

Kravchenko, Alexey; Duval, Yann

Working Paper

Estimating the effect of trade facilitation implementation on trade misinvoicing-based illicit financial flows and tax revenue in Asia and the Pacific

ARTNeT Working Paper Series, No. 224

Provided in Cooperation with:

Asia-Pacific Research and Training Network on Trade (ARTNeT), Bangkok

Suggested Citation: Kravchenko, Alexey; Duval, Yann (2022) : Estimating the effect of trade facilitation implementation on trade misinvoicing-based illicit financial flows and tax revenue in Asia and the Pacific, ARTNeT Working Paper Series, No. 224, Asia-Pacific Research and Training Network on Trade (ARTNeT), Bangkok

This Version is available at:

<https://hdl.handle.net/10419/268382>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

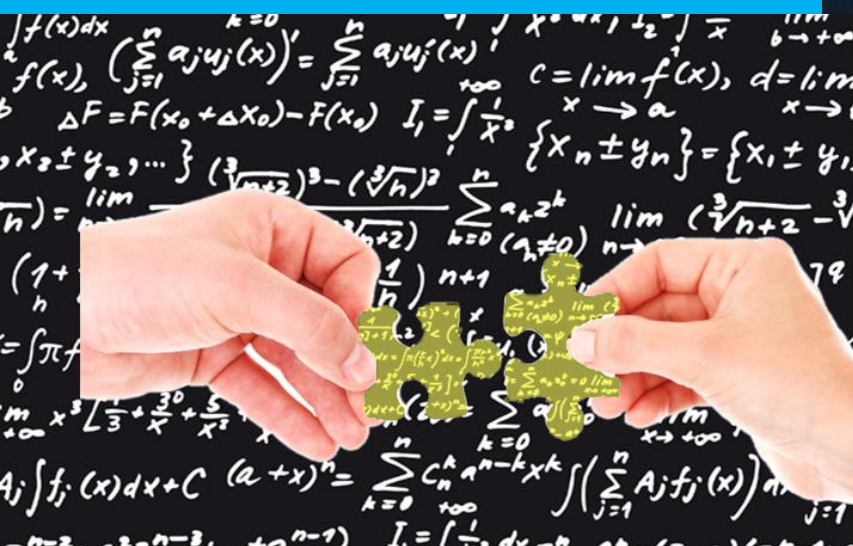
Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



Estimating the effect of trade facilitation implementation on trade misinvoicing-based illicit financial flows and tax revenue in Asia and the Pacific



Alexey Kravchenko
Yann Duval

ASIA-PACIFIC RESEARCH AND TRAINING NETWORK ON TRADE

Working Paper

No. 224 | 2022

The Asia-Pacific Research and Training Network on Trade (ARTNeT) is an open regional network of research and academic institutions specializing in international trade policy and facilitation issues. ESCAP, WTO and UNCTAD, as key core network partners, and a number of bilateral development partners, provide substantive and/or financial support to the network. The Trade, Investment and Innovation Division of ESCAP, the regional branch of the United Nations for Asia and the Pacific, provides the Secretariat of the network and a direct regional link to trade policymakers and other international organizations.

The ARTNeT Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about trade issues. An objective of the series is to publish the findings quickly, even if the presentations are less than fully polished. ARTNeT Working Papers are available online at <http://artnet.unescap.org>. All material in the Working Papers may be freely quoted or reprinted, but acknowledgment is requested together with a copy of the publication containing the quotation or reprint. The use of the Working Papers for any commercial purpose, including resale, is prohibited.

Disclaimer:

The designations employed and the presentation of the material in this Working Paper do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. Where the designation “country or area” appears, it covers countries, territories, cities or areas. Bibliographical and other references have, wherever possible, been verified. The United Nations bears no responsibility for the availability or functioning of URLs. The views expressed in this publication are those of the author(s) and do not necessarily reflect the views of the United Nations. The opinions, figures and estimates set forth in this publication are the responsibility of the author(s) and should not necessarily be considered as reflecting the views or carrying the endorsement of the United Nations. Any errors are the responsibility of the author(s). The mention of firm names and commercial products does not imply the endorsement of the United Nations.



ASIA-PACIFIC RESEARCH AND TRAINING NETWORK ON TRADE

WORKING PAPER

Estimating the effect of trade facilitation implementation on trade misinvoicing-based illicit financial flows and tax revenue in Asia and the Pacific

Alexey Kravchenko¹, Yann Duval²

Please cite this paper as:

Kravchenko, Alexey and Duval, Yann (2022). “Estimating the effect of trade facilitation implementation on trade misinvoicing-based illicit financial flows and tax revenue in Asia and the Pacific”, **ARTNeT Working Paper Series** No. 224, December 2022, Bangkok, ESCAP.

Available at <http://artnet.unescap.org>

¹ Economic Affairs Officer, Trade Policy and Facilitation Section (TPFS), Trade, Investment and Innovation Division (TIID), United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). Email: kravchenkoa@un.org

² Chief, TPFS, TIID, ESCAP. Email: duvaly@un.org

Abstract

Trade misinvoicing occurs when price, quantity or description of internationally traded goods is purposefully misrepresented for pecuniary gain. It is one type of illicit financial flows (IFFs), and combating IFFs has been explicitly included in the Sustainable Development Goals. Most literature on the topic so far focused on understanding and estimating misinvoicing. This study examines whether, as previously hypothesised, digital trade facilitation, in particular cross-border trade data exchange, can help in addressing misinvoicing. The study builds a simple index of misinvoicing at harmonized system (HS) four-digit level using UN Comtrade data for 2015, 2017 and 2019 to match the UN Global Survey on Digital and Sustainable Trade Facilitation data, together with a number of standard control variables commonly included in trade-related regression analyses. The results suggest that there is indeed a statistically significant association between misinvoicing as measured by the index and rates of implementation of various trade facilitation measures. The study proceeds to estimate a range of the impact of full implementation of trade facilitation measures (own and trade partners') on tax revenue, estimated to be at least \$119 billion to \$183 billion for countries in the Asia-Pacific region, per year. Notably, this is likely to be an underestimate because of the aggregation bias of analysis conducted at HS four-digit level. Nevertheless, these numbers provide a defensible, theoretically and logically consistent estimates supporting the argument that economies stand to gain significantly from exchanging trade data across borders to stem trade misinvoicing. Implementation of cross-border paperless trade measures promise to offer the most impact on tax revenues.

Keywords: Illicit financial flows (IFFs); trade misinvoicing; trade facilitation; Asia-Pacific

JEL Codes: F14, H26

Table of Contents

Abstract	iv
Abbreviations and acronyms	vii
1. Introduction	1
2. Data & Methodology	2
2.1 Trade Data	2
2.2 Trade Facilitation	6
3. Analysis of relationship between trade facilitation implementation and mismatching	7
4. Implications	12
5. Conclusion	17
List of references	18
Appendix	20

List of Tables

Table 1: Regression Analysis output, all available economies	11
Table 2: Illustrated reduction in trade data discrepancies due to unitary improvement in Azerbaijan's own formalities score	13
Table 3: Estimated range on tax revenues due to a unitary improvement in own in formalities score for Azerbaijan, using 2019 data, United States dollars, millions	14
Table 4: Impact of full digital trade facilitation implementation (own and partner), by Asia-Pacific economy	16

List of Figures

Figure 1: Simple Mismatching Score distribution, 2015, 2017 and 2019	3
Figure 2: HS versions in 2015, 2017, 2019, all available reporters.....	4
Figure 3: HS 4-digit bilateral Mismatching Score distribution, 2015, 2017 and 2019	5
Figure 4: Distribution of HS four-digit bilateral mismatching score in Asia-Pacific, by economy and trade flow, 2019.....	5
Figure 5: Bilateral mismatching score among Asia-Pacific economies, grouped by subregion, 2019.....	6
Figure 6: Digital and Sustainable Trade Facilitation in Asia and the Pacific, 2021	7
Figure 7: Trade facilitation implementation survey scores against mismatching score, own and partner implementation	8
Figure 8: Impact of full digital trade facilitation implementation (own and partner), by TF subgroup.....	15
Figure 9: Impact of full digital trade facilitation implementation (own and partner), by TF subgroup.....	17

Abbreviations and acronyms

ECA	United Nations Economic Commission for Africa
ECE	United Nations Economic Commission for Europe
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
ESCAP	United Nations Economic and Social Commission on Asia and the Pacific
ESCWA	United Nations Economic and Social Commission for Western Asia
GDP	Gross Domestic Product
GST	Goods and Services Tax
HS	Harmonized System
IFFs	Illicit Financial Flows
ITC	International Trade Centre
RTA	Regional Trade Agreement
UNCTAD	United Nations Conference on Trade and Development
VAT	Value-added tax

1. Introduction

Trade misinvoicing occurs when price, quantity or description of internationally traded goods is purposefully misrepresented for pecuniary gain. The scope of avenues for such gains is wide, ranging from indirect and direct tax avoidance to money laundering, profit shifting and illicit financial flows (IFFs). Combating IFFs in particular, has been explicitly included as part of the 2030 Development Agenda. Target 16.4 is “By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime”. The corresponding indicator is 16.4.1 “Total value of inward and outward illicit financial flows (in current United States dollars).” A consensus is starting to emerge on methodologies to estimate IFFs, of which trade misinvoicing is a subset (UNCTAD, 2021).

The costs to governments in the region are significant: ESCAP (2018) estimated that due to trade misinvoicing at least \$200 billion was lost in tax revenues in 2016 in Asia-Pacific region, comprising at least 6.1% of the region’s total tax revenues. It has been hypothesized that trade facilitation,³ in particular cross-border sharing of trade data and documents, could help address misinvoicing (Kravchenko, 2018; ESCAP 2018; ESCAP 2019; APFF Digital Trade Finance Lab, 2021). Anecdotal evidence from customs agencies suggests that data sharing is instrumental not only in detecting, but also having strong enough evidence to pursue with legal options to offending parties, providing further deterrents. Article 12 of the WTO Trade Facilitation Agreement encourages sharing of information to ensure effective customs control, but data sharing often remains limited and cumbersome, often still subject to complex and paper-based processes. In Asia-Pacific, the Framework Agreement on Facilitation of Cross-border Paperless Trade in Asia and the Pacific, a UN treaty fully dedicated to enabling electronic exchange of trade-related to data and documents among parties, may provide a useful multilateral platform to accelerate progress on this issue.

In that context, this study aims to measure the extent to which trade facilitation in general, and cross-border paperless trade measures in particular, may help reduce trade misinvoicing and combat illicit financial flows, tax avoidance and other related fraudulent behaviour, and ultimately increase government revenues. At the time of writing this study, the authors were not aware of any studies quantifying the effect of trade facilitation on misinvoicing. This study thus attempts to ascertain whether one should indeed expect trade misinvoicing to decrease with increased trade facilitation. This is accomplished through firstly constructing an index which measures the level of discrepancy between reported imports and exports, linking it to trade facilitation implementation data collected through the United Nations Global Survey on Digital and Sustainable Trade Facilitation

³ Trade facilitation, through trade digitalization, has already been linked to reduction in trade costs (Duval, Utoktham, Kravchenko, 2018). The authors estimate the full implementation of paperless trade measure lower the trade costs by as much as \$600 billion per year. It has also been shown to relate to the reduction in “burdensomeness” of non-tariff measures and related procedural obstacles reported by business engaged in international trade (ESCAP and ITC, 2019; ESCAP & UNCTAD, 2019).

(UNTF) survey, and ultimately estimating potential financial benefits of implementing trade facilitation measures.

2. Data & Methodology

2.1 Trade Data

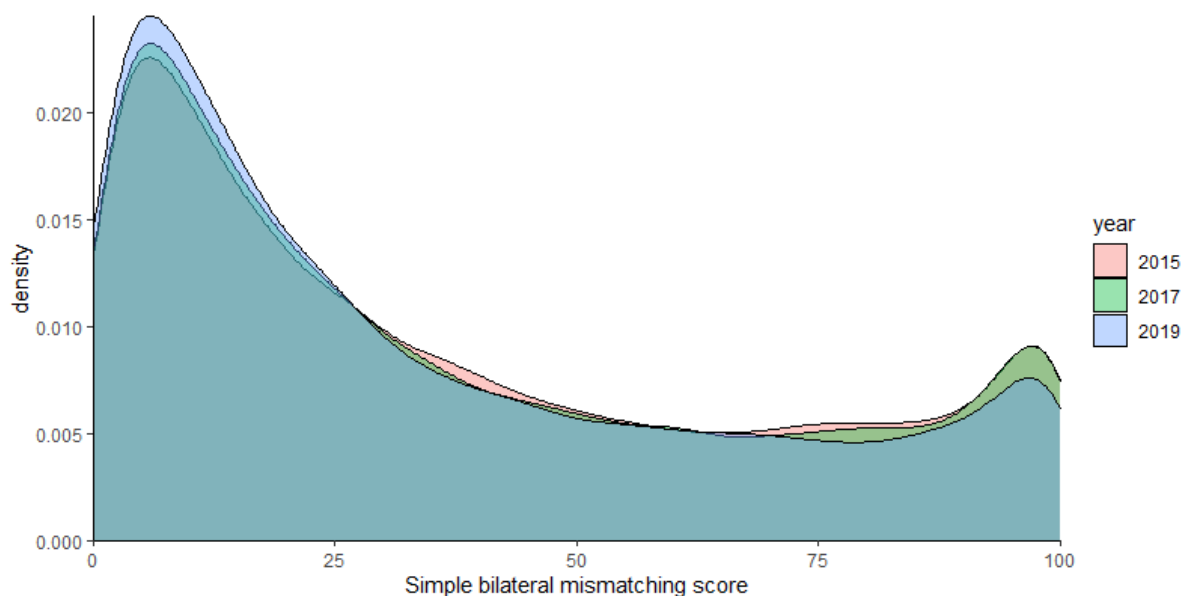
Trade data was obtained from United Nations Comtrade for 2015, 2017 and 2019 (to match UNTF survey data described below). A simple mismatching score (SMS_{ij}) index was initially constructed to examine the level of total bilateral mismatching during the years examined:

$$SMS_{ij} = \frac{|M_{ij} - X_{ji}|}{M_{ij} + X_{ji}} \times 100 \quad (1)$$

where SMS_{ij} between economy i and economy j , M_{ij} are the total imports of economy i from economy j , and X_{ji} are the corresponding exports of economy j to economy i (i.e. economy i 's mirror imports from economy j). Value close to zero implies close match between reported and mirror flows. Conversely, greater value implies higher level of discrepancy. Distribution of the index is presented in Figure 1. As can be seen, the highest level of discrepancies are relatively close to x-origin, implying that for most part mismatching is relatively minor. Indeed, some mismatching is expected due, for example time lag between exports and their arrival in destination countries. Furthermore, imports and exports are reported in different figures (cif vs fob), which may even explain the peak of skewness of the distribution.⁴ The distributions also imply that there have been gradual improvements since 2015 to 2019.

⁴ As a rule of thumb, IMF suggests that cif values are about 10% higher than the corresponding fob prices.

Figure 1: Simple Mismatching Score distribution, 2015, 2017 and 2019



Source: Authors' calculations based on UN Comtrade data

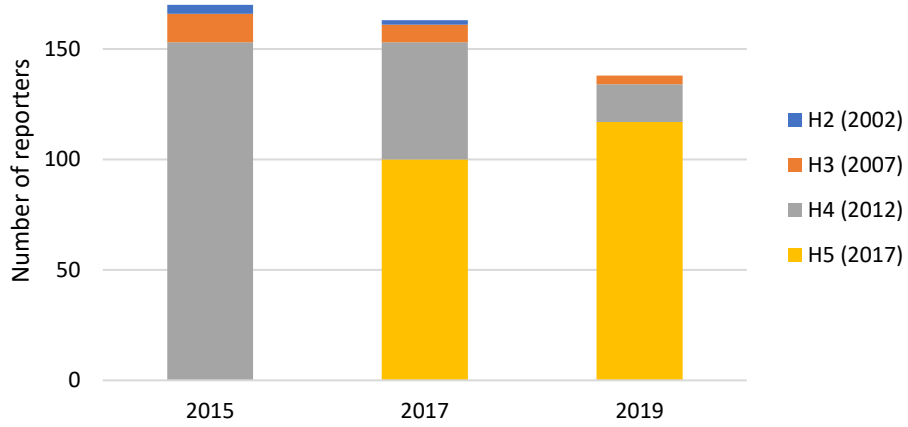
The construction is akin to the high-level analysis conducted by the earlier work by Global Financial Integrity, which utilises total bilateral trade flows to estimate the trade-misinvoicing-based illicit financial flows (without normalizing the values to 100 as done here). However, as explained in Kravchenko (2018) examining total bilateral trade values misses important nuances, most significant of which is that negative and positive discrepancies cancel each other out when aggregated.

To address the aggregation bias, each bilateral trade flow was matched with mirror values at HS four-digit level. If no mirror data were available because trade partner had no data available for that particular year, that trade flow was removed from subsequent analysis. However, if a reporter had trade data available for other products and/or partners, the mirror trade flow data was assumed to be zero.

It would have been preferable to conduct the analysis HS six-digit level for most accurate results, since even aggregation to four-digit level cancels out some variability going in opposite directions (see Figure 2 and explanation in Kravchenko, 2018). Analysis at HS four-digit level, however, eliminates the problem of HS concordance since different versions only are changed at HS six-digit version (see Figure 2 on distribution of HS version across the examined years). Only about 80% of products at HS six-digit level maintain their code between subsequent HS iterations. This is compounded by the requirement that mirror statistics need to be comparable across time periods *and* trade partners. Furthermore, customs officials at different economies have been known to have disagreements at HS six-digit level on the classification of products – an issue significantly reduced at HS four-digit level. Finally, previous analysis and background research has shown that exports and imports often have mismatching HS six-digit codes due to rules of origin requirements to make use of preferences of trade agreements. While a questionable practice, it does not necessarily indicate that prices/quantity of two traded goods were altered, but in bilateral six-digit analyses would show up as evidence

of trade discrepancies with opposite sign – again an issue that could be avoided at four-digit classification.

Figure 2: HS versions in 2015, 2017, 2019, all available reporters



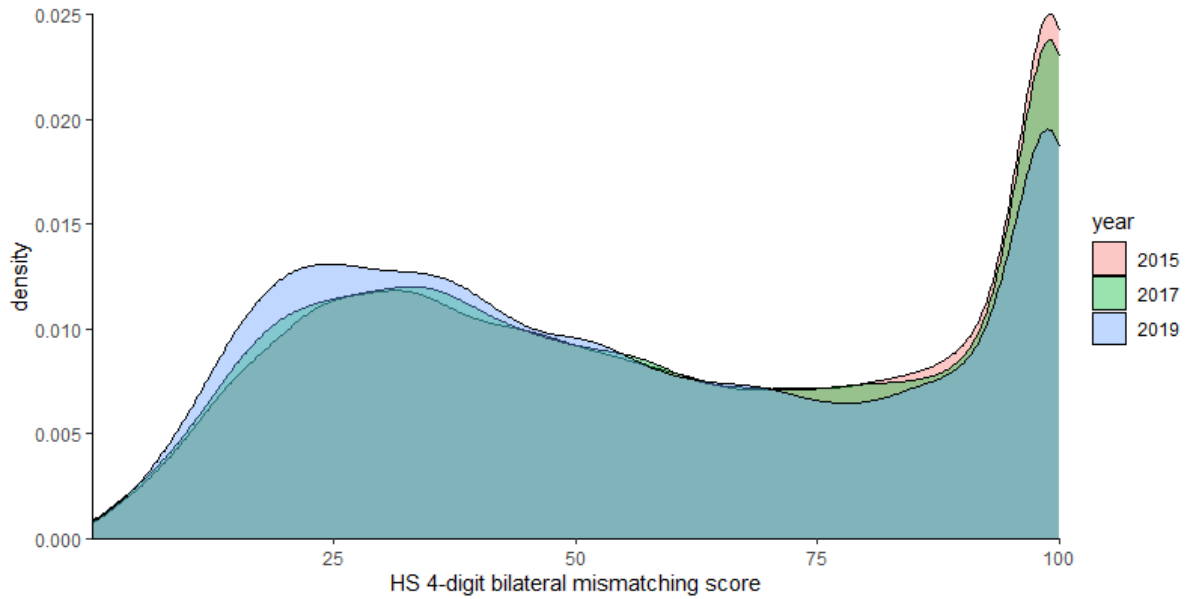
Source: Authors' calculations based on UN Comtrade data

As such, bilateral Mismatching Score MS_{ij} is calculated at HS four-digit level between economies i and j , but aggregating the discrepancies across all products, k , normalized by total and mirror total bilateral trade flows:

$$MS_{ij} = \frac{\sum_{k=1}^K |M_{ijk} - X_{jik}|}{\sum_{k=1}^K (M_{ijk} + X_{jik})} \times 100 \quad (2)$$

Distribution of the mismatching score (Figure 3) is significantly different to presented earlier that was estimated at total bilateral trade. As previously, values closer to zero mean a close match between reported statistics and its corresponding mirror statistics, and vice versa, but at corresponding HS four-digit levels. More recent data similarly suggest improvement of matching, but the peak is closer to 100, implying that there is no match between mirror statistics which gets cancelled out in simple mismatching score seen in figure 2.

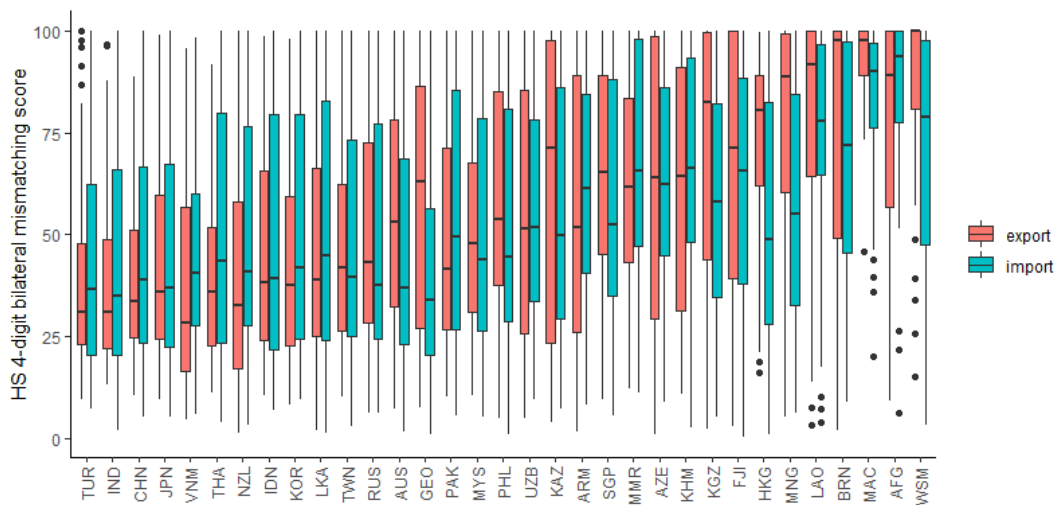
Figure 3: HS 4-digit bilateral Mismatching Score distribution, 2015, 2017 and 2019



Source: Authors' calculations based on UN Comtrade data

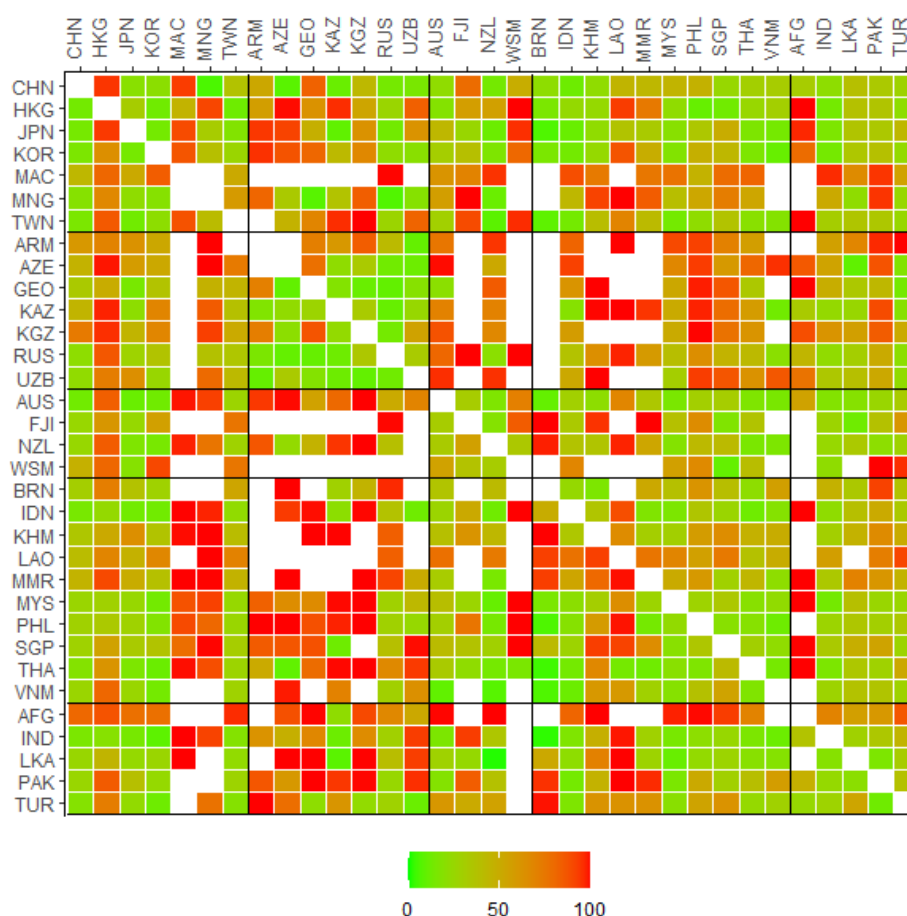
Examination of distributions at aggregate economy level (Figure 4) shows a large variability. Notably, mismatching seems to be as prevalent for both exports and imports. Figure 5 provides a bilateral heatmap of scores in Asia-Pacific in 2019, grouped by subregions. Some patterns are immediately evident, such as, for example, seemingly high mismatches between South-East Asia and North and Central Asia subregions. Conversely, South-East Asia subregion economies generally have good matching with economies in East and North-East Asia.

Figure 4: Distribution of HS four-digit bilateral mismatching score in Asia-Pacific, by economy and trade flow, 2019



Source: Authors' calculations based on UN Comtrade data

Figure 5: Bilateral mismatching score among Asia-Pacific economies, grouped by subregion, 2019

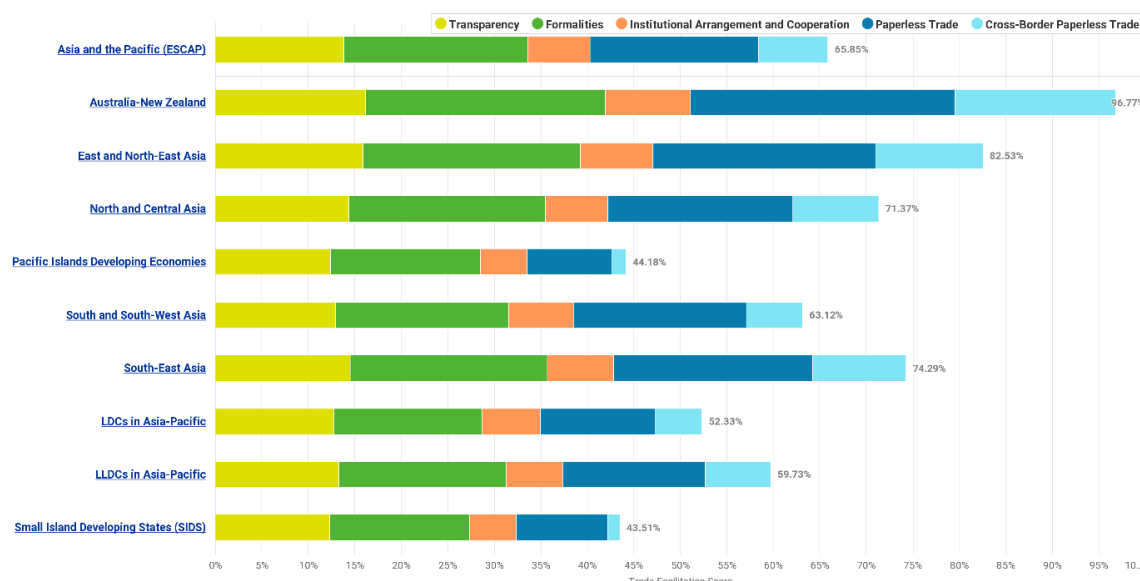


Source: Authors' calculations based on UN Comtrade data

2.2 Trade Facilitation

Trade facilitation data has been obtained from the United Nations Global Survey on Digital and Sustainable Trade Facilitation (UNTF) surveys, conducted by the United Nations Regional Commissions, including ECA, ECE, ECLAC, ESCAP and ESCWA, biennially from 2015, to review the progress of trade facilitation reforms in their respective Member States. The UNTF survey was prepared according to the final list of commitments included in the WTO Trade Facilitation Agreement (TFA), supplemented by forward looking measures included in the Framework Agreement on Facilitation of Cross-Border Paperless Trade in Asia and the Pacific. The latest results are presented in Figure 6.

Figure 6: Digital and Sustainable Trade Facilitation in Asia and the Pacific, 2021



Source: UN Global Survey on Digital and Sustainable Trade Facilitation 2021, untfsurvey.com

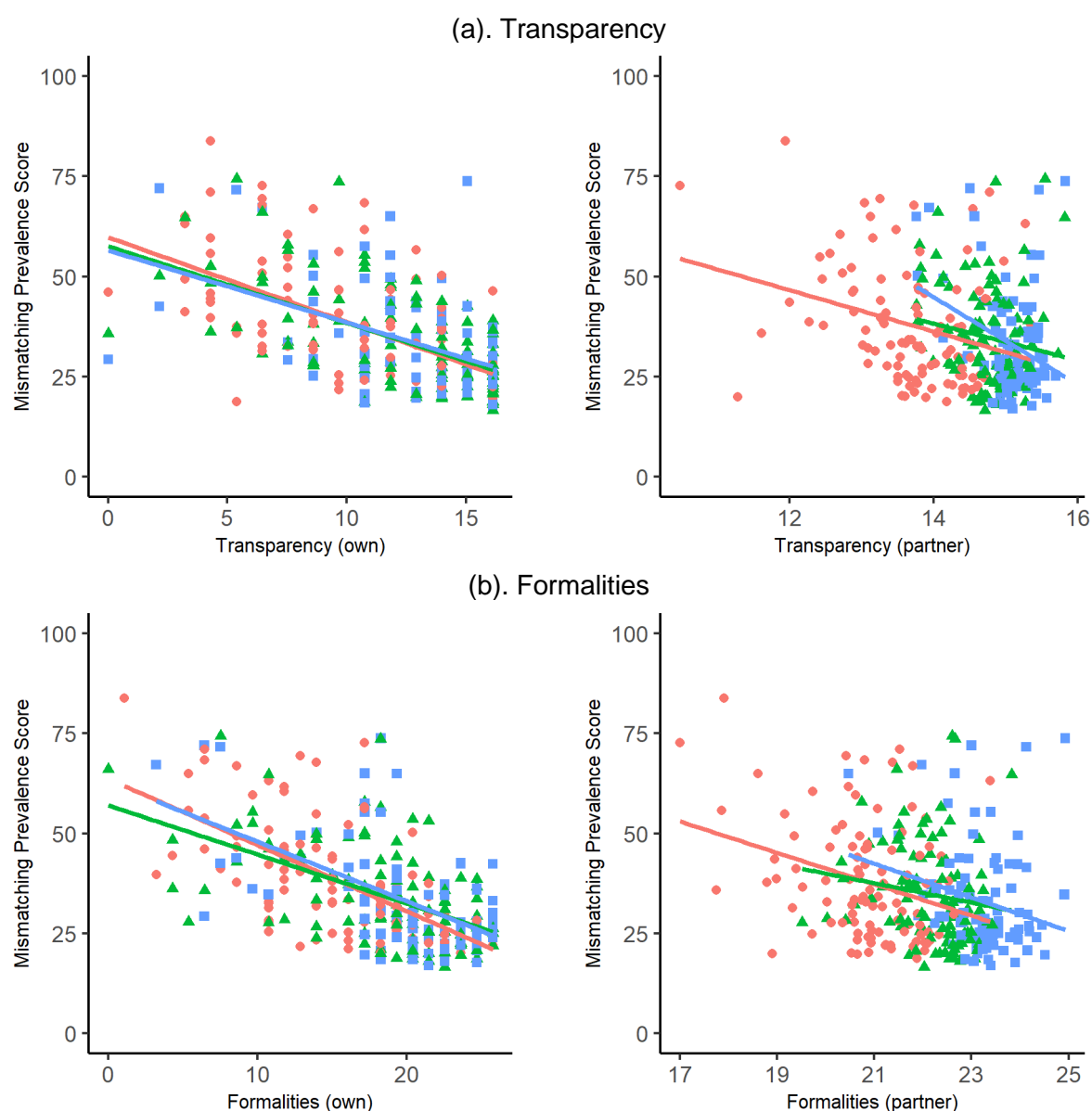
The survey covers 58 trade facilitation measures, which are classified into four groups and eleven sub-groups. Given trade facilitation measures focus, five subgroups, namely transparency, formalities, institution arrangement and cooperation, paperless trade and cross border paperless trade (see appendix on detailed measures included). The survey is fact-based rather than perception-based. A three-step approach to data collection and validation is generally followed, implemented over a 6-month period every 2 years: Step (1) Open data collection from experts; Step (2) Data verification by UN Regional Commission Secretariats; and Step (3) Data validation by national governments. For more details on the methodology, please refer to the 2021 Survey Methodology and methodology section of global and regional reports, which are available for 2015, 2017 and 2019.

3. Analysis of relationship between trade facilitation implementation and mismatching

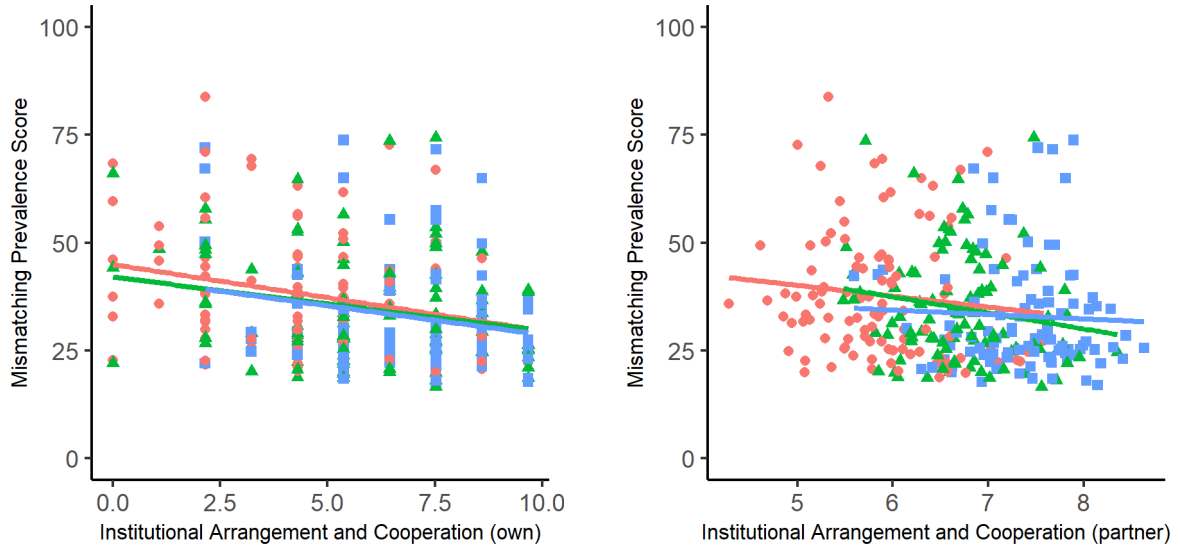
At the time of writing this report, since trade data were only available up to 2020, UNTF data for years 2015, 2017 and 2019 was used. Figure 7 below plots the five subgroups of trade facilitation measures implemented by reporters (left) and trade partners (right) against HS four-digit mismatching score. The trade facilitation indicators for each subgroup consisted of responses for 5, 8, 3, 9, and 6 questions for transparency, formality, institutional arrangements, paperless measures and cross-paperless measures, respectively. Each question (see annex) had a minimum value of 0 (not implemented) up to a maximum value of 3 (implemented), normalized to 100 from a factor of 93. This means that the maximum score for each indicator was 16.13 (i.e. $5 \times 3 / 93 \times 100$), 25.81, 9.68, 28.03 and 19.35, respectively. Trader partner's average scores were

weighted by respective trade values. As can be seen there are clearly negative relationships between mismatching scores and each of the subgroups of trade facilitation measure implementation by the reporter. The fact that best fit lines for each year stay fairly constant shows that the relationship is not due to the trend (where all countries essentially improve the TF scores). The relationships are less clear for partner's implementation.

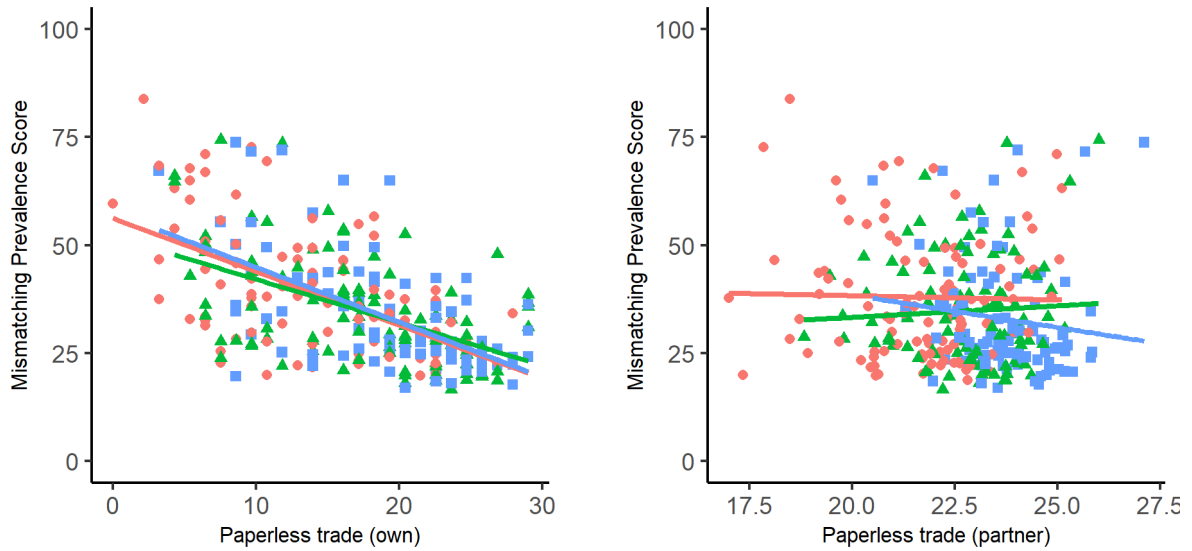
Figure 7: Trade facilitation implementation survey scores against mismatching score, own and partner implementation



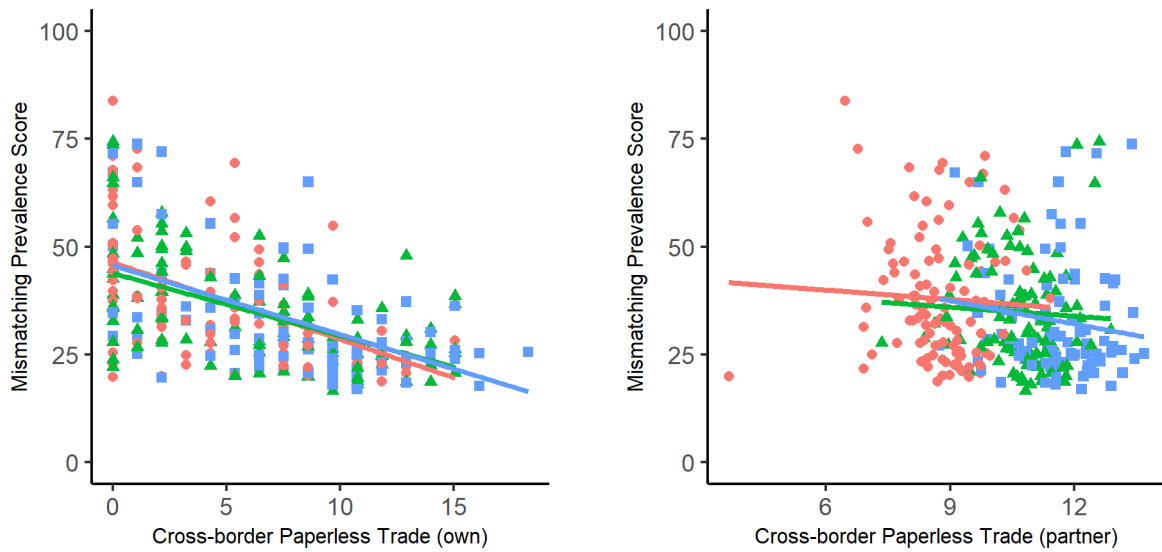
(c). Institutional arrangement and cooperation



(d). Paperless trade



(e). Cross-border paperless trade



Source: Authors' calculations based on UN Comtrade data and UNTF survey data 2021, untfsurvey.com

Note: 2015(●); 2017(▲); 2019 (■)

Multiple regression analysis was conducted to see whether the relationship between trade facilitation measures withholds when keeping other potential factors constant. Table 1 summarises the results. All regressions included year fixed effects and intercepts (not reported). Data limitation precluded addition of reporter and partner fixed effects to examine the within group variation of trade facilitation implementation subcomponents. For 119 economies for which TF data was collected across years, 20 had missing data in either 2015 or 2017, and 35 did not have data in 2017-2019. Furthermore, for 495 data entries (for 99 economies across five dimensions of trade facilitation, namely digital, cross border, etc), in 2015-2017, 234 – nearly half – did not exhibit changes. For 2017-2019, for 420 data points, 206 did not exhibit changes. Adding country-fixed effect dummy variables would compound them with TF variables, resulting in high value of predictive fit of overall regression but low significance insignificant coefficients: a classic case of multicollinearity. Heteroscedasticity adjusted standard errors (White's estimator) were used to ensure robust standard errors (Long & Ervin, 2000; White, 1980).

Regression (1) is a baseline regression estimating the impact of each of the subgroup's trade facilitation measures impact on the HS four-digit mismatching scores across three time periods. With the exception of the institution variable, all explanatory variables have the expected sign and have strongly statistical significance. What the coefficients mean is that improvement in trade facilitation indicators of countries is associated in a decrease in discrepancies with mirrored statistics of their partner countries (for imports). Regression (2) controls for trade partner's trade facilitation implementation. Similarly, all explanatory variables except for institution are statistically significant and have the expected sign. Paperless trade readiness assessment studies conducted by ESCAP⁵ suggest that while countries may have institutional mechanisms relevant to trade facilitation, they often do not have the resources or authority to coordinate effectively. This leads to inconsistent and uncoordinated efforts by agencies and other stakeholders, which potentially explains for the unexpected sign on the institution variable. Additional possible explanation is that the construction of subgroup indicator itself, which consists of only 3 questions and displays little variation across time.

Regression (3) controls for size of economies (GDP), level of economic development (GDP per capita), and other standard gravity modelling variables, including whether countries share official language and border, distance between capitals and whether countries have a regional trade agreement (RTA). An economy's own level of economic development (as measured by GDP per capita) is negatively associated with import trade discrepancies. Trade partners level of economic development, on the other hand, is positively associated with discrepancies, suggesting that traders use misinvoicing to either bypass international capital movement restrictions, or shift profits between partners with differing levels of economic development. Discrepancies are negatively associated with economic sizes (GDP_i and GDP_j), if countries share official language, if they share borders and if they have a trade agreement. As expected, discrepancies are positively associated with distance as higher distances imply longer travel time, meaning

⁵ Based on studies conducted in eight countries, see <https://www.unescap.org/our-work/trade-investment-innovation/trade-facilitation-digital-trade/paperless-trade>

that there is a higher chance than an export in one financial year maybe recorded as an import in a different financial year. Controlling for these additional variables, however, removes significance of own implementation of cross-border paperless implementation and transparency measures. Implementation of trade partner's cross-border paperless measures, on the other hand, is negatively associated with trade discrepancies.

Table 1: Regression Analysis output, all available economies

Dependent variable: bilateral mismatching score at HS four-digit level 2015, 2017 and 2019				
regressor	imports			exports
	(1)	(2)	(3)	(4)
$paperless_i$	-0.289 *** (0.0526)	-0.322 *** (0.0501)	-0.214 *** (0.0476)	-0.088 (0.0458)
$xbpaperless_i$	-0.263 *** (0.0703)	-0.352 *** (0.0672)	0.113 (0.0651)	-0.253 *** (0.0619)
$transparency_i$	-0.319 *** (0.0819)	-0.369 *** (0.0795)	0.024 (0.0797)	-0.194 * (0.0841)
$institution_i$	0.252 * (0.1004)	0.193 * (0.0966)	0.697 *** (0.0962)	1.165 *** (0.0980)
$formalities_i$	-0.483 *** (0.0627)	-0.534 *** (0.0611)	-0.223 *** (0.0616)	-0.508 *** (0.0658)
$\ln(GDP_i^{pc})$			-0.686 *** (0.1912)	1.288 *** (0.1990)
$\ln(GDP_i)$			-3.756 *** (0.1196)	-5.439 *** (0.1226)
$paperless_j$		-0.188 *** (0.0492)	-0.088 (0.0458)	-0.214 *** (0.0476)
$xbpaperless_j$		-0.818 *** (0.0653)	-0.253 *** (0.0619)	0.113 (0.0651)
$transparency_j$		-0.691 *** (0.0845)	-0.194 * (0.0841)	0.024 (0.0797)
$institution_j$		0.986 *** (0.0987)	1.165 *** (0.0980)	0.697 *** (0.0962)
$formalities_j$		-0.674 *** (0.0661)	-0.508 *** (0.0658)	-0.223 *** (0.0616)
$\ln(GDP_j^{pc})$			1.288 *** (0.1990)	-0.686 *** (0.1912)
$\ln(GDP_j)$			-5.439 *** (0.1226)	-3.756 *** (0.1196)
official common language			-5.470 *** (0.5627)	-5.455 *** (0.5630)
contiguity			-6.028 *** (0.9590)	-6.034 *** (0.9586)
distance			0.713 *** (0.0440)	0.703 *** (0.0440)
RTA_{ij}			-8.126 *** (0.4420)	-8.071 *** (0.4416)
year fixed effects	yes	yes	yes	yes
df	22,318	22,313	21,688	21,688
\bar{R}^2	0.041	0.116	0.258	0.258
***, **, * denote 0.1%, 1%, and 5% statistical significance, respectively. Robust standard errors reported in parenthesis under coefficients.				

Regression (4) uses export data discrepancies and as expected due to the nature of mirror technique employed the coefficients on trade facilitation variables are flipped between own and trade partner's implementation. The narrative of interpretation, however, is interesting. For example, from an exporter's point of view now, own level of economic development (higher GDP per capita) is positively associated with discrepancies. This means that countries may experience revenue loss due to excessive GST refunds, or it may be a symptom of profit shifting to other less developed jurisdictions with lower tax rates.

4. Implications

Results from the regression analysis strongly support the hypothesis that trade facilitation, particularly paperless and cross border paperless measure implementation can significantly reduce discrepancies in trade data, and therefore address trade misinvoicing. As noted, previous study estimated that trade misinvoicing could cost upwards of \$200 billion a year in lost tax revenues, or more than 6% of regional tax revenue (Kravchenko, 2018).

Estimating resultant extra tax revenues collected is problematic for a number of reasons. First, it is necessary to make a judgement on which sources of reported trade flows are less trustworthy: is it on the side of exporter or importer. Depending on the answer the same transaction can thus be considered, for example, as export under-invoicing or import over-invoicing. Second, the estimates on the coefficients were conducted at HS four-digit level, which as has been pointed out likely to significantly mask the level of misinvoicing due to aggregation bias.

Nevertheless, the coefficients from the regression analysis can be used to provide a range of estimates of budgetary benefits of improved trade facilitation implementation, in particular of paperless and cross-border paperless measures. Looking at equation (2) used to derive the mismatching indicator, the dominator is used as a deflator to ensure the range of scores falls between 0 and 1. As such, any meaningful variation in the score would be from the reduction in the numerator, or the sum of absolute differences between reported and mirror statistics. As the differences can be both positive and negative, it is necessary to decompose the absolute sum into positive and negative components. Table 2 illustrates the exercise with an example of Azerbaijan, using 2019 trade data.

Table 2: Illustrated reduction in trade data discrepancies due to unitary improvement in Azerbaijan's own formalities score

total value (\$ bil)	total mirrored value (\$ bil)	(1)+(2) (\$ bil)	$\sum_{j=1}^J \sum_{k=1}^K M_{ijk} - X_{jik} $ (\$ bil)	(4)/(3)*100	Δ in discrepancies (\$ mil)
(1)	(2)	(3)	(4)	(5)	(6)
Imports					
12.87	12.03	24.90	11.20	44.98	55.6
Exports					
19.43	17.00	36.43	8.84	24.26	185.1

Azerbaijan's total imports and exports in 2019 were \$12.87 billion and \$19.43 billion, respectively (column (1)). Corresponding total mirrored sums of import and export values were \$12.03 billion and \$17.00 million, respectively (column 2). The sum of totals reported and mirror values - the denominator from equation (2) for all trade partners across - are given in column (3). The sum of absolute differences between values at HS four-digit level where reported values by Azerbaijan and corresponding HS codes reported by trader partners are summarized in column 4 - the numerators in equation (2) across all products and for all partners. The mismatching scores for imports and exports are given in column (5).

According to the results from the regression analysis, unitary improvement in formalities implementation score is associated with a 0.223 decrease in mismatching score for imports and 0.508 decrease for exports (i.e. from 44.98 to 44.75 for imports and from 24.26 to 22.75 for exports). Excluding the implications of changes in the denominator (which is roughly double of total imports or exports), the reduction in the discrepancies would be in the numerator, or by $-0.223 \times (24.90)/100 = \55.6 million for imports, and $0.508 \times (36.43)/100 = \185.1 million for exports. As noted, it would be challenging to ascertain for each transaction whether this reduction would be associated with country's own reported values getting closer to mirrored trade values from trade partners, or vice versa. As such, a number of potentially mutually exclusive government revenue leakages are possible.

Import under-invoicing, where declared values of imports are lower than what was actually imported, would affect tariff revenue and indirect tax revenue (GST or VAT) collected at the border (Table 3). Potential export over-invoicing reduction could result in reduction of excessive export-related indirect tax rebates. Taken together, if reductions in mismatching comes solely from reduction in import under-invoicing and export over-invoicing mean that up to \$50.10 million could be added to government revenues with unitary increase in formalities scores.

On the other hand, if instead of import under-invoicing and export-over invoicing the goal of discrepancies was capital flight (with corresponding export under-invoicing and import-over invoicing), this could instead mean profit shifting loss of (\$31.29 mil). It is likely that for each economy there is a combination of motivations for trade misinvoicing. For the purposes of providing an order of magnitude estimates, the net effect on tax base in Azerbaijan is at least \$31.29-\$50.10 million.

It should be stressed again, that because the estimation was run at a relatively aggregated HS four-digit level due to concordance issues across multiple years and trade partners, this is likely to have had a significant attenuating effect, meaning that the potential true savings are likely to be significantly higher. In addition, higher tariff rates are likely to induce more avoidance behaviour, which means that average tariff used could further underestimate the impact of trade facilitation score improvement.

Table 3: Estimated range on tax revenues due to a unitary improvement in own in formalities score for Azerbaijan, using 2019 data, United States dollars, millions

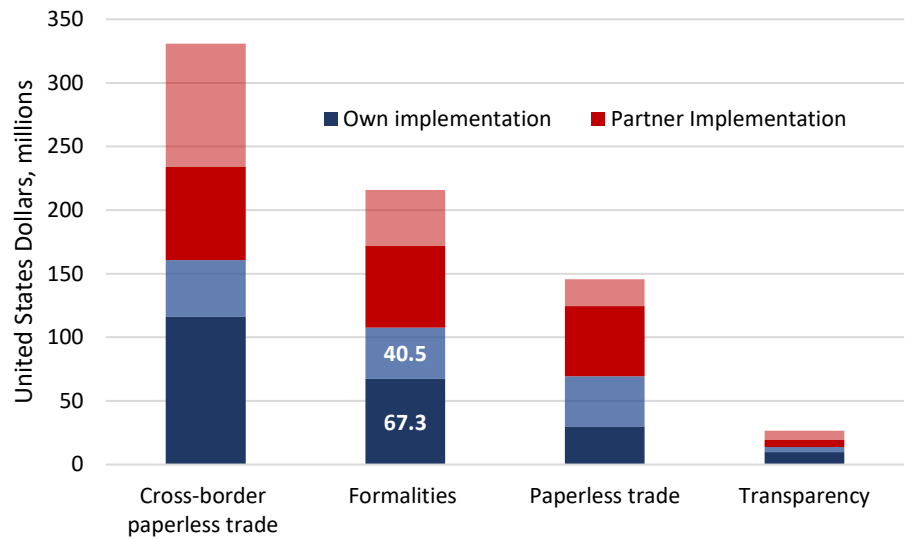
(1) Import Under Invoicing	\$55.6 mil		
<i>Indirect tax lost (18%)</i>		\$10.00 mil	
<i>tariff revenue lost (12.9%)</i>		\$6.78 mil	
Total		\$16.78 mil	
(2) Export Over Invoicing	\$185.1 mil		
<i>Excessive Indirect tax refund (18%)</i>		\$33.33 mil	
Total		\$33.33 mil	
TOTAL (1) + (2)			\$50.10 mil
(3) Financial Outflows	\$240.72 mil		
(export under invoicing + import over-invoicing) – Profit tax of 13%		\$31.29 mil	
TOTAL (3)			\$31.29 mil

The results presented in Table 3 are derived assuming a unitary change in the indicator of own formalities. As noted in previous section, the maximum value (full implementation (=3) of each of the 8 questions in paperless subgroup of trade facilitation measures, deflated by 93/100) was 25.81. Azerbaijan had scored relatively well in that category, with a score of 23.66, meaning to achieve full implementation the score would need to increase by $25.81 - 23.66 = 2.15$. As such, to estimate the impact on revenue increase due to reduction in misinvoicing of full implementation of formalities provisions in Azerbaijan, the results would be increased by the derived factor, i.e. $2.15 \times (\$31.29 \text{ to } \$50.10) = \$67.3 \text{ to } \107.7 mil .

The same exercise was conducted for other trade facilitation groups with statistically significant coefficients (highlighted in table) with the exception of coefficients on the institutional arrangements variable which, as discussed previously are likely to signalling effects and/or limited number of indicators which stayed relatively constant, had positive coefficients. For partner measures implementation, trade-weighted average implementation scores were subtracted from maximum attainable scores for each subgroup of measures for exports and imports separately. For the case of Azerbaijan, the results are presented in Figure 8. The example of own implementation range of formalities is highlighted from the minimum of \$67.3 mil up to additional $107.7 - 67.3 = \$40.5 \text{ mil}$ – depending on the assumptions of the channel of reduction in misinvoicing. Full implementation of all trade facilitation measures by Azerbaijan could potentially

improve tax revenue by at least \$223-\$351 mil and full implementation by partner economies by additional \$198-\$368 mil.

Figure 8: Impact of full digital trade facilitation implementation (own and partner), by TF subgroup



Source: Authors' calculations.

Corresponding figures for other economies in the Asia-Pacific across all measures are presented in Table 4. Column (1) presents estimates of the combined government revenue impact of attending full trade facilitation implementation scores in each subgroup of trade facilitation examined under the assumption of import under invoicing and export over invoicing (using respective economy’s average trade-weighted tariffs and latest GST rates). Conversely column (2) presents values of capital outflows and resultant losses through lower corporate tax collection (assuming import over-invoicing and import under-invoicing). Columns (3) and (4) conduct similar analysis but for partner full implementation. To provide a range of assumption-dependent total values, column (5) sums minimum values of own and partner implementation impact on tax revenue, while column (6) sums up maximums.

Table 4: Impact of full digital trade facilitation implementation (own and partner), by Asia-Pacific economy

	Own implementation		Partner implementation		Min total	Max total
	Import UI + Export OI	Financial outflows	Import UI + Export OI	Financial outflows	min((1),(2)) + min((3),(4))	max((1),(2)) + max((3),(4))
	(1)	(2)	(3)	(4)	(5)	(6)
Afghanistan	278	397	116	150	394	547
Armenia	174	141	90	70	211	264
Australia	960	2,456	2,202	4,650	3,162	7,106
Azerbaijan	351	223	368	198	421	719
Brunei Dar.	0	122	6	78	6	200
China	24,764	19,900	25,715	20,052	39,952	50,479
Fiji	71	69	35	29	98	105
Georgia	109	84	160	125	209	268
Indonesia	1,701	2,787	1,606	2,268	3,307	5,054
India	7,804	9,106	7,689	7,970	15,493	17,076
Japan	1,630	4,962	7,085	15,125	8,716	20,087
Kazakhstan	1,280	1,618	648	745	1,928	2,363
Kyrgyzstan	258	109	103	43	151	361
Cambodia	416	663	326	426	742	1,089
Rep. of Korea	1,215	2,186	6,516	8,303	7,731	10,489
Lao P.D.R.	168	259	65	92	233	351
Sri Lanka	574	40	280	16	56	855
Myanmar	306	1,453	141	458	447	1,911
Mongolia	251	212	70	53	266	321
Malaysia	2,322	4,860	2,398	4,004	4,721	8,864
New Zealand	186	366	534	931	720	1,296
Pakistan	1,719	1,530	981	793	2,323	2,700
Philippines	891	1,392	1,114	1,616	2,005	3,007
Russian Fed.	6,318	2,704	7,175	3,041	5,745	13,493
Singapore	597	171	1,904	562	732	2,501
Thailand	1,336	3,670	2,162	4,354	3,499	8,024
Turkey	3,051	2,945	4,090	3,681	6,627	7,142
Uzbekistan	467	216	309	144	359	776
Viet Nam	6,407	12,006	2,396	3,939	8,803	15,946
Samoa	17.6	8.0	4.5	2.0	10.0	22.1
TOTAL					119,066	183,418

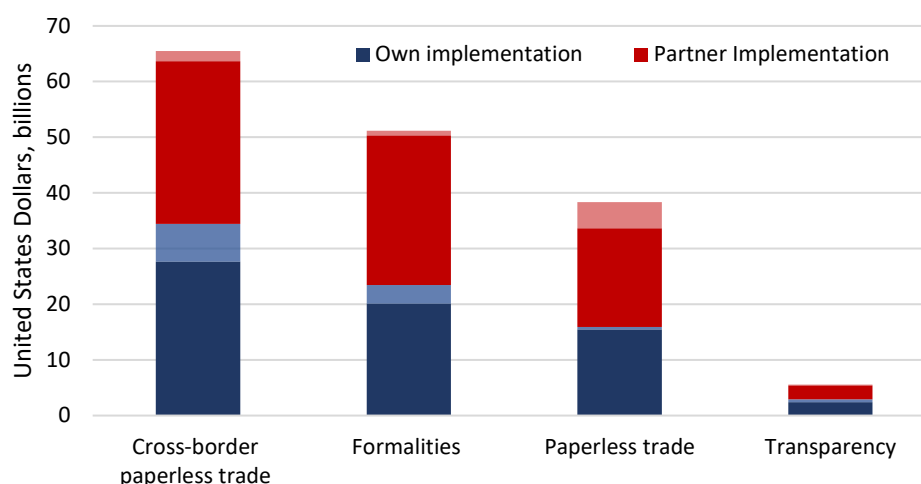
Source: Authors' calculations

Note: OI = Over-invoicing, UI = Under-invoicing

The range of the impact of full implementation of measures (own and partners') on tax revenue in the region is estimated to be at least \$119 billion to \$183 billion, per year. Notably, as stressed throughout the paper, this is likely to be an underestimate because of the aggregation bias of analysis conducted at HS four-digit level. Nevertheless, these numbers provide a defensible, theoretically and logically consistent estimates supporting the argument that economies stand to gain significantly from exchanging

trade-data across borders to stem trade misinvoicing. In terms of impact of individual measures (Figure 9), as expected, own and trade-partners' implementation of cross-border paperless trade measures promise to offer the most impact on tax revenues.

Figure 9: Impact of full digital trade facilitation implementation (own and partner), by TF subgroup



Source: Authors' calculations

5. Conclusion

This paper estimated the effect of trade facilitation implementation on trade misinvoicing-based illicit financial flows and tax revenue in Asia and the Pacific. The overall results support an earlier hypothesis that trade facilitation implementation, in particular cross-border paperless trade and paperless trade measures implemented by countries themselves as well as by their trade partners could potentially significantly reduce discrepancies, which are a symptom of trade misinvoicing, and add significant resources to states' budgets. To accelerate trade facilitation measures' implementation, countries may wish to join the Framework Agreement on Facilitation of Cross-border Paperless Trade in Asia and the Pacific.⁶ The Framework Agreement was adopted on 19 May 2016 by the United Nations Economic and Social Commission for Asia and the Pacific, making it the newest UN treaty in the area of trade and development. The Framework Agreement is fully dedicated to the digitalization of trade processes and enabling the seamless electronic exchange and legal recognition of trade-related data and documents across borders, rather than only between stakeholders located in the same country. Implementation of the Agreement is expected to greatly reduce transaction time and costs as well as increase regulatory compliance. The Agreement entered into force on 20 February 2021. As of December 2022, 13 countries have either acceded to, signed, or ratified the Agreement, and several other ESCAP member States are in the process of completing their domestic processes for accession.

⁶ <https://www.unescap.org/projects/cpta>

List of references

APFF Digital Trade Finance Lab (2021). Combating Trade-Based Money Laundering Whitepaper: Recommendations and Key Asks to APEC Finance Ministers. Available from:

https://www2.abaconline.org/assets/2021_Progress_Report_of_APFF_APFIF_and_API_P_2021-07-22_Final.pdf

Duval, Y., Utoktham, C., & Kravchenko, A. (2018). *Impact of implementation of digital trade facilitation on trade costs* (No. 174). ARTNeT Working Paper Series.

ESCAP (2018). Financing for Development in Asia and the Pacific: Highlights in the Context of the Addis Ababa Action Agenda: Available from <https://www.unescap.org/resources/financing-development-asia-and-pacific-highlights-context-addis-ababa-action-agenda>

ESCAP (2019). Financing for Development in Asia and the Pacific: Highlights in the Context of the Addis Ababa Action Agenda: 2019 Edition. Available from https://www.unescap.org/sites/default/files/Final%20Action%20Agenda%202019_Text_4.pdf

ESCAP. (2021). Digital and sustainable trade facilitation in Asia and the Pacific 2021. Available from: <https://www.unescap.org/kp/2021/untf-survey-2021-regional>

ESCAP & ITC. (2019). Company perspectives on non-tariff measures in Asia-Pacific. Available from <https://www.unescap.org/resources/company-perspectives-non-tariff-measures-asia-pacific>

ESCAP & UNCTAD. (2019). Asia-Pacific trade and investment report 2019: navigating non-tariff measures towards sustainable development. Available from: <https://www.unescap.org/publications/APTIR2019>

Kravchenko, A. (2018). Where and how to dodge taxes and shift money abroad using trade misinvoicing: a beginner's guide. Trade, Investment and Innovation Working Paper Series 1 (2018). United Nations Economic and Social Commission for Asia and the Pacific, Bangkok, Thailand.

Kravchenko, A. (2020). How to raise \$200 billion annually to finance COVID-19 recovery in Asia-Pacific. Available from <https://www.unescap.org/blog/how-raise-200-billion-annually-finance-covid-19-recovery-asia-pacific>

Long J. S., Ervin L. H. (2000). "Using Heteroscedasticity Consistent Standard Errors in the Linear Regression Model." *The American Statistician*, **54**, 217–224.

UNCTAD (2021). Methodologic guidelines to measure tax and commercial illicit financial flows: methods for pilot testing. Available from https://unctad.org/system/files/non-official-document/20210917_IFFsGuidelinesForPilots_en_0.pdf

White H. (1980). "A Heteroskedasticity-Consistent Covariance Matrix and a Direct Test for Heteroskedasticity." *Econometrica* **48**, 817–838.

Appendix

Sub-groups	Measures
Paperless trade (Ten measures)	Automated Customs System (e.g., ASYCUDA)
	Internet connection available to Customs and other trade control agencies at border-crossings
	Electronic Single Window System
	Electronic submission of Customs declarations
	Electronic application and issuance of import and export permits
	Electronic submission of Sea Cargo manifests
	Electronic submission of Air Cargo manifests
	Electronic application and issuance of Preferential Certificate of Origin
	E-payment of Customs duties and fees
	Electronic application for Customs refunds
Cross-border paperless trade (Six measures)	Laws and regulations for electronic transactions are in place (e.g., e-commerce law, e-transaction law)
	Recognized certification authority issuing digital certificates to traders to conduct electronic transactions
	Electronic exchange of Customs declaration
	Electronic exchange of Certificate of Origin
	Electronic exchange of Sanitary and Phyto-Sanitary Certificate
	Paperless collection of payment from a documentary letter of credit



The Asia-Pacific Research and Training Network on Trade - ARTNeT - is an open network of research and academic institutions and think-tanks in the Asia-Pacific region. Since its inception, ARTNeT aims to increase the amount of high quality, topical and applied research in the region by harnessing existent research capacity and developing new capacities. ARTNeT also focuses on communicating these research outputs for policymaking in the region including through the ARTNeT Working Paper Series which provide new and policy-relevant research on topics related to trade, investment and development. The views expressed in this publication are those of the authors and do not necessarily reflect the views of the United Nations and ARTNeT secretariat or ARTNeT members.

Readers are encouraged to quote or reproduce material from ARTNeT Working Papers for their own publications, but as the copyright holder, ARTNeT requests due acknowledgement and a copy of the publication.

This and other ARTNeT publications are available from artnet.unescap.org



ARTNeTontrade



@ARTNeTontrade



ARTNeT Group



artnetontrade@un.org

ARTNeT Secretariat, United Nations ESCAP

Rajadamnern Nok Avenue

Bangkok 10200, Thailand

Tel: +66(0) 22881425

Fax: +66(0) 22881027