User Guide and Explanatory Note for the ESCAP Trade Analytics Portal

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INTRODUCTION

The purpose of this explanatory note is to narrate how to use the ESCAP Trade Analytics Portal and corresponding datasets by researchers and practitioners. While this note mainly discusses the datasets, its sources of data, how to use the database properly, and how to interpret results for policy analyses, kindly refer to Shepherd (2016), "The Gravity Model of International Trade: A User Guide (An updated version)" for a detailed theoretical explanation and other technical detail and application of the gravity model of trade.¹

ACCESSING THE PORTAL

To access the ESCAP Trade Analytics Portal, please type the following link into a modern web browser's (such as Firefox, Chrome or Safari) address bar:

https://trade.unescap.org/analytics

OVERVIEW OF DATASETS AND THEORY

Screen 1 shows five available datasets that gravity models can be applied to answer policy questions based on policymakers' interests. The following datasets are currently available:

- 1. Basic Gravity Model of Trade (limited variables)
- 2. Comprehensive Gravity Model of Trade
- 3. Trade Cost Model
- 4. Augmented Gravity Model of Trade with NTMs and segregated sector
- 5. Trade Cost Model with NTMs and segregated sector

Screen 1: Selecting a preferred dataset

Basic Gravity Model of Trade (limited variables)	\sim
This limited dataset is designed for policymakers and trade researchers to jumpstart into using the gravity model of trade and do their mpact analysis on overall trade flows as a result of the change in policy implications. This dataset provides classic bilateral trade and solicy indicators including tariff and RTA from 1995-2016 on 200+ economies.	5
Comprehensive Gravity Model of Trade	
his dataset is designed for policymakers and trade researchers to do their impact analysis on overall trade flows as a result of the hange in policy implications. This comprehensive dataset provides additional bilateral trade and policy indicators such as behind-the- border infrastructure, including various Doing Business index components from the World Bank, from 1995-2016 on 200+ economies.	5
Trade Cost Model	0
a variation of the traditional gravity model of trade, this dataset incorporates ESCAP-World Bank trade cost estimates as dependent ariable instead of trade flows, from 1995-2016 on 200+ economies.	S
Augmented Gravity Model of Trade with NTMs and segregated sector	
is an extension of the Gravity Model of Trade dataset, this dataset expands policy scope to cover non-tariff measures in impact nalysis on imports. Add-on coverage of this database allows policymakers and trade researchers to conduct an analysis at sectoral evel, including agriculture, manufacturing and overall goods sector. Data available from 2012-2016 on 200+ economies.	5.0
Trade Cost Model with NTMs and segregated sector	0
is an extension of the Trade Cost Model dataset, this dataset expands policy scope to cover non-tariff measures in impact analysis on mports. Add-on coverage of this database allows policymakers and trade researchers to conduct an analysis at sectoral level, including wirefulture, manufarming and measure to Tasa anallable form 3012-3016 con 2006 acronomies.	<u>S</u>

¹ Online available at <u>https://artnet.unescap.org/publications/books-reports/gravity-model-international-trade-user-guide-updated-version</u>

Basic gravity model of trade, comprehensive gravity model of trade, and trade cost model

Basic gravity model of trade gives an introduction what the gravity model is. In brief, gravity model is the application of Newton's theory in gravitation: bilateral trade flows are determined by the size of economic mass, measured by GDP of 2 countries; and distance between 2 countries. The model is widely used to quantify impacts mainly from trade-related policies. This database introduces a limited set of independent variables (i.e., gravity-related variables) and limited number of traditional policy variables (such as tariffs and RTA).

Comprehensive gravity model of trade provides an exhaustive list of independent variables, especially policy-related and behind-the-border trade facilitation variables for gravity models. *Table 1* classifies types of dependent and independent variables in this dataset, while *Table 2* categorizes additional types of independent variables in this dataset.

Table 1: dependent and independent variables in "Basic Gravity Model of Trade (limited variables)"

Dependent variables	Classic gravity-related independent			
	variables			
Bilateral imports	• GDP of reporting countries and trading			
Bilateral exports	partners			
Bilateral trade	 Geographical distance between reporting countries and trading partners Other geographical aspects between 2 countries e.g., contiguity, landlockedness Cultural distance between 2 countries e.g., sharing common language, historically being the same country in the past, sharing colonial tie 			
	Classic policy-related independent			
	variables			
	Bilateral tariffs			
	Bilateral RTA			

Table 2: additional independent variables in "Comprehensive Gravity Model of Trade"

	Classic gravity-related independent		Other policy-related and behind-the-		
	variables	border independent variables			
•	GDP of reporting countries and trading partners and other GDP-related indicators e.g. real GDP, GDP growth, per capita GDP (both real and nominal figure)	•	Behind-the-border trade facilitation e.g., Ease of doing business indicator / ease of trading across border / logistics performance index Quality of cross-border infrastructure e.g., Liner shipping connectivity		

Policymakers may examine their research questions from another perspective: policy questions may change from how to increase trade flows to how to reduce trade costs between countries and which policy factors or infrastructural-related issues significantly affect

trade costs. Trade costs from Arvis et al. (2013)², which is derived from the gravity equation of Anderson and van Wincoop (2004), is the measure of trade hurdles in **Trade Costs Model**. With a similar econometric setup, the difference between **Comprehensive Gravity Model of Trade** and **Trade Costs Model** is a set of dependent variables. While the Gravity Model of Trade uses trade flows (either export, import or trade) as dependent variable, the Trade Cost Model uses comprehensive trade costs (either include or exclude tariff costs) as dependent variables.

SETTING YOUR PREFERENCES

To illustrate how to use these three databases, the **Basic Gravity Model of Trade Database** is used as an illustrative example on how to use the ESCAP Trade Analytics Portal. *Screen 2* and *3* shows the list of reporting and trading partner economies, respectively, available in the dataset. A user can manually click on the box in front of an economy's name or click once on pre-defined groups of economies (e.g., Asia-Pacific (ESCAP)) in grey boxes to set their preferences. To de-select the pre-defined set of countries, click once again on grey box of corresponding pre-defined group. Once the user has finished choosing reporting economies, clicking "continue" will move the page from *Screen 2* to *Screen 3* to choose trading partners. *Screen 3* offers an additional choice if users would like to apply the same set of reporting economies a user is interested in. The database limits the selection up to 100 countries for both reporters and partners. Asia-Pacific (ESCAP) as reporting economies as well as trading partners.





² The measure suggests that the more the trade between two countries are, the lower the trade frictions, and as a result, the lower the measure is. As trade cost measure are all inclusive i.e. it covers all factors that affect differences between domestic and international prices such as geographical, quality of connectivity, behind-the-border trade facilitation factors, decomposition of trade costs is needed to identify which factors affecting trade costs most.

Screen 3: Selecting partner economies



Screen 4 and 5 shows the list of dependent and independent variables as described in *Table* 1. The ESCAP Trade Analytics Portal allows one dependent variable and up to 30 independent variables for the model of interest. In this example, the gravity model is checking on the effect of economic size, distance, common colonizer and tariff on trade with control on reporter, partner and year fixed effects.

Equation 1: Basic setup of the gravity model

$$\log(x_{ijt}) = \beta_0 + \beta_1 \log(GDP_{it}) + \beta_2 \log(GDP_{jt}) + \beta_3 \log(dist_{ij}) + \beta_4 (comcol_{ij}) + \beta_5 \log(tarif f_{iit}) + \beta_6 \log(tarif f_{jit}) + \gamma_i + \gamma_i + \gamma_t + \varepsilon_{ijt}$$

Screen 5 also shows the selection of all variables in the model based on the basic setup above. Clicking the information icon behind a variable will open a modal window explaining the respective variable and listing its source. After clicking the "Continue" button and arriving on the last selection page (see *Screen 6*), the user has the option to choose years as well as fixed effects (reporter, partner and year) in their model. In this example, all years and all control on all types of fixed effects are chosen. Then the user can click the blue "Run regression" button to obtain the empirical results.

Screen 4: Selecting a dependent variable

TEP 4: Please select dependent and independe	nt variables below:		Go back Continu
ELECT ONE DEPENDENT VARIARI F			
electione dependent variable.			
Net exports of i to j [In_export_ij]		U .	
Net exports of i to j [In_export_ij] Net imports of i to j [In_import_ij]	de 10		
Net exports of i to j [In_export_jj] Net imports of i to j [In_import_jj] Net export and import (X+M) of i to j [In_tra In(export _{ij})	de_ij] i comlang _{abro}	ļ	(
Net exports of i to j [In_export_j] Net imports of i to j [In_import, j] Net export and import (X+M) of i to j [In_tra In(export _{ij}) In(import _{ij})	de.jj] (i) comlang _{abua} (i) colony		(

SELECT UP TO 30 INDEPENDENT VARIABLES:			
$\ln(export_{ij})$	i	comlang _{ethno}	i
$\begin{tabular}{ c c } & \ln(import_{ij}) \end{tabular}$	i	colony	i
$\ln(trade_{ij})$	i	comcol	i
$\ln(\overline{1+(tariff_{ij}/100)}^S)$	i	curcol	i
$\checkmark \ln(\overline{1+(tariff_{ij}/100)}^W)$	i	col45	i
$\ln(\overline{1+(tariff_{ji}/100)}^S)$	i	smctry	i
$\checkmark \ln(\overline{1+(tariff_{ji}/100)}^W)$	i	$landlocked_i$	i
$\ln(GM(\overline{tariff}^S))$	i	$landlocked_j$	i
$\ln(GM(\overline{tariff}^W))$	i	$landlocked_{ij}$	i
\checkmark $\ln(dist)$	i	RTA	i
contig	i	\checkmark $\ln(GDP_i)$	i
comlang _{off}	i	$\checkmark \ln(GDP_j)$	i
		You have selected 6 in	ndependent variables (maximum 3
			Go Back Continue

Screen 5: Selection of all variables in gravity model's basic setup

Screen 6: Selecting years and optionally fixed effects

Informatio	on R	eporters	Partners	• Variables	Years & Effects
STEP 5: Please select	t a period and possibly	fixed effects below:			
SELECT YEARS OF INT	TEREST:		OPTIONALLY SELE	CT FIXED EFFECTS:	
Unselect all years	2002	2010	🛃 Add year dun	nmies	
1995	2003	2011	Add reporter	dummies	
1996	2004	2012	🛃 Add partner d	dummies	
1997	2005	2013			
1998	2006	2014			
1999	2007	2015			
2000	2008	2016			
2001	2009				
				Go Ba	ack RUN REGRESSION →

INTERPRETING RESULTS

Screen 7 shows the results based on the gravity model's basic setup as shown in *Equation 1*. The number that is adjacent to each bar represents the beta coefficient of the model. At a glance, the model concludes that geographical distance and weighted average tariffs have negative effects to exports. Looking into details, all coefficients are significant. Basic interpretation based on coefficients in the regression parameter table is as follows:

Distance:

1% change in distance in km leads to 2.34% reduction in exports

Common colonizer:

when two economies used to be under the same colonial power (e.g., Malaysia and India under British colonization), it leads to $(e^{\beta} - 1) * 100\% = (e^{1.228} - 1) * 100\% = (3.3381 - 1)*100\% = 233.81\%$ increase in exports

Tariff(ji): Trade-weighted average tariff of country j charging to export of i

1% change in tariff (ji) leads to 1.52% reduction in exports

Tariff(ij): Trade-weighted average tariff of country i charging to export of j 1% change in tariff (ij) leads to 0.83% reduction in exports



Screen 7: Sample empirical results

The regression statistics table, containing R-squared, number of observation as well as degree of freedom of the model, is presented on the right side of regression parameter table. The dataset name, available reporters and trading partners that are included in the selection in the models are also displayed below regression statistics table, along with years, fixed effects, and missing countries (due to missing values).

The ESCAP Trade Analytics Portal also offers several options to save the result of the model, including: (1) exporting the results to excel (CSV), (2) copying the results table to clipboard, (3) saving the visualization (JPEG) and, (4) printing the page or saving it as PDF. Buttons for these options are positioned below the regression parameters table. Users can change the setup of the model by clicking "Modify parameters" at the top right on *Screen 7*.

TRADE POTENTIAL & TRADE SIMULATION

Two important features of the ESCAP Trade Analytics Portal are the post-estimation options on trade potential and trade simulation. Recall that trade potential determines how much the estimated trade is more or less than the actual one, which determines which trading partners an economy may have room for trade improvement/growth.

Equation 2: Trade potential

$TP_{ij} = \frac{estimated \ trade_{ij}}{actual \ trade_{ij}}$	where	$TP_{ij} > 1$: potential for trade expansion
-		TP _{ii} <1 : exceeding trade potential

Users can generate trade potentials based on their setup by clicking "Generate trade potential" below the regression parameters table. *Screen 8* and 9 illustrate how to find trade potential of Lao PDR with all trading partners in 2015. Results in *Screen 9* show that while exports of Lao PDR to Australia, China, and India have exceeded its potentials, there is lots of room for improvement for exports to Hong Kong and Indonesia.

Users can obtain trade potentials of other economies in other years by clicking the "back to the form" or "modify conditions" buttons to go back to *Screen 8* to choose the other economies and years of interest.

Apart from trade potentials, users can also generate a trade simulation, using the same regression result, by clicking on the "Generate trade simulation" button next to "Generate trade potential" button, as displayed on *Screen* 7.

Screen 10 and *11* illustrate a trade simulation or "what if" scenario to the trade model. Suppose *tariff(ji)*, which represent tariffs of Lao PDR's trading partners, was reduced by 5%, what would happen to exports of Lao PDR in 2015?

Recall:

$$\log(x_2) - \log(x_1) = \log\left(\frac{x_2}{x_1}\right) \approx \left(\frac{x_2}{x_1}\right) - 1$$

From the example we can see that the reduction in weighted average tariff of Cambodia and China increases Lao PDR's exports by 0.1% and 0.2%, respectively. Again, users have three options to save the results: (1) exporting the results to excel (CSV), (2) copying the results table to clipboard, and (3) printing page or saving the page as PDF. Users can obtain simulation of other economies and/or in other years by clicking "back to the form" or "modify conditions" to go back to *Screen 10* to choose the other economies and years of their interest

Screen 8: Exploring trade potential of Lao PDR with trading partners in 2015

In order to determine the trade potential, please fill out the form below. You can select the reporter, year, as well as multiple partners.				
Determine trade potential Dependent variable: $ln(export_{ij})$			• Back to regression results	
Step 1) please select one reporter of interest:		Step 2) please select one year of interest:		
Lao PDR	×	2015	Å	
Step 3) please select one or multiple partners of interest: Deselect all	I	Mongolia		
✓ ■ Armenia		🔽 🖬 Myanmar		
🔽 🗃 Australia		🖌 🖻 Nepal		
🔽 📼 Azerbaijan		🔽 💷 New Zealand		
🛃 🔳 Bangladesh		🛃 🖪 Pakistan		
🛃 🔤 Bhutan		🔽 🛄 Palau		
🔽 🚾 Brunei		🛃 🔤 Papua New Guinea		
🔽 🖂 Cambodia		🛃 📨 Philippines		

Screen 9: Results of trade potential of Lao PDR and its trading partners in 2015

Irade potential results for dependent variable In_export_if of Lao PDR are available. Regression results Data of reporter Lao PDR and 45 partners over the year 2015 has been included. New regression								
Trade potential results < Back to the form								
The following was set:								
• Dependent variable: $\ln(export_{ij})$								
e Reporter: 🖾 Lao PDR	Reporter: I Lao PDR							
Year of reference: 2015								
Modify settings	C Modify settings							
The aforementioned settings resulted in:								
Partner	$\ln(export_{ij})$	$\ln(\widehat{export}_{ij})$	Estimated to actu	ual trade ratio				
Afghanistan	Image: Afghanistan N/A 10.713 N/A							
💻 Armenia	Armenia N/A 7.846 N/A							
Australia 15.029 14.397 0.958								
Azerbaijan N/A 9.740 N/A								
Bangladesh 10.503 13.831 1.317								
Bhutan N/A 8.415 N/A								
🐱 Brunei	10.669	9.900	0.928					
i								

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