Misreported Trade

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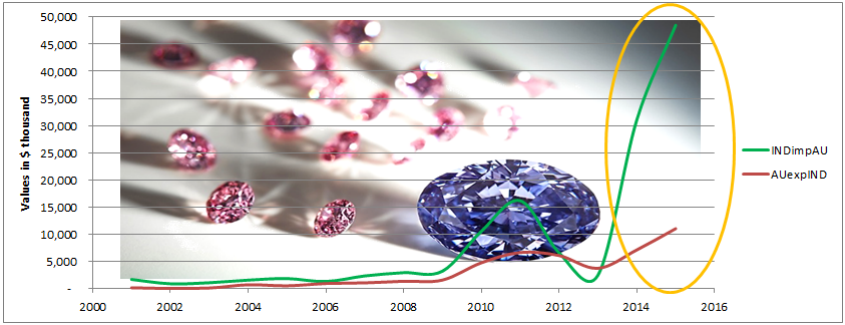
Key Points

- Proposes a novel methodology to measure misreported trade that does not rely on any *ex ante* assumptions of reliability.
- Provides both a ranking of countries and products by the degree of misreporting.

Motivation

Are trade data misreported?

Australian export of Diamonds to India reported by Australia and
Indian import of Diamonds from Australia reported by India, 2001-2015



- Strong empirical evidences of both under- and over- reporting of export and import values and quantities (e. g., Feenstra et al., 1999; Ferrantino et al., 2012)

Motivation

Why is trade data misreported?

- Importers: Tariff and VAT evasion, income tax avoidance, capital flight/money laundering etc.
- Exporters: Avoidance of capital control, income tax and VAT evasion, misappropriation of export support etc. (Bhagwati, 1964; 1967)

Why do we care about misreporting of trade data?

- Puts legitimate business at a comparative disadvantage
- Misleading impact estimations, inappropriate policy interventions and trade negotiations
- Influence democratic decision making process

Previous findings

How does empirical literature measure misreporting of trade?

- Focused on underlying motivations of misreporting
  - Tariff/tax evasion (Fisman and Wei, 2004; Ferrantino et al, 2012)
  - Capital flight or money laundering (Bhagwati,1967; and Kar and Spanjers, 2014)
- Broadly divided in two groups based on the methodologies used:
  - simply the differences of reported mirror trade flows (e.g., Morgenstern et al., 1963; Bhagwati, 1964; Sheikh, 1974, among others),
  - the difference in logarithms of bilateral mirror trade flows (Fisman and Wei, 2004; Ferrantino et al., 2012).

Our contribution

What are the gaps?

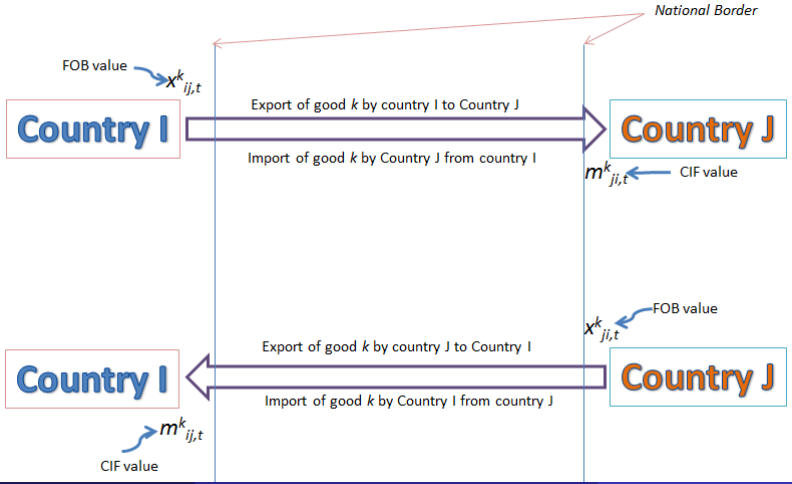
- Only capture the trade reporting gap
- Biased assumption that one country (developed) reporting accurately, whereas the other is not!
- Focused on bilateral trade partners or few selected county groups

How does this study aim to contribute?

– To objectively derive a trade misreporting index that is:
  - non-discriminatory (i.e., without *a priori* definition of one country's reports as more credible than another's),
  - scale-independent (i.e., independent of country, economy, and population size), and
  - comparable across countries and over years.

Measurement of Misreported Trade Data

How is trade data reported?



Measurement of Misreported Trade Data

Example:

- In a given year Brazil reports exporting $100 million worth of coffee to Tunisia;
- however, Tunisia reports only $60 million worth imports of coffee from Brazil.

Who is misreporting?

- Assume Brazil reported total export in that year is $1,060 million; and
- all its partners reported all imports from Brazil is $1,180 million in aggregate;
- Suppose the total absolute reporting distance between Brazil and their counterparts' numbers is $520 million.

In this case, the *export weighting factor* (EWF) for Brazil is:

$$1 - \frac{520{,}000}{1{,}060{,}000+1{,}180{,}000} = 0.768.$$

Step 1: Deriving Weighted Trade Values

Export Weighting Factors (EWFs):

$$(EWF)_s^x = 1 - \frac{\delta_{sD}^K}{X_{sD}^K + M_{Ds}^K}. \quad (1)$$

where,
X_{sD}^K = total reported exports of all products by each exporter to all destinations

M_{Ds}^K = total reported imports of all products by all importers from a single country

δ_{sd}^k = the sum of 'absolute reporting distance' of each product measured as the difference of reported export value from its mirror import value

Intuitively, the closer the *EWF* comes to zero, the more misreporting we detect; as the *EWF* approaches one, less misreporting is detected.

Step 1: Deriving Weighted Trade Values

Example:

- Assume Tunisia reported total import in that year is $880 million; and
- all its partners reported all exports to Tunisia is $1,360 million in aggregate;
- Suppose the total absolute reporting distance between Tunisai and their counterparts' numbers is $720 million.

Import Weighting Factors (IWFs)

Similar to EWF, the *import weighting factor* (*IWF*) for Tunisia, in above example is:
$1 - \frac{720{,}000}{880{,}000+1{,}360{,}000} = 0.679.$
Formally, the *IWF* can be derived analogously to equation 1 with

$$(IWF)_d^m = 1 - \frac{\delta_{dS}^K}{M_{dS}^K + X_{Sd}^K} \tag{2}$$

Step 1: Deriving Weighted Trade Values

Calculating Weighted Trade Values

Derive weighted export value of each product, as:

$$\widehat{x}_{sd}^{k} = \frac{(EWF)_{s}^{x}}{(EWF)_{s}^{x} + (IWF)_{d}^{m}} \times x_{sd}^{k} + \frac{(IWF)_{d}^{m}}{(EWF)_{s}^{x} + (IWF)_{d}^{m}} \times m_{ds}^{k}. \tag{3}$$

Example: Predicted export of coffee from Brazil to Tunisia becomes:
$(\frac{0.768}{0.768+0.679} \times 100,000 + \frac{0.679}{0.768+0.679} \times 60,000) = \$81,230$

Likewise, calculate predicted import values:

$$\widehat{m}_{ds}^{k} = \frac{(IWF)_{d}^{m}}{(IWF)_{d}^{m} + (EWF)_{s}^{x}} \times m_{ds}^{k} + \frac{(EWF)_{s}^{x}}{(IWF)_{d}^{m} + (EWF)_{s}^{x}} \times x_{sd}^{k}. \tag{4}$$

Step 2: Constructing Trade Misreporting Indices

Export Misreporting Index(EMI)

Find the misreported export value for each product as:

$$\tilde{x}_{sd}^{k} = x_{sd}^{k} - \hat{x}_{sd}^{k}. \tag{5}$$

Calculate overall export misreporting index for each source country:

$$EMI_{s}^{x} = \frac{\tilde{X}_{s}^{K}}{\tilde{X}_{s}^{K} + X_{s}^{K}}. \tag{6}$$

where,

$\tilde{X}_{s}^{K}$= total absolute misreported export value, measured as: $\sum_{k=1}^{K} \sum_{d=1}^{D} |\tilde{x}_{sd}^{k}|$.

Step 2: Constructing Trade Misreporting Indices

Export Under-reporting Index (EUIs)

$$EUI_s^x = \frac{\underline{X}_s^K}{\underline{X}_s^K + X_s^K}. \tag{7}$$

where, $\underline{X}_s^K$ = total under-reported export value, measured as: $\sum_{k=1}^{K} \sum_{d=1}^{D} |\underline{x}_{sd}^k|$

Export Over-reporting Index (EOIs)

$$EOI_s^x = \frac{\overline{X}_s^K}{\overline{X}_s^K + X_s^K}. \tag{8}$$

where, $\overline{X}_s^K$ = total over-reported export value, measured as: $\sum_{k=1}^{K} \sum_{d=1}^{D} |\overline{x}_{sd}^k|$

Step 2: Constructing Trade Misreporting Indices

Similarly, three distinct **import misreporting indices** can be estimated:

(i) the overall import misreporting index (IMI_d^m),
(ii) the import under-reporting index (IUI_d^m), and
(iii) the import over-reporting index (IOI_d^m).

Trade Misreporting Index (TMI)

$$TMI_{it} = \frac{\tilde{X}_s^K + \tilde{M}_d^K}{(X_s^K + M_d^K) + (\tilde{X}_s^K + \tilde{M}_d^K)}. \tag{9}$$

Trade data

- Trade data form a single source: the UNcomtrade through WITS
- Some robustness tests performed while deriving the indices:
  - Aggregated vs. disaggregated trade data; and rationale of using trade data at the HS 4-digit level
  - Applicable to any level of precision.
  - IMF recommended CIF/FOB conversion factor 1.06 (robust to other conversion factor e.g. 1.10)
  - The role of entrepôt trade
  - Whether the indices are influenced by 'neighborhood' effects.
- Use bilateral trade data reported by 160 WTO members from 1996 to 2015, which gives 58,515,054 pairs of mirror trade data

Country Rankings

Top and bottom ten countries in 2015 for trade misreporting index (*TMI*).

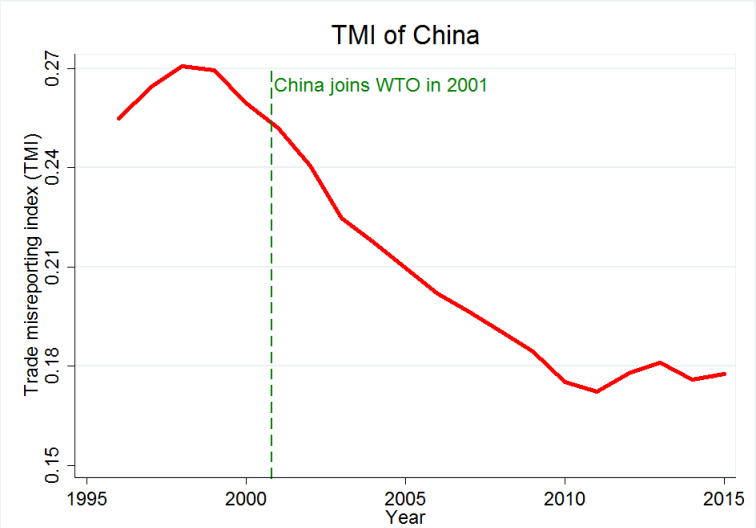
Top 10 Misreporting Country			Bottom 10 Misreporting Country		
Rank		Trade misreporting index	Rank		Trade misreporting index
1	Togo	0.784	118	Brazil	0.154
2	Antigua and Barbuda	0.713	119	Japan	0.148
3	Panama	0.712	120	Germany	0.144
4	Afghanistan	0.636	121	Italy	0.140
5	Malta	0.614	122	Argentina	0.137
6	Benin	0.613	123	United States	0.133
7	Kuwait	0.592	124	Mexico	0.133
8	Sierra Leone	0.561	125	Chile	0.124
9	Solomon Islands	0.494	126	Peru	0.123
10	Niger	0.481	127	Canada	0.098

Which Products are most prone to Trade Misreporting?

Top five misreported product groups (at HS 2-digit product groups) are:

- Ships, boats and floating structures (Chapter 89),
- Arms and ammunition, parts and accessories thereof (Chapter 93),
- Works of art; collectors pieces and antiques (Chapter 97),
- Aircraft, spacecraft and parts thereof (Chapter 88); and
- Nickel and articles thereof (Chapter 75)

Trade Misreporting: The Case of China



Trade Misreporting: The Case of China

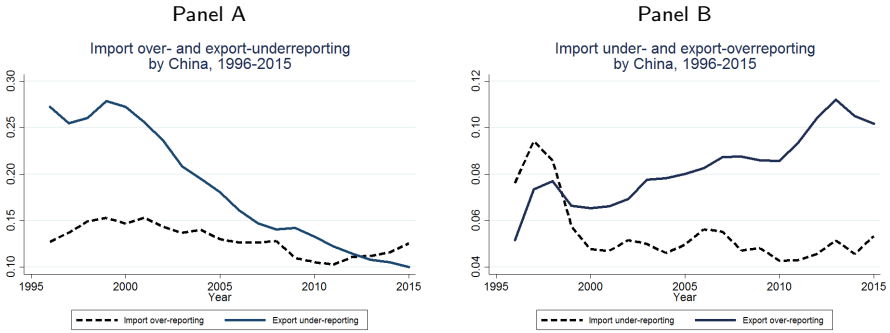


Figure: Different trade misreporting indices for China from 1996 to 2015.

Tariffs, VAT Rates, and Under-Reporting Imports

- Present empirical application of the import under-reporting index, using panel data set of 107 countries from 1996-2015. Specification
- Economic intuition, as well as several country-specific studies, suggest that larger tariff or VAT rates should increase importers' incentives to under-report in order to avoid taxation.
- Indeed, results provide evidence consistent with that hypothesis on a global level, even after accounting for a list of potentially confounding factors, as well as country- and year-fixed effects. Results

Key Takeaways

- A new and objective methodology to measure trade misreporting which incorporates full range of available data
- The indices are comparable across countries and over time
- As shown by the case study and empirical application, the proposed indices can be of value for different empirical analysis
- Overall misreporting shows decreasing trend over time; however, specific types of misreporting is still very much exist and need to be considered; and
- There should be continued effort to improve the accuracy of trade reporting.

Thank you!

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Tariffs, VAT Rates, and Under-Reporting Imports

Econometric specification:

$$IUI_{i,t} = \beta_0 + \beta_1 \left(Tariff\right)_{i,t} + \beta_2 \left(VAT\right)_{i,t} + \mathbf{X}_{i,t}\gamma + \alpha_i + \omega_t + \varepsilon_{i,t}, \tag{10}$$

where,

- $URI_{i,t}$ refers to the import under-reporting index for country i in year t,
- $\left(Tariff\right)_{i,t}$ measures the trade-weighted applied tariff rates for all products from all countries to each importing country i at time t,
- $\left(VAT\right)_{i,t}$ represents the value added tax rates applicable to all imports by the importing country,
- $\mathbf{X}_{i,t}$ constitutes a vector of other observable country characteristics, specifically: (i) capital account openness, (ii) trade openness, (iii) democracy, and (iv) corruption,
- α_i and ω_t represent country- and time-fixed effects
- whereas $\varepsilon_{i,t}$ represents the usual error term. Application

Empirical results

Predicting the import under-reporting index (*IUI*) with tariff and VAT rates. Application

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Import under-reporting index (mean=14.90)						
Tariff	0.654		0.733	0.548	0.222	0.195
	(0.097)***		(0.100)***	(0.104)***	(0.084)***	(0.087)**
	[0.261]**		[0.263] ***	[0.257]**	[0.084]***	[0.087]**
VAT		0.317	0.411	0.423	0.192	0.202
		(0.057)***	(0.064)***	(0.066)***	(0.065)***	(0.064)***
		[0.153]**	[0.162]**	[0.165]**	[0.065]***	[0.064]***
Control covariates				Yes	Yes	Yes
Country-FE					Yes	Yes
Time-FE						Yes
# of countries	107	107	107	107	107	107
# of years	20	20	20	20	20	20
Observations	1,344	1,344	1,344	1,344	1,344	1,344

Robust standard errors are displayed in parenthesis, whereas standard errors clustered by reporting country are listed in brackets.