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Covid-19 and seaborne trade: The Italian perspective

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**A B S T R A C T**

Covid-19 pandemic impacted on all major trade flows, shuffling global value chains and pushing major industries to re-think their procurement strategies. While long term impacts are still subject to speculation, the immediate response of local industries need to be evaluated in order to target relevant policy interventions and to understand which economic players have been hit the most. Current paper tries to fill such gap, using the Italian Custom Agency database for verifying which trade sectors and ports suffered the most from the Covid-19 first wave. In order to achieve the research goal, all containerized import and export flows have been collected for the period 2012–2020, comparing historical patterns with the one observed in the first semester 2020. Results aim at contributing to the current understanding of the crisis’ impact and they will be used for driving future recovery plans.

1. Introduction

The spread of the SARS-CoV-2 virus has led to a series of unprecedented macroeconomic shocks in most countries around the world. The measures adopted by different countries to contain the virus led firstly to the imposition of restrictions on the movement of people and then quickly stiffened until the complete lockdown of entire regions and countries. In most countries, the first wave generated either local or national lockdowns for several weeks between March and June 2020 with the partial and progressive re-opening from May onwards until the autumn 2020 when some countries had to reinstate lockdowns and other restrictions due to the so-called second wave.

During the first phase of the pandemic, the lockdowns’ effect on regional economies was amplified by the asymmetric starting and ending dates of local restrictions, with some countries starting to have first national rules in early February (e.g. Far East countries) while others introduced lockdowns in March (e.g. European countries) or even later (e.g. American countries). These asymmetries generated different impacts on the production activities and the related trade operations, with only some activities considered essential that could continue at “business as usual” conditions. Despite this, all activities had to adopt special precautions and they rarely had the possibility to operate at maximum capacity. The magnitude of such impact is represented by a recent IMF outlook (2020) that highlights a reduction in the world GDP of 4.9% in 2020, with an uncertain recovery in 2021 depending on the evolution of the pandemic: the same outlook stresses how in 2009, after the world financial crisis, the world GDP dropped only of 0.1%, highlighting the different magnitude of the two crises. Notteboom et al. (2020) argued that the differentiated effects of the two crises can be also observed in terms of impact on international trade and related shipping services, with companies reacting differently during the 2008–09 crisis in respect with the effects of the Covid-19 pandemic.

These generalised negative outcomes at world level are in contrast with the economic performances of some countries (e.g. China) that recorded a positive record in 2020: the Covid-19 crisis generated asymmetric impacts not only in terms of responses but in terms of economic consequences as well. Within this overall picture, European countries have suffered a heavy toll, particularly during the so-called first wave of the pandemic (i.e. February–June 2020). Among the different EU countries, Italy registered the second highest toll in terms of fatalities and the highest percentage decrease in terms of GDP. This latter aspect is linked with the Covid-19 spread pattern: more than 50% of the Italian cases were concentrated in Lombardy, the region that contributes the most to the Italian industrial production. Moreover, being the first EU country having registered Covid-19 patients, it suffered the longest lockdown among EU member states, with many economic sectors that have been, at least partially, shut down with differentiated impact on local logistics. Within this framework, and considering the structure of the Italian manufacturing system, it is particularly relevant to mention that most of the trade surplus generated by Italy is due to commodities travelling mainly through containers: the overall general cargo sector accounts for about 50% of the overall Italian trade.

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port throughput (Assoproti, 2021), making the smoothness of the production process of finished goods a strategic activity for the Italian economy.

Given these premises, the first wave of the pandemic in Italy can be used to study the variations suffered in terms of trade and the related impacts that a partial or complete closure of either domestic or foreign markets can generate on specific industrial sectors. This latter element can be considered of relevance to better plan the recovery phase as well as for better understanding which sectors rely more on which foreign markets.

1.1. Study rationale

The evolution of the pandemic crisis heavily affected both port activities and national logistic services, with shipping lines that had to reschedule services and to adapt to new rules, port closures, and the reduced demand for services (e.g. Notteboom et al., 2020). The impact of such drastic change was visible in the need for shipping liners to extensively use the practice of blanket sailings (i.e., the cancellation of scheduled services, that reached a peak of more 100 cancellations between February and March) and to drastically reduce the deployed capacity per service, as shown in Fig. 1.

From a general point of view, shipping continued to operate even during the lockdown, but inevitably the industry was affected by the contraction in production, the effects on demand for raw materials and finished goods due to the economic crisis (i.e. the decrease in household disposable income and a general reduction in consumer confidence), and the needed restructuring of different global value chains. This latter issue has been mainly developed for adapting service levels to tackle changes in demand as well as to find a new balance between imports and domestic supplies of different kind of goods in a time when the higher reliability – characterised by travel restrictions and regulatory uncertainties – of local markets over international ones promoted regional trades over interregional ones. Moreover, for certain trades, the shift of priorities (e.g. medical supplies) and of trade partners pushed towards new logistics solutions, making the shipping sector somehow replaceable (e.g. favouring air or rail operations).

Against this backdrop, extant literature highlights the difficulties for liners to adapt to network disruptions and market shocks (e.g. Achurra-Gonzales et al., 2019; Chen et al., 2016), thus implying potential long-term consequences for the future of the liner shipping industry due to the Covid-19 pandemic, as highlighted by preliminary studies published in late 2020 on either the general shipping businesses (e.g. Notteboom et al., 2020) or on specific segments (e.g. Rahman et al., 2020). Notteboom and Haralambides (2020) have pointed out as the pandemic substantially changed the competing playbook for the port sector, with the derived uncertainty that is heavily impacting on the planning and investment capability of most ports. Despite this, Ferrari and Tei (2021) argued that the shipping business was capable of adapting to the Covid-19 pandemic better than for previous crisis (e.g. 2009 financial crisis). As such, understanding better the consequences of the pandemic crisis on specific national port sectors could shed lights also for better understanding the long-term effects and then for driving the related recovery phase.

Transport network industries are particularly vulnerable to external shocks, as demonstrated by past events (e.g. Rouset & Ducruet, 2020), with logistics disruptions that cause cascading effects on interconnected markets (e.g. Kaliszewski et al., 2020). Multiple attempts of studying the resilience of the overall logistics network have been proposed for better adapting infrastructure and services to the possible impact of external shocks. For instance, Calatayud et al. (2017, pp. 195-208) demonstrated how the different role of ports in the regional economies could determine asymmetric impacts of network disruptions, with related effects on the logistics processes. Similarly, Viljoen and Joubert (2016) showed how maritime networks are generally resilient to shocks but this could either generate extra-costs for users or increase flexibility of carriers, depending on the specific network hierarchization and on the level of connectivity of the different ports. Within this vein, Vonck and Notteboom (2016) showed how seaports are complex adaptive systems and their level of resilience is dependent on the capability of different stakeholders to adapt to the changing market environments. As such, understanding better if (and how) the pandemic shifted the cargo traded by different national ports could help in assessing the resilience of current logistics solutions, hopefully leading to a better response in case of future shocks.

Within the extant Covid-19 related literature, a series of authors discussed how to make logistic networks both resilient and adaptive to such scenarios (e.g. Chatterjee & Layton, 2020). Moreover, Covid-19 pandemic determined a series of suggested interventions and solutions for evaluating disruption impacts not only on logistics operations but on value chains as well. Most recent studies focused on either specific industries (e.g. rice in West Africa [e.g. Arouna et al., 2020]; lettuce in US [e.g. Loker, 2020]) or types of companies (e.g. Juergensen et al., 2020) with the aim of providing insights on how to mitigate relevant effects. Despite these early studies on Covid-19 pandemic, provided solutions are still far to be effective and a lack of understanding of the actual impact of worldwide disruptions on local value chains is present. One of the limitations of these studies is the limited availability of data: because of this lack, most papers provide insights without comparability or possibility of generalising the related results.

The present study contribute to current knowledge in three specific ways: i) using an extensive database, it represents one of the first attempts to quantitatively assess the impact of the pandemic on the national maritime logistics; ii) using an ad-hoc modelling solutions, the study differentiate the impact of the crisis in respect to the different stages of the first wave of the pandemic and in respect to different traded cargoes, as such it helps in providing insights to policy makers for better planning the recovery phased; and iii) the research clearly identifies key impacts on both the cargo and the logistics system. In order to achieve the abovementioned goal a distinctive database has been used (i.e., Italian Custom’s database) being able to identify all imported and exported cargo in the analysed period (2012–2020) via all Italian port authorities.

The paper is structured as follows: after this introduction, Section 2 describes the research approach, and section 3 focuses on the outcome of the analysis. Section 4 addresses the conclusive remarks.

2. Research approach

This work uses a detailed database that has been provided by the Italian Customs Agency concerning all the extra-UE import and export trades that have crossed the Italian border from January 2012 to July 2020. The original dataset was composed of about 233 million records that collect information about the main features of the commercial transaction: i. the exact date (in yyyy-mm-dd format) of the customs operation; ii. the identification code of the customs office where the goods transited; iii. the commodity category of the goods; iv. the transport mode used to reach the Italian border; v. the country of origin, 1

1 Database ADM. Data extraction by Statistics and Open Data Office of the Italian Custom Agency.
2 The database currently available covers the period January 2012–July 2020. Authors are aware that longer time series could have provided more information on the general trend of trade distribution: despite this, current dataset allowed us to compare the Covid-19 pandemic reaction with the impact of other “similar” crisis, such as the trade friction with major trade partners (e.g. US, China, Russia) and other extreme events that disrupted global supply chains (e.g. weather events).
3 Eight-digit code otherwise known as TARIC code: a numeric code used to uniquely identify a specific product according to international denomination of goods Harmonized System. It’s also used to identify the correct customs tariff to be applied.
with regard to import, or the country of destination in case of export; vi.
the Italian province of destination for imports, or the province of origin,
in case of export flows; vii. a dummy variable indicating whether the goods
have been carried in containers or not; viii. the weight and the monetary value of the goods.

2.1. Managing the original dataset

The raw data were filtered and reorganized to be analysed according
to our purposes. Specifically, to identify container port traffic, all non-
containerized traffic or traffic arriving at the Italian border by a mode
other than maritime transport has been excluded. It is interesting
noticing that non-EU imports and exports coming from other EU coun-
tries account for 0.1% and 0.2%, respectively, making them marginal
flows in respect to current Italian logistics chains.

In addition, the identification codes of all the customs offices have
been reorganized by matching each of them, where it was possible, to
one of the 15 Italian Port System Authorities (PAs). Moreover, for
obvious reasons of interpretability of the results, the over 37 thousand
product categories have been reclassified into 14 macro-categories. For
similar reasons, the 279 country identification codes of origin/destina-
tion of goods have been grouped into 8 geographical regions (Africa,
Europe, Far East, Latin America, Middle East, North America, Oceania,
Other Asian countries) and the 110 Italian provinces have been
regrouped in 5 groups in accordance with the European NUTS1 classi-
fication (North West, North East, Center, South, and Isles). In the latter
case, it was necessary to add a further category (intra EU) to identify
traffic not originating nor directed to an Italian province but rather to a
Member State of the European Union.

2.2. Panel settings

Then, we proceeded to set up two different datasets, for import and
export trades respectively, by collapsing the information of the original
dataset with respect to the variable weight of the goods,4 aggregating
the information with respect to the following grouping variables: the year
and the month of the customs operation (time series of 103 months), the
Port Authority where the cargo was handled (15 levels), the NUTS1
region of destination/origin (6 levels), the extra UE geographical region
of origin/destination (8 levels) and the macro category of goods (14
levels), thus obtaining two unbalanced panels of 207,915 units for im-
ports and 277,429 units for exports respectively. Table 1 shows the
average value for the period 2012–2020 of the metric tonnes handled in
the assessed ports by trade partner, cargo category, port of entry/exit,
and Italian region that generated the trade flow.

Table 1 shows how the main trading partners are located in the Far
East region (40% of imports and 16% of export), while North America is
the main customer for the Italian export (about 20% of the total trade
goods). Food and Ceramics represent the main exported cargoes while
the imported commodities are represented by more balanced flows with
more than 6 categories counting for more than 10% of the overall im-
ports. As far as ports and region of entry/exit, foreign trade appears
quite concentrated with more than a third of both import and exports
concentrated in the North West regions and cargos handled by local port
authorities (i.e. Ligurian Sea ports). This latter aspect is of particular
importance for the imports: 43% of them are destined to North West of
Italy and half of the imported cargoes is ultimately handled in either one
of the two Ligurian Port System Authorities.

Looking at specific trends, Fig. 2 and Fig. 3 show first semester
variations over the past three years for both selected ports and cargo
trades.

On the one hand, Fig. 2 shows how the selected ports all recorded
negative performance in terms of overall import activity, under-
performing in respect with previous years, while export flows were more
balanced, either registering values not too far away from previous years
or bouncing back after a decreased trend characterising the first months

4 Authors are aware that often studies prefer to use the value of the goods
rather than the weight. Our choice is related to the goal of the presented
research. On the one hand, the weight is a proxy of the actual cargo handled by
ports and related logistics operators and – as such – a more reliable information
of the actual impact of the crisis on transport and logistics operations. On the
other hand, cargo value is not providing us with such information, being
heavily impacted by market conditions that could have changed – beyond the
simple inflation rate – during the pandemic, making comparisons and pattern
assessments less reliable.
of the pandemic only.

On the other hand, Fig. 3 underlines how major traded cargos were cleared at the specific port system authority and 0 otherwise. Therefore, for this model, a total of 90 dummy variables (15 levels × 6 months) were created. Similarly, we created 36 dummy variables for the two models (import/export) on NUTS1 regions, 48 for those on Macro Regions, and 84 for those on commodity categories.

2.4. General specification of the models

Stating with $D_{2020,m}$ the monthly dummy variable of the month $m$ of year 2020 (valued with 1 if the trade takes place in month $m$ of 2020 and 0 otherwise) and with $D_{j}$ ($j = 1 \ldots L$) the $L$ dummy variables (one for each category level) of the explaining variable chosen to be included into the model, we can write the fixed effect regression model as follows:

$$Y_{it} = \sum_{m=1}^{L} \beta_{j,m} (D_{2020,m} \times D_{j}) + \alpha_{i} + u_{it}$$

where $Y_{it}$ is the log transformation of the goods weight (import or export flows); $D_{2020,m} \times D_{j}$ is the interaction dummy variables created in order to scrutinize the average effect on the dependent variable due to each category of the independent variable considered (i.e. Port Authority, NUTS1 region of destination/origin, Geographical Area of origin/destination, Goods category) during the pandemic period; $\alpha_{i}$ is the panel levels (5,474 for imports; 6,525 for exports); $T$ is the number of months of the monthly time series (103 months); $u_{it}$ are entity specific intercepts that capture heterogeneities across entities; $\beta_{j,m}$ is the error term. In order to deal with heteroskedasticity and autocorrelation issues, we used clustered robust variance estimator for the estimation of the regression coefficients.

3. Results

The outcomes of each model are displayed, for convenience, in a two-way table where the rows show all levels of the independent variable used in the model to generate the dummy variables, as described above, and the columns report the months from February to July 2020. In Table 2, coefficient estimates are reported with the observed significance next to them, coded as usual. The choice to visualize the outcomes in this manner, involves a second advantage related to the possibility of diachronic reading of the results, thus being able to identify temporal patterns as well as different distributions of goods flows among the categories considered. All tables (2–5) point out a specific time pattern: imports have been – at least partially – already affected in February, exports have been impacted starting from March–April, recording a delay in respect with the first consequences of the pandemic and with the beginning of main lockdowns.

From a transportation point of view, this preliminary finding shows an inconsistency in respect to normal operational elements: given that most loops have a 30 days transit time, even if considering first trade frictions that happened in late January, imports should have been

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**Table 1**

| Goods category | IMPORT | EXPORT | IMPORT | EXPORT |
|----------------|--------|--------|--------|--------|
| Metals         | 5.064  | 1,194  | 5.04  | 1,172  |
| Plastics       | 4.006  | 0.987  | 4.00  | 0.987  |
| Minerals       | 1,859  | 0.471  | 1,85  | 0.471  |
| Textiles       | 411    | 0.921  | 41    | 0.921  |
| Mechanicals    | 1,412  | 0.352  | 1,41  | 0.352  |
| Vegetables     | 1,130  | 0.271  | 1,13  | 0.271  |
| Paper          | 1,053  | 0.242  | 1,05  | 0.242  |
| Food derivatives | 762  | 0.172  | 76    | 0.172  |
| Chemicals      | 1,341  | 0.321  | 1,34  | 0.321  |
| Metals         | 1,996  | 0.471  | 1,99  | 0.471  |
| Minerals       | 1,609  | 0.392  | 1,61  | 0.392  |
| Textiles       | 1,411  | 0.321  | 1,41  | 0.321  |
| Mechanicals    | 1,409  | 0.321  | 1,41  | 0.321  |
| Vegetables     | 1,301  | 0.321  | 1,30  | 0.321  |

**Source:** own elaboration from Italian Custom Agency data, 2020.

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**Note:**

- *Some macro-categories have differentiated sets of commodities included, despite their general label. As such, “Paper” includes all wood works and book and publishing products; “Mechanicals” also includes electronics, optics, and appliances; “Metals” includes all derived products (e.g. plates, vases) from metallic materials; and “Minerals” also include derived chemical products (e.g. soap, paintings), pharmaceutics, and cosmetics.
- *AdSP stands for “Autorità di Sistema Portuale”, the Italian acronym referred to Port System Authority. Similarly, the acronym AP stands for “Autorità Portuale” or Port Authority.”
affected with at least a month delay (i.e. then starting from March, at least) in comparison with export flows. Despite this, the latter was impacted earlier than imports due to the closure of first Asian ports. Moreover, until the second half of March, the now called pandemic was not considered a high risk in many countries, including most EU and North America states: as such, risk management strategies have only limited effect until the Spring 2020. Despite this, several production processes never fully stopped in many industrialised countries, including Italy, allowing companies to continue to export until either the closure of overseas markets or the contraction of inputs flows needed for the export activity. This issue, together with the fact that the domestic demand contracted almost immediately due to the uncertainty of the overall situation, generated the unusual asymmetric reaction of imports and exports.

Table 2 shows the port view, i.e. the differentiated impact of the pandemic in respect with containers traded in different Italian ports. The table shows an asymmetric impact between import and export flows, with import flows that have been negatively impacted about two months earlier, on average, in respect to export. Moreover, different port system authorities have been impacted differently, with smaller ports (e.g. Adriatico Meridionale and Adriatico Orientale) that even register positive variations. This outcome is of particular importance and due to the distinctive links that some of the “minor” ports enjoy with specific local production and logistics chains (as in the case of the Apulian Ports – i.e. Adriatico Meridionale – for the agri-food products). Moreover, while bigger ports (e.g. Ligurian ports) are normally serving intercontinental markets, several minor ports rely more on regional connections that have been less impacted by the Covid-19 pandemic (i.e. trade with Far East and Americas versus intra-Mediterranean flows).

Table 3 shows the distinction among different Italian NUTS-1
increased during the first wave of the pandemic. This outcome is of
regression model shows that the crisis impacted all Italian macro-
regions. While the second wave has impacted more evenly, the first
wave impacted mainly in the North-West of Italy. Despite this, the
first wave impact during the summer, delaying the recovery from the
variations; on the other hand, the Americas experienced most of the first
trade flows, as such, both import and export experienced only marginal
positive nor negative consistent effects in the market. This was partic-
Table 5, generated a variety of situations that did not produce neither
Table 4), the pandemic initially generated frictions with Asian countries but, after April, only the
Americas recorded statistically significant negative values: on the one hand most Asian countries recovered quicker than European and American economies, allowing them to effectively restructured their trade flows, as such, both import and export experienced only marginal variations; on the other hand, the Americas experienced most of the first wave impact during the summer, delaying the recovery from the pandemic and then affecting the related businesses.

Imports from Europe increased as a consequence of a reorganization of several logistics and production chains on a regional basis, as testified by the initial decrease in imports from Far East (then returned on the usual values) and then on flows coming from North America and other
Asian countries. The fact that trade with non-EU countries was not affected by the first wave of the pandemic while intercontinental trade was (particularly with the Americas) is also a confirmation of the reason for the good performance of the Adriatic ports, with most of the related value chains heavily linked with the Eastern European markets, rather than with other global areas.

Covid-19 pandemic impacted on exports only in April; all geographical trades recorded a relevant decrease but Far East, and then quite immediately recovered and only trades with Africa, Latin America and other Asian countries continued to decrease.

Cargo export appears more statistically significant than import. Nevertheless, both flows highlight that each cargo category experienced differentiated impacts in terms of magnitude, and asymmetries in terms of both timing and sign. The pandemic, depending on specific trades (see Table 5), generated a variety of situations that did not produce neither positive nor negative consistent effects in the market. This was particularly true for certain cargoes: the paper and the plastic industries (i.e. “Papers” and “Plastics”), for instance, registered a positive trend all over the period, stressing how specific sectors could exploit the overall new economic environment. These two specific industries were more subject to the variations of consuming patterns, with packaging (i.e. paper) and personal protective equipment (i.e. masks and shields are made by

### Table 2

| Port Authority | February 2020 | March 2020 | April 2020 | May 2020 | June 2020 | July 2020 |
|---------------|---------------|-----------|-----------|----------|-----------|-----------|
| AdSP del Mar Ligure Occidentale | -0.018 | 0.0287 | -0.0665 | -0.1163 | -0.0058 | 0.1358 |
| AdSP del Mar Tirreno Centrale | 0.04 | -0.0286 | -0.1065 | -0.0872 | -0.0284 | 0.0811 |
| AdSP del Mar Ligure Orientale | 0.0661 | -0.1703 | 0.0226 | -0.2786** | 0.077 | -0.0037 |
| AdSP del Mar Tirreno Settentrionale | -0.3098** | -0.1251 | -0.1135 | -0.4114*** | -0.3415*** | -0.3050** |
| AdSP del Mare Adriatico Settentrionale | 0.1666 | 0.2935** | -0.0539 | 0.0142 | 0.0744 | 0.220azo |
| AP di Gioia Tauro e della Calabria | 0.2644** | -0.1994 | 0.2131* | -0.1849 | -0.116 | 0.3305*** |
| AdSP del Mare Adriatico Centrale | 0.1016 | 0.2884** | 0.0699 | 0.1413 | 0.2217* | -0.0217 |
| AdSP del Mare Adriatico Centro Settentrionale | 0.3285** | -0.2465 | 0.2691* | 0.0517 | -0.0040 | -0.1344 |
| AdSP del Mare Adriatico Orientale | 0.4409*** | 0.0996 | 0.4630** | 0.107 | -0.1213 | 0.4625*** |
| AdSP del Mare Adriatico Meridionale | 0.4209** | 0.2795* | 0.5299*** | 0.0815 | 0.5250*** | 0.4868** |
| AdSP del Mare di Sicilia Orientale | 0.2185 | 0.0245 | 0.3732** | 0.0321 | 0.3909*** | 0.3146** |
| AdSP del Mare Tirreno Centro Settentrionale | 0.6413*** | 0.3453 | 0.0283 | 0.0942 | 0.4017* | 0.3815* |
| AdSP del Mare di Sicilia Occidentale | -0.5114** | -0.1226 | -0.2487 | -0.0626 | -0.0063 | -0.2297 |
| AdSP del Mar di Sardegna | 0.4697* | -0.283 | 0.113 | -0.6096 | -0.3682 | -0.0835 |
| AdSP del Mare Ionio | (omitted) | -4.9474*** | -2.4755* | (omitted) | -2.1157** | -0.0626 |

**constant** 4.1244***
**N** 207915
**rho** 0.7596

### PANEL B: EXPORT

| Port Authority | February 2020 | March 2020 | April 2020 | May 2020 | June 2020 | July 2020 |
|---------------|---------------|-----------|-----------|----------|-----------|-----------|
| AdSP del Mar Ligure Occidentale | 0.0665 | -0.121 | -0.4669*** | -0.3405*** | -0.2533** | 0.0882 |
| AdSP del Mar Tirreno Centrale | 0.0727 | 0.1823* | -0.3802*** | -0.1952* | -0.0977 | -0.0324 |
| AdSP del Mar Ligure Orientale | 0.0105 | -0.0792 | -0.6345*** | -0.3656*** | -0.2822*** | -0.0358 |
| AdSP del Mar Tirreno Settentrionale | -0.1676 | -0.1117 | -0.5867*** | -0.3592** | -0.1593 | -0.1714 |
| AdSP del Mare Adriatico Settentrionale | 0.1085 | 0.3268** | -0.4240** | -0.0779 | -0.0925 | 0.1063 |
| AP di Gioia Tauro e della Calabria | 0.3718* | 0.1792 | 0.3425* | -0.1671 | 0.1 | 0.1435 |
| AdSP del Mare Adriatico Centrale | -0.0027 | 0.1107 | -0.2011 | -0.0155 | -0.143 | 0.1581 |
| AdSP del Mare Adriatico Centro Settentrionale | -0.011 | 0.1351 | -0.4322** | -0.3199* | -0.1609 | -0.0577 |
| AdSP del Mare Adriatico Meridionale | 0.2894 | 0.3700* | 0.2457 | 0.5545** | 0.1549 | 0.6730*** |
| AdSP del Mare Adriatico Meridionale | 0.098 | 0.3904*** | 0.1114 | 0.0879 | 0.1732 | -0.0968 |
| AdSP del Mare di Sicilia Orientale | -0.141 | -0.2558 | 0.1308 | 0.0846 | -0.0263 | 0.2048 |
| AdSP del Mar Tirreno Centro Settentrionale | 0.1269 | 0.1138 | -0.3612 | -0.4263 | -0.293 | 0.4157* |
| AdSP del Mare di Sicilia Occidentale | -0.1234 | -0.3714 | -0.1498 | -0.0144 | 0.1799 | 0.1985 |
| AdSP del Mar di Sardegna | -0.7274* | -0.1149 | -0.3186 | 0.0433 | -0.3667 | 0.2409 |
| AdSP del Mare Ionio | (omitted) | (omitted) | (omitted) | (omitted) | (omitted) | -1.4355** |

**constant** 3.8832***
**N** 277429
**rho** 0.7767

Fixed effects (panel A and B):

- Regional (destination) yes
- Geographical (origin) yes
- Port Authority yes
- Goods classifications yes
plastic related materials) that recorded a growth during the first months of the pandemic. On the one hand, this trend is certainly relevant for all related environmental problems and the potential ineffective application of related plastic reduction policies. On the other hand, the lockdowns affected the mobility patterns, with the automotive sector (especially for the export flows) that have been impacted the most (e.g. for the closure, in certain countries, of car showrooms), promoting alternative greener mobility solutions (e.g. bike, electric cars).

Table 3
Italian regions’ view.

| PANEL A: IMPORT | Italian NUTS 1 | February 2020 | March 2020 | April 2020 | May 2020 | June 2020 | July 2020 |
|-----------------|----------------|---------------|------------|------------|-----------|-----------|-----------|
| North West      | 0.1384*        | 0.0746        | 0.081      | 0.0022     | 0.1116    | 0.1273*   |
| North East      | -0.0196        | -0.0264       | -0.0251    | -0.1586*   | -0.0064   | 0.0372    |
| Center          | 0.1606*        | 0.0702        | 0.0753     | -0.1815*   | -0.1038   | 0.099     |
| South           | 0.0743         | -0.0727       | 0.07       | 0.0038     | 0.0631    | 0.1095    |
| Isles           | 0.2472**       | -0.1748       | 0.0854     | -0.3298*   | 0.0547    | 0.1368    |
| intra UE        | 0.1705         | -0.2499       | 0.2946     | 0.8441*    | 0.3176    | 0.4291    |
| constant        | 4.1256***      |               |            |            |           |           |
| N               | 207915         |               |            |            |           |           |
| rho             | 0.7595         |               |            |            |           |           |

| PANEL B: EXPORT | Italian NUTS 1 | February 2020 | March 2020 | April 2020 | May 2020 | June 2020 | July 2020 |
|-----------------|----------------|---------------|------------|------------|-----------|-----------|-----------|
| North West      | 0.0464         | 0.0536        | -0.3125*** | -0.1992**  | -0.1814*  | 0.0611    |
| North East      | 0.0204         | 0.0471        | -0.3983*** | -0.1721**  | -0.1665** | 0.0977    |
| Center          | -0.0407        | 0.0117        | -0.6413*** | -0.3572*** | -0.2477***| -0.0459   |
| South           | 0.1735         | 0.2073**      | -0.1885*   | -0.1025    | 0.0376    | 0.015     |
| Isles           | -0.1297        | -0.1146       | -0.0171    | -0.0292    | 0.0083    |           |
| intra UE        | -0.5263        | -0.0329       | 0.1681     | -0.0462    | 0.0491    | 0.4016    |
| constant        | 3.8837***      |               |            |            |           |           |
| N               | 277429         |               |            |            |           |           |
| rho             | 0.7786         |               |            |            |           |           |

Fixed effects (panel A and B):
Regional (destination) yes
Geographical (origin) yes
Port Authority yes
Goods classifications yes

Table 4
Trade partners’ view.

| PANEL A: IMPORT | Geographic region | February 2020 | March 2020 | April 2020 | May 2020 | June 2020 | July 2020 |
|-----------------|-------------------|---------------|------------|------------|-----------|-----------|-----------|
| Africa          | 0.0228            | 0.0284        | 0.0249     | -0.2104**  | 0.0195    | -0.0688   |
| Latin America   | -0.1005           | 0.1277        | 0.0604     | 0.0589     | 0.139     | 0.1543    |
| North America   | -0.147            | -0.0231       | -0.0867    | -0.3055*** | -0.3638***| -0.2801** |
| Europe          | 0.4416***         | 0.5123***     | 0.3248***  | 0.1412     | 0.4937*** | 0.4434*** |
| Far East        | -0.1601**         | -0.2778**     | -0.0242    | 0.0127     | -0.0228   | 0.0083    |
| Middle East     | 0.1421            | -0.2335       | 0.1073     | -0.1113    | 0.2226    | 0.1516    |
| Oceania         | -0.4536*          | -0.3721*      | -0.1022    | -0.2189    | 0.2643    | 0.1713    |
| Other asian     | 0.1657**          | 0.0136        | 0.1089     | -0.3087*** | -0.2211** | 0.1066    |
| constant        | 4.1256***         |               |            |            |           |           |
| N               | 207915            |               |            |            |           |           |
| rho             | 0.7595            |               |            |            |           |           |

| PANEL B: EXPORT | Geographic region | February 2020 | March 2020 | April 2020 | May 2020 | June 2020 | July 2020 |
|-----------------|-------------------|---------------|------------|------------|-----------|-----------|-----------|
| Africa          | 0.0211            | 0.0075        | -0.6365*** | -0.3114*** | -0.1498*  | -0.0604   |
| Latin America   | -0.0169           | -0.1331       | -0.6751*** | -0.5591*** | -0.3265** | -0.2204*  |
| North America   | 0.0878            | 0.2421**      | -0.2625**  | -0.1297    | -0.0257   | 0.1544    |
| Europe          | 0.1011            | 0.2647**      | -0.3591**  | -0.1428    | -0.1434   | 0.0933    |
| Far East        | -0.3123**         | -0.1808       | -0.0494    | 0.0331     | 0.1035    | 0.1139    |
| Middle East     | 0.1297            | -0.032        | -0.4911*** | -0.125     | -0.2245*  | -0.0292   |
| Oceania         | 0.0282            | 0.1357        | 0.0429     | 0.1109     | 0.0198    | 0.1082    |
| Other asian     | 0.2181*           | 0.1139        | -0.5342*** | -0.4962*** | -0.3437***| 0.083     |
| constant        | 3.8837***         |               |            |            |           |           |
| N               | 277429            |               |            |            |           |           |
| rho             | 0.7787            |               |            |            |           |           |

Fixed effects (panel A and B):
Regional (destination) yes
Geographical (origin) yes
Port Authority yes
Goods classifications yes
Eventually, primary goods (e.g., food, vegetables) recorded a solid performance throughout the period while the macro-category related to pharmaceuticals (i.e., “Minerals”) recorded a majority of upward trends in import and downward trend in export, highlighting the potential effect of the national policies on health service sector.

4. Conclusive remarks

The presented analysis is based on a series of regressions made using the complete dataset of the Italian Custom Agency with the aim of understanding the impact of the Covid-19 pandemic on the Italian logistics and the related value chains. In doing so, it represents a first attempt to quantitatively assess the impact of the pandemic, differentiating such impact in respect to the different time periods and in respect to several alternative characteristics (e.g., ports, products, regional distribution). The use of the custom’s database allowed us to track all import and export flows, handled by the Italian ports, determining robust estimations, beyond the statistical significance, comparing the long-term trends with the first 7 months of the pandemic crisis. Despite this, the short time period assessed (i.e. February–July 2020) and the variety of the potential effects of the crisis certainly represent a shortcoming of the analysis given the long-term implications that the crisis could generate for the Italian transport and economic system.

Despite this, the model outcomes show how the pandemic did not impact the Italian economy in a balanced way, from both a time and a spatial perspective. Some ports, cargoes, and regions have been subjected to the crisis with different magnitudes, in different time periods, and in an asymmetric way. This allowed certain sectors and ports to react to the crisis with different magnitudes, in different time periods, and in an asymmetric way. This allowed certain sectors and ports to recover quicker than smaller ports. In this case, though, big ports also the first phase of recovery (i.e. until the first part of 2021) was characterized neither spatially nor temporally and future recovery actions should take these asymmetries into consideration so to allow a faster bouncing back effect and customised tools for the different sectors. Interestingly, also the first phase of recovery (i.e. until the first part of 2021) was characterised by an uneven growth with some ports (and regions) that recorded a faster growing rate than other. In this case, though, big ports recovered quicker than smaller ports.

From a general point of view, trade partners – and then origin/destination of the Italian cargo flows – reacted differently, with most of the activities for Asian partners that were immediately restored already

| Table 5 |
| Cargo view. |

**Panel A: Import**

| Goods category | February 2020 | March 2020 | April 2020 | May 2020 | June 2020 | July 2020 |
|----------------|--------------|------------|------------|----------|-----------|-----------|
| Animals        | -0.2589***   | -0.1223*   | -0.2020*   | -0.4172*** | -0.2775** | -0.1610*  |
| Weapons        | -0.1147      | -0.2263*   | -0.1416*   | -0.2908*  | -0.1122*  | -0.1134*  |
| Automotive     | -0.3292*     | 0.2092     | -0.1077*   | -0.2286*  | 0.021     | 0.147     |
| Paper          | -0.1323      | 0.1682     | -0.1359    | -0.179    | -0.0444*  | 0.0384    |
| Ceramics       | 0.2384*      | -0.0912    | 0.2421*    | -0.1177   | -0.0676*  | 0.0086    |
| Food derivatives| -0.2065      | 0.0488     | 0.1285     | 0.0132    | 0.1669*   | 0.2176*   |
| Mechanicals    | 0.3620**     | 0.0581     | 0.1866*    | -0.0886   | -0.0531   | 0.2364*   |
| Metals         | 0.2267       | -0.0521    | -0.1567    | -0.2833   | -0.0558   | 0.185     |
| Minerals       | -0.0013      | 0.0619     | 0.2372*    | -0.0078   | 0.2703*** | 0.086     |
| Furniture      | 0.2181       | -0.184     | -0.0308    | -2.206-01 | -0.2403*  | -0.0482   |
| Watches and musical instruments | -0.1327 | -0.8568** | -0.6317* | -1.272** | -0.8103* | -0.361*   |
| Plastics       | 0.3075**     | 0.108      | 0.2730*    | 0.1727    | 0.4123*** | 0.2608**  |
| Textiles       | 0.2313**     | -0.0848    | -0.2329*   | -0.1603   | -0.2310*  | 0.0982    |
| Vegetables     | 0.0157       | 0.0403     | 0.4038***  | 0.1656*   | 0.2598**  | 0.1597*   |

**Panel B: Export**

| Goods category | February 2020 | March 2020 | April 2020 | May 2020 | June 2020 | July 2020 |
|----------------|--------------|------------|------------|----------|-----------|-----------|
| Animals        | 0.2949*      | 0.5036***  | -0.153     | 0.1      | 0.0914    | 0.3541*** |
| Weapons        | -0.3441**    | -0.5807*** | -1.6011*** | -0.8587*** | -0.3231*  | -0.0797  |
| Automotive     | -0.3597**    | -0.3006**  | -1.0171*** | -0.3858** | -0.3231*  | -0.0797  |
| Paper          | 0.2035       | 0.1057     | 0.147      | 0.1343   | -0.0458   | 0.0336    |
| Ceramics       | -0.2489*     | -0.2641*   | -0.8484*** | -0.4918** | -0.3736** | -0.1134  |
| Food derivatives| 0.1545*      | 0.3230***  | 0.3245**   | 0.1845*  | 0.1867**  | 0.2058**  |
| Mechanicals    | -0.0699      | -0.1036    | -0.5848*** | -0.2307** | -0.1782   | 0.1136    |
| Metals         | -0.0072      | 0.0943     | -0.5784*** | -0.2166   | -0.0007   | 0.0655    |
| Minerals       | -0.0626      | 0.1366     | -0.1192    | 0.1941   | 0.1911    | 0.0572    |
| Furniture      | 0.1374       | 0.0696     | -1.2244*** | -0.3642** | -5.416-02 | 0.2879*** |
| Watches and musical instruments | -0.1765 | -0.3335 | -1.992** | -1.1984** | -0.6065 | 0.2693 |
| Plastics       | 0.2916**     | 0.2638**   | 0.0535     | 0.0783   | 0.0805    | 0.1324    |
| Textiles       | -0.1775      | -0.1491    | -0.8461*** | -0.3717* | -0.5171*** | -0.3565*  |
| Vegetables     | 0.3436**     | 0.2987*    | -0.1909    | -0.4396*** | -0.4440** | -0.4890** |

**Fixed effects (Panel A and B):**

- Constant: 4.1257***
- N: 207915
- rho: 0.7591

**Fixed effects (panel A and B):**

- Month - year: yes
- Regional (destination): yes
- Geographical (origin): yes
- Port Authority: yes
- Goods classifications: yes
in Spring 2020 and the trade with the Americas that was still underperforming during the last time period registered. Moreover, as also pointed out by Notteboom et al. (2020), the trade of both primary (e.g. food) and luxury (e.g. furniture) goods have been only partially affected by the pandemic crisis while other durable goods (e.g. weapons, automotive) have been impacted the most, representing an investment that could be postponed over time. Only during the last recorded months there have been a partial recovery of latter cargo category, maybe also in connection with the needed inventory activities.

From a general point of view, it is also important to link the recorded effects with the general policy framework: not only the generalised lockdowns did not impact evenly on neither the Italian regions nor seaports but some outcomes suggest that best performing sectors were the ones that are often associated with the worst environmental performance (e.g. plastic) generating trade-offs between different political goals.

Current paper represents a preliminary impact assessment of the first wave of the Covid-19 pandemic on the Italian logistics and only future analyses will define if what has been observed will generate a “new normal” or only a short-term adaptation phase. As such, future studies will focus more on the specificities of certain value chains and on longer time periods, with the aim of better defining specific patterns. Statistics seem also to suggest a shift between long haul trade and regional one and, sometime, the need for quicker deliveries, with new logistics solutions (e.g. the withdraw of maritime logistics in favour of land transport for shorter routes or air transport for priority equipment) that could have been introduced. Such new solutions should be further investigated as well, with the aim of understanding if they could represent long term solutions rather than just short-term speculative behaviours.

Despite the many further questions that could be raised, presented results could help policy makers for future fine-tuning of policy actions and stimulus packages given that even with the system shock caused by Covid-19 – relevant asymmetric and asynchronous effects have been observed.

CRediT authorship contribution statement

Claudio Ferrari: Conceptualization, Supervision, Methodology, Resources, Writing – review & editing. Luca Persico: Data curation, Formal analysis, Resources, Validation, Visualization, Writing – original draft. Alessio Tei: Conceptualization, Methodology, Resources, Validation, Writing – original draft.

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