Bilateral Trade Asymmetries in Asia Pacific

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Abstract

International Merchandise Trade Statistics have a wide variety of applications, including the measurement and analyses of important macroeconomic variables. It is therefore crucial to ensure their reliability and consistency. Asymmetries in bilateral trade flows have been a long-standing concern of trade analysts. It is rarely the case that the exports reported by country A to B match the imports reported by country B from A. While these asymmetries will never be entirely eradicated, an understanding of the nature of asymmetries among bilateral trade partners can aid in minimizing inconsistencies and improving reliability of trade statistics. This paper analyzes bilateral trade asymmetries in fifteen Asia Pacific economies, characterizing the direction and magnitude of discrepancies and providing an overview of the possible sources of asymmetries for the unique case of Hong Kong, China and Singapore. The paper also presents the methodology used by the Asian Development Bank (ADB) in harmonizing bilateral trade flows in its Multiregional Input Output Table (MRIOT).

Keywords: bilateral trade asymmetries, international merchandise trade statistics, mirror trade data, multiregional input output tables

1. Introduction

Bilateral trade statistics are two sides of the same coin. In an ideal world where perfect information is available, the value of exports reported by country A to country B should be equal to the value of imports reported by country B from country A. However, underlying differences in capabilities and estimation practices of statistical bodies make asymmetries in bilateral trade flows virtually unavoidable. Asymmetric bilateral trade has been an issue in international statistics since it was first recorded in the early nineteenth century. Understanding the nature and sources of these asymmetries is the first step towards addressing and reconciling consistency challenges in the reporting of official trade statistics.

This paper characterizes trade asymmetries among Asia Pacific economies and presents the methodology used by the Asian Development Bank (ADB) in addressing bilateral asymmetries in the ADB Multiregional Input-Output Tables (MRIOT). The paper is structured as follows: Section 2 defines a measure of bilateral trade asymmetries commonly used in trade literature, Section 3 presents the results of a case study of trade asymmetries among Asia Pacific economies and identifies potential sources of inconsistencies, and Section 4 discusses the reconciliation method used in constructing bilateral trade matrices in the ADB MRIOTs. This paper only covers asymmetries in trade in goods, although the similar issues concern trade in services.

2. Measuring Bilateral Trade Asymmetries

Literature defines some measures of bilateral trade asymmetries derived from *mirror statistics,* a comparison of two estimates of a single trade flow. One commonly used measure of trade asymmetry is called the *bilateral trade discrepancy index* or *DIF* (Guo, 2010). This index reveals the magnitude and direction of trade asymmetries and can ultimately be used to detect sources of inconsistencies in reported statistics. The DIF

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expresses the difference in mirror data between economies A and B as a proportion of the value reported by the importing economy. The index is formally defined as:

$$DIF^{AB} = \frac{M^{AB} - E^{AB}}{M^{AB}}$$

M^{AB} is the value of imports reported by economy B coming from economy A, while E^{AB} is the value of exports reported by economy A going to economy B. The flow of goods is represented by the order of the superscripts – A is the source or exporting economy while B is the destination or importing economy.

The degree of asymmetry between an economy of interest and any of its trade partners may be measured in two ways, one from the perspective of the reporting economy as an exporter and the other as an importer. The discrepancy index of reporting economy A as an exporter, $DIF(E)^A$, is equal to the discrepancy index of its partner economy B as an importer, $DIF(I)^B$. Similarly, the index of economy A as an importer, $DIF(I)^A$, is equal to the index of economy B as an exporter, $DIF(E)^B$.

Table 1 presents the two variations of the DIF for economy A and introduces general deductions that can be made based on the size and sign of the indices.

Table 1. Interpretations of the bilateral trade discrepancy index

Flow of goods	Country A → Country B	Country B → Country A
Index	$DIF(E)^A = \frac{M^{AB} - E^{AB}}{M^{AB}} = DIF(I)^B$	$DIF(I)^A = \frac{M^{BA} - E^{BA}}{M^{BA}} = DIF(E)^B$
Positive (+)	reported exports < reported imports • A is under reporting exports to B • B is over reporting imports from A	reported exports < reported imports • B is under reporting exports to A • A is over reporting imports from B
Negative (-)	reported exports > reported imports • A is over reporting exports to B • B is under reporting imports from A	reported exports > reported imports • B is over reporting exports to A • A is under reporting imports from B

Source: Asymmetries in International Merchandise Statistics (Javorsek, 2016).

Literature suggests that a DIF not exceeding 20% in absolute value is still considered small enough to be accurate (Gelhar, 1996).

3. Trade Asymmetries in Asia Pacific Economies

Using the index defined above, trade asymmetries among a sample of 15 Asia Pacific economies[2] are observed from years 2010-2019. Statistics obtained from the United Nations Comtrade database are used to calculate discrepancy indices for 210 bilateral trading relationships. Export data is valued free-on-board (FOB), while import valuation includes cost, insurance, and freight (CIF).

In 2019, total trade asymmetry from the 15 economies amounted to approximately USD 867 billion, equivalent to around 26.86% of total trade within the region. The top sources of asymmetries are East Asia and Southeast Asia, subregions that are highly trade-oriented. Approximately 39% of total trade asymmetry from the 15 economies can be attributed to Hong Kong, China. The second and third largest sources of asymmetry are the People's Republic of China (PRC) and Singapore, accounting for 14% and 11% respectively.

Figures 1 and 2 present a matrix-like visualization of discrepancy indices for each of the 210 bilateral trading relationships. Examining the tables row-wise shows discrepancy indices of the economies as exporters, while looking at the tables column-wise shows discrepancy indices of the economies as importers. To maintain the readability of the tables, DIFs with absolute value of less than 20% are kept translucent. In 2010, 99 out of the 210 trading combinations had discrepancy indices greater than 20% in absolute value. That is, out of 210

[2] East and Northeast Asia: Hong Kong, China, Japan, Republic of Korea, People's Republic of China; Southeast Asia: Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, Thailand, Viet Nam; South and Southwest Asia: India, Turkey; Pacific: Australia, New Zealand

bilateral trade relationships among 15 economies, 47% showed inconsistencies in reported import and export values. By 2019, this decreased to 78 out of 210 or 37% of bilateral trade flows in the region.

Figure 1. Bilateral Discrepancy Indices
Selected Economies in the Asia Pacific Region, 2010

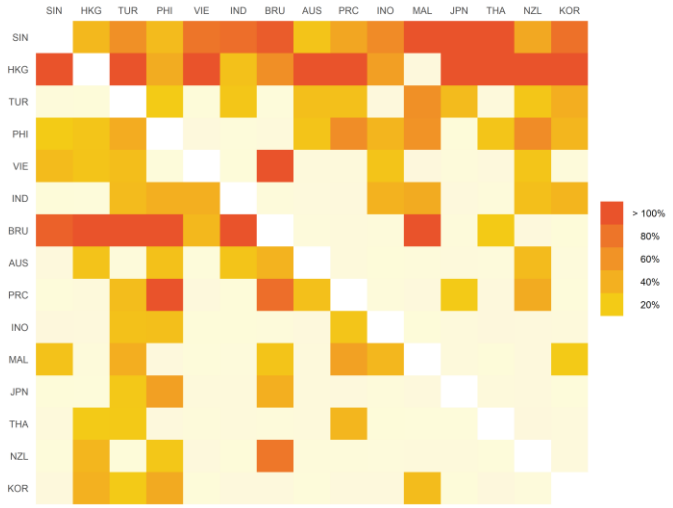
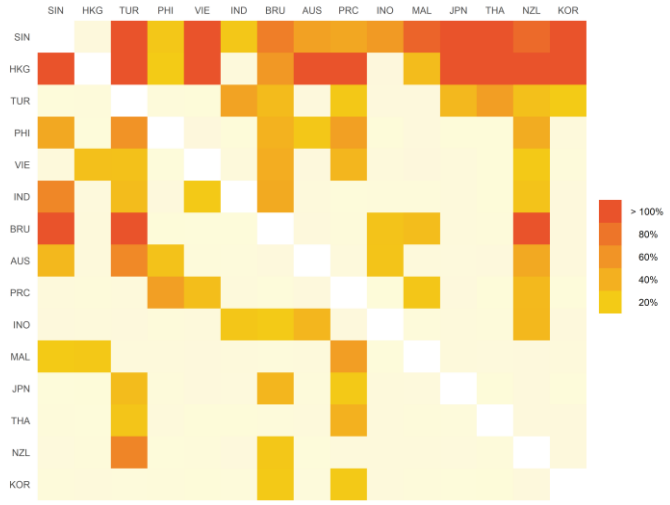


Figure 2. Bilateral Discrepancy Indices
Selected Economies in the Asia Pacific Region, 2019



SIN = Singapore; HKG = Hong Kong, China; TUR = Turkey; PHI = Philippines; VIE = Viet Nam; IND = India; BRU = Brunei Darussalam; AUS = Australia; PRC = People's Republic of China; INO = Indonesia; MAL = Malaysia; JPN = Japan; THA = Thailand; NZL = New Zealand; KOR = Republic of Korea.
Source: UN Comtrade Database (accessed May 2021); Authors' estimates.

Some economies like the Republic of Korea and Thailand show minimal asymmetries from both exporter and importer perspectives. In 2019, Republic of Korea as an exporter only had two bilateral trade partners with DIFs exceeding 20% - Brunei Darussalam and PRC. As an importer, high DIFs were recorded only for Singapore, Hong Kong, China, and Turkey. This suggests that the Republic of Korea's data recording and estimation processes are more or less aligned with majority of its trade partners. The same can be observed for Thailand.

In contrast, some economies exhibit high discrepancy indices in one of the two perspectives. For instance, PRC showed high importer DIFs for 9 out of 14 bilateral trade flows in 2019. Going back to the interpretations of the DIF in Table 1, this suggests overestimation of PRC's reported imports or underestimation of exports reported by trade partners. Another interesting case is the exporter DIFs of Hong Kong, China and Singapore. For 2010 and 2019, the two economies recorded DIFs greater than 20% for almost all of their trade partners. The magnitude of the discrepancy indices decreased in 2019, but export DIFs of the two economies remained to be the highest out of the 15 economies.

To paint a more complete picture of the nature of asymmetries among bilateral trade flows in Asia Pacific, Figures 3 and 4 chart the distribution of discrepancy indices of each of the 15 economies from 2010-2019 using standard box plots. Results reveal that asymmetries for most economies appear to be manageable in the sense that at least half of calculated DIFs for the last 10 years fall within the threshold of ± 20%. Japan, Republic of Korea, Indonesia, and Thailand have had particularly low and stable discrepancy indices across the years, from both exporter and importer perspectives. In contrast, Hong Kong, China and Singapore reveal larger and more dispersed DIFs.

In particular, Singapore shows rather extreme values. In the last decade, 75% of bilateral trade flows involving Singapore as an exporter had discrepancy indices between -40 to -90. This means that for majority of trade partners, exports reported by Singapore were 40 to 90% higher than the values reported by importing economies. For Hong Kong, China, 50% of export discrepancy indices fell between -20 to -85 in the last decade. This means that for half of its trade partners, exports reported by Hong Kong, China were 20 to 85% higher than the values reported by importing economies.

Figure 3. Distribution of Export DIFs
Selected Economies in the Asia Pacific Region, 2010-2019

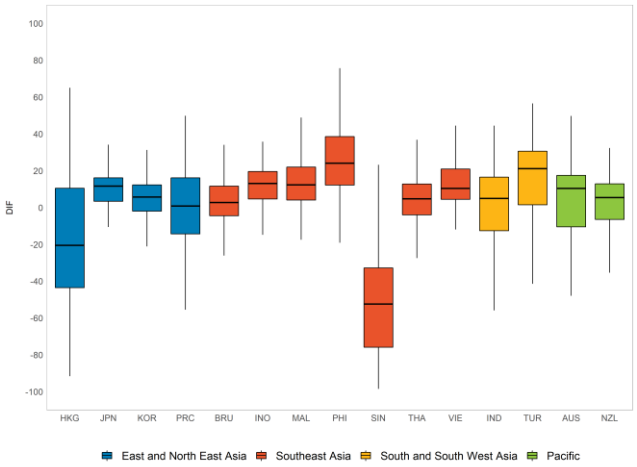
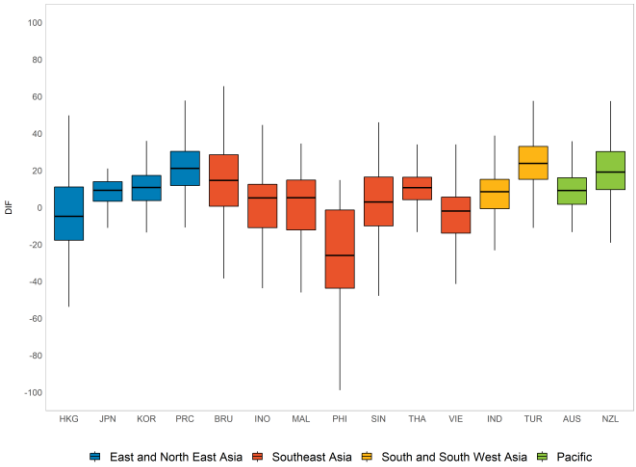


Figure 4. Distribution of Import DIFs
Selected Economies in the Asia Pacific Region, 2010-2019



HKG = Hong Kong, China; JPN = Japan; KOR = Republic of Korea; PRC = People's Republic of China; BRU = Brunei Darussalam; INO = Indonesia; MAL = Malaysia; PHI = Philippines; SIN = Singapore; THA = Thailand; VIE = Viet Nam; IND = India; TUR = Turkey; AUS = Australia; NZL = New Zealand.
Source: UN Comtrade Database (accessed May 2021); Authors' estimates.

Literature identifies several possible sources of asymmetries in mirror trade statistics. In the case of Hong Kong, China and Singapore, large asymmetries as exporters are in part a consequence of the economies' strategic position as major trade and transshipment hubs in Asia. As seen in Figure 3, majority of the two economies' exporter discrepancy indices fall below zero – an indication that Hong Kong, China and Singapore are overreporting their exports as opposed to partner economies under reporting their imports.

As transshipment hubs, goods that are not necessarily produced within Hong Kong, China and Singapore pass through their territories as goods-in-transit or re-exports. The recording of re-exports can cause significant bilateral trade asymmetries in cases where there is a difference in partner country attribution for imports and exports. The IMTS manual recommends a country of origin attribution for imports and country of last known destination for exports. Following these principles, Hong Kong, China and Singapore record re-exports in their trade statistics but importing economies attribute the same goods as imports from countries where the goods were originally produced. An alternative attribution recommended by the IMTS manual is the country of consignment. Conceptually, this should resolve asymmetries arising from differences in partner country attribution. In practice, however, very few countries have been able to implement this change.

Other sources bilateral trade asymmetries include difference in valuation of imports (CIF) and exports (FOB), difference in trade systems (general or special) between partner economies, difference in currency conversion, difference in time of recording or time lags, difference in product classifications, partner-country attribution, and confidentiality (Ortiz-Ospina and Beltekian, 2018; Javorsek, 2016; United Nations Statistics Division, 2013). Various reasons for asymmetries in bilateral trade statistics are often interlinked and are difficult to untangle. Nonetheless, in depth analyses of trade asymmetries and bilateral reconciliation studies can help uncover which of these reasons are likely to be the main cause of inconsistencies between trading partners.

4. Harmonized Bilateral Trade Data in the ADB Multiregional Input Output Table

The Asian Development Bank Multi-Regional Input-Output Table (MRIOT) database, which provides information on production and trade linkages of economies, builds on the World Input Output Database[3]

[3] Developed by the University of Groningen with funding from the European Commission. The latest WIOD tables cover years 2000-2014, 43 economies, and 56 sectors.

(WIOD) by expanding the period and the economies covered. As of this writing, the MRIOT covers 63 economies, 35 sectors, and the years 2000, 2007 to 2019.

To harmonize the trade data in the ADB-MRIOTs, import flows are used to mirror export flows. Economy A's imports of product i from economy B are assumed equal to B's exports of the same product i to A. Using imports data is preferred because of the greater incentive over time to accurately monitor imports data for tariff revenues collection.

Figure 5 shows how bilateral trade matrices are constructed for the MRIOT. The main sources of imports data by trade partner, by product, and by end-use categories (intermediate use, final consumption, and capital) are the UN Comtrade database and the OECD-WTO Balanced International Trade Statistics (OECD BaTIS) database. Available import matrices from the economies' national input-output tables are used for the sectoral distribution of the commodity-partner data. Where necessary, ADB also refers to the IMF Direction of Trade Statistics (IMF DOTS) and the Eora MRIO database to cross-check its data. The total imports and exports per economy in the MRIOT should approximate the statistics published by the economy's national statistics agencies.

Figure 5. Constructing Bilateral Matrices in the ADB-MRIOTs

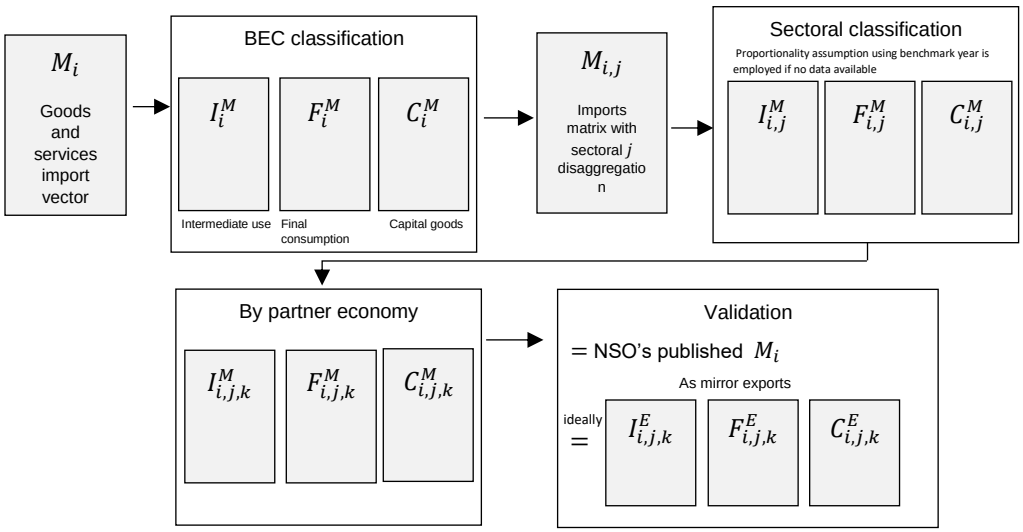


Table 2 shows a comparison of the exports and mirror exports (imports reported by partner economies) of Singapore extracted from the ADB MRIOT and the UN Comtrade Database for 2019. In the Comtrade database, exports of Singapore tend to be higher than mirror exports. These discrepancies are minimized in the ADB MRIOT using the framework illustrated above. The difference between Singapore's reported exports and the balanced exports in the MRIOT ranges from 30% to 60%. Meanwhile, the difference between mirror exports reported by Singapore's partner economies and the balanced exports in the MRIOT is much lower, with discrepancies as small as 1%.

The harmonization of trade flows in the ADB MRIOT has important analytical implications. In the case of Singapore, for instance, failing to reconcile bilateral trade data in the input-output table would suggest not only an overestimation of its exports but also an overstating of its contributions to the economic activity in other countries. Data presented in IOTs provide an extensive account of an economy's trade and production activity that go beyond insights derived from macroeconomic aggregates. These tables are used as basis for complex trade analyses such as Trade in Value Added (TiVA) accounting and Global Value Chain (GVC) analysis. It is therefore necessary to ensure that bilateral trade matrices in IOTs are consistent, reliable, and accurately reflect the economic activities in question.

Table 2. Singapore, Exports of Goods to Partner Country, 2019, in Mil US$

Partner Country	*MRIOT*	*Comtrade*		*MRIOT v Exports*	*MRIOT v Mirror*
	Balanced Exports	**Exports**	**Mirror Exports**		
Australia	7,283	11,295	7,489	- 36%	- 3%
India	14,137	11,441	14,894	24%	- 5%
Indonesia	16,769	27,359	17,590	- 39%	- 5%
Japan	6,304	17,633	7,803	- 64%	- 19%
Republic of Korea	6,577	15,210	6,660	- 57%	- 1%
Malaysia	15,225	41,152	21,606	- 63%	- 30%
Philippines	5,216	8,532	6,935	- 39%	- 25%
China, People's Rep of	36,911	51,619	35,230	- 28%	5%
Thailand	6,124	15,354	6,835	- 60%	- 10%

Source: ADB Multiregional Input Output Tables 2019 (to be published July 2021) and UN Comtrade Database (accessed May 2021).

This paper presented an overview of bilateral trade asymmetries among Asia Pacific trading partners using the bilateral discrepancy index. Findings reveal that trade asymmetry in the region is highly concentrated in Hong Kong, China and Singapore, largely due to the prevalence of re-exports in both economies. The paper also illustrated how trade asymmetries are addressed in the construction of the ADB MRIOT and showed an example of harmonized statistics derived from the reconciliation.

Many trade analysts have studied bilateral trade asymmetries over the past years in order to understand the sources of inconsistencies and formulate strategies to minimize them. While methodological approaches to harmonizing trade data are already in place, in the long run, the best way to ensure consistency and reliability of trade statistics is still to address the issue of trade asymmetries at its roots. Doing so would require an understanding of the nature of bilateral trade asymmetries both at the country and sector level.

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