on the Harmonized System classification at the four-digit level, HS-1511 for palm oil	UN Comtrade (2022)
GDP	Gross Domestic Product that reflect the income of the country	World Bank (2022)
POP	Size of population of a country that reflect the market size	World Bank (2022)
ER	Exchange rates of a country	World Bank (2022)
DIST	Bilateral distances (*in kms*) from Malaysia and Indonesia to importing countries	CEPII (2022)
Tariff	Tariff rate of palm oil exports	Macmap (2022)
NTM	Non-tariff measures that have been implemented on palm oil exports. It is a dummy variables that equal to one for the year that the NTM is implemented, and zero otherwise.	TRAINS (2022)
TA	Trade agreement related to the agriculture or palm oil sector that are still in force to date. This variable is a dummy variable, where a value of 1 is given if an agreement was first implemented in a particular year between the importing countries of Malaysia and Indonesia. A value of 0 indicates that there is no trade agreement between the countries in a particular year.	Macmap (2022)

Table S3. Trade agreements for Malaysia

Agreement	Starting year
AANZFTA	2010
Armenia for Developing Countries	2015
Belarus (EAEU) for Developing Countries	2016
CECA, ASEAN-Korea	2007
CECA, India-Malaysia	2011
CEPA, Malaysia-Pakistan	2008
EPA, ASEAN-Japan	2009
EPA, Japan-Malaysia	2006
FTA, ASEAN-China	2005
FTA, ASEAN-Hong Kong	2019
FTA, ASEAN-India	2010
FTA, Australia-Malaysia	2013
FTA, Chile-Malaysia	2012
FTA, Malaysia-New Zealand (MNZFTA)	2010
FTA, Malaysia-Turkey (MTFTA)	2015
Group of Eight (D8)	2016
Kazakhstan (EAEU) for Developing Countries	2016
Kyrgyzstan for Developing Countries	2015
Russian Federation (EAEU) for Developing Countries	2016

Source: Macmap (2022)

Table S4. Trade agreements for Indonesia

Agreement	Starting year
AANZFTA	2012
Armenia for Developing Countries	2015
Belarus (EAEU) for Developing Countries	2016
CECA, ASEAN-Korea	2007
EPA, ASEAN-Japan	2018
EPA, Indonesia-Japan	2008
FTA, ASEAN-China	2005
FTA, ASEAN-India	2010
FTA, Chile-Indonesia	2019
Group of Eight (D8)	2016
GSTP	2004
Kazakhstan (EAEU) for Developing Countries	2016
Kyrgyzstan for Developing Countries	2015
PTA, Indonesia-Pakistan	2013
Russian Federation (EAEU) for Developing Countries	2016
Turkey for GSP countries	2002

Source: Macmap (2022)

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APPENDIX B

Methodology for *TRI* calculation. The specifications of the impact of trade barriers on palm oil imports are given as follows:

$$\ln m_{n,c} = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \beta_{n,c} NTM_{n,c}^T + \\ + \delta_{n,c} NTM_{n,c}^{NT} + \varepsilon_{n,c} \ln\left(1 + t_{n,c}\right) + \mu_{n,c} \quad \text{(S1)}$$

where: $m_{n,c}$ – value of good n (palm oil products) imports in country c; α_n – coefficient for the tariff line that can see the effect of specific goods; C^k_c – k variable that represents the specific criteria of each country (endowment factor); $\alpha_{n,k}$ – parameter that can detect the effect of the specific country; $NTM^T_{n,c}$, $NTM^{NT}_{n,c}$ – dummy variables representing the presence of technical and non-technical trade barriers for palm oil in country c, respectively; $\beta_{n,c}$, $\delta_{n,c}$ – parameters measuring the impact of implementing technical and non-technical NTMs for palm oil in country c, respectively; $t_{n,c}$ – *ad valorem* tariff for palm oil in country c; $\varepsilon_{n,c}$ – elasticity of import demand for palm oil in country c; $\mu_{n,c}$ –error term.

Kee et al. (2009) stated that the impact of tariffs on imports depends entirely on the level of import demand elasticity. The value of this elasticity for each item, as per the six-digit Harmonized System (HS) classification in 149 countries, was previously estimated by Ghodsi et al. (2016). Consequently, this study employs the elasticity values specific to the palm oil product code, as outlined in Equation (S1). To address the issue of tariff endogeneity, the term $\varepsilon_{n,c} \ln(1 + t_{n,c})$ is moved to the left side of the equation as follows:

$$\ln m_{nc} - \varepsilon_{n,c} \ln\left(1 + t_{n,c}\right) = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \\ + \beta_{n,c} NTM_{n,c}^T + \\ + \delta_{n,c} NTM_{n,c}^{NT} + \kappa_{n,c} \quad \text{(S2)}$$

where: $\kappa_{n,c}$ – new error term, arising because the import demand elasticity is estimated with the error $\varepsilon_{n,c}$.

Equation (S2) illustrates that the impact of non-tarrif measures (NTM) implementation varies for each country and each tariff line. However, international databases such as Macmap, COMTRADE, UNCTAD, and the World Bank do not offer time-varying NTM data. Consequently, this study has modified equation (S2) to allow the parameters β and δ to vary for each tariff line and country without reducing degrees of freedom. This modification is crucial to accurately estimate the specific impact for each product in each country, utilizing the benefits approach as follows:

$$\beta_{n,c} = \beta_n + \sum_k \beta_{n,k} C_c^k \quad \text{(S3)}$$

$$\delta_{n,c} = \delta_n + \sum_k \delta_{n,k} C_c^k \quad \text{(S4)}$$

where: $\beta_{n,k}$ – parameter estimated to assess the impact of technical NTMs on specific products; $\delta_{n,k}$ – parameter estimated to evaluate the impact of non-technical NTMs on specific products.

The above equation demonstrates that the variation in parameters for each country is a result of the interaction between technical and non-technical NTMs and endowment factor variables, such as the capital-to-GDP ratio, labor-to-GDP ratio, agricultural land ratio to GDP, and GDP itself. By substituting equations (S3) and (S4) into equation (S2), we derive the following equation:

$$\ln m_{nc} - \varepsilon_{n,c} \ln\left(1 + t_{n,c}\right) = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \\ + \left(\beta_n + \sum_k \beta_{n,k} C_c^k\right) NTM_{n,c}^T \\ + \left(\delta_n + \sum_k \delta_{n,k} C_c^k\right) NTM_{n,c}^{NT} \\ + \kappa_{n,c} \quad \text{(S5)}$$

However, model (S5) encounters an endogeneity issue between NTMs and imports, as well as the zero-trade problem. To address these econometric challenges, this study employs a two-level regression approach. In the first stage, we conduct a probit regression for both technical and non-technical NTMs. Probit regression is chosen because NTM is a dummy variable, set to one if there is at least one NTM implemented by the importing countries. To mitigate the endogeneity problem between NTMs and imports, this study incorporates an instrumental variable, which is the average implementation of NTMs across the three nearest countries, as follows:

$$f\left(NTM_{n,c} | X, \overline{NTM}_{n,c}\right) = \\ = \Phi\left(Z_c \delta + \delta^{NTM} \overline{NTM}_{n,c}\right)^{NTM_{n,c}} \times \\ \times \left[1 - \Phi\left(Z_c \delta + \delta^{NTM} \overline{NTM}_{n,c}\right)\right]^{1 - NTM_{n,c}} \quad \text{(S6)}$$

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where: Z_c – control variable in the second stage of the regression; $\overline{NTM}_{n,c}$ – average implementation of NTMs for the three nearest countries; δ – coefficient of Z_c; δNTM – coefficient of $\overline{NTM}_{n,c}$.

We used the three nearest countries following Kee and Nicita (2016). Recent work by Jiao and Wei (2020) offers a theoretical rationale, grounded in the median voter theorem, for considering the trade policies of other nations as exogenous. This perspective aligns with the criteria for exclusion restrictions, rendering these policies suitable as instrumental variables (IVs). Additionally, a country's trade policy is likely influenced by its neighbors due to factors like regional trade agreements or shared cultural/historical ties. However, a country's bilateral import levels from a specific trade partner should not directly affect the bilateral trade policies of its neighboring countries towards the same partner, thereby meeting the exclusion restriction requirements.

From this probit regression, the study calculates the inverse mills ratio (IMR) for both technical NTM ($IMR^{T}_{n,c}$) and non-technical NTM ($IMR^{NT}_{n,c}$). These IMRs are then utilized in the second stage of the regression, as demonstrated in the following equation:

$$IMR_{n,c} = \frac{\Phi\left(Z_c\hat{\delta} + \hat{\delta}^{NTM}\overline{NTM}_{n,c}\right)}{\Phi\left(Z_c\hat{\delta} + \hat{\delta}^{NTM}\overline{NTM}_{n,c}\right)} \tag{S7}$$

Subsequently, we conducted a second-stage regression using the Poisson pseudo-maximum likelihood (PPML) method to address the zero-trade problem. In this stage, the study incorporates the values of the inverse Mills ratio ($IMR^{T}_{n,c}$ and $IMR^{NT}_{n,c}$) into Equation (5). This integration results in a PPML regression model, structured as follows:

$$\frac{m_{nc}}{\left(1+t_{n,c}\right)^{\varepsilon_{n,c}}} = \exp\left[\begin{array}{l}\alpha_n + \sum_k \alpha_{n,k} C_c^k + \\ + \left(\beta_n + \sum_k \beta_{n,k} C_c^k\right) NTM_{n,c}^{T} + \\ + \beta^{T} IMR_{n,c}^{T} + \\ + \left(\delta_n + \sum_k \delta_{n,k} C_c^k\right) NTM_{n,c}^{NT} + \\ + \beta^{NT} IMR_{n,c}^{NT}\end{array}\right] \times \kappa_{n,c} \tag{S8}$$

The TRI calculation is performed by estimating equation (S8) for each palm oil product under the HS-4 digit classification, specifically code 1511. This estimation aims to derive the values of coefficients $\beta_{n,c}$ and $\delta_{n,c}$, in accordance with equations (S3) and (S4). Once these coefficients are obtained, the next step involves calculating the *ad valorem* equivalence (AVE) for both technical and non-technical NTMs. This calculation is crucial to facilitate a comparison between tariff and non-tariff barriers.

To equate NTMs with ad valorem tariffs, it is necessary to convert the quantity impact of NTMs into price equivalents. This conversion involves cross-differentiating the impact of domestic prices on imports with the impact of NTMs on domestic prices. The effect of prices on imports is equivalent to the elasticity of import demand ($\varepsilon_{n,c}$), whereas the impact of NTMs on imports can be deduced from the values of the coefficients $\beta_{n,c}$ and $\delta_{n,c}$. Consequently, this study employs the following formula to estimate the ad valorem value of both technical and non-technical NTMs for each country and product:

$$\frac{\partial \ln m_{nc}}{\partial NTM_{n,c}^{T}} = \frac{\partial \ln m_{nc}}{\partial \ln p_{n,c}^{d}} \times \frac{\partial \ln p_{n,c}^{d}}{\partial NTM_{n,c}^{T}} = \varepsilon_{n,c} ave_{n,c}^{NTM^{T}} \tag{S9}$$

$$\frac{\partial \ln m_{nc}}{\partial NTM_{n,c}^{NT}} = \frac{\partial \ln m_{nc}}{\partial \ln p_{n,c}^{d}} \times \frac{\partial \ln p_{n,c}^{d}}{\partial NTM_{n,c}^{NT}} = \varepsilon_{n,c} ave_{n,c}^{NTM^{NT}} \tag{S10}$$

which equations (S9) and (S10) can also be arranged as follows:

$$ave_{n,c}^{NTM^{T}} = \frac{1}{\varepsilon_{n,c}} \times \frac{\partial \ln m_{nc}}{\partial NTM_{n,c}^{T}} = \frac{\beta_{n,c}}{\varepsilon_{n,c}} \tag{S11}$$

$$ave_{n,c}^{NTM^{NT}} = \frac{1}{\varepsilon_{n,c}} \times \frac{\partial \ln m_{nc}}{\partial NTM_{n,c}^{NT}} = \frac{\delta_{n,c}}{\varepsilon_{n,c}} \tag{S12}$$

The values derived from equations (S11) and (S12) are utilized to assess the impact of technical and non-technical non-tariff measures (NTMs) on global palm oil exports. Following this, by estimating the ad valorem value of NTMs, the study calculates the overall level of protection imposed by country c on palm oil imports. This calculation is performed using the following equation:

$$T_{n,c} = t_{n,c} + ave_{n,c}^{NTM^{T}} + ave_{n,c}^{NTM^{NT}} \tag{S13}$$

In this context $T_{n,c}$ represents the overall level of protection imposed on palm oil in country *c*, $t_{n.c}$ denotes the *ad valorem* tariff for palm oil in that country *c*, $ave_{n,c}^{NTM^{T}}$ and $ave_{n,c}^{NTM^{NT}}$ correspond to the technical

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and non-technical ad valorem NTM equivalent values for palm oil in country *c*, respectively. A higher value of $T_{n,c}$ signifies a greater overall level of protection against palm oil imports in a country. Conversely, a $T_{n,c}$ value of zero indicates the absence of trade barriers for palm oil in country *c*.

Upon determining the $T_{n,c}$ values, the study proceeds to calculate the trade restrictiveness index (TRI). This TRI computation reflects the overall extent of trade restrictions a country employs to limit trade. The formula for the TRI, as used in this study, is based on the methodology outlined by Kee et al. (2009) and is as follows:

$$TRI_c = \left(\frac{\sum_n m_{n,c} \varepsilon_{n,c} T_{n,c}^2}{\sum_n m_{n,c} \varepsilon_{n,c}} \right)^{\frac{1}{2}} \quad \text{(S14)}$$

where: $m_{n,c}$ – import value of palm in country *c*; $\varepsilon_{n,c}$ – elasticity of import demand for palm oil in that country; $T_{n,c}$ – overall level of protection for palm oil in country *c*.

A higher TRI value denotes a greater degree of trade restrictions on palm oil imports by country *c*. Conversely, a TRI value of zero implies the absence of trade restrictions on palm oil imports in country *c*.

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APPENDIX C

Table S5. TRI (trade restrictiveness index) Malaysia

Region	ISO3	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Asia	ARE	0.308	0.311	0.457	0.349	0.074	0.299	0.386	0.339	0.262	0.347	0.338	0.315
Asia	BHR	0.287	0.319	0.295	0.301	0.061	0.285	0.417	0.359	0.291	0.345	0.333	0.299
Asia	CHN	0.303	0.319	0.300	0.401	0.188	0.347	0.523	0.468	0.401	0.432	0.416	0.373
Asia	HKG	0.000	0.000	0.000	0.051	0.004	0.153	0.257	0.296	0.311	0.221	0.197	0.135
Asia	IND	0.961	1.025	1.420	0.929	0.870	0.936	0.961	0.485	0.549	0.808	0.830	0.889
Asia	ISR	0.040	0.040	0.040	0.040	0.040	0.218	0.280	0.268	0.227	0.213	0.195	0.146
Asia	JOR	0.088	0.115	0.116	0.120	0.120	0.000	0.296	0.204	0.194	0.189	0.177	0.147
Asia	JPN	0.000	0.000	0.000	0.000	0.000	0.097	0.179	0.118	0.095	0.104	0.092	0.062
Asia	KAZ	0.064	0.079	0.216	0.457	0.172	0.242	0.305	0.250	0.213	0.256	0.248	0.227
Asia	KOR	0.000	0.000	0.000	0.000	0.000	0.000	0.358	0.302	0.239	0.215	0.189	0.118
Asia	KWT	0.050	0.050	0.050	0.240	0.112	0.287	0.377	0.319	0.272	0.278	0.259	0.209
Asia	LBN	0.149	0.145	0.147	0.150	0.150	0.000	0.000	0.000	0.000	0.000	0.000	0.067
Asia	LKA	0.675	1.267	1.276	0.692	0.519	0.592	0.658	0.816	0.727	0.800	0.800	0.802
Asia	MMR	0.010	0.010	0.010	0.010	0.010	0.244	0.618	0.492	0.442	0.397	0.352	0.236
Asia	NPL	0.235	0.150	0.357	0.388	0.298	0.274	0.655	0.527	0.561	0.503	0.475	0.402
Asia	OMN	0.079	0.215	0.204	0.082	0.075	0.188	0.286	0.210	0.195	0.218	0.207	0.178
Asia	PAK	0.299	0.299	0.298	0.298	0.427	0.256	0.568	0.505	0.488	0.451	0.435	0.393
Asia	PHL	0.228	0.266	0.253	0.333	0.173	0.323	0.507	0.424	0.319	0.386	0.369	0.326
Asia	QAT	0.339	0.280	0.541	0.193	0.060	0.055	0.050	0.266	0.268	0.220	0.222	0.227
Asia	SAU	0.050	0.050	0.050	0.068	0.051	0.108	0.225	0.294	0.380	0.231	0.210	0.156
Asia	SGP	0.106	0.338	0.792	0.046	0.017	0.287	0.476	0.448	0.460	0.456	0.427	0.350
Asia	THA	0.007	0.000	0.134	0.029	0.050	0.086	0.153	0.096	0.091	0.105	0.097	0.077
Asia	TUR	0.176	0.176	0.229	0.271	0.278	0.375	0.459	0.269	0.257	0.317	0.307	0.283
Asia	VNM	0.116	0.321	0.342	0.378	0.190	0.331	0.582	0.465	0.408	0.449	0.425	0.364
Europe	BEL	0.081	0.086	0.082	0.082	0.077	0.081	0.079	0.079	0.082	0.081	0.081	0.081
Europe	CHE	0.181	0.212	0.175	0.104	0.004	0.740	0.150	0.716	0.680	0.460	0.430	0.350
Europe	DEU	0.085	0.088	0.086	0.084	0.080	0.086	0.084	0.086	0.088	0.086	0.086	0.085
Europe	DNK	0.077	0.089	0.090	0.089	0.079	0.088	0.089	0.090	0.090	0.090	0.089	0.087
Europe	ESP	0.083	0.044	0.049	0.035	0.042	0.046	0.043	0.072	0.079	0.058	0.058	0.055
Europe	FRA	0.057	0.056	0.050	0.043	0.044	0.063	0.053	0.042	0.053	0.051	0.051	0.051
Europe	GBR	0.080	0.074	0.074	0.082	0.083	0.088	0.088	0.087	0.087	0.085	0.085	0.083
Europe	GRC	0.087	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.089	0.090	0.090	0.090
Europe	IRL	0.086	0.031	0.025	0.089	0.071	0.089	0.019	0.019	0.090	0.046	0.049	0.056
Europe	ITA	0.086	0.084	0.083	0.082	0.083	0.082	0.074	0.073	0.077	0.077	0.078	0.080
Europe	NLD	0.034	0.042	0.048	0.036	0.031	0.023	0.034	0.040	0.051	0.040	0.039	0.038
Europe	RUS	0.119	0.080	0.198	0.227	0.097	0.155	0.224	0.308	0.253	0.236	0.224	0.193
Europe	SWE	0.085	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090
Oceania	AUS	0.155	0.185	0.177	0.222	0.043	0.159	0.197	0.181	0.142	0.179	0.175	0.165
Oceania	NZL	0.005	0.000	0.008	0.023	0.048	0.101	0.160	0.230	0.191	0.148	0.133	0.095
America	BRA	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.200	0.122	0.119	0.113
America	CAN	0.037	0.033	0.033	0.047	0.034	0.067	0.096	0.065	0.033	0.061	0.058	0.051
America	CHL	0.060	0.060	0.060	0.060	0.060	0.060	0.000	0.000	0.000	0.017	0.023	0.036

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Table S5. To be continued

Region	ISO3	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
America	COL	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
America	MEX	0.140	0.130	0.134	0.140	0.140	0.050	0.050	0.050	0.050	0.066	0.074	0.093
America	PER	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
America	USA	0.001	0.110	0.105	0.140	0.006	0.104	0.141	0.126	0.097	0.121	0.114	0.097
Africa	BEN	0.393	0.397	0.383	0.453	0.433	0.495	0.856	0.736	0.699	0.671	0.640	0.560
Africa	CIV	0.167	0.162	0.078	0.123	0.118	0.233	0.138	0.393	0.357	0.249	0.237	0.205
Africa	CMR	0.511	0.389	0.368	0.300	0.321	0.402	0.509	0.605	0.765	0.548	0.529	0.477
Africa	DZA	0.196	0.202	0.245	0.208	0.219	0.245	0.333	0.308	0.285	0.287	0.278	0.255
Africa	ETH	0.357	0.307	0.300	0.435	0.402	0.454	0.842	0.707	0.667	0.637	0.604	0.519
Africa	GHA	0.188	0.209	0.458	0.396	0.312	0.347	0.487	0.443	0.590	0.466	0.446	0.395
Africa	MAR	0.153	0.300	0.373	0.089	0.239	0.117	0.170	0.464	0.442	0.314	0.302	0.269
Africa	MUS	0.192	0.260	0.247	0.270	0.079	0.253	0.397	0.327	0.271	0.315	0.301	0.265
Africa	NER	0.316	0.165	0.167	0.240	0.517	0.441	0.757	0.586	0.611	0.539	0.512	0.441
Africa	NGA	0.412	0.436	0.404	0.383	0.351	0.396	0.392	0.435	0.392	0.406	0.405	0.401
Africa	SEN	0.219	0.148	0.128	0.184	0.363	0.354	0.632	0.522	0.536	0.462	0.434	0.362
Africa	TGO	0.372	0.393	0.394	0.435	0.350	0.460	0.846	0.735	0.698	0.666	0.632	0.544
Africa	TUN	0.283	0.348	0.330	0.367	0.199	0.331	0.413	0.399	0.346	0.376	0.367	0.342

Source: Authors' own calculation

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Table S6. TRI (trade restrictiveness index) Indonesia

Region	ISO3	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Asia	ARE	0.563	0.407	0.193	0.454	0.172	0.235	0.635	0.475	0.346	0.370	0.224	0.370
Asia	BHR	0.540	0.365	0.184	0.373	0.131	0.137	0.370	0.405	0.215	0.293	0.212	0.293
Asia	CHN	0.342	0.152	0.154	0.480	0.299	0.398	0.643	0.411	0.331	0.341	0.205	0.341
Asia	HKG	0.000	0.000	0.000	0.103	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009
Asia	IND	1.376	1.323	1.064	1.076	0.824	0.899	0.893	0.347	0.234	0.894	0.905	0.894
Asia	ISR	0.040	0.040	0.040	0.040	0.040	0.177	0.390	0.299	0.222	0.132	0.034	0.132
Asia	JOR	0.075	0.085	0.120	0.120	0.120	0.000	0.000	0.000	0.000	0.062	0.098	0.062
Asia	JPN	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.001
Asia	KAZ	0.118	0.096	0.266	0.496	0.240	0.307	0.483	0.302	0.183	0.268	0.193	0.268
Asia	KOR	0.000	0.000	0.000	0.000	0.000	0.000	0.480	0.318	0.227	0.099	0.023	0.104
Asia	KWT	0.050	0.050	0.050	0.287	0.124	0.163	0.483	0.357	0.265	0.189	0.069	0.190
Asia	LBN	0.150	0.150	0.150	0.150	0.150	0.000	0.000	0.000	0.000	0.088	0.000	0.076
Asia	LKA	0.631	0.927	0.984	0.755	0.508	0.526	0.614	0.794	0.676	0.719	0.770	0.719
Asia	MMR	0.010	0.010	0.010	0.010	0.010	0.305	0.492	0.265	0.203	0.131	0.064	0.137
Asia	NPL	0.479	0.415	0.162	0.537	0.174	0.131	0.098	0.086	0.178	0.251	0.246	0.251
Asia	OMN	0.984	0.139	0.050	0.085	0.053	0.080	0.050	0.050	0.050	0.168	0.136	0.168
Asia	PAK	0.298	0.300	0.299	0.301	0.438	0.287	0.584	0.349	0.275	0.342	0.290	0.342
Asia	PHL	0.255	0.050	0.083	0.377	0.253	0.376	0.533	0.338	0.213	0.261	0.138	0.262
Asia	QAT	0.427	0.293	0.169	0.242	0.103	0.179	0.296	0.228	0.172	0.228	0.173	0.228
Asia	SAU	0.050	0.050	0.050	0.072	0.050	0.050	0.231	0.146	0.183	0.093	0.045	0.093
Asia	SGP	0.248	1.124	0.409	0.075	0.078	0.124	0.501	0.339	0.153	0.335	0.301	0.335
Asia	THA	0.072	0.001	0.065	0.022	0.047	0.074	0.000	0.000	0.000	0.000	0.000	0.026
Asia	TUR	0.176	0.176	0.229	0.272	0.268	0.287	0.249	0.249	0.249	0.239	0.237	0.239
Asia	VNM	0.482	0.430	0.152	0.404	0.275	0.420	0.507	0.286	0.216	0.341	0.242	0.341
Europe	BEL	0.077	0.076	0.073	0.056	0.083	0.065	0.030	0.064	0.054	0.066	0.079	0.066
Europe	CHE	0.111	0.109	0.034	0.174	0.047	0.667	0.230	0.783	0.702	0.308	0.222	0.308
Europe	DEU	0.066	0.069	0.076	0.079	0.067	0.069	0.061	0.068	0.079	0.071	0.074	0.071
Europe	DNK	0.083	0.068	0.067	0.063	0.064	0.074	0.085	0.088	0.087	0.075	0.069	0.075
Europe	ESP	0.069	0.059	0.048	0.052	0.056	0.084	0.072	0.086	0.087	0.067	0.060	0.067
Europe	FRA	0.052	0.050	0.059	0.064	0.058	0.057	0.072	0.078	0.072	0.062	0.058	0.062
Europe	GBR	0.077	0.079	0.073	0.084	0.085	0.085	0.076	0.074	0.085	0.080	0.080	0.080
Europe	GRC	0.077	0.081	0.082	0.075	0.085	0.088	0.089	0.089	0.090	0.084	0.083	0.084
Europe	IRL	0.087	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090
Europe	ITA	0.057	0.051	0.056	0.063	0.071	0.081	0.081	0.085	0.084	0.069	0.064	0.069
Europe	NLD	0.046	0.046	0.041	0.039	0.041	0.053	0.038	0.047	0.051	0.045	0.045	0.045
Europe	RUS	0.119	0.081	0.221	0.222	0.093	0.096	0.011	0.367	0.266	0.168	0.199	0.168
Europe	SWE	0.087	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090
Oceania	AUS	0.132	0.020	0.071	0.280	0.118	0.182	0.473	0.320	0.224	0.189	0.071	0.189
Oceania	NZL	0.097	0.005	0.019	0.011	0.032	0.051	0.000	0.319	0.222	0.084	0.081	0.084
America	CAN	0.085	0.033	0.037	0.047	0.030	0.034	0.028	0.028	0.000	0.000	0.000	0.029
America	CHL	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060
America	COL	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
America	MEX	0.138	0.140	0.090	0.140	0.140	0.050	0.050	0.050	0.050	0.096	0.113	0.096
America	PER	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.003	0.004

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Table S6. To be continued

Region	ISO3	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
America	USA	0.061	0.019	0.040	0.190	0.058	0.091	0.268	0.168	0.119	0.105	0.036	0.105
Africa	BEN	0.388	0.194	0.231	0.625	0.498	0.691	0.776	0.574	0.520	0.484	0.343	0.484
Africa	CIV	0.167	0.075	0.167	0.076	0.083	0.081	0.302	0.108	0.275	0.144	0.106	0.144
Africa	CMR	0.640	0.646	0.417	0.590	0.452	0.539	0.775	0.462	0.468	0.543	0.442	0.543
Africa	DZA	0.415	0.463	0.282	0.255	0.213	0.174	0.159	0.150	0.149	0.254	0.279	0.254
Africa	ETH	0.351	0.130	0.190	0.412	0.486	0.679	0.705	0.471	0.451	0.417	0.299	0.417
Africa	GHA	0.159	0.475	0.262	0.578	0.203	0.448	0.565	0.216	0.536	0.372	0.278	0.372
Africa	MAR	0.025	0.797	0.313	0.395	0.036	0.325	0.137	0.025	0.155	0.248	0.269	0.248
Africa	MUS	0.385	0.000	0.025	0.320	0.112	0.208	0.525	0.274	0.272	0.219	0.069	0.219
Africa	NER	0.171	0.298	0.139	0.167	0.507	0.651	0.267	0.267	0.766	0.362	0.386	0.362
Africa	NGA	0.489	0.456	0.395	0.437	0.350	0.350	0.388	0.250	0.166	0.364	0.355	0.364
Africa	SEN	0.333	0.415	0.220	0.169	0.369	0.468	0.267	0.267	0.267	0.309	0.318	0.309
Africa	TGO	0.338	0.326	0.229	0.430	0.523	0.720	0.786	0.587	0.560	0.486	0.361	0.486
Africa	TUN	0.273	0.129	0.141	0.423	0.274	0.390	0.688	0.512	0.393	0.341	0.189	0.341

Source: Authors' own calculation

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Table S7. Correlation matrix for Malaysia and Indonesia

Variables	lnGDP_j	ln$POPj$	lnTRI_j	ln$Tariff_j$	ln$AVE_NTM_T_j$	ln$AVE_NTM_NT_j$	ln$Dist_{ij}$	lnER_{ij}	$TA_{i,j}$
Malaysia									
lnGDP_j	1	–	–	–	–	–	–	–	–
ln$POPj$	0.5885	1	–	–	–	–	–	–	–
lnTRI_j	–0.353	0.1344	1	–	–	–	–	–	–
ln$Tariff_j$	–0.1807	0.2574	0.6693	1	–	–	–	–	–
ln$AVE_NTM_T_j$	–0.2624	–0.0988	0.5074	0.0649	1	–	–	–	–
ln$AVE_NTM_NT_j$	–0.2349	–0.0217	0.4822	0.1546	0.1761	1	–	–	–
ln$Dist_{ij}$	0.0638	0.0178	–0.2247	0.0993	–0.3299	–0.1872	1	–	–
lnER_{ij}	–0.3796	0.212	0.3481	0.2892	0.0812	0.1443	–0.1203	1	–
$TA_{i,j}$	0.2348	0.3648	0.0724	–0.1679	0.1312	0.1178	–0.5729	0.2664	1
Indonesia									
lnGDP_j	1	–	–	–	–	–	–	–	–
ln$POPj$	0.5885	1	–	–	–	–	–	–	–
lnTRI_j	–0.3116	0.1062	1	–	–	–	–	–	–
ln$Tariff_j$	–0.179	0.2586	0.6382	1	–	–	–	–	–
ln$AVE_NTM_T_j$	–0.3345	–0.0975	0.4228	0.1347	1	–	–	–	–
ln$AVE_NTM_NT_j$	–0.1539	–0.0124	0.5604	0.0895	–0.0685	1	–	–	–
ln$Dist_{ij}$	0.0693	0.0283	–0.175	0.114	–0.1357	–0.2605	1	–	–
lnER_{ij}	–0.3808	0.2115	0.3096	0.2937	0.145	0.1226	–0.1273	1	–
$TA_{i,j}$	0.2451	0.4132	0.1061	–0.1711	0.0062	0.2168	–0.6707	0.2814	1

GDP – gross domestic product; *POP* – population; *TRI* – trade restrictiveness index; *Tariff* – tariff rate; *AVE_NTM_T* – *ad valorem* equivalent for technical non-tariff measures; *AVE_NTM_NT* – *ad valorem* equivalent for non-technical non-tariff measures; *Dist* – bilateral distances; *ER* – exchange rates; *TA* – trade agreements

Source: Authors' own calculation

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