Big Data on Vessel Traffic: An Innovative
Approach to Nowcast Trade Flows in Real-Time

**Keywords:** Big Data, Trade Statistics, Automatic Identification System (AIS), Vessel Traffic.

# Introduction

Maritime transport is at the core of world trade. Over 80 percent of global merchandise trade by volume and more than 70 percent of its value is carried by the international shipping industry. Nowadays, cargo traffic can be tracked in real time. Cargo ships are equipped with a device that periodically emits a radio signal (Automatic Identification System message, or AIS) which contains information on the vessel’s location, speed, destination, draught, etc. In this paper, we show that big data on vessel traffic can be used to nowcast trade flows of countries with large shares of imported goods by sea. We use Malta as a benchmark case to show the usability of our approach and compare our results to the official trade statistics and maritime statistics disseminated by Eurostat.

# Methods

We develop indicators on maritime traffic and trade activity based on port calls. Data on port calls track arrivals and departures of vessels based on their positions. We use a two-step approach to derive these indicators. First, we filter the port calls data to eliminate duplications, vessels in transit, and cargo ships that are expected to generate trade activity by unloading and loading goods in the port. Our filter is designed to identify unique arrivals of cargo ships in ports. Second, we calculate high-frequency indicators of vessel traffic activity on the filtered ships aggregating static and voyage-related information contained in the port call data. We calculate two indicators of vessel traffic: (i) the *cargo number* indicator, which counts the number of incoming ships; and (ii) the *cargo load* indicator, which combines information on the ship’s deadweight tonnage and draught reported in AIS messages.

# Results

We verify the quality of our indicators through comparison with official trade and maritime statistics. The results of this comparison indicate that:

* The cargo number indicator shows a larger number of ships with respect to data available from official port statistics, while following the same trends. We interpret this finding as a sign of exhaustive coverage of commercial vessels using port calls based on AIS.
* The cargo load indicator appears to be a good proxy of Malta’s trade volumes (Figure 1). Our indicator detects very well the large peak of trade activity in mid-2016, and the subsequent deceleration in the next months.
* The cargo load indicator does not seem to provide a good distribution of trade by partner country. For the specific case of Malta, port call data record directions of trade based on shipping routes rather than countries of origin and destination. Better results can be achieved by combining port call data around the world to track the full journey of ships.

**Figure 1. AIS-based Indicator Highly Correlated with Official Trade Volume**

*(Cargo load indicator versus official trade volume index, 2016=100. Period: 2015-18)*

# Conclusions

We show that vessel traffic data based on Automatic Identification System (AIS) can be used to nowcast trade activity. Provided that the challenges associated with “port call” data can be overcome through appropriate filtering techniques, these emerging “big data” on vessel positions could allow statistical agencies to supplement existing data sources on trade and introduce new statistics that are more granular (port-by-port) and more timely (practically real-time), offering an innovative way to nowcast trade activity in volume terms.

# References

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