Asia-Pacific Financial Forum

Digital Trade Finance Lab

Analysis of Financial Institution Trade Transaction Data to Uncover Instances of Goods Misinvoicing to Combat Trade-Based Money Laundering

Results and Recommendations

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1. Introduction

A common method of trade-based money laundering (TBML) is misrepresenting the price of goods by over- or under-invoicing through collusion between trade counterparties. Financial institutions face challenges verifying the correct or reasonable price of goods financed, due to lack of reliable price reference points.[1]

In October 2022, the Asia-Pacific Finance Forum (APFF) Digital Trade Finance Lab and S&P Global Market Intelligence outlined a proposal to create and develop a regulatory sandbox for the identification of price manipulation and misreporting in trade finance transactions. This followed the APFF Digital Trade Finance Lab's publication of the "Combating Trade-Based Money Laundering Whitepaper" in June 2021.[2]

Led by S&P Global Market Intelligence, a Proof of Concept (PoC) was developed in order to test the following core competencies:

- **Use of Private[3] Customs and Government Statistical Datasets (Regulatory Sources):**

  S&P Global Market Intelligence maintains a repository of data from Regulatory Sources such as customs authorities and government statistical departments and compiles pricing data according to HS codes, trade corridor and other criteria. This test would use this data source to validate unit prices reported in FIs' trade finance transactions for consistency with market norms.

- **Standardising Goods Descriptions for Automatic HS Code Assignment:**

  The use of Harmonised System (HS) Codes provides a uniform classification system that facilitates accurate categorisation of goods across borders, ensuring consistency in customs procedures and trade statistics compilation worldwide.[4] Automated assignment of HS codes based on goods descriptions requires accuracy and consistency in classification. This test would use the goods descriptions provided by FIs to automate the assignment of HS Codes thereto.

- **Using Data Available to FIs to Validate Price Discrepancies:**

  Validating price discrepancies helps FIs mitigate risks associated with over- or under-invoicing. This test would evaluate if data commonly available to FIs can be used to validate possible price discrepancies in their trade finance transactions.

A number of commercial banks in the APEC region were approached to participate by sharing their trade data covering non-confidential pricing content which could be tested in the PoC. The data

[1] ICC (2023), Financial crime risk controls – Price checking of goods and services in trade transactions. https://iccwbo.org/news-publications/policies-reports/financial-crime-risk-controlsprice-checking-of-goods-and-services-in-trade-transactions/.
[2] The whitepaper is available as Appendix C in the 2021 Progress Report of APFF, APFIF and APIP. https://www2.abaconline.org/assets/2021_Progress_Report_of_APFF_APFIF_and_APIP_2021-07-22_Final.pdf
[3] The customs and government statistical datasets are generally not public information. S&P Global Market Intelligence consolidates such content in 120+ economies on a monthly basis and categorises this by HS Codes.
[4] The Harmonized System (HS) is developed by the World Customs Organization (WCO). An overview of the HS is provided by the WCO: https://www.wcoomd.org/en/topics/nomenclature/overview.aspx

required included trade corridor, total trade value, quoted currency, goods volume and measurement unit of goods. An analysis of this data would be performed against the relevant Regulatory Sources data available at S&P Global Market Intelligence. The data from banks were extracted from their recent transactions, and compared to S&P Global Market Intelligence's data from the preceding 12 months corresponding to when the banks shared their data.

FIs were given two options: either provide raw data for S&P Global Market Intelligence to perform the analysis via an API endpoint, or conduct the analysis themselves using the PoC user interface, each built specifically for the PoC. The aim of both options was to determine if the bank's dataset of transactional pricing was closely correlated with the corresponding data from the relevant Regulatory Sources. "Relevant" in this context means the geographical jurisdictions of the Regulatory Sources correspond to those defined by the banks' transactional ports of loading and ports of discharge.

This paper presents the findings from the screening of bank trade transaction pricing data. A number of recommendations are included based on a careful analysis of the original source material and data.

2. Methodology

The original trade data for screening was provided by participating banks. They included for each transaction the following:

- goods description
- a total trade value,
- the trade corridor/route (ports of loading and discharge),
- currency of the trade and
- volume or quantity of the goods
- unit of measurement of the goods

An overall collection of actual recent trade transactions from multiple banks was provided and subsequently analysed with a comparative dataset obtained from Regulatory Sources made available by S&P Global Market Intelligence.

The trade data collected from banks was from periods between 2022 to 2023. The pricing data taken from Regulatory Sources (customs and government statistics) were from the period July 2022 to July 2023.[5]

The content was in the format of a series of average values for a particular set of goods organised by the 6-digit HS Code.

Each jurisdiction's value of its goods were in United States Dollar (USD), and where applicable conversion of non-USD local currency into USD was made based on foreign exchange values from the U.S. Federal Reserve. The conversion rates are monthly averages which are calculated from a daily average in each particular month.

[5] Regulatory Sources data is reported on a monthly basis, with a time-lag that differs by jurisdiction.

In order to properly review and assess whether data from Regulatory Sources can be used to identify instances of price misreporting or discrepancies in transactions, a number of metrics and key performance indicators (KPIs) for the PoC were defined:

- Ability for the FI end-user to provide complete data fields necessary to generate a unit price output, for example, does the end-user have all the information required to generate a successful request to the PoC database.
- How many instances in each transaction were any of the required inputs not available (for example, was there a unit of currency or a unit of measurement missing in the FI's trade transaction data), and were there any alternatives that could be used in place of missing data inputs.
- Accuracy assessment, presented as a percentage, of converting a raw goods description to the most appropriate HS code. Was a successful HS code returned for a goods description, how many HS codes returned were incorrect (which ones were correct and incorrect)? Was the HS code returned sufficiently granular e.g., did it resolve to the international 6-digit level? How are vague goods descriptions such as 'Scrap Metal', 'Electronics' and 'Textiles' to be handled in the PoC?
- The percentage of accurately assigning a relevant unit price to the original goods description. Did the unit price for the transactions tested conform to expectations? What were the instances for no data being returned?
- Statistical accuracy of generating a red flag alert for a particular goods description, for example, by using predefined threshold settings, how accurate was an alert relating to the bank's transactional data, what were the instances for false red flags being generated i.e., at what level was the threshold set, and what were the instances for 'real' red flags being returned.

3. PoC Result Analysis and Findings

A number of banks in the Asia-Pacific region participated in the PoC. Following the input instructions, users from each bank were able to test real-world transaction data without disclosing sensitive and confidential information. The PoC did not specify whether the bank trade data relates to the banks' documentary trade transactions or open account trade transactions.

A minimum of 50 transactions were required of each participant to ensure the dataset used was statistically viable.

Results were analysed against the predefined metrics aforementioned. The findings addressing each aspect with testing results from the participating banks are set out below.

A. Results 1 – Availability of Bank Data

In order to return a successful response from the Regulatory Sources database, as a first step in the evaluation of goods for fair pricing purposes, a set of mandatory data fields were required to be input by the participating FI. The dataset comprised:

- Goods Description

- Total Trade Value
- Unit of Measurement
- Currency
- Volume/Quantity
- Port of Loading
- Port of Discharge

In all instances, the banks were able to complete the full list of fields. There were no instances where data was not available, missing or unusable. Data provided by the banks was also complete and did not have any missing datapoints or fields.

An example of a successfully completed transaction is included here.

Input Values, provided by participating bank –

Goods	Total Trade Value	Currency	Volume	Unit of Measure	Unit Price*	Load Port	Discharge Port
16/1 100PCT COTTONOE YARN UNWAXED FOR WEAVING (CONTAMINATION FREE) ORIGIN : MALAYSIA	223488.7	USD	107446.5	KGS	2.08	PORT KLANG, MALAYSIA	NINGBO PORT, CHINA

**Unit Price was determined by the PoC software as a calculation based on the bank's input data from 'Total Trade Value' and 'Volume'.*

Output Values, generated by the S&P Global Market Intelligence dataset –

HS Code*	HS Code Description	Unit Price Exporter (Malaysia)**1**	Unit Price Importer (China)**2**	Measure	Price Variation Exporter (Malaysia)**3**	Price Variation Importer (China)**4**
520512	Cotton Yarn Nesoi, 85% Or More By Weight Of Cotton, Not Put Up For Retail Sale, Single Uncombed Yarn, Over 14 Nm But Not Over 43 Nm	2.34	2.35	KG	-11.11%	-11.49%

**HS Code and its corresponding description were automatically generated by the PoC algorithm via an evaluation of the 'Goods Description' input field,*
1 and 2. Unit Price was populated by lookup of the HS Code for both Malaysia and China and returning the latest average value for these goods

3 and 4. Price Variation for both economies is determined through a calculation between the unit price from each Regulatory Sources and the unit price provided by the bank end-user

B. Results 2 - HS Code Attribution

The results of the HS Code attribution analysis are summarised in the table below. Out of all transactions data provided by banks, 80% successfully mapped the goods description to an HS Code. Among these transactions, 93% were classified at the internationally recognised 6-digit level, with 74% of these classifications confirmed to be accurate via manual review. A smaller number of goods descriptions were classified at the 4-digit level and 8-digit levels, predominantly aligning with the correct HS Code.

Attribute	**Percentage**
Successfully mapped to a HS Code	80%
Failed to map to a HS Code	20%

Of the Mapped HS Codes:	**Percentage**
Mapped to 6-digit HS Code	93%
Correct at 6-digit Level	74%
Incorrect at 6-digit Level	18%
Mapped to 4-digit HS Code	6%
Correct at 4-digit Level	5%
Incorrect at 4-digit Level	1%
Mapped to 8-digit HS Code	1%
Correct at 8-digit Level	1%

An example of a correctly mapped goods description to an HS Code

Goods Description	Automated HS Code	Automated HS Code Description
USED 'SUMITOMOSH135X-3B EXCAVATOR BRAND: SUMITOMO MODEL: SH135X-3B SERIAL NO. SMT135X3E00SC8108 CC:4300 ENGINE NO. 4BG14JJ1161690	8429.52	Mechanical Shovels, Excavators And Shovel Loaders With 360 Degree Revolving Superstructure, Self-Propelled

Goods description incorrectly mapped at the 6-digit level were due to the goods description being vague, the descriptions containing sets of goods which were not easily identifiable, or the use of unfamiliar acronyms such as 'HMC' for Heavy Mineral Concentrates, consequently returning incorrect HS Codes. All cases of automatically assigned HS Codes underwent manual review to assess overall accuracy using a 'best effort' method which analysed the goods description and aligned it to a 6-digit HS Code from the Harmonised System.

For descriptions mapped only to 4-digit HS codes, which could be too broad to be used for determining the unit price for the exact goods, they were mostly due to the input description being overly generic. For example, an input containing "steel beam" was mapped to HS code 7308 - STRUCTURES NESOI & PARTS THEREOF, OF IRON OR STEEL. While this mapping is correct, there are a series of sub-categories under HS 7308 defined by specific steel parts, shapes or other particulars which may result in a high degree of variation in unit price.

C. Results 3 – Unit Price Accuracy

Of all the trade transactional details provided by participating banks, 81% generated a unit price output. This accuracy is determined by comparing the unit price for the goods as input by the bank and the relevant, comparative jurisdiction's unit price derived from the respective Regulatory Sources.

In order to achieve this accuracy for this metric, a number of attributes need to align between the bank input data and the Regulatory Sources dataset. The unit of measurement must be the same in both cases, for example, if goods are classified in kilograms in the Regulatory Sources, then this also needs to be the case in the banks initial input to ensure the goods are comparable. In some cases, there are differences but many of these can be covered by unit conversion factors such as kilograms to pounds. Equally, a HS Code must also be automatically attributed to a goods description, this HS Code can then be used to access the jurisdiction's specific Regulatory Sources data in regard to the load and discharge port (trade route or corridor). The currency of the trade transactions provided by a bank were generally quoted in United States Dollars (USD). There were a small number of cases where values were provided in other currencies such as Japanese Yen (JPY), United Kingdom Pounds (GBP) or Euro. To ensure a standard base from which to compare data, all currencies were converted to USD, using the latest conversion rate for the data on which trade transaction data was submitted. Similarly, all unit conversions for weight and measurement were converted where required.

With correctly returned and comparative data, an analysis could take place on the unit prices calculated from Regulatory Sources with those from the banks transactional trade data. This comparison found that 67% of price values from the Regulatory Sources dataset fell within a 30% -/+ band of the banks original content. 52% of the unit prices returned by Regulatory Sources data were within a 15% -/+ band of the banks input dataset. This would imply a good standard of accuracy, of both the automatically generated HS Code and the corresponding data returned from the relevant customs authority especially with a 30% threshold level setting. A 30% threshold is applied at both sides of the transaction price value, for example, a trade value of goods at $100 would mean that the over-and-under threshold limit would range between $70 and $130. If the

goods value entered by the FI breached these two bands, a red flag alert would be displayed. A threshold lower than 30% would result in a higher degree of potential false positives requiring a greater degree of manual review for each incorrect hit. Additionally, the 30% threshold can be altered, higher or lower, dependent on the FIs risk profile and the nature of the goods being financed.Some examples of unit prices generated by the Regulatory Sources fell outside of the 30% threshold band. The reasons for this were due to; multiple goods listed in the goods description or a mismatch between the units of measurement described by Regulatory Sources and the bank, for example, one describes in kilograms and the other in litres. In such a circumstance a conversion factor is not available.

There were a small number of instances where the unit price from Regulatory Sources and that from a bank was widely different. There are two examples where this should be clarified.

Example 1

A stainless-steel consignment between Malaysia and India provided a unit price on the bank side of US$1,470 but from Malaysia Regulatory Sources it was expressed as US$529, giving a difference of 177%. This discrepancy could be explained as an anomaly as Indian Regulatory Sources recorded a value for this type of good as US$1,362, providing a price difference of only 8%. Further investigation would be needed into the price values from Malaysian Regulatory Sources to identify a potential cause.

Example 2

Other instances exist where a large price variation occurs between Regulatory Sources and bank data. A shipment of palm oil was determined to be priced per kilogram at US$1.41 according to a bank's transactional data but Regulatory Sources had quoted an average price of US$0.81 and US$0.91 (import and export Regulatory Sources' values). The difference in percentage terms as 73% appears large but in the overall context of the low value of the goods it could be viewed as potentially valid.

D. Results 4 – Vague Goods Descriptions, Multiple Goods

A number of transactions submitted by banks included vague goods descriptions such as 'Inorganic Chemicals' or 'Auto Spare Parts'. As these are the defined inputs by banks and are received through trade documents there is little opportunity to request for better or more detailed descriptions. In both cases a relevant 6-digit HS Code could be returned by the PoC model, largely due to the match between keywords in the goods description such as 'Auto' and 'Chemical'.

The overall correctness of the 6-digit HS Code cannot be validated in whole due to the multiple variations of inorganic chemical entries in the HS Code schema. Selecting or defining the correct HS Code is challenging for those goods descriptions with non-granular, high-level descriptions.

Auto spare parts as a goods description also has the same challenges due to the numerous instances of the 4-digit HS Code covering '8708 - Parts And Accessories For Tractors, Public-Transport Passenger Vehicles, Motor Cars, Goods Transport Motor Vehicles And Special Purpose

Motor Vehicles'. Under this HS Code there are multiple categories of auto parts each separated by component such as brakes, bumpers, wheels, clutches. Identifying the correct 6-digit HS Code from the term 'Auto Spare Part' can result in a significantly different unit price returned by the Regulatory Sources.

4. Conclusion and Recommendations

The PoC has successfully outlined a way forward for the identification of price discrepancies in trade documents. While not being 100% accurate it does offer a sense of completeness and consistency when merging valuable datasets from the private sphere. One of the constant refrains from those tasked with the identification of underlying over-and-under-price invoicing is the lack of reliable data sources. Content largely used today for managing price discrepancies consists of e-commerce websites and other free-to-air services which do not always have the most up to date price values, ease of search or integrated access into bank platforms.

The availability of data from Regulatory Sources adds a degree of standardisation and reliability in terms of content and accuracy. The data from Regulatory Sources is always logically organised by the use of HS Codes. As HS Codes are not always documented in letters of credit, documentary collections, invoices and other documents in international trade, a method of connecting one data source (HS Code) to the other (trade document) has always been an issue for banks and how they can move forward with this. An automated solution, proposed here to translate goods description to a HS Code, is now workable but as a key component in this exercise it needs frequent attention to ensure its reliability and suitability.

Therefore, a number of recommendations are provided as an outcome of the PoC outlined in this document.

Priority	Recommendation Description
High	Mapping Goods Description Correctly to a HS Code - A feedback loop to learn from acronyms and the multiple ways in which goods can be described is an important future enhancement. 'HMC' for Heavy Mineral Concentrates is an example where certain terminology should be used to train the algorithm when mapping a goods description to a HS Code. Additionally, descriptions featuring metals such as TiO2 which incorrectly became assigned to an inorganic chemical rather than a base metal. Examples such as this can be corrected via manual review and loaded back into the models algorithm for future improvements. It is not recommended that FIs need to capture HS Codes from their trade documents or to assign a HS Code manually. An automated process to standardise the goods description and resolve it to the most appropriate HS Code would ensure overall time and resource savings.
High	The ability to override an automatically assigned HS Code for a goods description. In cases evaluated within the scope of this PoC, a number of auto-generated HS Codes were incorrect for a variety of reasons. The ability for FI users to change this to a more relevant HS Code manually would be required.

High	Historical Regulatory Sources data is needed to ensure that seasonality and other price spikes can be 'smoothed' so that anomalies do not cloud overall judgement when using data from Regulatory Sources.
High	As evidenced in several samples, the data received for a particular trade corridor from the respective Regulatory Sources varies depending on the origin and destination as the costs of freight and insurance can differ. FIs should consider such costs when evaluating the price discrepancy.
High	Resolving mismatches between user-input units of measurement and how they are captured by Regulatory Sources. In some instances, a bank's input would be in 'm2' but the Regulatory Sources data express values only in 'units' or 'sets'. A solution for how such unit conversions can be resolved, where no such conversion factor exists, requires further investigation.
Medium	Price values from a data source such as a customs authority must be considered alongside the risk appetite of the FI. The range of values available for a set of goods must be evaluated by the FI in accordance with a tolerance band or threshold level. A threshold level can generate a red flag in regard to an overall indicator for price discrepancy. In the context of the PoC findings documented in this paper, the setting could be set at 30%. This would be a recommendation across all goods and their corresponding HS Codes.

Manual input of information should be automated to reduce expensive resourcing and human errors. A proactive approach of screening all transactions against a repository of Regulated Sources data helps FIs identify potential TBML activities, maintain regulatory compliance and protect themselves against reputational and financial risks.

Whilst this paper addresses price screening from the perspective of financial institutions, it should be recognised that the effort to determine under-and-over invoicing should not rest entirely with FIs. The main Regulatory Sources used in this PoC to understand price for a range of goods originates from customs and government statistical authorities. The ownership of such content implies a shared objective across the trade finance and supply chain sector where organisations and firms with access to shipping data and associated documents can play a crucial role in bringing together the constituent sections of the trade process through the sharing of data, therefore, to be better enabled in identifying illicit financial flows.

This PoC pricing comparison was between the banks' trade data and generic data sets over a certain period from Regulatory Sources. More precision could be achieved by cross-reference with actual customs filings by the bank customer. An example of this possibility is the Singapore Customs' service called Trade Finance Compliance (TFC) Service on the Networked Trade Platform, which allows banks to perform price checks at two levels: (1) generic, based on anonymised data; and (2) trader-specific, based on the trader's customs submissions. An FI user of TFC can access the former without consent from the trader, but trader-consent is needed for the latter.[6] This layered approach by Singapore

[6] Succinct information on the TFC: https://www.customs.gov.sg/news-and-media/media-releases/2019-09-05-media-release.pdf

Customs underscores the importance of integrating various data sources and regulatory frameworks to enhance the accuracy and reliability of price screening for their trade finance transactions.

Financial institutions can utilise their own internal data accumulated over time to create their own repository of historical pricing data on trade transactions they have processed. Such data can be cross-referenced with external data such as those available from regulatory sources and commercial sources. FIs might also be able to share their own data within the FI community. These elements combined would make for a robust goods pricing check capabilities to combat TBML.

Systematic price checking does not ensure zero failure, as information whether from Regulatory Sources, the service provider or FI user may not be perfect. However, it is still useful because it reduces the risk of TBML detection failures. Whilst the information from Regulatory Sources and users may not be perfect and can result in false hits and false negatives, the implementation of such systematic checks ensures continuous monitoring of data points against suspicious or unusual transactions. Having screened all transactions, FIs are enabled to take a risk-based approach by focusing only on red flags where the risks are higher, and also avoid indiscriminate de-risking through scaling down of client coverage or trade financing activities.

Without doubt, the conversation on what can be done to enable efficient, cost-effective and effective pricing checks to combat TBML will extend beyond this paper.

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