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Impact of COVID-19 on trade in services

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During past shocks (e.g., the 2008–2009 global financial crisis), the services trade was found to be more resilient than the goods trade; however, the ongoing novel coronavirus (COVID-19) pandemic has restricted cross-border mobility, which is disastrous to the services trade because it often requires physical proximity between suppliers and consumers. We empirically examined the impact of COVID-19 on the services trade using quarterly data from 146 countries in 2019 and 2020. Its severity is measured according to the number of cases, the number of deaths, and an index measuring the severity of lockdown orders. We found that the pandemic had a more significantly negative impact on the services trade than the goods trade, particularly on the import side. Moreover, the extent of the impact varied among disaggregated services sectors, reflecting the nature of services. Travel services were the most severely affected, followed by transport and construction services, which are largely related to the international movement of people and goods. On the other hand, other services typically provided as cross-border supply, including computer services, experienced almost no significant effect.

\section{1. Introduction}

Services have become one of the most dynamic sectors of the economy as a key driver of global trade. Reflecting the fact that the trade in services has expanded faster than the trade in goods, the services share of global trade in gross terms has grown from just 9% in 1970 to over 20% today—and it is expected to rise to one-third of global trade by 2040 based on a World Trade Organization (WTO) forecast (WTO, 2019). This represents a 50% increase in its share in only two decades. According to the WTO (2019, 2020), services now generate more than two-thirds of all economic output, attract over two-thirds of foreign direct investment (FDI), provide the most jobs globally (almost two-thirds of all jobs in developing countries and four-fifths in developed countries), and account for over 40% of global trade in value-added terms. These numbers definitely confirm the importance of the services sector.

This study aims to quantitatively examine the impact of the novel coronavirus disease 2019 (COVID-19) pandemic on the trade in services. It is well-known that the services trade is resilient to external shocks, especially compared to the goods trade. The resilient nature of the services trade could be observed during the 2008–2009 global financial crisis (GFC). During the GFC, while the trade in goods experienced a sharp drop, the trade in services hardly changed. Several studies have empirically investigated this resilience in the services trade during the GFC. They have demonstrated that this could be attributed to the low sensitivity of the services trade to demand shocks, a lower cyclical demand for a range of traded services, and less dependence on external financing (Borchert and Mattoo, 2010; Ariu, 2016; Ceglowski, 2017). Based on this experience, we might expect an ongoing shock like the COVID-19 pandemic to have a negligible effect on the trade in services.

However, unlike past shocks, the COVID-19 pandemic is having a serious effect on the services trade. Indeed, as we later show, while the global trade in goods returned to a normal level by the end of 2020, the trade in services has not yet done so. One of the most distinctive features of this pandemic is how it has forced us to introduce mobility restrictions and social distancing measures for public health reasons. This creates a drastic effect, especially on the trade in services, because unlike the trade in goods, some services trade requires physical proximity between suppliers and consumers and the cross-border mobility. For instance, services trade that is categorized into modes 2 and 4 by the WTO General

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Agreement on Trade in Services (GATS) requires cross-border mobility of consumers and suppliers, respectively. Thus, restrictive orders on cross-border mobility will have a more serious impact on the services trade. Moreover, this impact may vary among service sectors/sub-sectors, depending on whether or not physical proximity between suppliers and consumers is necessary and whether or not an online supply is available.

To examine the impact of COVID-19 on exports and imports of services, we employ quarterly data for 146 countries in 2019 and 2020. By including trade during the pre-pandemic period (i.e., 2019) in our study sample, we identify the effects of COVID-19 on the trade in services. Due to the current availability of global data, the services data we use are not those on bilateral trade but those on exports to, or imports from, the world. The severity of COVID-19's damages is measured by the number of newly confirmed cases, the number of deaths, or a severity index on the policies that restrict behavior. To control for unobservable factors, we introduce various types of fixed effects. In addition, to capture their features more clearly, we compare them to the impact on the trade in goods. Furthermore, we quantitatively estimate the impact of COVID-19 on the services trade by sector/subsector and explore the possibility of sectoral heterogeneity of the effects, if any. We estimate these models using the Poisson pseudo maximum likelihood (PPML) method.

Our main findings are summarized as follows. The spread of COVID-19 had a negative impact on services exports and imports. This result does not change, even when we address endogeneity in our COVID-19 variables. Further, we demonstrate that the degree of the impact varies among disaggregated service sectors, reflecting the nature of services. Travel services that rely heavily on mode 2 were affected the most, followed by transport services. Although transport services are primarily categorized as mode 1, passenger transport services are directly connected to the cross-border movement of people (mode 2 or mode 4), and freight transport services are both directly and indirectly connected to the cross-border movement of people and goods. Construction services that may largely depend on mode 4 in our dataset have also been affected, though trade values are small. The harmful effects on trade in these services, in particular, were more serious than those on the goods trade. Conversely, other service sectors that are typically provided through mode 1, such as computer-related services, had almost no significant effect.

The number of economic studies on COVID-19 has grown rapidly since 2020. Among the various strands of literature, our study belongs to the strand that analyzes COVID-19’s influence on international trade. There are several empirical studies on the trade in goods (e.g., Friedt and Zhang, 2020; Hayakawa and Mukunoki, 2021a, 2021b, 2021c; Kejzar and Velic, 2020; and Meier and Pinto, 2020). These studies have found that the severity of COVID-19’s damages in both exporting and importing countries led to a decreasing trade in goods. They also showed the propagation of such negative effects throughout supply chains. However, there are few studies on the trade in services. Two studies have conducted descriptive analyses on the services trade in India (Veeramani and Anam, 2021) and Spain (Minondo, 2021). Thus, this study is the first to systematically investigate the association between COVID-19 and the trade in services using global data and to conduct a comparison with the trade in goods.

The remainder of this paper is organized as follows. The next section discusses the basic issues regarding trade statistics in services. Section 3 provides an overview of the recent trade in services. Section 4 presents our conceptual framework for the effects of the COVID-19 on the trade in services. After providing our empirical framework in Section 5, we present our estimation results in Section 6. Section 7 concludes.

2. Definition and data of the services trade

The GATS categorizes the services trade according to four modes of supply. Mode 1 is cross-border supply, in which services are supplied from one country to another. In this case, a consumer in an importing country receives services from a supplier located in an exporting country through its telecommunications or postal infrastructure. Mode 2 is consumption abroad, in which one national of an importing country moves to an exporting country as a tourist, student, or patient to consume services in that exporting country. Mode 3 is commercial presence, in which services are provided to local consumers within an importing country by a locally established affiliate, subsidiary, or representative office of a foreign-owned firm. Mode 4 is the presence of natural persons, in which a foreign national of an exporting country moves temporarily to an importing country and then provides services within that importing country as an independent supplier or the employees of a service supplier.

This GATS definition of the four modes of supply is significantly broader than the balance of payments (BOP) concept of services trade. Certain services transactions under the GATS definition, particularly in the case of mode 3, typically involve those between residents of the country concerned. The BOP, however, focuses on residency rather than nationality and counts transactions between residents and non-residents as services trade. Thus, BOP statistics are useful to capture services transactions mainly for cross-border supply (mode 1), consumption abroad (mode 2), and the presence of natural persons (mode 4), but do not sufficiently cover services, particularly those via commercial presence (mode 3). In that sense, Foreign Affiliates Statistics (FATS), which describe the activities of foreign affiliates, can be used as a supplement. Recently, the WTO provided a new experimental dataset, Trade in Services by Mode of Supply (TISMOS) that combines the BOP and FATS information to offer an entire picture of international trade in services for the 2005–2017 period according to the four modes of supply defined in the GATS.

In our study, we employ data on the services trade on a BOP basis. As previously discussed, in BOP statistics, some services of the services trade are not sufficiently covered, particularly services trade via commercial presence. However, the BOP-based services trade statistics provide comprehensive information in terms of the coverage of countries, periods, frequency (such as quarterly and annually), and sectors/subsectors, in addition to the availability of more recent information. Therefore, this paper employs quarterly data on services trade on a BOP basis available from the United Nations Conference on Trade and Development (UNCTAD) STAT and trade in goods from the WTO Stats.

The services trade in the database we use is composed of four sectors – goods-related services, transport services, travel services, and other services. Goods-related services refer to manufacturing services on physical inputs owned by others and maintenance and repair services. The other services sector can be further decomposed into eight subsectors: construction, insurance and pension services (insurance, hereafter), financial services, charges for the use of intellectual property (IP charges), information, computer, and telecommunications (ICT) services, other business services (including research and development and professional and management consulting services, and technical, trade-related, and other business services), personal, cultural, and recreational services (including audiovisual and related services and other personal, cultural, and recreational services) (personal services), and government goods and services, n.i.e. (government services). This paper investigates not only the total services trade (i.e., aggregated trade in services), but also the disaggregated services trade along this sector/subsector classification.

1. For more details on TISMOS, see the WTO website: https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm#TISMOS.
2. See https://unctadstat.unctad.org/EN/Index.html.
3. See https://stats.wto.org/.
4. The term “n.i.e.” means not included elsewhere.
5. See, for instance, IMF (2014); Ch.12 for the details of the BOP categorization.
Let us briefly discuss the major mode of aggregated and disaggregated service sectors. According to the services trade statistics in 2017 available from the TISMOS, mode 3 is the dominant mode for services as a whole; the composition is 28% for mode 1, 10% for mode 2, 59% for mode 3, and 3% for mode 4. For disaggregated sectors, while mode 3 is dominant for most of them, there are some exceptions. For instance, transport is supplied mainly through mode 1, while goods-related services, tourism and business travel, and education services are mostly delivered via mode 2. Note that our data of services trade on the BOP basis basically do not cover mode 3. In that sense, the major mode in our dataset would be mode 1 for most of our sectors/subsectors including transport, while it may be mode 2 for good-related services and travel and mode 4 for construction.

3. Trade in services during the pandemic

This section provides an overview of the trade in services amid the COVID-19 pandemic. First, let us briefly check the spread of COVID-19 and the related restrictive measures based on the stringency index. Fig. 1 shows (a) the aggregated number of daily new confirmed cases and deaths attributable to COVID-19 in the world and (b) the world average of the stringency index. The former numbers are obtained from the COVID-19 Data Repository by the Center for Systems Science and Engineering at Johns Hopkins University. The latter index is drawn from Hale et al. (2021) and records the strictness of the “lockdown-style” policies that primarily restrict people’s behavior. A higher index indicates that more restrictive measures are in effect.

April 2020 witnessed the first COVID-19 peak in terms of the number of deaths. Although the number declined after this first peak, it increased again rapidly in the fourth quarter (Q4) of 2020. Conversely, the number of cases continued to increase without any significant peak, and expanded drastically in Q4 of 2020. Similar to the number of deaths, the world average severity of restrictive measures also recorded its highest level in April 2020. Although regulations seem to relax slightly thereafter, they maintained higher levels during Q3 and Q4 of 2020. Therefore, the services sectors, particularly those that require physical proximity between suppliers and consumers and the cross-border mobility of suppliers/consumers, may have been affected throughout the year.

How did the services trade respond to such drastically changed circumstances? Table 1 summarizes the annual patterns in world trade in services in the pre-pandemic year, 2019, and amid the pandemic, 2020, based on BOP statistics. As mentioned in the previous section, we obtain quarterly data on the trade in services from UNCTAD STAT and trade in goods from WTO Stats. For our sample, more or less a quarter of all services in the pre-pandemic year are for travel (22%/25% for exports/imports), around 20% are transport, 3–4% are goods-related services, and about half of all services are other services. Among the subsectors of the other services, other business services account for half, followed by ICT services, IP charges, and financial services.

The annual changes in 2020 are as follows. The table shows that trade in services experienced a greater decline in 2020 than trade in goods. In terms of both global exports and imports, services trade and goods trade decreased by over 20% and 7%, respectively. Thus, contrary to the case of the GFC, the ongoing pandemic seems to have a larger negative effect on the services trade than on the goods trade. In addition, similar to the trade in goods, sectoral differences exist for the trade in services. Travel services, in particular, decreased in 2020 by over 60%, followed by transport services with a decline of around 20% and goods-related services by less than 20%. Other services had a generally much smaller negative impact with a decline of 7%/5% for exports/imports, although the trade in some subsectors of other services declined by over 10%, such as construction for exports and imports and personal services for exports.

To observe the trade changes more closely, Fig. 2 presents quarterly changes in the trade in services and goods as the index to Q1 of 2019. Trade in services and goods commonly experienced a huge drop in Q2 of 2020; close to – 30% for the services trade and – 20% for the goods trade. After that, however, the trade in goods realized a drastic recovery in Q3 in 2020 and even exceeded its pre-pandemic level in Q4 of 2020, clearly showing a V-shape recovery. On the other hand, the trade in services remained low and even slightly declined again from Q3 to Q4 of 2020 after an increase in Q3 from the bottom in Q2; the trade in services in Q3 and Q4 are around 80% of pre-pandemic levels. Some services sectors that require proximity between the suppliers and consumers and the cross-border mobility of suppliers/consumers must have directly suffered from the expanding spread of COVID-19 around the world, particularly in Q4 (Fig. 1a), and continuing restricted mobility (Fig. 1b).

Fig. 3 presents the quarterly services exports and imports by disaggregated sectors as the index to Q1 of 2019. The most serious decline is observed for the trade in travel services, which is only 20% of the pre-pandemic level (Q1 of 2019) in Q2 of 2020, and is still only around 30–40% in Q3 and Q4 of 2020, indicating that this sector is still far from recovered. The trade in transport services also decreased and reached the bottom in Q2 of 2020, lower than 80%. Although trade in this sector gradually increased after that quarter, it was still more or less 80% of the pre-pandemic level in Q3 and Q4 of 2020. Similarly, trade in goods-related services reached the bottom in Q2 at 80% of the pre-pandemic level, which may partially reflect a decline in the trade in goods. The trade in construction services, particularly exports, declined significantly; the bottom of exports was less than 70% of the pre-pandemic level in Q1 of 2020, while the bottom of imports was about 80% in Q2 of 2020. Unlike these services, trade in personal services and financial services recorded the lowest levels in Q4 of 2020. In contrast, other sectors such as insurance, IP charges, and ICT services maintain their levels within plus and minus 10% of their pre-pandemic levels.

4. Conceptual framework

This section describes a conceptual framework for the effects of the

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6 For more details, see Appendix A. Note that the classification of disaggregated sectors in Appendix A is slightly different from ours on the BOP basis.
7 Over 90% of construction services are traded across borders via mode 3, suggesting that the dominant mode of construction services, in particular, is mode 3.
8 See https://github.com/CSSEGISandData/COVID-19. Also see Dong et al. (2020).
9 In Table 1, world exports exceed world imports. This asymmetry in trade in services is probably due to statistics. This is consistent with, for instance, the case of asymmetries in the UK’s trade in services (ONS, 2017); mirror data (export-side data) is greater than import data. The figure for global exports and imports by the four modes of services provided in Shingal (2020) also shows that the former exceeds the latter.
10 According to the WTO (2019), around half of global trade in transport services is induced by trade in goods. In 2017, one-third of global trade is directly related to the cost of shipping goods, mainly by sea or air, and 16% supports transport services such as cargo handling, storage, and warehousing.
11 The sectoral composition based on TISMOS is available in Appendix A. The differences between the sectoral composition in Appendix A and Table 1 may be largely due to whether or not the services trade includes those via a commercial presence.
12 For instance, see Hayakawa and Mukunoki (2021c) for sectoral differences in the impact on the trade in goods.
13 For example, Cegłowski (2017c) presents the quarterly trade values since the 2008–2009 GFC as the index to Q1 of 2008.
14 Services trade through mode 3 is large for ICT services in 2017 (see Appendix A). Thus, ICT services trade in 2020, in particular, may be much larger if such trade through mode 3 is included.
Fig. 1. Spread of COVID-19 and the Related Restrictive Regulations in the World, (a) The number of COVID-19 cases and deaths, (b) Stringency index. Notes: The numbers of COVID-19 for the world are the aggregated daily new confirmed cases and deaths. The stringency index for the world is a simple average. Source: Our World in Data.
COVID-19 on the trade in services. As discussed in Hayakawa and Mukunoki (2021c), in the case of trade in goods, in importing countries the pandemic decreases consumption opportunities due to stay-at-home orders. This decrease further worsens business performance and thus lowers revenues and incomes. These decreases of consumption opportunity and income result in shrinking the demand size and imports of goods. Similarly, work-from-home orders in exporting countries decrease production in factories. Also, infection control measures in factories (e.g., social distancing) may lower productivity. These decreases reduce production sizes and thus the exports of goods. In sum, the severity of COVID-19 damages leads to decreasing both the exports and imports of goods.

For the services trade, labor shortages and income decreases caused by COVID-19 are, in general, expected to reduce both services exports and imports, as in the case of the goods trade. However, the more detailed effects will differ across services sectors, especially according to the services mode type. In particular, modes 2 and 4 require the cross-border movement of consumers and suppliers, respectively. For example, travel services (mode 2) require the movement of consumers from importing countries to exporting countries. Similarly, in construction services (mode 4), foreign nationals of exporting countries, such as skilled professionals, must move temporarily to an importing country to provide services within its territory. Since such travelers and skilled professionals may hesitate to move to countries in which COVID-19 is spreading, the COVID-19 damages in countries where services are actually provided will result in decreasing mode 2 services exports and mode 4 services imports.

COVID-19 damages in the corresponding partner countries will also have a negative effect on services of these two modes. When the spread of COVID-19 becomes severe in a country, this country will restrict even people’s intra-national movement to prevent its further spread, raising moving costs to international airports or the travel costs to adjacent foreign countries. In addition, foreign countries may restrict the entry of people from this country to avoid additional inflow of the virus. Furthermore, this country per se will raise the restriction level (e.g., quarantine duration) against entrants, including home nationals returning from abroad. As a result, the severity of COVID-19 damages in a country from which people actually move across borders to consume mode 2 services or supply mode 4 services decreases its mode 2 services imports and mode 4 services exports. Thus, services trade in these two modes are expected to be negatively affected by the extent of COVID-19 damages in both exporting and importing countries.

The effects on mode 1 services trade are a bit different from those on the two modes, 2 and 4. Since mode 1 services trade does not require the movement of suppliers or consumers, this type of service may not be seriously affected or even increase. This type of service may be divided into three groups according to the effects of COVID-19 damages. The first includes ICT services, other business services, and personal, cultural, and recreational services. Stay-at-home orders may increase the demand for online services such as online recreational or educational channels (i.e., imports of personal services) and the use of online meeting tools (i.e., imports of ICT services) in the form of business-to-consumer (B2C) services. These positive effects may partially mitigate the negative effects of COVID-19 in the importing countries of these services. On the other hand, although some of these services may be exported online, there are some sources that could yield negative effects of COVID-19 in exporting countries. For instance, COVID-19 forced various sports games to be canceled (e.g., baseball games in the United States or soccer games in Europe) as well as film shoots to be postponed. The decrease of this content would lower exports of personal services.

The second group includes insurance and pension services, financial services, and IP charges. As in the first group, the cross-border supply of some of these services may be available online. The spread of COVID-19 in importing countries, however, may reduce business-to-business (B2B) transactions of these services; for instance, the demand for cross-border insurance or financial services such as foreign exchange transactions may decline due to the shrinkage of FDI or trade activities, and the demand for the use of IP rights with charges across borders may decrease due to the slowdown in economic or firms’ activities. In sum, the COVID-19 situation in a country in which consumers are located may negatively affect the demand for these services, while the spread of COVID-19 in exporting countries may not seriously affect the extent of the online supply.

The third group includes transport services, which are mostly defined as mode 1 but are not the typical mode 1 type. Inter-modal or inter-sectoral linkages play a key role in this sector. First, passenger transport services must be directly linked with services trade in modes 2 and 4, because they require the movement of people across borders. The negative impact on those two service modes will also appear as a negative effect on trade in passenger transport services. Second, freight transport services can be indirectly linked with the reduction in services trade in modes 2 and 4. For example, the WTO (2020) emphasizes significant bottlenecks in air cargo transportation because the world’s passenger aircraft fleet typically transports almost half of all air cargo shipments. Third, freight transport services are directly linked with goods trade; around one-half of the global trade in transport is driven by the goods trade. Therefore, the decline in goods trade due to COVID-19

15 Besides by-mode effects described in this sector, the inter-modal substitution effect may also exist. To avoid face-to-face transactions, a shift toward the more active use of online sales and teleworking transpired, and global demand for online services and digital technology was boosted amid the pandemic. In that sense, in favor of mode 1, some portion of trade in services may be shifted from other modes to mode 1, and the relative importance of mode 1 may have been enhanced and will continue to be. For instance, foreign language training that once required traveling to a language school in that language-speaking country as mode 2 may be substituted with online training with teachers located in that foreign country as mode 1. Similarly, cross-border online sightseeing business (mode 1) may be newly created/expanded to partially compensate for actual visits (mode 2). If the pandemic acted as a trigger of boosting the shift to mode 1 from other modes or the expansion of mode 1 services, an increase in digitalized services would mitigate the negative effects of COVID-19 on services. Although such inter-modal substitution effects cannot be directly analyzed in this paper, this possibility can be considered as an effect of COVID-19 on services.

16 Actually, construction projects were delayed or postponed in many countries due to the pandemic (WTO, 2021).
will certainly reduce the freight transport services. Due to these factors, transport services trade is expected to be negatively and seriously affected by the extent of COVID-19 damages in both exporting and importing countries, though their major type is mode 1.

5. Empirical framework

This section presents our empirical framework to examine the impact of COVID-19 on the trade in services. We empirically investigate these impacts of the COVID-19 pandemic by exploring quarterly data for each country’s exports to or imports from the world in 2019 and 2020. Our data are compiled in three dimensions (i.e., country, year, and quarter). Our empirical model is specified as follows:

\[ \text{Trade}_{iyq} = \exp(\beta \times \text{COVID}_{iyq} + \delta_i + \delta_q + \delta_{yq}) \times c_{iyq} \quad (1) \]

\( \text{Trade}_{iyq} \) is the trade value in country \( i \) in quarter \( q \) of year \( y \). We estimate this equation for exports and imports separately. \( \text{COVID}_{iyq} \) is the extent of COVID-19 damages in country \( i \). We control for three kinds of fixed effects \((\delta_i, \delta_q, \text{and } \delta_{yq})\). \( c_{iyq} \) is a disturbance term. As previously discussed, we expect negative effects to result from COVID-19 damages. As is consistent with this expectation, a non-negligible fraction of observations have a zero value for the trade in total services (around 20%). To naturally incorporate observations with zero-valued trade, we estimate this equation using the PPML method.

We obtain quarterly data on the services trade from the same source used in the previous section (i.e., UNCTAD STAT). We employ data from Q1 of 2019 to Q4 of 2020. We first examine exports or imports of total services. For comparison purposes, we also investigate those of total goods, of which the data are drawn from the WTO Stats. Then, we explore the effects on trade in each disaggregated services sector. To measure the extent of COVID-19’s damage, we use the three indicators.

### Table 1
World trade in services and goods (Billions of USD, %).

|          | Export |          | Import |          |
|----------|--------|----------|--------|----------|
|          | 2019   | 2020     | Growth | 2019     | 2020     | Growth |
| **Total**|        |          |        |          |          |        |
| Value    | 5,125  | 4,045    | -21    | 4,690    | 3,660    | -22    |
| Share    | 100    | 100      |        | 100      | 100      |        |
| **Goods-related services** |        |          |        |          |          |        |
| Value    | 202    | 168      | -17    | 142      | 126      | -11    |
| Share    | 4      | 4        |        | 3        | 3        |        |
| **Transport** |    |          |        |          |          |        |
| Value    | 866    | 700      | -19    | 990      | 777      | -22    |
| Share    | 17     | 17       |        | 21       | 21       |        |
| **Travel** |      |          |        |          |          |        |
| Value    | 1,111  | 405      | -64    | 1,170    | 453      | -61    |
| Share    | 22     | 10       |        | 25       | 12       |        |
| **Other services** |     |          |        |          |          |        |
| Value    | 2,946  | 2,743    | -7     | 2,388    | 2,267    | -5     |
| Share    | 57     | 68       |        | 51       | 62       |        |
| **Construction** |   |          |        |          |          |        |
| Value    | 97     | 74       | -24    | 59       | 51       | -13    |
| Share    | 2      | 2        |        | 1        | 1        |        |
| **Insurance** |    |          |        |          |          |        |
| Value    | 106    | 104      | -3     | 152      | 159      | 5      |
| Share    | 2      | 3        |        | 3        | 4        |        |
| **Financial services** |   |          |        |          |          |        |
| Value    | 455    | 443      | -3     | 225      | 223      | -1     |
| Share    | 9      | 11       |        | 5        | 6        |        |
| **IP charges** |   |          |        |          |          |        |
| Value    | 378    | 365      | -3     | 338      | 320      | -5     |
| Share    | 7      | 9        |        | 7        | 9        |        |
| **ICT services** |   |          |        |          |          |        |
| Value    | 502    | 494      | -2     | 346      | 340      | -2     |
| Share    | 10     | 12       |        | 7        | 9        |        |
| **Other business services** | 1,235 | 1,122    | -9     | 1,106    | 1,005    | -9     |
| Value    | 24     | 28       |        | 24       | 27       |        |
| Share    |       |         |        |          |          |        |
| **Personal services** | 74     | 60       | -18    | 75       | 69       | -8     |
| Value    | 1      | 1        |        | 2        | 2        |        |
| Share    | 1      | 1        |        | 1        | 1        |        |
| **Government services** | 61     | 57       | -8     | 55       | 51       | -8     |
| Value    | 1      | 1        |        | 1        | 1        |        |
| Share    | 1      | 1        |        | 1        | 1        |        |
| **Total goods** | 17,644 | 16,442 | -7 | 18,029 | 16,688 | -7 |

Source: UNCTAD and WTO.

Note: This table is compiled, based on the quarterly trade data.
examined in the previous section. The first and second are the number of COVID-19 cases and the number of COVID-19 deaths, that is, the sum of the numbers of newly confirmed cases and deaths in each quarter. The numbers are set to zero for observations in 2019, and we add a value of one to these numbers before taking their logs. The third measure is the stringency index of lockdown-style policies. We take a simple average of the daily index by quarter. All these data are obtained from the same sources used in the previous section. Appendix B lists our study countries, which include 146 countries.

It is worth discussing the qualitative differences among these variables measuring the severity of COVID-19. The stringency index captures the existence of lockdown measures to avoid the spread of infection, which directly affects the movement of consumers or suppliers across borders. Although the numbers of cases and deaths primarily represent physical damages, larger numbers have more adverse psychological effects on even uninfected people. In particular, the effectiveness of lockdown policies depends on the cooperation of the citizenry. If they agree that the pandemic is relatively severe (e.g., a large number of newly confirmed cases or deaths), they tend to abide by strict control measures; otherwise, they attempt to violate them (Zhang et al., 2021). The number of cases may give people a different perception of COVID-19’s severity from the number of deaths. Thus, these two different figures will have different elasticities on trade.

Finally, a set of fixed effects controls for various elements: $\delta_y$ is country-year fixed effects, which control for countries’ competitiveness as the respective services suppliers or demand sizes in the corresponding

Fig. 3. Quarterly World Trade in Services by Disaggregated Sector (2019.Q1 = 1), (a) Exports, (b) Imports. Source: UNCTAD.
consumer services. Since this type of fixed effect also controls for pop-
ulation size, the effects of the number of cases or deaths are equivalent to
those of their number per population. $\delta_q$ is country-quarter fixed effects
and controls for the seasonality of trade in each country. For example,
the long holiday season, which is a chance for traveling abroad, differs
country by country. $\delta_q$ is year-quarter fixed effects, which controls for varia-
tions in the demand and supply of services globally. This type of fixed
effect plays a key role in capturing trading partners’ demand and supply
because our dataset is not defined at a bilateral level. Furthermore, given
that most countries started to close their borders to foreign travelers
starting approximately in the latter half of March 2020, this type of fixed
effect may also control for the effects of people’s cross-border
movements.

6. Empirical results

This section presents our estimation results of Eq. (1). We first
examine the trade in total services as well as the trade in total goods.
Then, we analyze trade in various types of disaggregated services
sectors.

6.1. Total services

In Table 2, the upper panel shows the PPML estimation results for the
trade in total services. Except for Column (I) using the number of cases
for services exports, all the coefficients for COVID-19 damages are
significantly negative. Specifically, a 1% rise of COVID-19 deaths de-
creases both the exports and imports of total services by around 0.01%.
The lower panel in turn presents the corresponding results for the trade
in goods, which shows that as found in previous studies, all the co-
efficients for COVID-19 damages are significantly negative, except for
Column (V) using the number of deaths for services imports. These re-
sults suggest that the spread of COVID-19 and more restrictive measures
are different between high-income and low-income countries. Conversely, we find a significant
difference in its effect on imports in goods according to countries’ in-
come level, while there is no significant difference on the export side.
This result for imports implies that the damages of COVID-19 decrease imports by low-income countries but do not necessarily reduce those by high-income countries.

Second, as discussed in the previous section, unlike the case of the trade in goods, the trade in services, especially in modes 2 and 4, tend to require physical proximity between suppliers and consumers or the cross-border movement of consumers or suppliers. Such movement of people (i.e., the inflow of foreigners or the return home of nationals from abroad) may result in raising the severity of COVID-19’s damages. This possibility of reverse causality could create an endogeneity bias in our estimates. For example, exports of travel services imply the inflow of foreign tourists/business persons, which may increase the number of cases in the exporting countries. In this case, the error term has a posi-
tive correlation with the number of confirmed cases. The estimates ob-
tained using the ordinary least squares method suffer from an upward
bias. As a result, the negative effect of COVID-19 is underestimated.

To address this endogeneity issue, we estimate the logged version of
Eq. (1) using the instrumental variable (IV) method. In the literature, the
coefficients for COVID-19 cases or deaths tends to be instrumented by
weather conditions. For example, Qiu et al. (2020) used the averages of
daily maximum temperature, total precipitation, average wind speed,
and the interaction between precipitation and wind speed in the pre-
ceding third and fourth weeks. These weather variables would work well
in analyses at a daily or weekly level. However, in our quarterly-level
analysis, these variables in 2020 would take a similar level to those in
2019. The country-quarter fixed effects absorb most variations in such
weather variables. Therefore, we use the index on people’s mobility in
parks, the data for which were obtained from the COVID-19 Community
Mobility Reports provided by Google.\(^{21}\) This index indicates the per-
centage change in visits to parks, compared with those during the
5-week period from January 3–February 6, 2020. Since people’s visits
to parks are related to the COVID-19 situation but do not directly affect
trade in services, we chose this index as an instrumental variable.\(^{22}\)
One notable drawback of the IV method is that we are forced to drop

\(^{21}\) See https://www.google.com/covid19/mobility/data_documentation.html.
\(^{22}\) The COVID-19 Community Mobility Reports provide mobility indices on
various sites, including not only parks but also workplaces and retail shops.
However, the mobility in the latter two sites seems to be related to service
activities. To lower the possibility of this connection, we chose mobility in
parks.

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Table 2

PPML estimation results: services versus goods.

| Measures | Export | Import |
|----------|--------|--------|
|          | (I)    | (II)   | (III)  | (IV)   | (V)   | (VI)   |
| Services |        |        |        |        |       |        |
| Measure  | Case   | Death  | String | Case   | Death | String |
| Number of obs | 940  | 938   | 940   | 940   | 938   | 940   |
| Pseudo R-sq | 0.998 | 0.998 | 0.998 | 0.998 | 0.998 | 0.999 |
| Goods    |        |        |        |        |       |        |
| Measure  | Case   | Death  | String | Case   | Death | String |
| Number of obs | 728  | 726   | 728   | 720   | 718   | 720   |
| Pseudo R-sq | 0.999 | 0.999 | 0.999 | 0.999 | 0.999 | 0.999 |

Notes: This table reports the estimation results obtained using the PPML method. *** *, and * indicate the 1%, 5%, and 10% levels of statistical significance, respectively. The standard errors reported in parentheses are those clustered by country. In all specifications, we control for country-year fixed effects, country-quarter fixed effects, and year-quarter fixed effects.

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\[\delta_i, \delta_q, \delta_t, \delta_y, \delta_{iq}, \delta_{it}, \delta_{iqt} \]
In addition, estimations using the IV method must drop some countries that do not have data available on the mobility index (e.g., China) from observations with zero-valued trade when taking the log of trade values. In all specifications, we control for country-year fixed effects, country-quarter fixed effects, and year-quarter fixed effects.

The estimation results by the IV method are reported in Table 4.\textsuperscript{23} In all estimations, the test statistics for under-identification (Kleibergen–Paap rk Lagrange Multiplier (LM) statistic) and weak identification (Kleibergen–Paap rk Wald F) show reasonably high values. A high value in the former test indicates that the rank condition is satisfied and that the equations are identified, while a high value in the latter test suggests that our IV estimates are unlikely to suffer from bias due to weak instruments. For the services trade, all coefficients for COVID-19 variables are estimated to be significantly negative. In addition, the absolute magnitude of the coefficients rises compared with that in Table 2. For example, a 1% rise in COVID-19 deaths decreases services exports by 0.09% and services imports by 0.05%. Furthermore, similar to the trade in services, COVID-19 variables have significantly negative coefficients for the trade in goods.

Finally, we compare the magnitude of COVID-19’s impact between the trades in services and goods. The preceding results indicated that the spread of COVID-19 and restriction measures were likely to have a more harmful effect on services imports than on goods imports. As we discuss in detail in the next subsection, this more serious effect in the services trade must be related to the nature of the service type (e.g., physical proximity between suppliers and consumers). On the export side, the PPML estimation results presented in Table 2 reveal an unclear magnitude relationship in the effect of COVID-19 between services exports and goods; however, the IV estimation results clearly demonstrate that the coefficients of COVID-19 are negative and statistically significant in all cases of total services exports, and their absolute values are higher for total services than for total goods. In sum, the spread of COVID-19 and restriction measures tended to have a more harmful effect on trade in services than on trade in goods, particularly on the import side.

### 6.2. Disaggregated services

Next, we examine the effects of COVID-19 on trade in disaggregated services to explore which services sectors experienced more severe effects. Table 5 presents the PPML estimation results for four services sectors – goods-related services, transport services, travel services, and other services. This table clearly illustrates a contrasting picture between two sectors and the other two, suggesting heterogeneous effects among the services sectors. The absolute values of the coefficients are negative and statistically significant in all cases of exports and imports for the transport and travel sectors, except for the number of cases for transport exports (I). On the other hand, no case with statistical significance is found for goods-related services, while only two, (III) and (V), out of six equations have negative and statistically significant coefficients for other services. As other services are a composite of various services subsectors, we will conduct a further examination later.

The absolute values of the coefficients on the COVID-19 numbers/stringency index are the highest for travel services among the four services sectors and the goods sector for both exports and imports. In addition, the negative effects are likely to be greater for services imports than exports. These results suggest that travel services of mode 2 tend to have the most harmful impacts in terms of both exports and imports, and the COVID-19 situations and restriction policies in importing countries are likely to have more serious effects than those in exporting countries. The latter result implies that traveling is more sensitive to the restrictive measures in their home countries than in their destination countries. Following travel services, the absolute values of the coefficients on the COVID-19 numbers/stringency index are the second-largest in transport services. As discussed in Section 4, inter-modal or inter-sectoral linkages will be key sources of these negative effects of COVID-19 on this sector. We will provide further discussion on the details of transport services in the next subsection.

Goods-related services (i.e., manufacturing services on physical inputs owned by others and maintenance and repair services n.i.e.) are unlikely to have suffered from the pandemic, as no case with statistical significance suggests for exports and imports. There would be several possible reasons behind there being no impact on this sector. First, as found in Section 3, the trade in goods declined by a lesser extent than the trade in services, and it started to recover quickly. Second,

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\textsuperscript{23} The first stage estimation shows a significantly negative coefficient for the mobility index. Namely, people’s visits to parks are negatively associated with the severity of COVID-19.
Third, e-commerce has expanded explosively amid the COVID-19 pandemic to cope with social distancing practices and limited mobility (Hayakawa et al., 2021d). The increase of e-commerce use may raise the impacts of COVID-19 numbers in terms of both exports and imports, but they are more sensitive to the restrictive measures in their home countries than in their destination countries.

The rest of the subsectors demonstrate a negative impact only on either exports or imports. Negative coefficients with statistical significance for exports are found in some cases for ICT services, other business services, and personal, cultural, and recreational services. As expected, however, the negative impacts on exports are much smaller for these services of mode 1, compared with services of mode 2 or mode 4, because the major supply form is the cross-border supply through online. In particular, the negative impacts on ICT services exports are the lowest. On the other hand, the insignificant result for exports will indicate that more significant negative effect of COVID-19 in importing countries of these services will be due to the decrease of B2B transactions of these services. We will further discuss ICT services in the next subsection.

Conversely, the numbers of COVID-19 deaths and new cases (and restrictive measures) are negatively associated with imports for insurance and pension services, financial services, and IP charges, without any significant results for exports. As discussed in Section 4, the significantly negative effect of COVID-19 in importing countries of these services will be due to the decrease of B2B transactions of these services. On the other hand, the insignificant result for exports will indicate that the spread of COVID-19 in exporting countries does not seriously affect the extent of the online supply of these services.

6.3. Further discussion

In this subsection, we will present a supplemental discussion on the impacts of COVID-19 on services trade and their modes of supply. To do so, we shed light on two subsectors, that is, transport and ICT services, and attempt to examine further decomposed data of these subsectors. Unfortunately, disaggregated quarterly data on trade in these services in 2019 and 2020 is not available (as of January 2022); thus, using annual data, instead of quarterly data, we present an interesting table in Appendix D for trade in transport services by three modes of transport (sea, air, and other modes) and three types of transport (passenger, freight, and other). The table demonstrates that the annual percentage rate of decline in 2020 for passenger transport services was over 40%; larger than that for freight (around 10%) and other transport services (close to 20%). As a result, passenger transport services accounted for 56%/41% (export/import) of the decrease of trade in total transport services in 2020, which is much larger than its component share in 2019 of 26%/19%. In other words, passenger transport services experienced a large portion of fall in total transport services trade. As the major modes of travel and construction services are modes 2 and 4, which are directly related with passenger transport services, we can assert that trade in services that require (or are directly related to) the movement of people across borders (e.g., trade in travel services, passenger transport services, and construction services) explains a substantial portion of the negative impact of COVID-19 on overall trade in services.

Table 4
IV estimation results: services versus goods.

| Measure       | Export | Import |
|---------------|--------|--------|
|                | (I)    | (II)   | (III)  | (IV)   | (V)   | (VI)   |
| COVID         | -0.097*** | -0.091*** | -1.204*** | -0.054*** | -0.050*** | -0.663*** |
|               | [0.026]  | [0.025]  | [0.326]  | [0.016]  | [0.014]  | [0.177]  |
| Number of obs | 766     | 764     | 766     | 766     | 764     | 766     |
| Underidentification test | 40.3 | 38.2 | 36.1 | 40.3 | 38.2 | 36.1 |
| Weak identification test | 52.8 | 43.4 | 65.5 | 52.8 | 43.4 | 65.5 |
| Goods         | -0.044*** | -0.038*** | -0.530*** | -0.041*** | -0.035*** | -0.506*** |
|               | [0.014]  | [0.012]  | [0.169]  | [0.008]  | [0.006]  | [0.096]  |
| Number of obs | 664     | 662     | 664     | 656     | 654     | 656     |
| Underidentification test | 38.3 | 41.2 | 35.0 | 37.7 | 40.7 | 34.2 |
| Weak identification test | 51.9 | 50.5 | 54.2 | 50.5 | 49.5 | 53.0 |

Notes: This table reports the estimation results obtained using the IV method. ***, ***, and * indicate the 1%, 5%, and 10% levels of statistical significance, respectively. The standard errors reported in parentheses are those clustered by country. In all specifications, we control for country–year fixed effects, country–quarter fixed effects, and year–quarter fixed effects. The underidentification test and weak identification test show the Kleibergen–Paap rk LM statistic and Kleibergen–Paap rk Wald F statistic, respectively.

For instance, Ando et al. (2021) and Ando and Hayakawa (2021) emphasized that production systems in East Asia seem to be almost intact so far, although the negative impacts on trade did exist temporarily. Like the previous shocks, such as the 2008–2009 GFC and the 2011 East Japan Earthquake, strong incentives to maintain production networks were effective, and quick adjustments for recovery were implemented amid the COVID-19 pandemic.

The results for the services trade and the goods trade in Tables 2, 4, 5, and 6 are summarized in Appendix C, with the suggested major modes of each disaggregated services sector for trade on a BOP basis.

For other business services, only one equation (III) for exports with the COVID-19 stringency index shows the negative and significant effect among six equations.

25 For instance, Ando et al. (2021) and Ando and Hayakawa (2021) emphasized that production systems in East Asia seem to be almost intact so far, although the negative impacts on trade did exist temporarily. Like the previous shocks, such as the 2008–2009 GFC and the 2011 East Japan Earthquake, strong incentives to maintain production networks were effective, and quick adjustments for recovery were implemented amid the COVID-19 pandemic.

26 The results for the services trade and the goods trade in Tables 2, 4, 5, and 6 are summarized in Appendix C, with the suggested major modes of each disaggregated services sector for trade on a BOP basis.

27 Note that services trade statistics on a BOP basis do not include transactions between internal residents (e.g., a case that a Japanese resident uses international passenger transport services provided by Japan Airline); thus, the decline of passenger transport services must be much larger in practice.
We can also contend that the negative impact of COVID-19 on overall trade in services is at least partially explained by the negative impact on services related to the movement of goods across borders. As noted, freight transport services and other transport services declined in 2020 by 9%/13% (exports/imports) and 18%/17%, respectively, which correspond to 23%/37% and 20%/20% of the trade decline in the whole transport services sector. Although annual percentage declines are much smaller than those of passenger transport services, the international movement of goods partially explains a certain amount of the decline in total services trade.

Further, as discussed in Section 4, not a small portion of air cargo shipments are transported by the passenger aircraft fleet. The table in Appendix D demonstrates that freight transport services via air transport declined by 20%, on average, whereas those by sea and other modes of transport dropped by only around 10%. This difference between air transport and others may imply indirect negative effects on freight transport services caused by the reduction of travel services due to the mobility restrictions.

In contrast, other services, which are typically provided through mode 1, had almost no significant effect. In particular, ICT services had the smallest negative impact on exports among all services sectors/subsectors with statistical significance at 10%, with no impact on the import side. To examine the role of mode 1 further, we next examine subcategories of ICT services (i.e., telecommunication services, computer services, and information services). Figure (a) in Appendix E confirms the positive annual growth of computer services, unlike other subcategories of ICT services, and the largest annual percentage change among all services sectors/subsectors. This indicates how actively computer services were boosted amid the pandemic and rising digitalization. Figure (b) in Appendix E presents the annual growth of computer services exports for individual countries with more than 1%. This clearly demonstrates that many countries experienced double-digit positive growth across various regions at different income levels in 2020, unlike other services sectors with negative growth. Considering that computer services grew rapidly amid the pandemic, and that digital technology is necessary for transactions of mode 1, less/no significant effects on services of mode 1 may imply the importance of digital technology for ICT services as well as other services and manufacturing sectors.

7. Concluding remarks

This study examined the impact of COVID-19 on services exports and imports using quarterly data for 146 countries in 2019 and 2020. Our results indicated that the spread of COVID-19 had a negative impact on services exports and imports, and such harmful effects tended to be larger for trade in services than trade in goods, particularly on the import side. Furthermore, we found heterogeneous effects according to the disaggregated services sector, reflecting the nature of services. Specifically, travel services were the most affected, followed by transport and construction services. Trade in travel services, passenger transport services, and construction services mostly require, or are directly related to, the movement of people across borders. While trade

28 Although we cannot obtain the information on ICT services of mode 3 in 2020, computer services exports, including those of mode 3, must be much larger in 2020 because mode 3 is around three times that of mode 1 for ICT services in 2017 (see Appendix A).

29 For instance, Ando et al. (2022) note that an increasingly large proportion of services are now digitized and delivered online, and at the same time, an increasingly large segment of the manufacturing sector and other traditional sectors is also transformed into online services. Nayyar, et al. (2021), which shed lights on the services sector and assess the prospects for services-led development, emphasize that services offer new opportunities for scaling up and growing revenues and that digital technologies reduce the need for face-to-face and allow for more remote delivery of services.
Table 6
PPML estimation results for sub-sectors in other services.

|                        | Export (I) | (II) | (III) | Import (IV) | (V) | (VI) |
|------------------------|------------|------|-------|-------------|-----|------|
| **Construction**       |            |      |       |             |     |      |
| Construction          | -0.063***  | -0.039*** | -0.589 | -0.029***   | -0.018*** | -0.456 |
| (0.013)               | (0.005)    | (0.399) | (0.007) | (0.005)     | (0.280)    |      |
| Measure                | Case       | Death| String| Case        | Death| String|
| Number of obs         | 570        | 568  | 570   | 562         | 624  | 626  |
| Pseudo R-sq           | 0.989      | 0.989 | 0.989 | 0.987       | 0.987 | 0.987 |
| **Insurance and pension services** |            |      |       |             |     |      |
| Insurance and pension services | 0.002   | 0.003 | 0.155 | -0.026**   | -0.013* | -0.304 |
| (0.010)               | (0.008)    | (0.169) | (0.012) | (0.007)    | (0.190) |      |
| Measure                | Case       | Death| String| Case        | Death| String|
| Number of obs         | 664        | 662  | 664   | 748         | 746  | 748  |
| Pseudo R-sq           | 0.994      | 0.994 | 0.994 | 0.995       | 0.995 | 0.995 |
| **Financial services** |            |      |       |             |     |      |
| Financial services    | -0.011     | -0.002 | -0.095 | -0.020**   | -0.024*** | -0.173 |
| (0.014)               | (0.008)    | (0.183) | (0.008) | (0.008)    | (0.120) |      |
| Measure                | Case       | Death| String| Case        | Death| String|
| Number of obs         | 700        | 698  | 700   | 724         | 722  | 724  |
| Pseudo R-sq           | 0.998      | 0.998 | 0.998 | 0.996       | 0.996 | 0.996 |
| **Charges for the use of intellectual property** |            |      |       |             |     |      |
| Charges for the use of intellectual property | -0.016   | -0.003 | -0.095 | -0.030***   | -0.022*** | -0.259* |
| (0.010)               | (0.008)    | (0.105) | (0.010) | (0.005)    | (0.134) |      |
| Measure                | Case       | Death| String| Case        | Death| String|
| Number of obs         | 602        | 600  | 602   | 678         | 676  | 678  |
| Pseudo R-sq           | 0.999      | 0.999 | 0.999 | 0.998       | 0.998 | 0.998 |
| **Telecommunications, computer, and information services** |            |      |       |             |     |      |
| Telecommunications, computer, and information services | -0.012   | -0.008* | -0.210* | -0.001    | 0.001  | 0.008 |
| (0.008)               | (0.004)    | (0.115) | (0.007) | (0.005)    | (0.093) |      |
| Measure                | Case       | Death| String| Case        | Death| String|
| Number of obs         | 750        | 748  | 750   | 754         | 752  | 754  |
| Pseudo R-sq           | 0.998      | 0.998 | 0.998 | 0.997       | 0.997 | 0.997 |
| **Other business services** |            |      |       |             |     |      |
| Other business services | -0.009   | -0.005 | -0.285*** | -0.02     | -0.019  | -1.164 |
| (0.006)               | (0.004)    | (0.103) | (0.014) | (0.013)    | (0.722) |      |
| Measure                | Case       | Death| String| Case        | Death| String|
| Number of obs         | 726        | 726  | 726   | 742         | 740  | 742  |
| Pseudo R-sq           | 0.999      | 0.999 | 0.999 | 0.994       | 0.994 | 0.994 |
| **Personal, cultural, and recreational services** |            |      |       |             |     |      |
| Personal, cultural, and recreational services | -0.027**  | -0.019* | -0.339** | 0.007    | 0.018  | 0.304 |
| (0.012)               | (0.010)    | (0.170) | (0.025) | (0.021)    | (0.415) |      |
| Measure                | Case       | Death| String| Case        | Death| String|
| Number of obs         | 602        | 600  | 602   | 640         | 638  | 640  |
| Pseudo R-sq           | 0.991      | 0.991 | 0.991 | 0.991       | 0.991 | 0.991 |
| **Government goods and services** |            |      |       |             |     |      |
| Government goods and services | -0.037*** | -0.016* | -0.439* | 0.044    | 0.012  | 0.810* |
| (0.009)               | (0.009)    | (0.235) | (0.027) | (0.011)    | (0.428) |      |
| Measure                | Case       | Death| String| Case        | Death| String|
| Number of obs         | 854        | 854  | 854   | 884         | 882  | 884  |
| Pseudo R-sq           | 0.99       | 0.99  | 0.99  | 0.99        | 0.99  | 0.99  |

Notes: This table reports the estimation results obtained using the PPML method. ***, **, and * indicate the 1%, 5%, and 10% levels of statistical significance, respectively. The standard errors reported in parentheses are those clustered by country. In all specifications, we control for country–year fixed effects, country–quarter fixed effects, and year–quarter fixed effects.
in services that are directly related to the international movement of people explains a substantial portion of the negative impact of COVID-19 on overall trade in services, trade in services related to the cross-border movement of goods, such as freight transport services, also offers a partial explanation. Conversely, other services that are typically provided through mode 1 experienced almost no significant effect. In particular, ICT services had the smallest negative impact on exports, with no impact on the import side.

In sum, the larger the number of COVID cases/deaths (or the more severe the restrictive regulations), the more the trade in services declines, and such a negative impact is particularly observed for services that require the movement of people; thus, the pandemic will not come to an end if the timing of COVID spread varies among countries. Also, COVID-19 will easily spread again through the movement of people across borders from other countries even if some countries successfully suppress COVID spread. These findings imply that international cooperation is necessary to minimize the differences in the timing of the recovery from the pandemic. Vaccine donation to countries with lower vaccination rates would be an urgent measure that can be taken. Moreover, less/no significant effects on services of mode 1, in particular ICT services, indicate the importance of the active use of digital technology for both ICT services and other services and manufacturing sectors, considering that computer services rapidly grew amid the pandemic and that digital technology is necessary for mode 1 transactions.

Appendix A. World services trade by the mode of supply in 2017 (Billions of USD)

| Mode 1 | Mode 2 | Mode 3 | Mode 4 | Mode 1 | Mode 2 | Mode 3 | Mode 4 | Sectoral share |
|--------|--------|--------|--------|--------|--------|--------|--------|----------------|
| Goods-related services | 0.0 | 529.3 | 0.0 | 19.0 | 0.0 | 365.3 | 0.0 | 15.0 | 1% |
| Transport | 2,102.0 | 709.0 | 1,566.0 | 0.0 | 2,491.0 | 787.0 | 1,569.0 | 0.0 | 12% |
| (sea, air, and other transports) | (2,102.0) | (709.0) | (0.0) | (0.0) | (2,491.0) | (787.0) | (0.0) | (0.0) | |
| Tourism and business travel | 0.0 | 2,453.0 | 541.0 | 0.0 | 0.0 | 2,435.0 | 522.0 | 0.0 | 8% |
| (business and other personal travel) | (0.0) | (2,453.0) | (0.0) | (0.0) | (0.0) | (2,435.0) | (0.0) | (0.0) | |
| Construction | 0.0 | 0.0 | 1,378.0 | 126.0 | 0.0 | 0.0 | 978.0 | 87.0 | 3% |
| Insurance and financial services | 1,732.0 | 0.0 | 5,934.0 | 0.0 | 1,306.0 | 0.0 | 5,810.0 | 0.0 | 19% |
| IP charges | 1,160.0 | 0.0 | 0.0 | 0.0 | 1,277.0 | 0.0 | 0.0 | 0.0 | 3% |
| ICT services | 1,335.0 | 6.0 | 3,809.0 | 300.0 | 819.0 | 7.0 | 3,916.0 | 202.0 | 13% |
| Other business services (excl. trade-related) | 2,486.0 | 37.0 | 4,138.0 | 770.0 | 2,307.0 | 31.0 | 4,152.0 | 730.0 | 19% |
| Other personal services | 24.0 | 0.0 | 171.0 | 8.0 | 18.0 | 0.0 | 178.0 | 7.0 | 1% |
| Education services | 16.0 | 291.0 | 38.0 | 8.0 | 11.0 | 271.0 | 30.0 | 6.0 | 1% |
| Heritage and recreational services | 17.0 | 0.0 | 150.0 | 6.0 | 18.0 | 0.0 | 123.0 | 6.0 | 0% |
| Health services | 7.0 | 35.0 | 131.0 | 2.0 | 9.0 | 33.0 | 115.0 | 3.0 | 0% |
| Trade-related services (Distribution) | 2,123.0 | 0.0 | 5,388.0 | 0.0 | 2,409.0 | 0.0 | 5,491.0 | 0.0 | 20% |
| Total Services (sum of level 1 items above) | 11,001.0 | 4,059.0 | 23,243.0 | 1,240.0 | 10,666.0 | 5,929.0 | 22,884.0 | 1,058.0 | 100% |
| - By mode share in total commercial services | 28% | 10% | 59% | 3% | 28% | 10% | 59% | 3% |

Source: TISMOS.

Notes: TISMOS combines information from BOP and FATS and thus includes mode 3. The most major mode among the four modes other than mode 3 is highlighted. For transport services and travel services, the sum of the subcomponents is also presented in parentheses. The sectoral share of world trade is calculated based on the average of world exports and world imports. The categories of this table are slightly different from those of the BOP.

Appendix B. Study countries (146)

Afghanistan, Albania, Algeria, Angola, Argentine, Aruba, Australia, Austria, Azerbaijan, Bahamas, Bangladesh, Belarus, Belgium, Belize, Bermuda, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Cabo Verde, Cambodia, Cameroon, Canada, Chile, China, Hong Kong SAR, China, Macao SAR, China, Taiwan Province of, Colombia, Congo, Costa Rica, Croatia, Cyprus, Czechia, Denmark, Djibouti, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Eswatini, Ethiopia, Fiji, Finland, France, Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea, Kuwait, Kyrgyzstan, Lao People’s Dem. Rep., Latvia, Lebanon, Lesotho, Liberia, Lithuania, Luxembourg, Madagascar, Malaysia, Malta, Mauritania, Mauritius, Mexico, Moldova, Republic of, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Saudi Arabia, Serbia, Seychelles, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, Sudan, Suriname, Sweden, Switzerland, Liechtenstein, Tajikistan, Tanzania, United Republic of, Thailand, Timor Leste, Tonga, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States of America, Uruguay, Uzbekistan, Vanuatu, Venezuela, Viet Nam, Zambia, Zimbabwe.
Appendix C. Summary of the PPML results for trade in services on the BOP basis and their major modes: Comparison with the goods trade

|                              | Suggested major mode: | Major mode: | Export | Import |
|------------------------------|-----------------------|-------------|--------|--------|
|                              |                       | BOP         | TISMOS |        |
|                              |                       | Case | Death | Index | Case | Death | Index |
| Total goods                  |                       | N    | N     | N     | N    | N     | N     |
| Total services               |                       | N, L | N     | N     | N, L | N, L  | N, L  |
| Goods-related services       | Mode 2                | Mode 2  |        |        |
| Transport (linked with Modes 2/4) | Mode 1              | Mode 1  | N, L   | N, L  | N, L | N, L  | N, L  |
| Travel                       | Mode 2                | Mode 2  | N, L   | N, L  | N, L | N, L  | N, L  |
| Construction                 | Mode 4                | Mode 3  | N, L   | N, L  | N, L | N, L  | N, L  |
| Insurance                    | Mode 1                | Mode 3  | N, L   | N, L  | N, L | N, L  | N, L  |
| Financial services           | Mode 1                | Mode 3  | N, L   | N, L  | N, L | N, L  | N, L  |
| IP charges                   | Mode 1                | Mode 1  | N, L   | N, L  | N, L | N, L  | N, L  |
| ICT services                 | Mode 1                | Mode 3  | N      | N     |      |       |       |
| Other business services      | Mode 1                | Mode 3  | N      | N     |      |       |       |
| Personal services            | Mode 1                | Mode 3  | N, L   | N, L  | N    |       |       |
| Government services          |                      |        | N, L   | N, L  | N    |       |       |
| Total goods (IV)             |                       | N     | N     | N     | N    | N     | N     |
| Total services (IV)          |                       | N, L  | N, L  | N, L  | N, L | N, L  | N, L  |

Source: Tables 2, 4, 5, and 6 and Appendix A.

Notes: “N” and “P” denote negative and positive results with statistical significance, respectively. “L” indicates a larger effect of COVID-19 for the respective services sector/subsector than the goods sector. “Suggested major mode: BOP” is the most major mode, other than mode 3, in Appendix A for each disaggregated sector. The IV estimation results for total goods/services are also included as a reference.

Appendix D. World trade in transport services by three modes and three types of transport

|                              | Annual growth in 2020 | Each component’s share in total transport in 2019 | Contribution of each component to the change (decrease) in trade value of total transport in 2020 |
|------------------------------|-----------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------|
|                              | Export | Import | Average | Export | Import | Export | Import |
| Total transport (all)        | -20%   | -20%   | -20%    | 100%   | 100%   | 100%   | 100%    |
| a. Passenger (all)           | -44%   | -42%   | -43%    | 26%    | 19%    | 56%    | 41%     |
| b. Freight (all)             | -9%    | -13%   | -11%    | 52%    | 58%    | 23%    | 37%     |
| c. Other (all)               | -18%   | -17%   | -18%    | 22%    | 23%    | 20%    | 20%     |
| i) Sea transport             | -7%    | -9%    | -8%     | 40%    | 44%    | 14%    | 20%     |
| a. Passenger (sea)           | -15%   | -22%   | -20%    | 1%     | 2%     | 1%     | 2%      |
| b. Freight (sea)             | -7%    | -8%    | -8%     | 28%    | 33%    | 10%    | 13%     |
| c. Other (sea)               | -5%    | -10%   | -8%     | 10%    | 9%     | 3%     | 4%      |
| ii) Air transport            | -44%   | -41%   | -42%    | 37%    | 35%    | 81%    | 72%     |
| a. Passenger (air)           | -54%   | -50%   | -52%    | 23%    | 18%    | 61%    | 47%     |
| b. Freight (air)             | -8%    | -22%   | -20%    | 6%     | 8%     | 2%     | 11%     |
| c. Other (air)               | -43%   | -32%   | -37%    | 9%     | 8%     | 18%    | 13%     |
| iii) Other modes of transport| -8%    | -11%   | -10%    | 21%    | 20%    | 9%     | 11%     |
| a. Passenger (other)         | -21%   | -24%   | -23%    | 1%     | 1%     | 1%     | 1%      |
| b. Freight (other)           | -8%    | -11%   | -10%    | 15%    | 14%    | 6%     | 8%      |
| c. Other (other)             | -7%    | -10%   | -8%     | 5%     | 5%     | 2%     | 2%      |

Source: WTO, based on the BOP basis.

Notes: This table is compiled based on annual trade data; thus, the annual percentage changes in 2020 differ slightly from the corresponding figures in Table 1, largely because of countries’ differences in coverage. The three modes of transport are sea, air, and other modes, and the three types of transport are passenger, freight, and other. Each component’s share and the contribution rate for transport (all) are not completely consistent with the sum of subcategories.
Appendix E. Annual percentage change in computer services exports in 2020

(a) Comparison of ICT Services Subsectors and Other Services Sectors/Subsectors

Source: WTO, based on the BOP basis.

Notes: This figure is compiled based on annual trade data; thus, the annual percentage change rates differ slightly from the corresponding figures in Table 1, largely because of countries’ differences in coverage. Telecom (telecommunication services), Computer (computer services), and Information (information services) are subcategories of ICT total (ICT services).

(b) Individual Countries with more than 1% Growth
Source: WTO, based on the BOP basis.

Notes: This figure is compiled based on annual trade data. The countries included in this figure are those with more than 1% growth.

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