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Nowcasting Country-level Trade Estimates using IMF PortWatch

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ABSTRACT: This paper develops high frequency trade estimates at the country level by applying nowcasting methodologies to satellite-based big data on vessel movements sourced from IMF PortWatch. The approach provides a timely estimate of monthly trade at the country level that can be produced and released within 7 working days. The paper validates the nowcasting trade estimates against official data for an initial wave of countries representing advanced economies, emerging markets and small island developing states: Brazil, Jamaica, Japan, Samoa, and the United States. The nowcasting methodology produces trade estimates that perform well compared to the official statistics, with the best fit for advanced economies and large emerging markets. The paper identifies key complementary information to improve the presented nowcasting methodology to develop country trade estimates. The paper also considers an application to estimates of U.S. imports during a period of elevated trade tensions.

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1. Introduction

International trade statistics are critical for understanding macroeconomic developments and the international transmission of shocks. The recent period of rapidly changing global trade policy and heightened trade policy uncertainty underscores how understanding the dynamics of international trade flows is crucial for policy makers. However, official statistics on international trade in goods are released with a lag and the timeliness differs across countries. Some countries, such as Brazil and China, release estimates of monthly imports and exports of goods as soon as 7 days after the end of the reporting period, while other countries, such as Jamaica, can take as long as 3 months to publish official estimates. Hence, more timely trade nowcasts can provide additional information on economic developments at the country level and a more unified view of global trade dynamics.

This paper introduces new country-level trade estimates by applying the global nowcasting methodology developed in Arslanalp et al. (2025) and port-level data from IMF PortWatch to nowcast country-level maritime trade values and volumes. This approach leverages Automatic Identification System (AIS) data and mimics the features of the way statisticians compile trade data – measuring customs value of trade flows, forming price deflators and then estimating trade volumes at constant prices. The methodology can produce and release a monthly series of trade estimates after 7 working days, providing timely estimates of international trade flows ahead of official statistics for many countries.[1]

The paper validates the nowcasting trade estimates against official data for an initial wave of pilot countries representing advanced economies, emerging markets and small island developing states: Brazil, Jamaica, Japan, Samoa, and the United States. The validation exercise took place in four steps to verify the nowcasting approach: 1) Conduct a port review to ensure that PortWatch covers all major ports for each country and that the port boundaries are correct; 2) Validate that PortWatch captures the port calls at the port-level compared to official statistics; 3) Validate that PortWatch captures the physical volume of incoming and outgoing shipments compared to official statistics at the port and country level; 4) Assess the nowcasting estimates of trade value and statistical trade volume compared to official statistics.

The nowcasting methodology produces trade estimates that perform well compared to the official statistics, although the fit varies across countries. The assessment suggests that performance may be better for advanced economies and large emerging markets, as for Brazil, Japan and the U.S., the nowcasting estimates have a high correlation (correlation coefficient >0.8) and good level fit (normalized RMSE <1). The nowcast estimates for smaller emerging markets and low-income countries (especially small island developing states) may have a worse fit with official statistics, with the validation exercise showing lower correlations and higher RMSE for Jamaica and Samoa. This reflects the potential for countries with smaller trade flows to be more affected by idiosyncratic events and shipments, as well as a greater impact from methodological challenges such as transshipment where goods are discharged and loaded onto another vessel.[2]

[1] Nowcast estimates are provided for selected countries in the PortWatch Economy Monitor page and are updated weekly. AIS data are sourced from the UN Global Platform. The 7 day period to publish results is contingent on the availability of AIS data. Future work will extend the geographic coverage of the estimates to additional countries.

[2] This paper refers to transshipment where goods are discharged from one ship to a port and then loaded onto another ship to complete a journey to a further destination, often without clearing customs or undergoing any transformation. As such, transshipments are not normally reported in official trade statistics. This differs from goods that are imported and then re-exported which will normally be reported in official customs statistics. Our definition of transshipment does not refer to potentially illegal transactions where goods have their country of origin re-classified without undergoing significant transformations or processing.

The paper identifies important adjustments to the nowcasting methodology that can be made to improve the country-level trade estimates which are implemented for the pilot countries where appropriate. First, a rigorous review is required to ensure that PortWatch captures all of the major ports and port boundaries. This also includes capturing offshore platforms which can account for a significant share of trade for some oil and gas exporting countries. This step is implemented for all of the pilot countries in this paper. Second, a netting adjustment outlined in Arslanalp et al. (2025) can be applied for ports which are major transshipment hubs. This step is implemented for the Port of Kingston in. Third, official deflators can be applied to convert the nowcast of trade values into trade volumes when constructed deflators do not provide a good fit of the nowcast to official statistics. This is implemented for Japan among the pilot countries.

There are some important caveats of our nowcasting approach. First, the trade estimates are primarily a nowcast of maritime trade values as they are based on data for maritime vessels.[3] Second, the methodology prioritizes cross-comparability across countries and limits country-specific changes to the methodology. This can lead to divergences from official trade statistics where there are country-specific pricing dynamics, for example from seasonal composition of trade, or country-specific reporting lags in official trade data. However, these caveats also illustrate benefits of the nowcast estimates based on the PortWatch data as maritime trade can be less volatile than other modes of transport (especially air freight) and enables comparability across countries. However, the nowcast estimates based on PortWatch data are intended as high frequency complements and not substitutes to official estimates produced by national authorities.

Related Literature. Our work directly builds on the global nowcasting methodology developed in Arslanalp et al. (2025) which establishes a process to move from physical shipment volumes calculated from AIS data to trade estimates. This further builds on a growing literature that uses vessel-level big data to develop trade estimates and understand the impact of macroeconomic shocks (Arslanalp, Marini and Tumbarello 2019, Brancaccio, Kalouptsidi and Papageorgiou 2020, Cerdeiro et al. 2020, Cerdeiro and Komaromi 2020, Deb et al. 2020, Verschuur, Koks and Hall 2021, Arslanalp, Koepke, and Verschuur 2021, Furukawa and Hisano 2022, Nickelson, Nooraeni, Efliza 2022, Kim et al. 2023). Our paper builds on this literature by developing the approach to use vessel-level big data to nowcast country-level trade estimates.

The paper also contributes to the nowcasting literature, which has often been applied to produce estimates of global trade flows (for instance the WTO, UNCTAD and OECD) or macroeconomic outcomes, in particular GDP, (with the Federal Reserve Bank of New York and Atlanta for prominent examples). The nowcasting literature commonly utilizes dynamic factor models (Giannone, Reichlin and Small 2008, Guichard and Rusticelli 2011, Barhoumi, Darné and Ferrara 2016, d'Agostino, Modugno and Osbat 2017, Martinez-Martin and Rusticelli 2021, Jackson and Rivera Greenwood 2026), machine learning techniques (Hopp 2022, Chinn, Meunier and Stumpner 2023, Jaax, Mourougane and Gonzales 2024) and regression models (Stratford 2013) to nowcast global trade in goods and/or services. This paper builds on Arslanalp et al. (2025) in developing real-time trade estimates at the country-level mirroring the approach of statistical agencies to develop official statistics.

Outline. The rest of this paper is structured as follows. Section 2 provides a brief overview of the nowcasting methodology. Section 3 outlines the process to develop country estimates, including the validation process and methodological adjustments. Section 4 provides an assessment of the performance of the nowcast estimates compared to official statistics for each of the selected countries and highlights an application to estimates of U.S. imports during a period of elevated trade tensions. Section 5 highlights the cross-comparability of the PortWatch

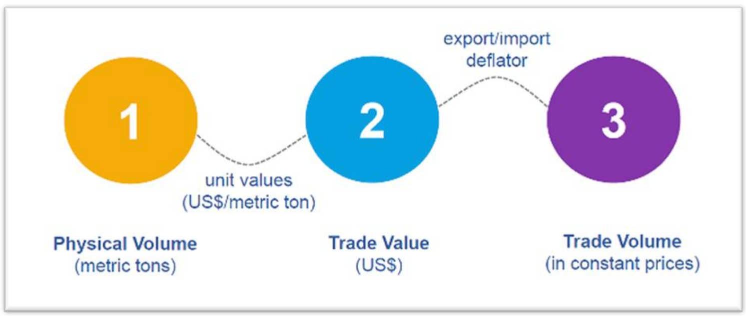
[3] These estimates could only be interpreted as the growth in total trade if the share of maritime trade in total trade was high or broadly unchanged over time.

estimates and acknowledges adjustments that are not incorporated into the nowcasting methodology. Section 6 concludes the paper.

2. Overview of nowcasting methodology

This section outlines the approach to develop the country trade estimates applying the global nowcasting methodology presented in Arslanalp et al. (2025), at the country level with country-specific data. The approach estimates country trade in both value and volume terms in three steps: from AIS volumes to values to statistical volumes:

Figure 1. From Physical Volume to Trade Estimates



Source: Arslanalp et al., 2025

Step 1: Country-level Vessel Shipments in Physical Volume: We aggregate the metric tons of goods shipped by different vessel types estimated from AIS-derived vessel draught data for all ports for each country monitored by IMF PortWatch. Specifically, we create three main groupings - container, dry bulk, liquid bulk (with container grouping together PortWatch data on containerships, "roll-on, roll-off" (Ro-Ro), and general cargo).

Step 2: Country-level Trade Value Index: Next, we calculate country-level trade value estimates by multiplying the physical trade volume estimates by relevant unit values for each vessel type and country as described in Equations 1 and 2.

$$V_{c,t}^{i} = \sum\nolimits_{j\in\{tn,bc,cs\}} U_{c,t}^{i,j} * UV_{c,t}^{i,j} \qquad i \in \{x,m\},\ t \in \{t_0, t_1, .., t_T\} \tag{1}$$

$$UV_{c,t}^{i,j} = UV_{c,t_o}^{i,j} * (1 + F_t^{i,j}) \qquad i \in \{x,m\},\ \ j \in \{tn,bc,cs\},\ t \in \{t_0, t_1, .., t_T\},\ F_{t_0}^{i,j} = 0 \tag{2}$$

where $V_{c,t}^{x}$ and $V_{c,t}^{m}$ are exports and imports in value terms respectively at period t for country c, $U_{c,t}^{x,j}$ and $U_{c,t}^{m,j}$ are exports and imports in physical volume respectively by vessel type j at period t for country c, $UV_{c,t}^{x,j}$ and $UV_{c,t}^{m,j}$ are average unit values of goods exported and imported respectively by vessel type j at period t for country c, and $F_t^{x,j}$ and $F_t^{m,j}$ are percentage changes in the average unit value of goods exported and imported respectively by vessel type j between the base period (t_o) and period t. In terms of vessel types (j), *tn*, *bc*, and *cs* stand for tanker, dry bulk carrier, and containership, respectively.

To construct the average unit value of goods (US$/metric ton) transported by different vessel types, we first compute base-year unit values for each country, then adjust them for vessel-type-specific price fluctuations and combine them with the physical shipment volumes to obtain the country-level trade value index. Specifically, we proceed as follows:

1) Base year unit values ($UV_{c,t_o}^{i,j}$). We use the CEPII BACI database to obtain harmonized trade data at the country and product level (6-digit HS codes) in both value (US$) and volume terms (metric tons). We use Cerdeiro, Komaromi, Liu, and Saeed's (2020) mapping between vessel types and HS codes to calculate the average unit value of goods exported/imported by vessel type for a base period for each country c.[4]
2) Change in unit values ($F_t^{i,j}$). We then update the base year unit values using changes in commodity prices and manufactured goods prices (these changes are global and not country specific). Specifically, we calculate the change in unit values for each vessel type as follows:
    a) Tankers. Percentage change in the fuel price index (excluding coal) available from the IMF's Primary Commodity Prices database.
    b) Dry bulk carriers. Percentage change in the non-fuel commodity price index (including coal but excluding precious metals) is available from the IMF's Primary Commodity Prices database.
    c) Containerships and other cargo vessels. Percentage change in the manufactured goods price index compiled by the WTO. Data are typically available with a lag of 3 months. For missing months, we use bridging data from two sources: (i) the US CPI index (excluding food, energy, and services); and (ii) the Cleveland Fed's US CPI inflation nowcast for the latest month.

Step 3: Country-level Trade Volume Index

We convert the estimated country-level trade value into a country-level trade volume index by applying export/import price deflators. This isolates changes in statistical volumes from price effects. This is shown in Equation 3.

$$Q_{ct}^{i} = V_{ct}^{i} \,/\, P_{ct}^{i} \qquad i \in \{x, m\},\ t \in \{t_0, t_1, .., t_T\} \tag{3}$$

where Q_{ct}^{x} and Q_{ct}^{m} are exports and imports in volume terms respectively at period t for country c, V_{ct}^{x} and V_{ct}^{m} are exports and imports in value terms respectively at period t for country c, P_{ct}^{x} and P_{ct}^{m} are export and import deflators respectively at period t for country c.

We consider two types of deflators, where for the remaining part of the paper we will refer to them as "constructed" and "official":

1) Constructed export/import price deflators for each country using a Laspeyres-type index following the approach of major statistical agencies and the approach taken in Arslanalp et al. (2025) for global deflators. The Laspeyres-type index uses base-period quantities for both the base period and the period for which the index is computed to estimate the price effect, as shown in Equation 4.

$$P_{ct}^{i} = \frac{\sum_{j \in \{tn,bc,cs\}} UV_{ct}^{i,j} * U_{ct_o}^{i,j}}{\sum_{j \in \{tn,bc,cs\}} UV_{ct_0}^{i,j} * U_{ct_o}^{i,j}} \qquad i \in \{x, m\}, \quad j \in \{tn, bc, cs\} \tag{4}$$

[4] The base year for estimates presented in this paper was 2019. The base year will be updated every 5 years to create a chained measure of prices to reflect shifts in the composition of traded goods. The base year for estimates on the PortWatch platform was updated to 2024 in early 2026.

where $UV_{ct}^{x,j}$ and $UV_{ct}^{m,j}$ are unit values for goods exported and imported by vessel type j at period t for country c, and $U_{ct}^{x,j}$ and $U_{ct}^{m,j}$ are exports and imports in physical volume by vessel type j at period t for country c. In terms of vessel types (j), *tn*, *bc*, and *cs* stand for tanker, bulk carrier, and containership, respectively. Finally, t_o stands for the base period (2019).

2) Official country-level deflators. Official price deflators act as a statistical tool to transform nominal trade values into constant prices which are used for analyzing developments in the trade balance, estimating the volume of GDP and measuring foreign prices' contribution to domestic inflation (Zieschang and Dridi 2002). Whereas global export/import price deflators are not available to construct global estimates in Arslanalp et al. (2025), official country-level deflators can be available, especially for advanced economies. As official deflators reflect the price indices calculated by national authorities, they may better reflect economic developments relevant for calculating import and export volumes.

3. Development of country-level trade estimates

In this section, we validate the nowcasting approach for a sample of countries: Brazil, Jamaica, Japan, Samoa, and the United States. The countries represent different income groups ranging from advanced economies to large and small emerging markets, and developing economies. We selected countries that satisfied three practical criteria: (i) a high share of maritime trade in total trade; (ii) the availability of port-level data; and (iii) not a major international transshipment hub.[5]

Nowcast estimates of trade based on PortWatch shipping data are informative for country-level trade estimates as maritime trade accounts for a high share of overall trade. Globally, maritime trade accounts for 80 percent of the volume of trade in goods, with an even higher share in the sample of countries selected in this paper (Figure 2). On the import side, the coverage ranges from 87 percent of import volumes for the U.S. up to over 99 percent for each of Jamaica, Japan, and Samoa. The share is even higher for export volume, ranging from 93 percent for Samoa up to over 99 percent for Jamaica. The share of trade value transported by sea is lower, especially for Japan and the U.S. reflecting that advanced economies have a higher share of trade with high unit values that are transported by alternative modes of transport, especially air freight, such as electronics and pharmaceuticals.[6]

To verify the country trade estimates, we follow four steps. First, we conducted a port review to ensure the coverage of major ports and refine port boundaries. Second, at the port level, we validated the data by matching port calls and physical shipment volumes. Third, we check that the aggregate port calls and physical shipments match the country-level official estimates. Finally, we performed a country-level assessment that compares the nowcast trade estimates with official statistics. The following subsection presents the baseline performance of the PortWatch nowcasting approach before implementing any modification, and then the following sub-sections

[5] Country selection followed a survey of the PortWatch Advisory Board, which indicated broad interest across income groups.

[6] Including the adjustment for "other or unidentified modes of transport" for the US may lead to an overestimate for the U.S. given its significant trade with neighbors with contiguous borders, with U.S. census data indicating that around 45 percent of import value and 35 percent of export value is transported by maritime vessels.

present changes to the PortWatch platform and nowcasting methodology implemented in each of the steps (with steps 2 and 3 combined as the changes affect both assessments).

Figure 2. Share of trade in goods transported by sea

Source: UNCTAD Trade-and-Transport Dataset.

Notes: Estimates combine "sea" and "other or unidentified" transport modes.

a. Baseline performance

We assess the baseline performance of applying the nowcasting methodology outlined in Section 2, which replicates the global nowcasting methodology of Arslanalp et al. (2025) at the country level, and comparing this to official merchandise trade statistics. As trade estimates can include seasonal trends and some official statistics may include seasonal adjustments, we focus the comparison on monthly year-over-year changes to assess the goodness of fit for the period January 2020 to December 2024.[7] We assess performance using two metrics: the Pearson correlation coefficient to capture trend accuracy and a root-mean-squared error (RMSE) to capture level accuracy. Following the benchmark in our global nowcasting study, we target a correlation of above 0.8 and RMSE threshold of less than 1 (which represents one standard deviation).[8]

The baseline performance (shown in Table 1) indicates that advanced economies and a large emerging market - specifically the United States, Japan, and Brazil - already meet the benchmarks for several trade flows, whereas smaller emerging markets such as Samoa and Jamaica generally fall short. One notable exception to this pattern are the trade volume estimates for Japan which have a very low correlation with the official statistics which could be driven by the product composition in our constructed deflator or seasonal variations which are better captured by the official deflator – addressed in the adjustments outlined later in the paper. This pattern likely reflects differences in data availability, economic structure, and measurement issues, underscoring the

[7] The assessment of year-over-year comparisons reflects our aim to assess overall trends in the data and does not represent a test of out-of-sample nowcast performance.

[8] We normalize the RMSE by the standard error of the official dataset to provide comparability across results. A low RMSE value could reflect high volatility in the official trade data rather than small absolute errors.

need for country-specific refinements. An initial observation appears to be that larger economies have higher correlations which could reflect that more aggregated data in larger economies will have a smoother fit and therefore a higher correlation between the PortWatch estimates and official statistics.

Table 1. Baseline assessment table

		Brazil	Jamaica	Japan	Samoa	United States
Export - Value	CORRELATION	0.75	0.36	0.82	0.05	0.90
	RMSE	0.72	1.01	0.57	16.86	0.53
Import - Value	CORRELATION	0.90	0.45	0.91	0.35	0.84
	RMSE	0.47	0.96	0.45	1.54	0.90
Export - Volume	CORRELATION	0.46	0.23	0.61	0.06	0.67
	RMSE	0.96	1.09	0.87	16.87	0.75
Import - Volume	CORRELATION	0.77	-0.01	0.04	0.23	0.73
	RMSE	0.64	1.43	1.37	1.79	1.30

b. Port review

The port review ensured that the PortWatch platform includes all major ports involved in trade for countries in our sample, with port boundaries that correspond to the definitions of authorities.[9] This exercise enabled us to make the following refinements to the PortWatch platform to ensure that we are capturing all of the relevant vessel port calls to develop the trade estimates.

i. Port coverage

We compare the port coverage of the PortWatch platform to the major ports for a country as defined by authorities. Where a major port is missing, we expand the port coverage. As a result of this step, we add 64 ports in total, 21 for Brazil (separate from offshore platforms discussed in the next section), 2 for Jamaica, 37 for Japan (covering all the officially defined "major ports" in Japan), and 4 for the United States. Generally these ports are relatively small, with a small contribution to global trade but can have a significant contribution for country trade.

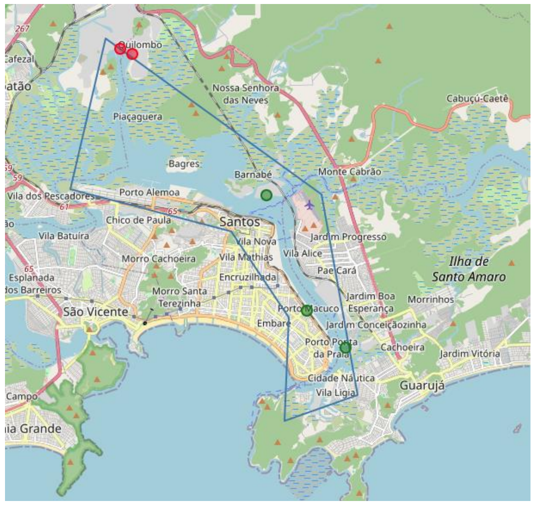
ii. Port boundaries

We also refine port-boundary polygons to capture port calls more accurately. Where information is available from authorities, we verify the area of and key berths of ports. We then adapt the mapping polygon in the PortWatch platform to capture all berths for a port. Even when port boundary information is not readily available, adjustments can be made to port boundaries to reflect the relevant aggregation of ports. Through this approach we refine the boundaries of 18 ports across our sample of countries.[10] For example Figure 3 shows that at the Port of Santos, the largest port in Brazil, we refine the boundary to encompass additional berths in red dots that were previously outside the polygon.

[9] Information on ports for each of our pilot countries are sourced from: Brazil – ANTAQ Waterborne Dashboard; Jamaica – Port Authority of Jamaica; Japan – Ministry of Land, Infrastructure, Transport, and Tourism; Samoa – Samoa Bureau of Statistics; United States – Bureau of Transportation Statistics.

[10] Across the pilot sample of countries the number of port boundaries that were adapted for each country: Brazil - 10; Japan - 5; United States - 2; Jamaica - 1.

Figure 3. Port of Santos Polygon



Notes: Map shows the Port of Santos. Green dots represent berths that were previously captured by the PortWatch polygon. Red dots indicate berths that were not previously captured by the PortWatch polygon. Blue lines indicate area of the polygon where a port call is defined by the presence of a vessel captured AIS signals within the polygon for a required period of time.
Source: PortWatch and ANTAQ - Agência Nacional de Transportes Aquaviários. (2014). *Painel Estatístico Aquaviário* (Version 1.0.1).

iii. Offshore platforms

As part of the port review, we identified additional offshore platforms that export oil or gas. These can account for a significant share of trade for some oil exporting countries. For example, petroleum is Brazil's second-largest export sector and around 95 percent of production occurs offshore (Figure 4. indicates the presence of offshore platforms in Brazil). Therefore, excluding these platforms would induce systematic under-measurement of export activity and a downward bias in our nowcast of export volumes and value. To overcome this, we have identified these offshore oil (and gas) platforms as additional port polygons.[11] These are identified by MMSI numbers of those vessels classified as FPSO, FSU, FSO, while excluding those that are within existing PortWatch port boundaries.

[11] For the pilot countries, 45 offshore platforms were added for Brazil, 1 for Jamaica, and 1 for the U.S. As a general extension, PortWatch now includes 181 additional offshore platforms across all countries.

Figure 4. Brazilian ports and offshore platforms

Notes: Blue icons indicate major ports for Brazil. Yellow dots indicate offshore platforms.
Source: ANTAQ - Agência Nacional de Transportes Aquaviários. (2014). *Painel Estatístico Aquaviário* (Version 1.0.1) and Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (ANP). *Dados abertos – Plataformas de Operação*. Dataset: **dados-abertos-plataformas-operacao.csv**.
Available at: https://www.gov.br/anp/pt-br/centrais-de-conteudo/dados-abertos/arquivos/arquivos-fase-de-desenvolvimento-e-producao/lpo/.

c. Port-level and country-level trade

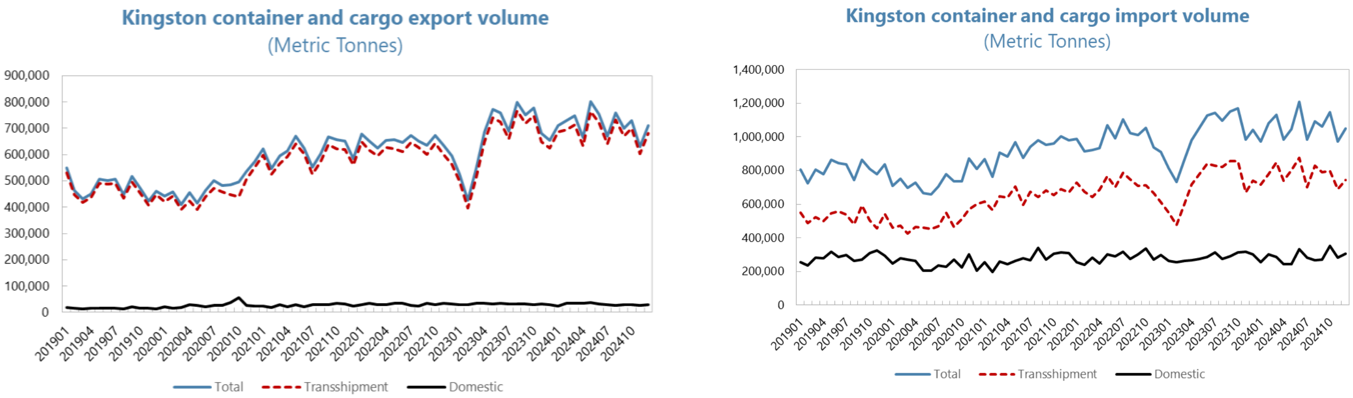
We compared the PortWatch estimates for port calls and physical trade volumes at the port and aggregated level with official estimates. This led us to make the following adjustments to the PortWatch platform.

i. Two-way trade and netting adjustment

AIS-based estimates face challenges separately identifying trade for the domestic market and transshipment when there is significant two-way trade as only the net change in a vessel's draft is observed. This is particularly common for containerized vessels in major transshipment hubs as illustrated in Figure 5 for the Port of Kingston in Jamaica. We extend the netting adjustment outlined in Arslanalp et al. (2025) to the Port of Kingston to address the potential bias of AIS-based estimates by using official container throughput data to complement AIS data to estimate the netting effect. [12] This creates a scaling factor for ports included in the netting adjustment which maps net imports (exports) into gross imports (exports). This scaling shifts the estimates of physical volumes of container ships, which will improve the nowcasting estimates – especially where the trends in transshipment cargo differs from domestic cargo.

[12] Arslanalp et al. (2025) incorporates 83 ports into the netting adjustment representing the largest container ports in the world which account for two-thirds of global container trade.

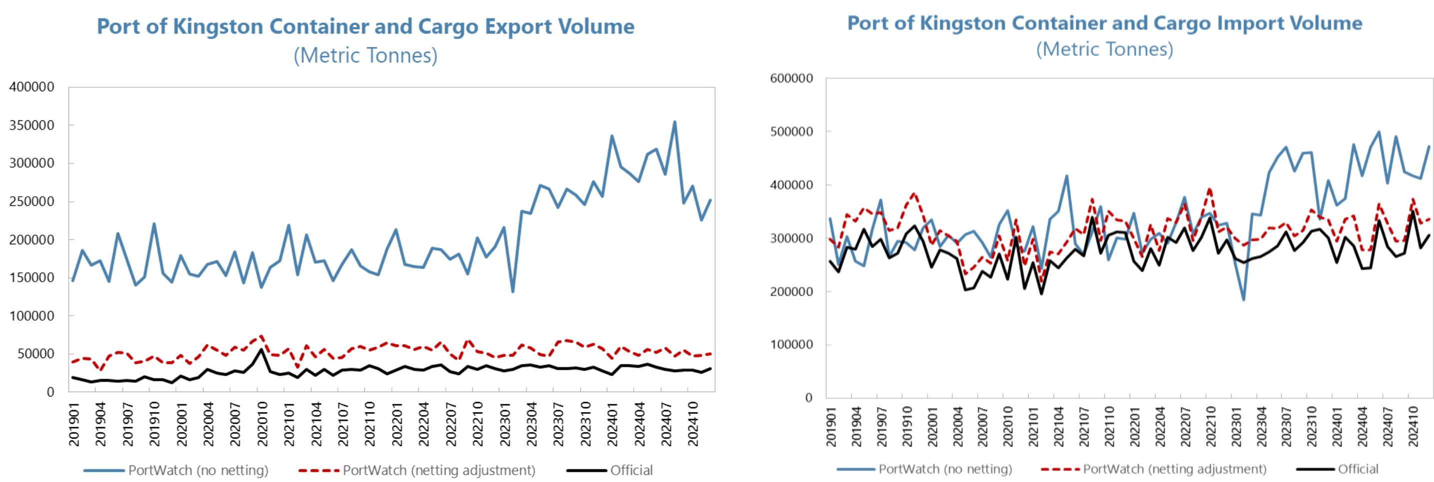
Figure 5. Port of Kingston (Jamaica) container trade volumes



Source: Port Authority of Jamaica

Incorporating the netting adjustment for the Port of Kingston improves the fit of the nowcasting estimates. We add the Port of Kingston to the PortWatch netting adjustment, scaling the PortWatch estimates of imports and exports with the share of container trade with the domestic market.[13] This netting adjustment scales the PortWatch estimates for container shipments in the Port of Kingston to the official estimates of domestic container shipments. This improves the fit for the estimates of the combined container, Ro-Ro and other cargo (these are not separated in the official statistics) for the Port of Kingston as shown in Figure 6. The better fit for imported shipments reflects the higher share of container cargo through the Port of Kingston which the netting adjustment captures, whereas export volumes have a higher share of other cargo that are not differentiated in the official statistics.

Figure 6. Port of Kingston PortWatch estimates incorporating netting adjustment



Source: Port Authority of Jamaica, PortWatch

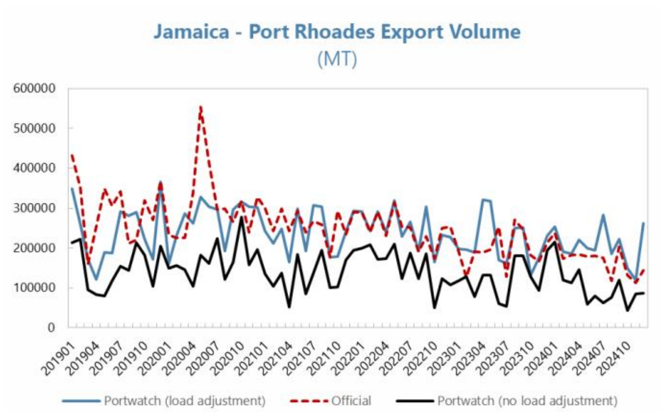
[13] Typically, container throughput data indicates the total volume through the port, aggregating both containers intended for the domestic market and those that are being transshipped. For the Port of Kingston, these estimates were reported separately enabling a scaling factor that estimates gross trade with the domestic market.

ii. Specialized export and import ports

Some ports can operate to serve a specific economic activity meaning that they specialize in exporting or importing. This can more commonly occur when a port is established to support the export activities of a commodity, such as agricultural, mining or energy products. This should be observed in the estimates for physical volumes as positive exports for the relevant vessel (for example bulk carriers for mining activity, tankers for energy) and zero imports for that vessel type. However, there may be instances where the corresponding AIS data does not match these patterns due to estimates for the load factors of ships, or data inconsistencies produced by back propagation or historic averaging. The trading dynamics of the specialized ports, identified through domain specific knowledge or official data, can be captured by setting the incoming load factor to zero for specialized export ports or outgoing load factor to zero for specialized import ports. Here we outline changes to two ports, which can be extended to other ports identified as specialized import or export ports.

As one prominent example, we set the incoming load factor to zero for Port Rhoades in Jamaica for all bulk carriers to reflect its status as a specialized export port of bauxite and alumina. The load factor adjustment primarily improves the level fit of the results illustrated in Figure 7.

Figure 7. Port Rhoades Export Volumes



Sources: Port Authority of Jamaica, PortWatch.

Samoa represents a different case: a port where we know, based on official trade statistics and domain knowledge, that there are no exports of oil or petroleum products. Tanker-related export values in the official data are consistently recorded as zero, reflecting the fact that Samoa does not export crude oil, refined fuels, or other hydrocarbon products. This may not be captured in the PortWatch estimates due to inaccurate or missing AIS data on the draft of the ship. To ensure consistency with economic reality and the official classifications, we set these handful of tanker port calls with non-zero export estimates to zero.

d. Nowcast estimates and official statistics

The final step for the development of the nowcast for country-level trade estimates considers appropriate deflators and choose the most relevant comparison statistics. First, we consider whether the estimates for trade volumes generated by the nowcasting methodology are improved by using official country deflators rather than constructed deflators based on global prices. Second, we recognize that the nowcast produces estimates of maritime trade, and therefore the most appropriate comparison statistics would be official estimates of maritime trade and consider whether such estimates can be constructed if official estimates are not available.

i. Deflators

The development of country-level trade estimates offers the potential use of official deflators rather than constructed deflators (outlined in Section 2) when converting from trade values to statistical volumes. As price dynamics vary across countries, an official deflator could better capture local economic developments than a constructed series. The choice does not automatically translate into better statistical fit, even if the same deflator is applied to both official statistics and PortWatch estimates (see Annex I).

The availability of deflators differs across countries. When using official deflators we apply the following hierarchy: i) we use monthly export/import price deflators where available, ii) we use quarterly export/import price deflators interpolated to create a monthly series, iii) where no export/import price deflators are available we use GDP deflators. In the pilot country sample, Brazil, Japan and the U.S. have monthly import and export price deflators. For Samoa, a monthly import deflator is not available, so we interpolate a quarterly import deflator to develop monthly estimates. For Jamaica import and export price deflators are not available, so we produce monthly estimates by interpolating annual GDP deflators.

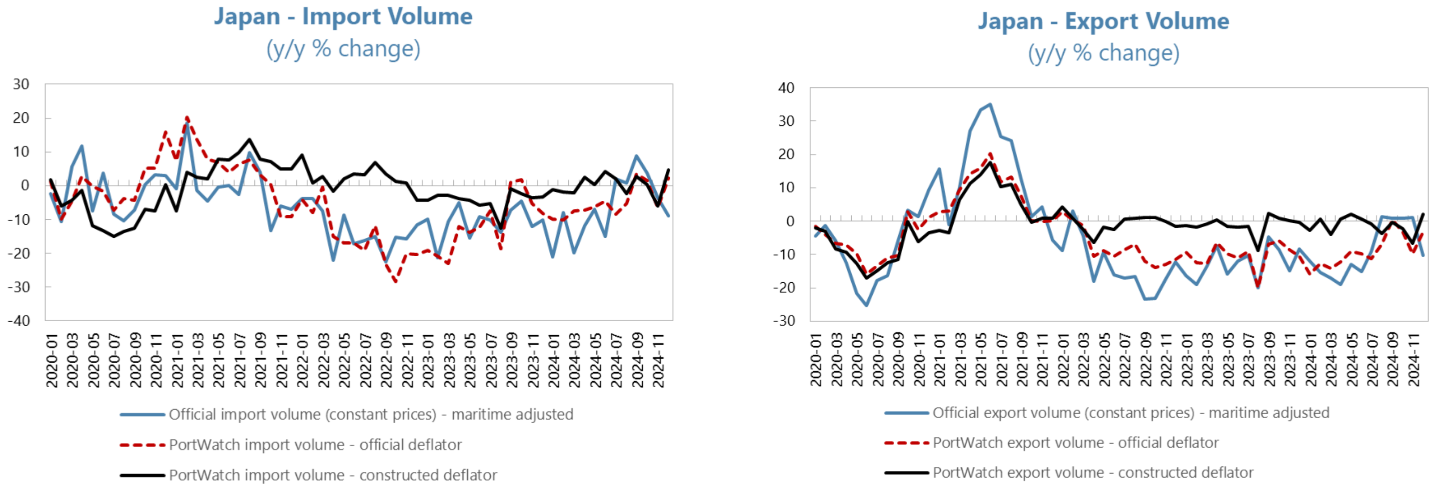
The application of official deflators has a considerable impact on the fit of the estimates for some of the sample countries. The fit for Japan improves significantly (also shown in Figure 8.) with the correlation for import volume increasing by 0.73 (without any other platform changes). This large difference could be driven by the product composition in our constructed deflator which may differ from the official deflator which may be able to more accurately capture the price dynamics in the economy.[14]

We apply a criterion for the use of official deflators over constructed deflators for the PortWatch platform that the results must improve the correlation of at least one of the import or export volume estimates for a country by more than 0.5 and that monthly import and export price deflators must be available within a few weeks of the end of a month. This rule means that we apply the official deflators only for Japan in our sample.

To implement official deflators in the real-time estimates on the PortWatch platform there are also operational consideration as official deflators may be less timely in publication than the availability of PortWatch estimates. While the official import and export price indices are published monthly, the latest month becomes available a few days after PortWatch's monthly release window. To bridge this timing gap, we proxy the final-month price deflator using the month-on-month deviations in average period JPY/USD exchange rate, which provides a reliable high-frequency indicator of short-term price dynamics.

[14] At the same time, there are factors that could have resulted in a constructed index for Japan providing a better fit than an official deflator including: i) The base year for the official deflator is 2010 whereas the constructed deflator is 2019 meaning that it has an updated set of product weights, ii) the constructed deflator may have more granular price information based on all HS6 level products (around 5000) whereas the official deflator uses a basket of 254 commodities, iii) the constructed deflator is in US dollars for cross-country comparability, whereas the official deflator is in yen, which could affect correlations when we convert all values into US dollars to calculate the correlations.

Figure 8. Japan Nowcast Estimates of Import and Export Volume, by type of deflator



Source: Haver Analytics, UN COMTRADE, PortWatch.

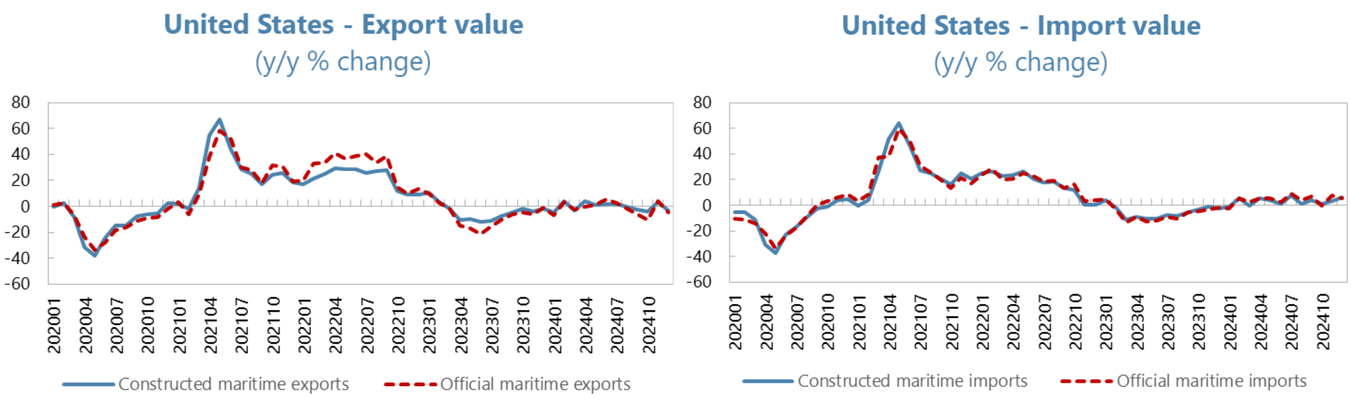
ii. Maritime comparison group

The PortWatch nowcast produces estimates of maritime trade whereas official headline statistics incorporate all transport modes (maritime, air, road, etc.).[15] To provide a direct comparison to the PortWatch nowcast estimates we would require official estimates for maritime trade – however, these are only available for a limited set of countries. We therefore construct a comparison benchmark by filtering official series to exclude non-maritime sectors. This approach is divided in three steps: (i) excluding sectors identified by Arslanalp et al. (2025) as not transported by vessels (precious metals and stones; aircraft and spacecraft; ships, boats, and floating structures; electrical energy); (ii) excluding additional non-maritime sectors (pharmaceuticals products; electronics; gold bullion); (iii) apply limited country-specific adjustments based on the domain knowledge (for example, in the pilot sample we introduce country specific adjustments for Samoa to remove re-exports as this includes the sale of oil to ships and aircraft).

We validate this approach to constructing a maritime data comparison for the United States where official estimates for maritime trade are available through the U.S. Census. The constructed maritime value for both imports and exports closely tracks the year-on-year changes in the official maritime data (Figure 9.) with a correlation coefficient of 0.97 for export value and 0.98 for import value.

[15] Where a country's merchandise trade is solely maritime or where the share of maritime trade was stable then the nowcast estimate could provide an estimate for the changes in the overall level of trade in goods. However, the potential for shifts in the share of trade by mode of transport (maritime, air, and land) may be more prominent at a national rather than global level.

Figure 9. United States constructed and official estimates for maritime trade



Source: U.S. Census, UN COMTRADE

4. Performance of nowcast

In this section, we evaluate the performance of PortWatch nowcast estimates against official trade statistics incorporating adjustments outlined in Section 3. We start with an assessment table that reports correlation and RMSE for each country and flow after incorporating the adjustments outlined in Section 3. Then we elaborate on the results for the sample countries: Brazil, Jamaica, Japan, Samoa, United States.

a. Assessment of revised results

The revised results incorporate the adjustments outlined in Section 3, in particular: 1) Implementing changes to the PortWatch platform and estimates from the port review, netting adjustment and adjustments for specialized ports; 2) comparing the PortWatch estimates to maritime data taken from official sources (where available) or removing non-maritime sectors from official trade data; 3) comparing volumes estimates based on constructed deflators, other than for Japan where official deflators are used. Table 2 provides an overview of the main changes for each country in our pilot.

Table 2. Summary of adjustments by country

	Brazil	Jamaica	Japan	Samoa	United States
Port coverage – additional ports	21	2	37	0	4
Port boundaries refined	10	1	5	0	2
Offshore platforms	45	1	0	0	1
Additional netting adjustment	0	1 addition – Kingston	0	0	0
Specialized import/export port adjustment	0	1 – Port Rhoades	0	1 - Apia	0
Deflators	Constructed	Constructed	Official	Constructed	Constructed
Maritime data source	Official – COMEX STAT	N/A	Constructed	Constructed	Official - U.S. Census

Table 3 presents the assessment of the revised results. Performance remains better in advanced economies and large emerging markets with high correlations and low RMSEs. Jamaica and Samoa continue to have lower correlations and higher RMSEs, reflecting that the estimates can be more volatile for smaller countries where idiosyncratic discrepancies have a greater impact on the assessment.

Comparing the baseline (Table 1) and revised (Table 3) results, the fit has improved for most country-flow groups. On volumes, two additional series, Japan export volumes and Brazil import volumes now meet the correlation coefficient criteria. Jamaica import values, Japan import volumes, and the United States import and export volumes are close to the threshold. RMSE results are consistent: most value series satisfy the criteria, with import volumes for Jamaica, Japan and the U.S. moving to below the threshold of 1. Samoa shows an improvement for the fit for imports, though still has a low correlation and high RMSE for exports.

Table 3. Revised assessment table

		Brazil	Jamaica	Japan	Samoa	United States
Export - Value	CORRELATION	0.73	0.34	0.90	0.06	0.95
	RMSE	0.89	1.14	0.47	21.46	0.33
Import - Value	CORRELATION	0.93	0.74	0.91	0.38	0.86
	RMSE	0.39	0.74	0.43	1.33	0.62
Export - Volume	CORRELATION	0.47	0.24	0.92	0.06	0.73
	RMSE	0.90	1.16	0.50	20.41	0.72
Import - Volume	CORRELATION	0.84	0.48	0.73	0.39	0.74
	RMSE	0.59	0.92	0.82	1.41	0.84

b. Brazil

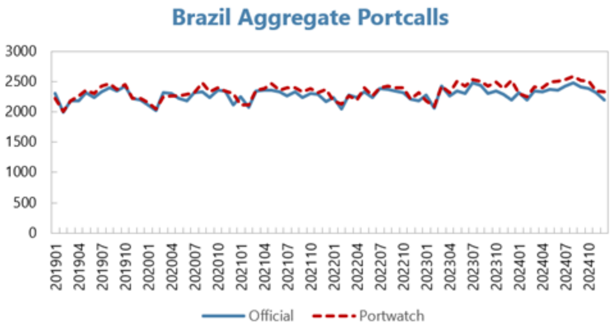
PortWatch trade estimates of Brazil generally fit well with the official statistics. The port review stage of this project added 21 ports for Brazil and included the addition of 45 offshore platforms – which were previously not included but account for over 90 percent of Brazil's oil exports. As a result, PortWatch estimates closely track the official estimates for the number of port calls in both levels and trends (top left chart of Panel 1). There is also a good fit for physical trade volumes (top right chart of Panel 1), with PortWatch capturing the seasonal dynamics in Brazil's exports, although slightly underestimating the level of physical volumes for both imports and exports.

The nowcasting estimates for Brazil's imports closely track the official statistics for both import values and volumes (middle charts of Panel 1). This is reflected in low RMSE indicating a good fit with the level estimates of the rate of growth and high correlation capturing the monthly dynamics. The performance is slightly better for import values reflecting the additional volatility in the import volume series.

The nowcast results for Brazil's exports also have a reasonable fit on values (bottom left chart Panel 1), with a correlation of 0.73 that is close to our criteria and an RMSE score that meets our criteria. Somewhat surprisingly, the performance slightly deteriorates from the baseline table despite the addition of the oil export platforms. However, this likely reflects the timing of reporting of oil exports in official statistics (discussed further in the next section). The performance on export volumes is weaker (bottom right chart Panel 1), with a good fit on the average rate of export growth across months, but a lower correlation as the nowcast results do not capture all of the monthly dynamics in the official data.

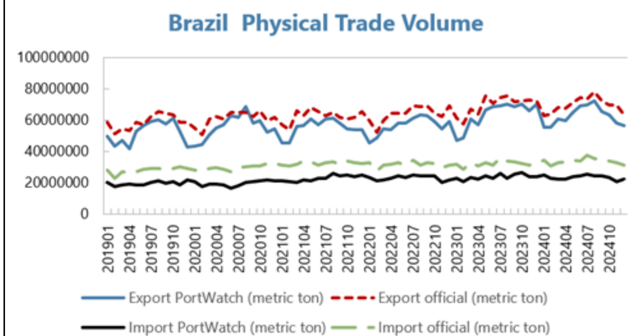
Panel 1: Brazil Results

PortWatch estimates of Brazil's port calls closely track official estimates.



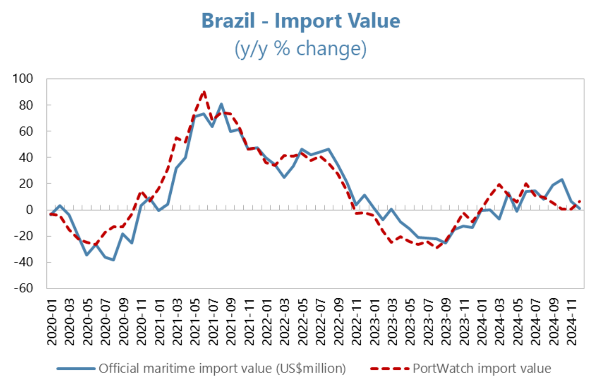
Source: ANTAQ Waterborne Dashboard, PortWatch.

The estimates of physical trade volumes capture seasonal trends, but slightly underestimate levels.



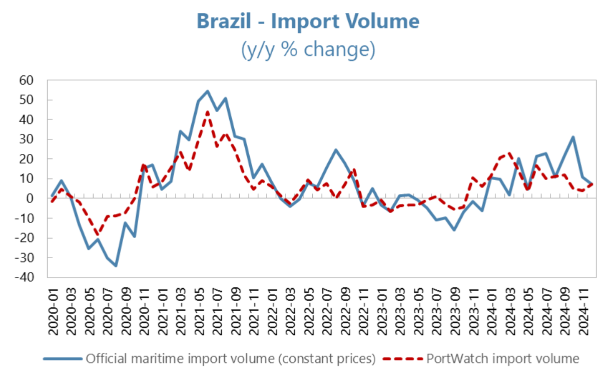
Source: ANTAQ Waterborne Dashboard, PortWatch.

Import value nowcast results have a good fit in the rates of growth and monthly dynamics.



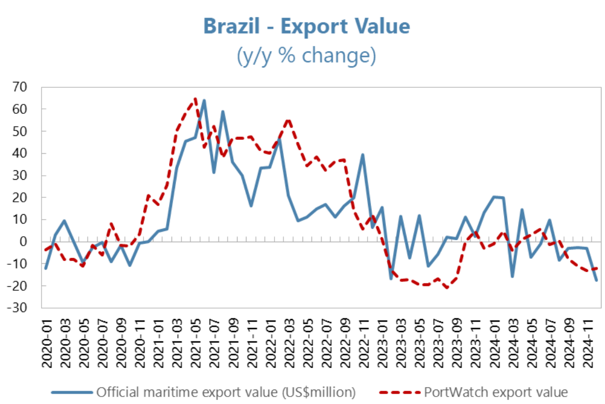
Source: Haver Analytics, PortWatch.

The results persist in import volume estimates, although the fit on monthly dynamics is weaker.



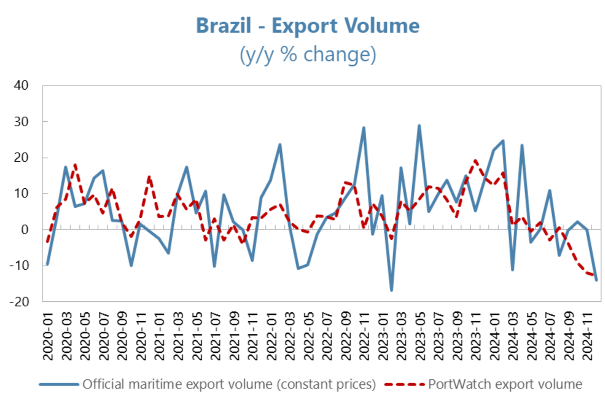
Source: Haver Analytics, PortWatch.

Estimates of Brazil's export values reflect general trends, but don't capture monthly dynamics.



Source: Haver Analytics, PortWatch.

Export volume estimates have a weaker fit whilst capturing the average rate of growth across months.



Source: Haver Analytics, PortWatch.

c. Jamaica

The PortWatch estimates for Jamaica have a reasonable fit with the official data on port calls and physical volumes, which supports a good fit of the nowcast for imports, although there is a weaker fit for exports.

PortWatch captures the aggregate number of port calls for Jamaica (top left chart of Panel 2). Across the period of January 2019 to December 2024, the average number of port calls matches the official statistics very closely (average number of monthly Portwatch port calls averages 96 percent of the level of the official non-cruise liner port calls). This fit is consistent across individual ports, although it is not possible to assess the fit by vessel type due to official data limitations.

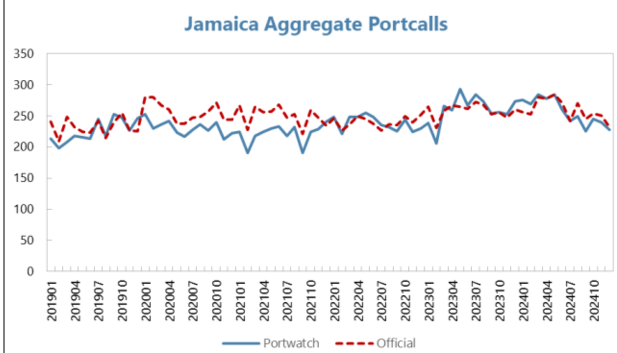
PortWatch has a good fit to the level of the official data for physical import and export volumes. Taking into account the methodological changes outlined in this paper, in particular introducing a netting adjustment for Kingston, the PortWatch estimates for physical imports closely matches the official estimates for imports intended for the domestic Jamaican country (top right chart of Panel 2). For export volumes (chart not shown), incorporating adjustments for specialized export ports results in a good fit for the bulk commodity export ports. However, there is a weaker fit for aggregate export volumes for Jamaica, which arises from challenges in matching the volumes of tanker exports from the processing facilities at the Port of Kingston and dry bulk exports from Ocho Rios (predominantly of sugar).

The nowcasting estimates have a stronger performance for imports than exports. The nowcast estimates have a good fit with the official import statistics (middle chart of Panel 2), with a correlation of 0.74 on import value close to our criteria, with normalized RMSE of 0.74. This marks a considerable improvement on the baseline estimates, reflecting the importance of the netting adjustment for container imports which account for the majority of Jamaica’s imports.

For exports, the fit is weaker (bottom charts of Panel 2), with a correlation of 0.34 on export value and 0.24 on export volume, with normalized RMSE of 1.14 and 1.16 respectively. The weaker fit for the nowcast for exports, despite the good fit to physical export volumes, could result from differences in pricing dynamics in commodity markets compared to the PortWatch methodology (elaborated further in the next section).

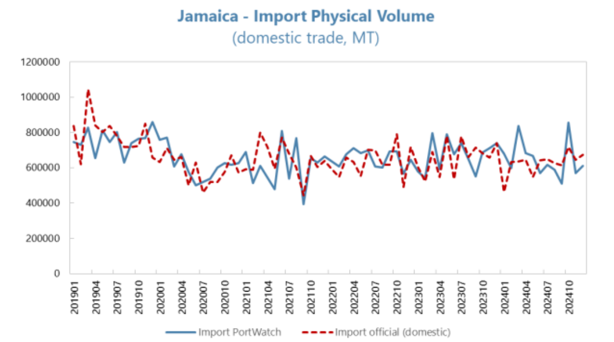
Panel 2: Jamaica Results

Portwatch closely captures the aggregate number of port calls in Jamaica.



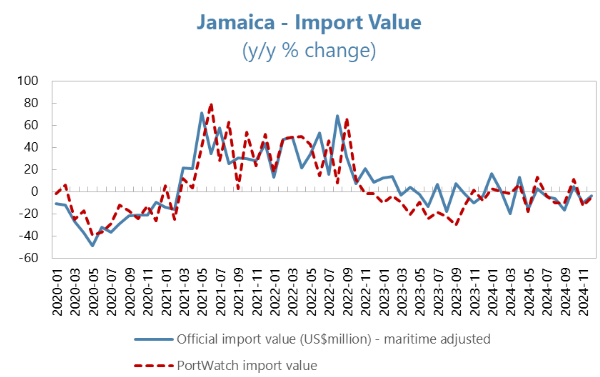
Source: Port Authority of Jamaica, PortWatch.

There is a good fit in the estimates of physical trade intended for the domestic market once a netting adjustment is incorporated.



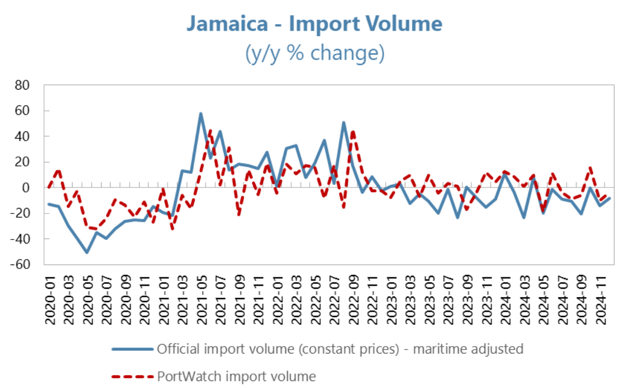
Source: Port Authority of Jamaica, PortWatch.

Import value nowcast estimates match the trends in official data, whilst overestimating the volatility during 2021-2022.



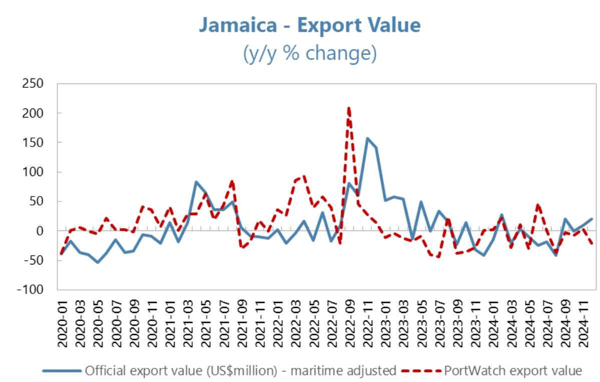
Source: Haver Analytics, PortWatch.

The estimates for import volumes also reflect the trends in growth rates of the official data.



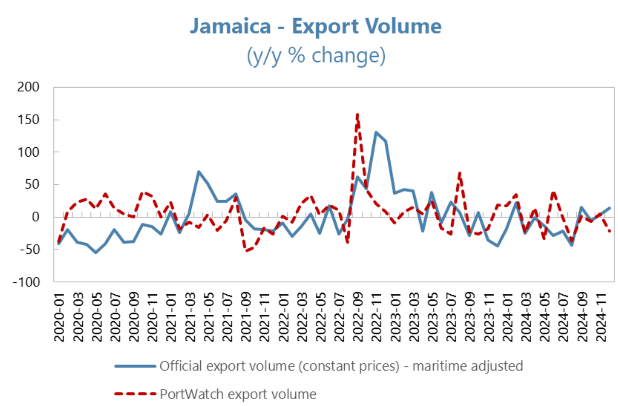
Source: Haver Analytics, PortWatch.

However, the export value nowcast has a weaker fit, potentially reflecting pricing dynamics of commodities not captured in the nowcast.



Source: Haver Analytics, PortWatch.

Differences persist between the nowcast estimates and official estimates for export volumes.



Source: Haver Analytics, PortWatch.

d. Japan

The PortWatch nowcast results have a good fit with Japan's official statistics for imports and exports, with the volume results improving considerably by using official rather than constructed deflators.

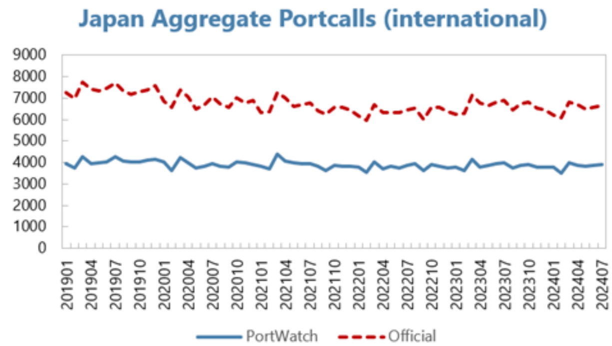
To ensure comprehensive coverage of Japan's maritime trade flows, we expanded PortWatch's port registry to include all 125 ports identified by Japan's Ministry of Land, Infrastructure, Transport and Tourism (MLIT) as part of the national port hierarchy—comprising 5 strategic international hub ports, 18 international hub ports, and 102 major ports. Incorporating this full set of ports allows PortWatch to capture Japan's dense and geographically dispersed port network.

In estimating Japan's trade volume, we found that applying the authorities' import and export price indices significantly improves the alignment of PortWatch's estimates with official data.

For Japan, PortWatch broadly captures the overall pattern in official data. Aggregate international port calls follow the trends seen in the authorities' statistics (top left chart of Panel 3), though levels differ because official figures include passenger vessels and other ship types not covered by PortWatch. For physical trade volumes (top right chart of Panel 3), PortWatch tends to underestimate levels owing to differences in the definition of international trade flows and the coverage of cargo vessel types, but it tracks the cyclical movements in the authorities' metric-ton series well. The fit for both trade values and trade volumes is strong (remaining charts in Panel 3), with PortWatch closely mirroring the main trends in the official data.

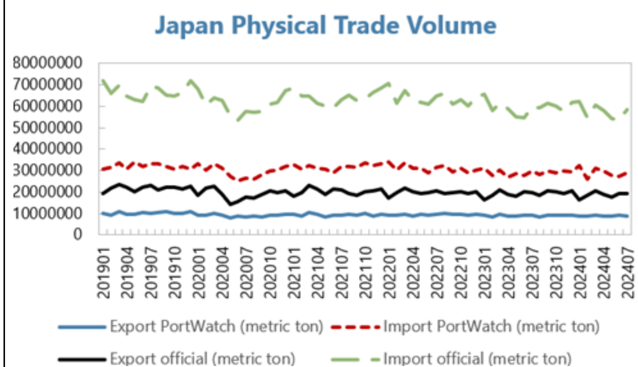
Panel 3: Japan Results

PortWatch captures the aggregate trends but not levels due to different classifications of international trade and vessel types.



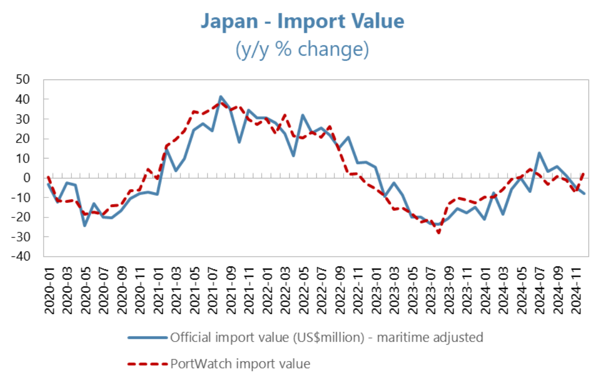
Source: Ministry of Land, Infrastructure, Transport, and Tourism, PortWatch.

PortWatch underestimates the physical trade volumes due to different coverage of cargo vessel types.



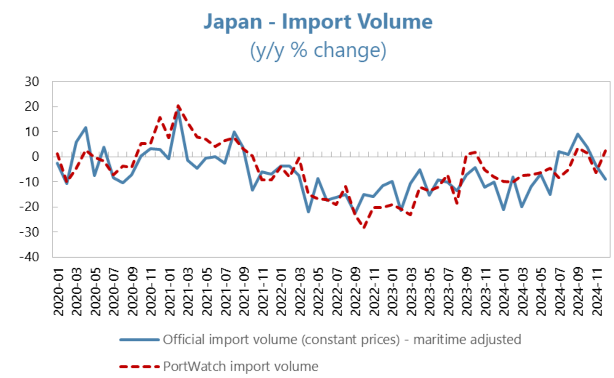
Source: Ministry of Land, Infrastructure, Transport, and Tourism, PortWatch.

PortWatch import value estimates track official values closely over time, capturing key trends.



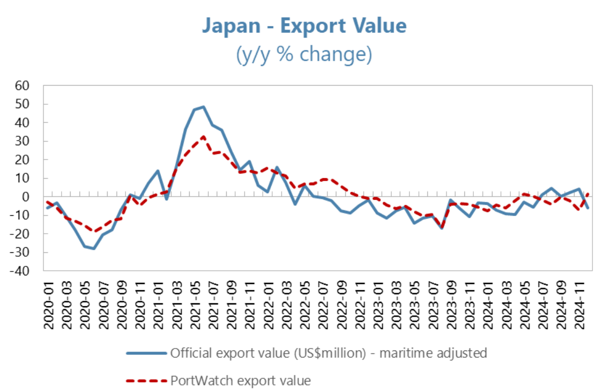
Source: Haver Analytics, PortWatch.

PortWatch import volumes track trends and fluctuations in official deflated import volumes.



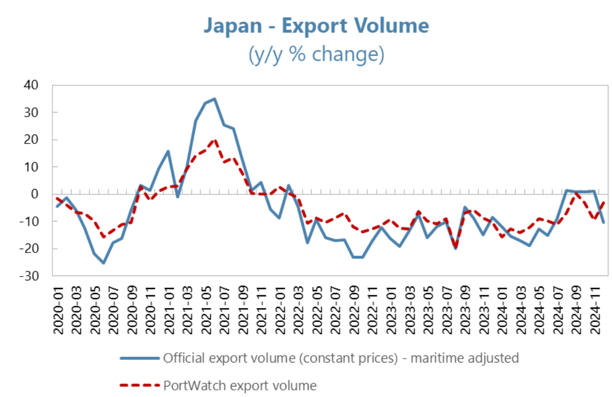
Source: Haver Analytics, PortWatch.

PortWatch export value estimates align well with official export values, capturing the overall level and month-to-month variation in Japan's export activity.



Source: Haver Analytics, PortWatch.

PortWatch export volumes align well with official data, reflecting similar movements and month-to-month dynamics in Japan's export activity.



Source: Haver Analytics, PortWatch.

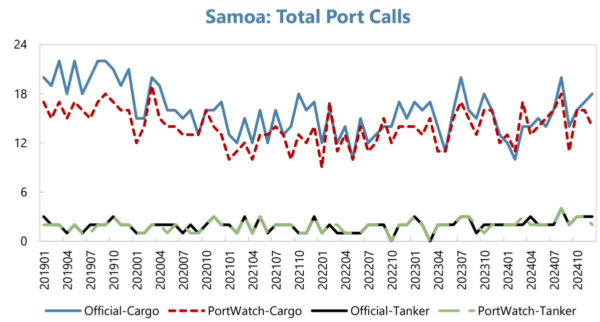
e. Samoa

Samoa is a small island developing state subject to idiosyncratic shocks. In general, PortWatch estimates tend to fit official data only loosely, indicating that further refinements to AIS-based methodology may be needed when applied to small island economies. Across both values and volumes, the fit of the import series (middle charts of Panel 4) is noticeably better than that of the export series (bottom charts of Panel 4) - possibly reflecting the fact that imports are structurally larger and more stable over time than exports.

To ensure comparability, official import and export values were adjusted to remove goods that are typically not transported by sea (such as pharmaceuticals, precious stones, aircraft, work of art, etc.) since PortWatch captures maritime trade. Official import volumes were constructed using the published import price index. However, because an official export price index is not available for Samoa, the GDP implicit price deflator was used as a proxy to derive export volumes from the official data. These adjustments place official and PortWatch data series on a more consistent basis. However, it is clear that the export series for Samoa produced from the nowcast does not accurately capture maritime exports, which are small and highly volatile; given the challenges in estimating these flows with precision, they are not currently incorporated in the PortWatch platform, though this could be considered in future refinements.

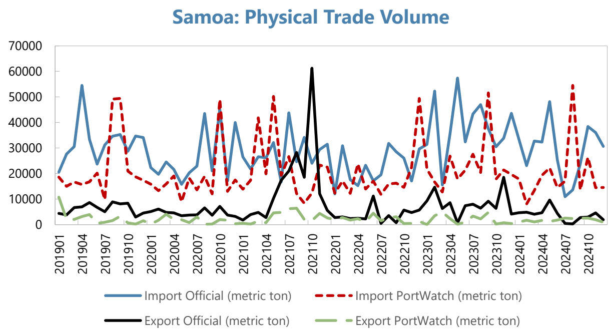
Panel 4: Samoa Results

PortWatch and official data show broadly consistent trends in Samoa's cargo and tanker port calls over time, with PortWatch closely tracking seasonal patterns and fluctuations.



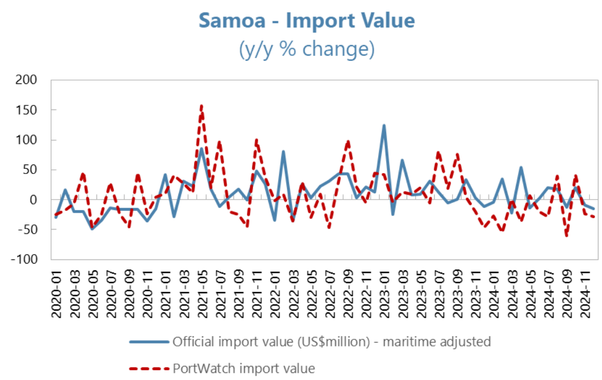
Source: Samoa Bureau of Statistics, PortWatch.

Official and PortWatch physical trade volumes for Samoa show large discrepancies, with PortWatch only loosely tracking the official import and export series.



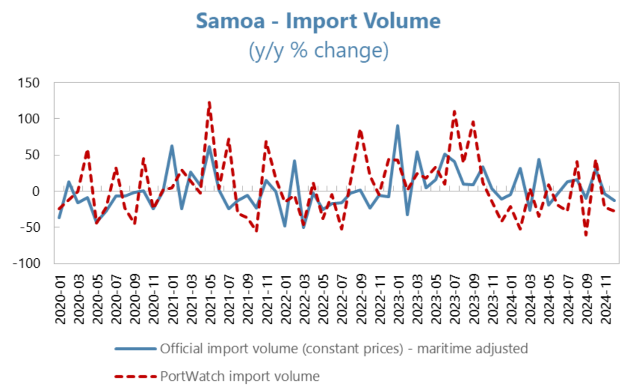
Source: Samoa Bureau of Statistics, PortWatch.

PortWatch import values track the average level of official data reasonably well for Samoa, although the correlation with monthly dynamics is weaker.



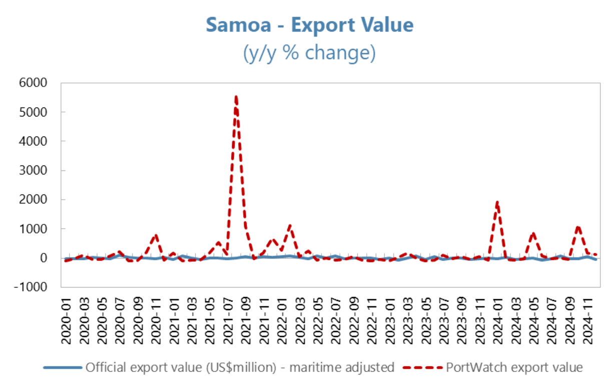
Source: Haver Analytics, PortWatch.

PortWatch import volumes broadly follow trends in official data while differences remain month-by-month.



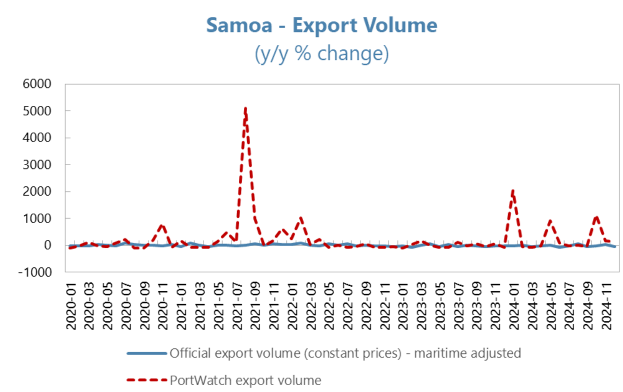
Source: Haver Analytics, PortWatch.

PortWatch export values track official data only loosely—showing weaker correlation and wider deviations than in the import series.



Source: Haver Analytics, PortWatch.

PortWatch export volumes are more volatile than official exports, suggesting the need for further improvements of underlying data.



Source: Haver Analytics, PortWatch.

f. United States

PortWatch data has a close match on port calls and physical volumes in the United States, which then supports good performance in the nowcast estimates.

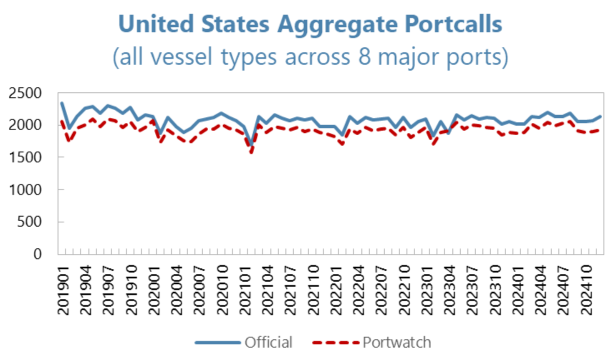
PortWatch data on port calls captures the trends in official records across major ports in the United States (top left chart of Panel 5). PortWatch has a strong correlation with port calls across the 8 major ports in the United States, where official statistics are available, with an overall correlation coefficient 0.93. The relationship is strongest for containerships with a correlation of 0.95 and weakest for tankers at 0.75. Remaining differences could reflect the official definitions of ports and tanker terminals.

PortWatch estimates of trade in physical volumes have a good fit with official data (top right chart of Panel 5). The fit is better for exports than imports, primarily driven by an overestimation of import volumes from container ships in ports where the netting adjustment for transshipment is used, which could reflect goods arriving into the United States without clearing customs as they are transported to other countries using non-maritime transport.

The nowcast results have a good fit with the value of official maritime statistics (reported by U.S. Census) across all four outcomes illustrated in the middle and bottom rows of charts. There is a very strong fit for the estimates of value, with the estimates capturing the monthly dynamics (correlation of 0.95 for exports and 0.86 for imports), and the levels reflected by the low normalized RMSE. The fit is slightly weaker for volumes, with the correlation results just below our threshold (correlations of 0.73 for export volumes and 0.74 for import volumes) while meeting our criteria on the level fit (normalized RMSE of 0.55 and 0.89 respectively). We then consider an application of the PortWatch nowcast estimates during the period of elevated trade tensions in the first half of 2025, illustrating that the PortWatch estimates capture the dynamics of maritime trade while excluding the more volatile trade by other transportation modes driving movements in the headline trade statistics.

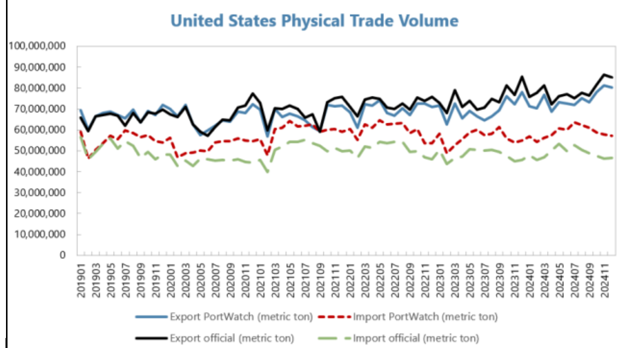
Panel 5: United States Results

PortWatch captures the aggregate trends in port calls across major U.S. ports.



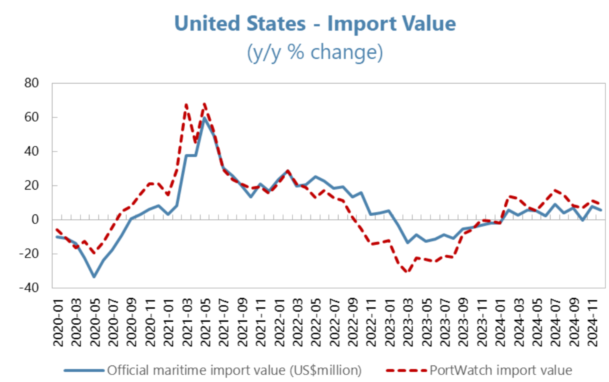
Source: Haver Analytics, PortWatch.

PortWatch closely matches the physical volume of exports, with a gap in volume of imports.



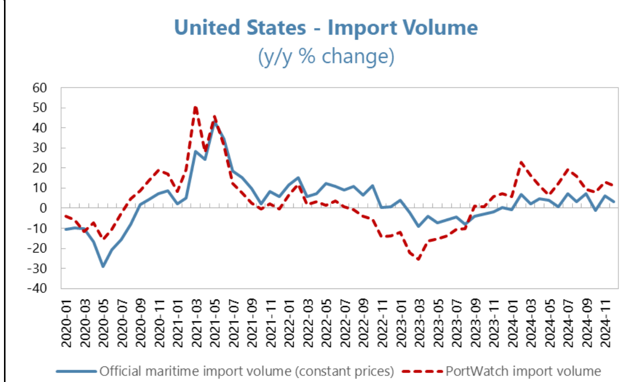
Source: Haver Analytics, PortWatch.

Nowcast estimates of import value have a good fit with official statistics in trends and levels.



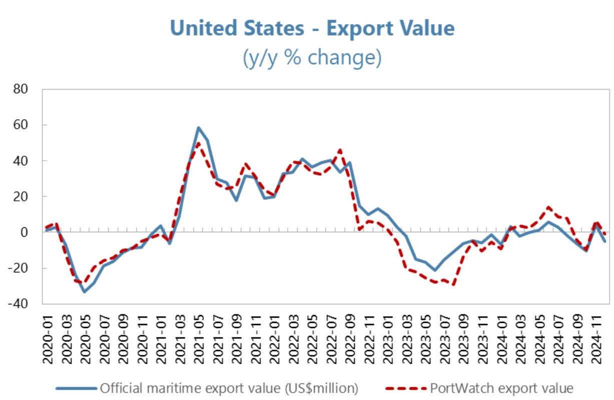
Source: Haver Analytics, PortWatch.

With a slightly weaker fit seen in the estimates for import volumes.



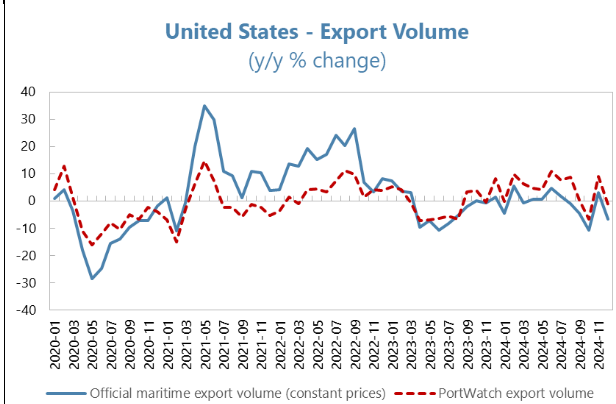
Source: Haver Analytics, PortWatch.

The correlation with maritime export value is also very strong in capturing the monthly dynamics.



Source: Haver Analytics, PortWatch.

While the estimates for export volumes have a slightly weaker fit, especially in 2021 and 2022.



Source: Haver Analytics, PortWatch.

Box 1. U.S. Imports amid Elevated Trade Tensions

This box highlights changes in U.S. imports, as estimated by the PortWatch nowcast and official statistics, in response to elevated trade tensions and increased tariff rates in 2025.

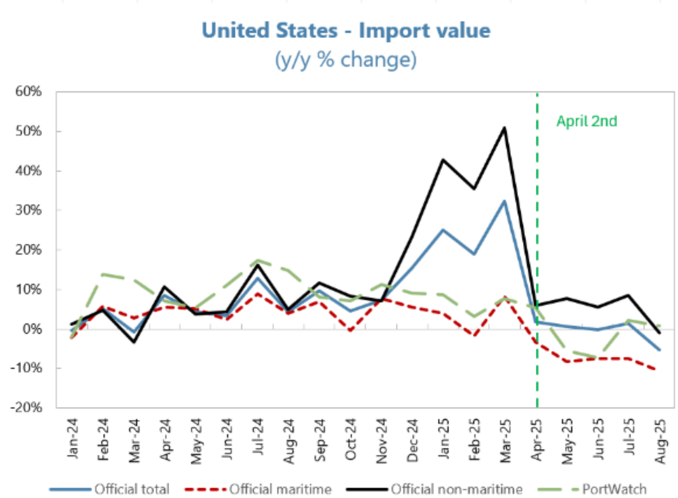
U.S. trade policy changed significantly in 2025 H1 with the U.S. effective trade-weighted tariff increasing from 2.5 percent in January to a peak of 23 percent in May, whilst there was also a rapid increase in trade policy uncertainty. This major policy development provides an opportunity to assess the performance of the PortWatch nowcast and potential implications for policymakers.

Official statistics from U.S. Census indicate a rapid increase in the value of U.S. imports between December 2024 and March 2025, which has been well-documented as a period of front-loading ahead of tariffs that were introduced between February and April – with universal tariff increases announced by the U.S. on April 2nd (IMF WEO, April 2025). However, the PortWatch nowcast do not capture this front-loading spike (Figure 1.1).

The PortWatch nowcast instead exhibits similar trends to the official maritime import statistics – with the PortWatch estimates for U.S. imports between January 2024 and June 2025 having a correlation with maritime imports of 0.82, compared to the correlation with total imports of 0.24. Maritime imports exclude products which are transported by air-freight and were the primary drivers of the front-loading spike as high-value and small volume goods were imported ahead of potential tariff increases (especially gold bullion, pharmaceuticals, electronics). This highlights that the PortWatch nowcast should primarily be considered an estimate of maritime trade rather than total goods trade, especially with potential composition changes in modes of transportation.

An implication of the PortWatch nowcast from this application is that it provides information related to less volatile components of international trade as international shipping has longer transportation times than other modes of transport. For example, shipping from China to the U.S. takes on average 4 weeks, whereas air-freight is completed in under 1 day. As such, maritime trade can be seen as capturing core economic activity. Just as core CPI strips out more volatile components of inflation, providing policy makers with information to understand underlying macroeconomic drivers of consumption and production behavior, the PortWatch nowcast essentially strips out more volatile components of trade.

Figure 1.1 United States imports of goods by transportation mode and PortWatch estimates



5. Cross-comparability of PortWatch estimates

The PortWatch nowcasts of country-level trade provide comparable estimates for imports and exports across countries. These estimates are developed using the same methodology and same underlying source of data for each country. This contrasts with official import and export statistics which are produced by each national authority and may have different data and methodologies, for example reporting timeframes and the definitions.[16]

The common methodology in the PortWatch estimates may lead to divergences with official data. We acknowledge that there are additional country-specific adjustments to the methodology that could be made to improve the fit of the PortWatch results with official statistics for particular countries. However, implementing these adjustments in an idiosyncratic way would reduce the cross-comparability of the PortWatch estimates. In the pilot phase of the project, we have identified the following areas of divergence which we do not incorporate into the nowcasting methodology.

Price indices: A key step in our nowcasting methodology is using price indices to transform estimates of physical volumes into trade values. However, this raises the question of whether we have appropriate price indices for the country. For the pilot countries in this paper, we identified two potential reasons why our constructed price indices may deviate from actual pricing behavior.

First, the PortWatch price index does not account for the seasonal composition of trade within a vessel type. For countries with highly seasonal composition in their trade volumes with different average unit values during those seasons, this may lead to under/over-estimation of trade values throughout the year when we convert from physical volumes to trade values. This is most likely to be the case for commodity exporting countries. For example, for Brazil the main bulk commodities are soybeans and iron ore which are exported at different seasons, leading to an under-estimation of trade value during the higher unit value soybean exporting season and corresponding over-estimation of trade value during the periods when iron ore is the dominant export. However, we do not create seasonal price indices for individual countries as we do not currently have a cross-comparable approach to create such an index for all countries. Instead, we present results based on the year-on-year changes, which remove much of the seasonality and are comparable to approaches taken with other economic indicators, such as CPI estimates.

Second, the PortWatch price index is based on contemporaneous prices for commodities. However, many commodity prices are set using long-term bilateral contracts, formulas linked to reference prices, negotiated benchmarks and transfer-pricing arrangements or futures prices. Contract-based pricing arrangements may lead to divergences relative to estimates based on contemporaneous prices for countries such as Jamaica which have high shares of commodity exports. As pricing dynamics may differ across commodities and countries, we do not incorporate contract pricing into the PortWatch price index.

[16] For example, in bilateral trade data some countries report the source country for imports based on the “country of origin” whereas others report the “country of dispatch”.

Reporting lags: PortWatch records trade at the time a vessel is loaded or discharged. However, official statistics may record transactions at a different time, such as when a good clears customs or another reference period. This can create a reporting lag, especially if customs processes take an extended period – for instance if goods are moved into bonded warehousing. This pilot project highlighted a potential reporting lag for Brazilian oil exports from offshore platforms as there is a window from the departure of a vessel for the export to be recorded, based off the potential timing of market transactions.[17] Incorporating a lag for the timing of Brazil's oil exports would improve the correlation coefficient of Brazil's export value with official statistics. However, as information on reporting lags is not always publicly available and may differ significantly across countries, we do not incorporate this into the PortWatch estimates.

[17] The legal deadline to submit final invoices for petroleum is 60 days, although in practice this may take longer up to 90 days: https://normasinternet2.receita.fazenda.gov.br/#/consulta/externa/81483/visao/vigente#

6. Conclusion

This paper outlines a methodology to develop a nowcast of country-level trade estimates using AIS satellite-based big data on vessel movements sourced from the PortWatch platform. It shows that the global nowcasting approach developed in Arslanalp et al. (2025) can be applied at the country-level with country-specific adjustments. First, domain specific knowledge can improve the underlying data, ensuring that all major ports (including offshore platforms) are captured and that port boundaries are appropriately defined. Second, implementing methodological improvements for specific ports such as the netting adjustment where there is significant two-way trade or by adjusting load factors for specialized import or export ports. Third, using official country-specific price deflators to create statistical volume estimates rather than using constructed deflators where this results in a significant improvement in the fit.

Our results indicate a better fit of the PortWatch nowcast estimates to official statistics in advanced economies and large emerging markets. Of the sample of 5 countries across a range of income groups, we find that Brazil, Japan and the United States meet our performance criteria of a correlation coefficient of greater than 0.8 and normalized RMSE of less than 1 in the majority of the statistics across trade flows. Smaller and developing economies – Jamaica and Samoa in our sample – had a weaker fit between the nowcast estimates and official statistics, although also showed the greatest improvement from incorporating domain specific knowledge and adjustments. While the performance of the nowcasts may not have as good fit, the availability of timely estimates of trade for smaller and developing economies could provide greater value in understanding economic developments for policy makers.

Annex I. Correlation of volume series using the same deflators

When deriving statistical volume by using deflators, even if we deflate both PortWatch and official trade value series by the same deflator, the correlation of the value and volume measures may not be the same. This is because deflator series are time-varying, with changing variances and covariances, which means the distribution of volume series are different from the distribution of value series. And this is still the case when we take the quasi-linear log-transformation. The proof is shown below:

$$
\begin{aligned}
&\textit{Let in time } t:\\
&V_t^{official} = \textit{Trade Value in official data},\\
&V_t^{pw} = \textit{Trade Value in PortWatch, and}\\
&P_t \;\; = \textit{Price deflator}
\end{aligned}
$$

Suppose $X_t = \ln V_t^{official}$, $Y_t = \ln V_t^{pw}$, $C_t = \ln P_t$, and $\operatorname{cov}(X, C) = \operatorname{cov}(Y, C) = 0$. The value correlation is

$$\rho_{\text{value}} = \frac{\operatorname{cov}(X, Y)}{\sqrt{\operatorname{var}(X)\ \operatorname{var}(Y)}}$$

The volume correlation is

$$
\begin{aligned}
\rho_{\text{volume}} &= \frac{\operatorname{cov}(X - C, Y - C)}{\sqrt{\operatorname{var}(X - C)\ \operatorname{var}(Y - C)}}\\
&= \frac{\operatorname{cov}(X, Y) - \operatorname{cov}(X, C) - \operatorname{cov}(Y, C) + \operatorname{var}(C)}{\sqrt{(\operatorname{var}(X) + \operatorname{var}(C) - 2\ \operatorname{cov}(X, C))\ (\operatorname{var}(Y) + \operatorname{var}(C) - 2\ \operatorname{cov}(Y, C))}}\\
&= \frac{\operatorname{cov}(X, Y) + \operatorname{var}(C)}{\sqrt{(\operatorname{var}(X) + \operatorname{var}(C))\ (\operatorname{var}(Y) + \operatorname{var}(C))}}
\end{aligned}
$$

Thus, as long as $\operatorname{var}(C) > 0$, in other words, the price index has some variances,

$$\rho_{\text{value}} \neq \rho_{\text{volume}} \text{ in general}$$

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