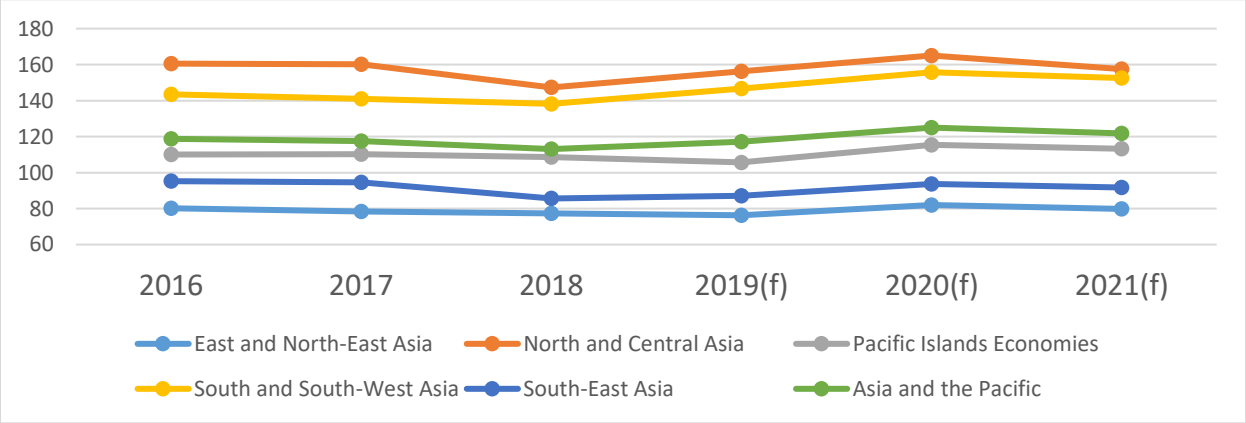
Forecasting ESCAP-World Bank Bilateral Trade Costs using Economic Intelligence Unit data: A Technical Brief[1]

Introduction

In order to estimate current and future bilateral comprehensive trade costs between countries, we use data from the Economic Intelligence Unit (EIU) available for 80 countries up to 2024 to derive alternative estimates of bilateral trade costs for 1997-2024 and use them to extend the ESCAP-World Bank Trade Cost database – currently limited to the period 1997-2018. The measures of bilateral comprehensive trade costs included in the database remain consistent with Novy (2009) and Arvis et al. (2016).[2]

Figure 1 – Trade costs of Asia-Pacific subregions with large developed economies (2016-2021)



Source: ESCAP (2020)

Notes: Trade cost numbers may be interpreted as tariff-equivalent trade costs, as per Novy (2009) and Arvis et al. (2016). The figure shows average trade costs of selected subregions with the following 4 developed economies: Germany, Japan, United States. Note that Pacific Island Economies include only Australia and New-Zealand because of data limitations on smaller Pacific Islands. Trade cost forecast after 2021 not shown given high level of uncertainties.

As shown in figure 1, trade costs in the Asia-Pacific region are forecasted to go up by 7% on average in 2020 as a result of the COVID-19 crisis. Trade costs are currently not expected to return to the levels seen prior to crisis before 2022, although they will fall from their 2021 peak as traders and shippers adapt to the new trade environment. Interestingly, the forecast exercise

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[2] Arvis et al. (2016), Trade Cost in the Developing World, World Trade Review, Volume 15, Issue 3 July 2016, pp. 451-474. Cambridge University Press. https://doi.org/10.1017/S147474561500052X

reveals that trade costs were already going up – although not as sharply - prior to the COVID-19 crisis, presumably because of increased protectionism and policy uncertainties.

Constructing an EIU-based trade cost dataset: Methodology and data sources

The final trade cost forecast database covers 80 countries based on the availability of data from the Economist Intelligence Unit (EIU), as shown in table 1. It features aggregate bilateral costs of trade in goods from 1997 to 2024, as well as sectoral bilateral costs of trade in agricultural goods, manufacturing goods, and industrial goods.

Table 1 – Database current country coverage

East Asia and the Pacific	Europe and Central Asia		Latin America and Caribbean
Australia	Austria	Latvia	Argentina
China	Azerbaijan	Lithuania	Brazil
Hong Kong, China	Belgium	Netherlands	Chile
Indonesia	Bulgaria	Norway	Colombia
Japan	Croatia	Poland	Costa Rica
Korea, Rep.	Cyprus	Portugal	Cuba
Malaysia	Czech Republic	Romania	Dominican Republic
New Zealand	Denmark	Russian Federation	Ecuador
Philippines	Estonia	Slovak Republic	El Salvador
Singapore	Finland	Slovenia	Mexico
Thailand	France	Spain	Peru
Viet Nam	Germany	Sweden	Venezuela
	Greece	Switzerland	
	Hungary	Turkey	
	Ireland	Ukraine	
	Italy	United Kingdom	
	Kazakhstan		

Middle East and North Africa		North America	South Asia	Sub-saharan Africa
Algeria	Libya	Canada	Bangladesh	Angola
Bahrain	Morocco	United States	India	Kenya
Egypt, Arab Rep.	Qatar		Pakistan	Nigeria
Iran, Islamic Rep.	Saudi Arabia		Sri Lanka	South Africa
Israel	Tunisia			
Jordan	United Arab Emirates			
Kuwait				

Based on the general definition of bilateral comprehensive trade costs of Novy (2009), the basic data needed includes (A) Bilateral international export & total exports of each country; (B) Gross output of each country; (C) Exchange rate; and (D) Elasticity of substitution. Details of how this data was obtained or approximated to generate both the ESCAP-World Bank (WB) Trade Cost Database (1997-2018) and an initial set of EIU-based trade cost dataset (1997-2024) is provided below, followed by a note on how that dataset was used to arrive at a final set of ESCAP-WB consistent trade cost estimates for the period 1997-2024.

A. Bilateral international trade flows & total exports of each country

Bilateral exports as well as total exports are downloaded from COMTRADE using the World Integrated Trade Solution (WITS) on 10 June 2020 for ESCAP-WB dataset. For EIU-based trade cost dataset, the trade data available from EIU – downloaded on 25 July 2020 - is aggregated and only total export to the rest of the world are available. Therefore, fraction of sectoral bilateral export from WITS are used to convert total export from EIU to bilateral export by sector up to 2018. As the fraction from 1997-2018 is fairly stable over time, fraction of export by sector in 2018 are used for export in 2019 onward to forecast bilateral export from total export figures.

All the data is in US Dollar. Sectoral trade flows are downloaded using ISIC Revision 3 - with reported nomenclature from HS 1988/92 for the purpose of getting the longest possible data series available under ISIC Revision 3.

Agricultural trade costs are based on trade flows in “Agriculture, hunting, forestry and fishing” defined as the aggregate of the following sub-sectors:

Agriculture, hunting, forestry and fishing
A – Agriculture, hunting and forestry
- 01 Agriculture, hunting and related service activities
- 02 Forestry, logging and related service activities

B – Fishing
- 05 Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing

Industry trade costs are based on trade flows in “Mining and quarrying” and “Manufacturing” defined as the aggregate of the following sub-sectors:

Mining and quarrying
C – Mining and quarrying
- 10 Mining of coal and lignite; extraction of peat
- 11 Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying
- 12 Mining of uranium and thorium ores
- 13 Mining of metal ores
- 14 Other mining and quarrying

Manufacturing

D – Manufacturing

15 Manufacture of food products and beverages
16 Manufacture of tobacco products
17 Manufacture of textiles
18 Manufacture of wearing apparel; dressing and dyeing of fur
19 Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21 Manufacture of paper and paper products
22 Publishing, printing and reproduction of recorded media
23 Manufacture of coke, refined petroleum products and nuclear fuel
24 Manufacture of chemicals and chemical products
25 Manufacture of rubber and plastics products
26 Manufacture of other non-metallic mineral products
27 Manufacture of basic metals
28 Manufacture of fabricated metal products, except machinery and equipment
29 Manufacture of machinery and equipment n.e.c.
30 Manufacture of office, accounting and computing machinery
31 Manufacture of electrical machinery and apparatus n.e.c.
32 Manufacture of radio, television and communication equipment and apparatus
33 Manufacture of medical, precision and optical instruments, watches and clocks
34 Manufacture of motor vehicles, trailers and semi-trailers
35 Manufacture of other transport equipment
36 Manufacture of furniture; manufacturing n.e.c.
37 Recycling

Aggregate trade costs are based on exports in all tradable sub-sectors, which include all sectors listed above. Total exports of each country are the sum of export flows of that country to the world in each of the sectors listed above.

B. Gross output of each country

For ESCAP-WB dataset, gross output (GO) and value added (VA) by sector is obtained from National Accounts Official Country Data (UN Database), available at: http://data.un.org (downloaded in June 2020) and World Development Indicator DataBank (WDI DataBank), available at http://data.worldbank.org (downloaded in June 2020) respectively. The data from WDI DataBank is in US Dollar already so no further conversion is needed; however, the UN database is in local currency so the study uses DEC conversion factor from World Development Indicator DataBank to convert data into US Dollar.[3]

[3] This is also reconciled to the methodology when the World Bank converts external data in local currency to US Dollar.

The most updated Systems of National Accounts (SNA) data (which is labeled under the combination of SNA and series codes[4]) are retrieved. Sectors in industrial classification ISIC rev. 3 are downloaded: A+B (Agriculture, hunting and forestry; Fishing); C (Mining and quarrying) and; D (Manufacturing). Total goods sector is the sum of agriculture and manufacturing sectors. Since GO is not available for most developing economies, however, missing GO data is approximated based on sectoral VA data – available for most countries. Table 2 shows the list of 142 countries whose gross output is available for further estimation.

Table 2 – Gross Output Data: Current country coverage

East Asia & Pacific (11)	Europe & Central Asia (43)			
Brunei Darussalam	Albania	Denmark	Kosovo	Portugal
Cook Islands	Armenia	Estonia	Kyrgyzstan	Romania
Hong Kong SAR, China	Austria	Faroe Islands	Latvia	Russian Federation
Japan	Azerbaijan	Finland	Lithuania	San Marino
Korea, Rep.	Belarus	France	Luxembourg	Serbia
Macao SAR, China	Belgium	Germany	Moldova	Slovenia
Mongolia	Bosnia and Herzegovina	Greece	Montenegro	Spain
Myanmar	Bulgaria	Hungary	Netherlands	Sweden
New Caledonia	Croatia	Iceland	North Macedonia	Ukraine
New Zealand	Cyprus	Italy	Norway	United Kingdom
Philippines	Czechia	Kazakhstan	Poland	

Latin America & Caribbean (37)		Middle East & North Africa (13)	North America (3)	South Asia (4)
Antigua and Barbuda	Guatemala	Algeria	Bermuda	Bangladesh
Argentina	Honduras	Bahrain	Canada	Bhutan
Aruba	Jamaica	Egypt	United States	India
Bahamas	Mexico	Iran, Islamic Rep.		Sri Lanka
Belize	Netherlands Antilles	Iraq		
Bolivia	Nicaragua	Israel	**Sub-Saharan Africa (25)**	
Brazil	Panama	Jordan	Angola	Lesotho
British Virgin Islands	Paraguay	Kuwait	Benin	Mauritania
Cayman Islands	Peru	Lebanon	Botswana	Mauritius
Chile	Sint Maarten	Malta	Burkina Faso	Mozambique
Colombia	St. Kitts and Nevis	Morocco	Burundi	Namibia
Costa Rica	St. Lucia	Oman	Cabo Verde	Niger
Cuba	St. Vincent and the Grenadines	Qatar	Cameroon	Nigeria
Curaçao	Suriname	Saudi Arabia	Central African Republic	Senegal
Dominica	Trinidad and Tobago	State of Palestine	Chad	Seychelles
Dominican Republic	Turks and Caicos Islands	Syrian Arab Republic	Côte d'Ivoire	Sierra Leone
Ecuador	Uruguay	Tunisia	Equatorial Guinea	South Africa
El Salvador	Venezuela	United Arab Emirates	Ghana	Sudan
Grenada		Yemen	Kenya	

Since GO is not available for most developing economies, missing GO data is approximated using a method based on sectoral VA data – available for most countries. A "correction factor" is calculated to calculate GO based on VA data across time, as follows:

[4] Introduction part of National Accounts Statistics: Main Aggregates and Detailed Tables provide more details on SNA and series code.

$$GO_{ikt}^{hat} = VA_{ikt} \left(\frac{\sum_{i=1}^{n} \left(\frac{GO_{ikt}}{VA_{ikt}} \right)}{n} \right) \quad \textbf{(3)}$$

where GO_{ikt}^{hat} is approximated gross output of country i, sector k and year t

GO_{ikt} is actual gross output of country i, sector k and year t [for which actual GO data is available]

VA_{ikt} is actual gross value added of country i, sector k and year t [for which actual VA data is available]

$\left(\frac{\sum_{i=1}^{n} \left(\frac{GO_{ikt}}{VA_{ikt}} \right)}{n} \right)$ is the sectoral correction factor, which is average of GO-to-VA ratio across country within sector k and year t

Approximated GO values are only used in the database when actual GO data is missing.

Then, estimate GO_{ikt}^{hat} is used in countries for which actual GO data is not available. In addition, since GO data featured in the UN database are based on different fiscal periods/year (FY),[5] we also calculate weighted GO and VA values (from UN Database) for all countries and years so they all match the western calendar year – used to report trade flow data.[6]

VA from UN Database (before FY adjustment) and WDI DataBank match exactly for some countries, but not for others, in particular after converting to USD. So, the study estimates gross output data from VA from WDI DataBank, as a main source, and with UN Database as secondary source to fill in missing values if the series of a country is all missing (i.e. if the data is missing only in some years, data from WDI DataBank will not be replaced).

Output data is 2-year lag i.e. the data is available up to 2018 in some countries in the update of 2020. Since output data series can be revised, correction factor as such can also be changed in every update. To get the most stable value of correction factors and, in turns, stable values of GO and VA, this study fixes correction factor except the most 2 recent years (2017 and 2018 in 2020 update) as it limits the change of the estimated GO from the change of correction factor. Since most of GO or VA revisions is in most recent years, the study uses 5-year moving average correction factor to reflect more stable values of GO or VA as a result of missing values in recent years in some countries.

[5] namely, a) western calendar, b) FY beginning 1 April, c) FY beginning 1 July, d) FY beginning 21 March, e) FY ending 30 June, f) FY ending 7 July, g) FY ending 15 July and h) FY ending 30 September.

[6] For FY b) and d), the weighted value is the sum of 0.75 of current-year value and 0.25 of preceding-year value. For c), the weighted value is the sum of 0.5 of current-year value and of 0.5 of preceding-year value, while the weighted value if e), f) and g) is the sum of 0.5 of current-year value and of 0.5 of following-year value. For h), the weighted value is the sum of 0.75 of current-year value and of 0.25 of following-year value.

Therefore, based on actual data for ESCAP-WB trade costs dataset, the study has annual sectoral correction factors up to 2018. For EIU-based trade cost dataset, the study extrapolates sectoral correction factor for 2019-2024 by (1) using value in 2018 to fill in value from 2019 onward and; (2) using average of its 3 preceding years to fill in the data i.e. values of correction factor in 2019 is from average of correction factors in 2016-2018. In calculating GO for EIU-based trade cost dataset, the study uses sectoral correction factor obtained from original ESCAP-WB dataset times VA obtained from EIU database.

The application of these 2 alternative methods to generate correction factors and associated gross outputs estimates, as shown in table 3 – are found to result in only minor differences in final trade cost estimates, so method 2 is selected as the default method for descriptive analysis of the data and for future work.

Table 3: Sectoral Correction Factors

year	Agriculture			Industry		
	Original	Method 1	Method 2	Original	Method 1	Method 2
1997	1.7674	1.7674	1.7674	3.1270	3.1270	3.1270
1998	1.7600	1.7600	1.7600	2.8318	2.8318	2.8318
1999	1.7611	1.7611	1.7611	3.5276	3.5276	3.5276
2000	1.7638	1.7638	1.7638	2.9390	2.9390	2.9390
2001	1.7580	1.7580	1.7580	2.4257	2.4257	2.4257
2002	1.7551	1.7551	1.7551	2.3685	2.3685	2.3685
2003	1.7765	1.7765	1.7765	1.9469	1.9469	1.9469
2004	1.7862	1.7862	1.7862	1.9792	1.9792	1.9792
2005	1.8212	1.8212	1.8212	2.0258	2.0258	2.0258
2006	1.8274	1.8274	1.8274	2.0296	2.0296	2.0296
2007	1.8559	1.8559	1.8559	2.0369	2.0369	2.0369
2008	1.9388	1.9388	1.9388	2.1186	2.1186	2.1186
2009	1.7902	1.7902	1.7902	1.9116	1.9116	1.9116
2010	1.8084	1.8084	1.8084	1.7655	1.7655	1.7655
2011	1.7992	1.7992	1.7992	1.7334	1.7334	1.7334
2012	1.7933	1.7933	1.7933	1.7154	1.7154	1.7154
2013	1.7588	1.7588	1.7588	1.6694	1.6694	1.6694
2014	1.7362	1.7362	1.7362	1.6679	1.6679	1.6679
2015	1.7270	1.7270	1.7270	1.6354	1.6354	1.6354
2016	1.7108	1.7108	1.7108	1.6703	1.6703	1.6703
2017	1.6938	1.6938	1.6938	1.6464	1.6464	1.6464
2018	1.6522	1.6522	1.6522	1.6337	1.6337	1.6337
2019		1.6522	1.6856		1.6337	1.6501
2020		1.6522	1.6772		1.6337	1.6434
2021		1.6522	1.6717		1.6337	1.6424
2022		1.6522	1.6782		1.6337	1.6453
2023		1.6522	1.6757		1.6337	1.6437
2024		1.6522	1.6752		1.6337	1.6438

C. Exchange Rate: DEC Conversion Factor

Since gross output and gross value added data from the UN Database are typically available in local currency term, we use DEC conversion factor from WDI DataBank to convert to USD for the period 1995-2020. GO and VA data in the latest currency of each country is used; however, the data in previous currency is used if data in the latest currency is not available. Previous legal tender is converted to latest currency by using metadata note from DEC conversion factor and International Financial Statistics (IFS): Country Notes.[7]

D. Elasticity of Substitution

Hummels (1999) finds that elasticity of substitution is lower for food-related manufacturing goods than for other more advanced manufacturing goods and ranges from 1 to 11.[8] Anderson and Van Wincoop (2004) propose to set elasticity of substitution to 8 for aggregate level analysis, but little consensus exists overall.

Forecasting ESCAP-World Bank trade costs

The EIU-based trade cost dataset is then used to estimate ESCAP-World Bank Trade Cost forecasted dataset using linear regression, as follows:

$$\tau_{ijt}^{ESCAP-WB} = \beta_0 + \beta_1 \tau_{ijt}^{TCF} + \varepsilon_{ijt}$$

where

$\tau_{ijt}^{ESCAP-WB}$ is aggregate trade costs (excluding mining and quarrying sector) from ESCAP-WB dataset

τ_{ijt}^{TCF} is aggregate trade costs (including mining and quarrying sector) from EIU-based trade cost dataset

Linear regression is used here as a simple data transformation technique to ensure that trade cost estimates released are generally consistent with those made available in the historical ESCAP-World Bank Trade Cost database and avoid unnecessarily confusing policy makers with multiple estimates. Coefficients are estimated using ordinary least square (OLS) and based on available data from both the EIU and the ESCAP-World Bank dataset available for the 1997-2018 period. Fixed effects were tried but not used in the final estimation, as they understandably resulted in excellent in-sample fit but very poor out-of-sample fit (i.e. very poor forecast).

Differences between estimated EIU trade cost data and ESCAP-World Bank Trade cost data are explained by differences in underlying trade data coverage (EIU trade data includes mining and quarrying sector while ESCAP-WB does not) as well as the reliance on "corrected" gross output data to arrive at EIU trade cost data. As such, for years between 1997-2018, ESCAP-WB trade cost data are always preferred to the EIU-based trade cost data. For 2019 to 2024, annual growth in ESCAP-World Bank forecasted trade costs ($\hat{t}_{ijt}^{ESCAP-WB}$) are used to calculate final ESCAP-World Bank bilateral trade cost estimates – as shown in Figure 1.

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[7] As DEC conversion factor is the World Bank's data adjustment of official exchange rate of IFS (from International Monetary Fund), the country note from IFS is useful when more details on exchange rate data is needed. Please follow the specific data series link for more information: http://data.worldbank.org/about/faq/specific-data-series

[8] Chen and Novy (2009) use sectoral elasticity of substitution from Hummels (2001).