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Abstract

Global services trade declined by 20% during 2020 with significant heterogeneity across countries, geographical regions and sectors. The decline was correlated with COVID-19-case incidence; stringency of imposed lockdowns; the decline in merchandise trade; and with different ways of transacting services trade across sectors. The latter depends on the sectoral composition of services trade across countries, which in turn emanates from more fundamental determinants of comparative advantage in services. Results from empirical analysis suggest that smaller, more capital- and PTA-intensive economies with more digital-trade-restrictive policies and lower ability to leverage ICT infrastructure were associated with relatively larger declines. Regulatory quality is found to have played both alleviating and intensifying roles in the decline, while geographical remoteness is found to be inversely related to it. Finally, the expected role of GVC-integration in accentuating the services trade decline finds strong support in both aggregate GMM and bilateral structural gravity results across sectors.

Keywords

Services trade; COVID-19; heterogeneity; modes of supply; structural determinants; gravity model

JEL codes

F1, F14

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Anirudh Shingal*

7 October 2021

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Global services trade declined by 20% during 2020 with significant heterogeneity across countries, geographical regions and sectors. The decline was correlated with COVID-19-case incidence; stringency of imposed lockdowns; the decline in merchandise trade; and with different ways of transacting services trade across sectors. The latter depends on the sectoral composition of services trade across countries, which in turn emanates from more fundamental determinants of comparative advantage in services. Results from empirical analysis suggest that smaller, more capital- and PTA-intensive economies with more digital-trade-restrictive policies and lower ability to leverage ICT infrastructure were associated with relatively larger declines. Regulatory quality is found to have played both alleviating and intensifying roles in the decline, while geographical remoteness is found to be inversely related to it. Finally, the expected role of GVC-integration in accentuating the services trade decline finds strong support in both aggregate GMM and bilateral structural gravity results across sectors.

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1 Introduction

COVID-19 has been an unprecedented health and economic crisis, leading, in its initial widespread outbreak in March 2020, to an immediate supply and concomitant demand shock emanating from stalled economic activity in the wake of widespread lockdowns imposed by countries across the world. Another significant fallout of the virus outbreak was the huge blow to international trade in goods and services, emanating, inter alia, from the disruption to regional and global value chains (GVCs) and travel restrictions.

One year later, while merchandise trade has witnessed a rebound, trade in services continues to be adversely affected. At the same time, the pandemic has seen a significant rise in e-commerce and a spurt in digitalization (WTO, 2020a). There has been a spate of work examining the impact of the pandemic on merchandise trade along different dimensions (Che et al. 2020; Friedt and Zhang, 2020; Kejzar and Velic, 2020; Bas et al. 2021; Berthou and Stumpner, 2021; Espitia et al. 2021; Hayakwa and Mukunoki, 2021; Liu et al. 2021; Pei et al. 2021) but no rigorous empirical analysis of the effect on services trade based on data reported during 2020. Against this background, the paper presents stylized facts on the decline in services trade, including at the disaggregated level, observed in 2020 and provides hypotheses and empirical analysis, using both aggregate and bilateral services trade data, seeking to explain the significant heterogeneity in decline observed across countries and sectors. Examining the determinants of this heterogeneous decline assumes significance for policy design to reduce service link costs and facilitate more rapid post-pandemic economic recovery, and is thus, the main contribution of the paper.

WTO data show that global services trade declined by 20% in 2020, which translates into a USD 1.2 trillion loss each in exports and imports of commercial services[1]. In fact, services trade declined by more than twice as much as trade in goods, and reported slower recovery. Moreover, there is considerable heterogeneity in the observed decline in services trade across countries, geographical regions and sectors. On average, the group of OECD countries and the largest services traders observed much smaller percentage declines in value in 2020 compared to the non-OECD countries and the small services trading economies. More disaggregated analysis shows that trade in commercial services was adversely affected across sectors with travel services trade (mainly tourism) being by far the worst hit; global travel services exports declined by 63% in 2020 relative to 2019. In contrast, world trade in other commercial services[2] only declined by 2%. This heterogeneity in decline alludes to

[1]Commercial services are all services except for government services.

[2]These include charges for the use of intellectual property; construction; distribution; insurance; financial; telecommunications; computer and information; personal, cultural and recreational (audio-visual, health

high uncertainty/adjustment costs and to the increased need for economic agents to adopt new/intensify existing risk mitigation strategies during the pandemic (Arriola et al. 2021).

While the incidence of COVID-19 cases and mortalities associated with the pandemic are expected to be obvious determinants of the decline in services trade value (both exports and imports) in 2020, this decline is also found to be positively correlated with the share of Modes[3] 2-4 in total services trade and inversely related to the Mode 1 share. Several Mode 1 services can be delivered digitally in work-from-home (WFH) scenarios, while services delivered via Modes 2-4 require physical proximity between the buyer and seller; the latter have been more adversely affected by travel bans and social distancing during the pandemic.

Thus, the primary hypothesis is that the differences in COVID-19-induced decline in services trade across countries and sectors can be explained by the different ways in which these countries transact services trade in the concerned sectors. For instance, trade in other commercial services, most of which are largely transacted online, have been the least adversely affected. In contrast, travel services have been the worst hit and the decline in travel services trade is found to be positively correlated with the stringency of travel restrictions and related measures imposed during lockdowns.

This said, the use of different modes of supply itself depends on the sectoral composition of services trade across countries, which in turn is governed by more fundamental determinants of services trade patterns that themselves vary across countries. These include traditional determinants like physical, natural and human capital endowments; economies of scale; geography; institutional quality; access to ICT infrastructure; regulatory policy; complementarity with merchandise trade as well as more recent factors such as integration and position in GVCs and intensiveness in preferential trade agreements (PTAs). These factors were largely unaffected by the pandemic, which helps in identification. Thus, the heterogeneity in the observed decline in services trade is ultimately linked to these fundamental determinants, generating several secondary hypotheses, which we explore econometrically at a more disaggregated level.

Results from empirical analysis suggest that attributes of COVID-19 incidence (the number of cases, deaths and the stringency of government-imposed measures) and the decline in

and education); and other business services (a diverse category that includes, inter alia, accounting, legal, engineering, research & development, management consulting, and technical services).

[3]In WTO GATS parlance, services trade is transacted via four modes of supply. Mode 1 or "cross-border trade" is the whole range of services transactions that take place online. Mode 2 or "consumption abroad" is the service transacted when the consumer travels to the economy of the supplier e.g. tourism. Mode 3 or "commercial presence" is foreign affiliate activities in the host economy i.e. investment. Mode 4 or "movement of natural persons" is the service delivered by the supplier in the economy of the consumer e.g. onsite software programmers.

merchandise trade were positively correlated with the magnitude of services trade decline across sectors. Moreover, smaller, more capital- and PTA-intensive economies with more restrictive policies on digital trade and lower ability to leverage ICT infrastructure were associated with relatively larger declines in services trade. While regulatory quality is found to have played both alleviating and intensifying roles in the decline, geographical remoteness is found to be inversely related to it. Meanwhile, the expected role of GVC-integration in accentuating the services trade decline is strongly supported by both aggregate GMM and bilateral gravity results across sectors.

The rest of the paper is structured as follows. Section 2 relates this study to existing literature on the determinants of services trade patterns and the growing work on the implications of the pandemic for services trade. Section 3 provides stylized facts on the decline in services trade observed in 2020, including at the disaggregated level. Section 4 introduces primary and secondary hypotheses that aim to explain the heterogeneity in observed declines and provides suggestive evidence in support of these hypotheses. Section 5 discusses the estimation methodology used to examine the hypotheses empirically along with the relevant data sources. Section 6 presents the results from estimation and Section 7 concludes.

2 Related literature

2.1 Determinants of services trade patterns

Much like trade in goods and investment (Baldwin, 1979), services trade patterns are determined by differences in Ricardian comparative costs among economies, which in turn emanate from HOS (Heckscher-Ohlin-Samuelson) variations in factor endowments - capital and labour as well as human capital. Comparative advantage in services is also a function of geography, technology, scale economies and market imperfections (Sapir and Lutz, 1981), though the heterogeneous nature of services means that the importance of determining factors may vary across sectors.

For instance, while comparative advantage in freight services may be related to capital intensity, scale, composition of trade, and distance from trading partners, trade patterns in passenger services are associated more with capital abundance and the flow of passengers (Sapir and Lutz, 1981). In contrast, the availability of human capital, ICT infrastructure and economies of scale may be more important determinants of trade in insurance, financial, telecoms and IT services. Conventional theories are also likely to explain trade in construction and distribution services since commercial presence is the dominant mode of supply in

these services. Meanwhile, regulatory requirements may be more important determinants of trade in professional services. Thus, differences in sectoral composition of services trade across countries will, ipso facto, influence the observed variations in services trade decline.

The need for physical proximity between buyers and sellers for services transactions to be effected gives rise to the "proximity burden" (Francois and Hoekman, 2010), though the ICT revolution has progressively diminished the significance of geography by enabling fragmentation and outsourcing. The latter also suggests that variations in GVC-integration and in countries' relative position in value-chains will also determine the observed cross-country differences in services trade decline. This said, services trade still requires a heavier dose of local presence of suppliers in the buyer's market than is the case with goods. Services provision is also characterized by "jointness in production" (Francois and Hoekman, 2010) i.e. the need for complementary inputs, including both goods and other services, for the transaction to be effected. This recognition led to the methodological development of the four modes of supply by Sampson and Snape (1985). Thus, the different ways in which different services are transacted across borders will also affect variations in services trade decline observed across countries.

Many service industries, especially the "margin sectors" that facilitate transactions between agents through communications, distribution, transport and intermediation activities (Deardorff, 2001) are characterized by a mix of network externalities, regulation and natural and policy barriers to entry (Francois and Hoekman, 2010). This is a source of market power that necessitates regulation and competition in services markets. While such regulation may be driven by both efficiency and equity considerations, the incidence of restrictive regulation and regulatory heterogeneity between countries act as deterrents to services trade (Nordås and Rouzet, 2017). This suggests that negotiating binding commitments via preferential services trade agreements that either liberalize or harmonize regulatory requirements on services trade also matters (Egger and Shingal, 2021). Moreover, the quality of institutions managing these regulations is further likely to facilitate services trade (van der Marel, 2012) as well as minimize shock-induced adverse effects by more effective crises-management.

2.2 The COVID-19 pandemic and services trade

Amongst the earliest commentary on the pandemic's implications for services trade came from Shingal (2020a). The author argued that travel restrictions and social distancing (both voluntary and selective) are likely to outlast economic lockdowns and these would continue to inflict damage on services transactions requiring proximity between buyers and sellers.

WTO (2020a) also highlighted the significant adverse impact of mobility restrictions and social distancing measures imposed for public health reasons on tourism, transport and distribution services. UNCTAD (2020a) too documented the massive disruptions to tourism, hospitality and retail sectors. Both Shingal (2020a) and WTO (2020a) also emphasized the knock-on effects of the decline in services trade on other sectors of economic activity, given increasing "servicification" (WTO, 2019) in countries across the world.

In other work, ADB (2020) modelled the increase in services trade costs arising from travel restrictions and outright bans, especially in aviation and outbound and inbound tourism. Complimenting this study, Benz et al. (2020) examined the impact of health-safety-induced regulatory restrictions on the cross-border movement of people on services trade costs. In their hypothesized scenarios wherein countries closed their borders to passengers but left freight trade open, services trade costs were estimated to rise by an average of 12% of export values across sectors and countries in the medium term. Their analysis identified significant heterogeneity in the increase in services-trade costs across sectors and countries, "reflecting the stringency of initial regulations and the relative importance of business travel and labour mobility to international services trade".

In a related assessment, Dingel and Neiman (2020) found some service activities to be more amenable to WFH, including educational; professional, scientific and technical; management; insurance and finance; and information services in particular, but also wholesale trade; and real estate, rental and leasing services. Their analysis also suggests that lower-income countries have a lower share of jobs that can be done at home, which is consistent with the level of economic development of these countries.

At the same time, Drake-Brockman (2020), OECD (2020), Stephenson and Sotelo (2020), UNCTAD (2020b), Villafuerte (2020) and WTO (2020a, b) highlight the spurt in online delivery of services during the pandemic in retail, health, education, telecommunications and audiovisual services and the potential of this development for greater use of Mode 1 trade in the future. Anecdotal evidence already suggests that services trade in different modes of supply may be fungible; in fact, governments and the private sector have been coming up with innovative solutions for moving businesses online to sustain economic activity during the pandemic, and lay the groundwork for eventual recovery (Shepherd and Shingal, 2021).

Shingal (2020b, 2021) provides regional analysis to examine the likely effect of the pandemic on Commonwealth and ASEAN+6 services trade and greenfield investment, respectively. This work suggests that at least 40% of Commonwealth services exports and more than 45% of its imports could be compromised by COVID-19, with tourism-reliant Caribbean and Pacific Commonwealth countries likely to be most severely impacted, and African and Asian

Commonwealth countries likely to be relatively less vulnerable. Similarly, while up to half of total services trade in the 15 RCEP member countries (plus India) could be adversely affected during the pandemic, announced greenfield investment in services sectors fell by a third during 2020, with the decline explained by COVID-19 incidence in the source country.

Overall, the growing literature on services trade during this crisis underscores the importance of services that enable online delivery - telecommunications and computer services, as well as the broader infrastructural role of financial, transport, distribution and logistics services - in facilitating merchandise trade and economic growth. It also highlights the role of the government in addressing infrastructure, institutional and regulatory challenges that exacerbate the digital divide both within and across countries. Finally, all this work emphasizes the vital role that revival of the services sectors and services trade will play in economic recovery in the aftermath of the pandemic.

However, none of these early studies attempt to explain the heterogeneous decline in services trade observed across countries and sectors or present stylized facts on the subject based on actual reported data for 2020, which is the main contribution of the present paper.

3 Stylized facts on the services trade decline

Data on aggregate exports and imports of commercial services for the years 2019 and 2020 from the WTO's Services Trade database show that global services trade declined by 20% in 2020, which translates into a USD 1.2 trillion loss each in exports and imports of commercial services. At the same time, there is considerable heterogeneity in the observed decline in services trade along several dimensions (see Table 1). On average, non-OECD countries observed larger percentage declines (24.2% for exports and 25.2% for imports) in their services trade in 2020 compared to OECD countries (17.8% for exports and 17.0% for imports). The average percentage declines observed by the bottom 10 services traders in 2019 in Table 1 are also far in excess of those observed by the top ten services traders. Likewise, countries with services trade below USD 10 billion in 2019 report much larger percentage declines, on average, than countries with services trade exceeding that threshold.

<Insert Table 1 here>

Table 1 further shows that larger, richer economies trading intensively in merchandise with less restrictive policies on digital trade and above-median values of human capital, ability to leverage ICT infrastructure, government effectiveness and PTA-intensiveness reported

relatively smaller percentage declines in services trade; as, counter-intuitively, did countries more integrated and downstream in GVCs. While more geographically remote economies were associated with larger percentage declines, the above- and below-median averages in this case were not significantly different from each other. Counter-intuitively again, countries with below-median incidence of COVID-19 cases reported a larger percentage decline in services exports on average[4].

The heterogeneity in services trade decline is also observed by geographical region and across sectors[5] (see Table 2). Travel services trade (mainly tourism) has been by far the worst hit irrespective of geography; global travel services exports declined by 63.2% in 2020 from their value in 2019, though in several countries including Papua New Guinea, Angola, Mongolia, Hong Kong, Taiwan, Chile, Malaysia, Montenegro and Fiji, the extent of the disruption was even more severe. Travel services exports dominate services exports in Africa, Latin America and the Caribbean, the Pacific and South-east Asia; countries in these regions witnessed huge disruptions to this trade, reporting above global-average declines.

In contrast, trade in other commercial services, which accounted for over half of total commercial services trade in 2019, seems to have been the least adversely affected during the pandemic. Global exports and imports of these services declined by only 2.3% and 2.6%, respectively. Regionwise, Europe, North America, and South Asia are more reliant on exports of other commercial services and were much less affected though Pacific, South-east Asian and African countries reported larger YoY percentage declines.

Meanwhile, transport and goods-related services exports reported declines of 18.8% and 12.9%, respectively, but with heterogeneity across countries and regions. Much like travel services, transport services trade was also disrupted across regions, with North America being the worst affected. There was more heterogeneity in trade of goods-related services - Georgia and Pakistan observed close to 80% declines in exports while Bangladesh, Bolivia, Brazil, Azerbaijan, Montenegro and Costa Rica reported increases in value exceeding 60%. However, the North American region reported the largest % YoY decline in trade of goods-related services; the South Asian region in contrast witnessed a significant increase in this trade despite the pandemic, especially on the import side, driven primarily by Bangladesh[6].

[4]The COVID-19 incidence measures are based on data on the number of cases and mortalities during January-December 2020. Data on all other variables (except for GVC-participation, GVC-position and share of services exports and imports in PTAs that pertain to 2015 and digital-trade-restrictiveness that pertain to 2016), on the basis of which the total sample is "split" above and below median to present stylized facts in this section, pertain to 2017. All data sources are discussed in Section 5.

[5]More disaggregated data on goods-related and other commercial services for all four quarters of 2020 are available only for a much smaller country sample. Table 2 therefore reports data on more aggregate sectors.

[6]Bangladesh saw its imports of goods-related services increase over 13 times in 2020 relative to 2019,

<Insert Table 2 here>

Finally, Figure 1 shows the evolution of the average decline in services trade and some select covariates over the four quarters of 2020. Both the value of services exports (blue bars, left panels) and imports (blue bars, right panels) fell sharply in Q2 though the magnitudes of the decline have also declined progressively over Q3 and Q4 of 2020. The same is true of the value of merchandise exports (red bars, bottom left), which in fact reported a slight increase in Q4 on a YoY basis. At the same time, the incidence of COVID-19 cases (red bars, top left) and mortalities (red bars, top right) has been on the rise through the year while lockdowns and related measures (red bars, bottom right) may have been the most stringent during Q2, with a slight reduction during Q3 and then rising again during Q4 of 2020.

<Insert Figure 1 here>

4 Exploratory hypotheses

4.1 Primary hypotheses

The incidence of COVID-19 cases and mortality rates associated with the pandemic are obvious determinants of the decline in services trade value emanating from the induced supply- and demand-shocks, and the travel and social restrictions imposed following the outbreak. At the same time, since certain countries have been more adversely affected than others and the stringency and frequency of the government-imposed lockdowns have varied both within and across countries, COVID-19 incidence is also likely to explain the observed heterogeneity in decline in services trade. This leads to the first primary hypothesis, PH1.

PH1: Decline in services trade was directly related to the incidence of COVID-19 cases and the mortality associated with the outbreak

Interestingly though, Figure 2 does not seem to support PH1. The magnitudes of the observed decline in services exports and imports are found to be smaller for countries with larger number of COVID-19 cases. The correlations remain qualitatively unchanged if we examine the observed declines in merchandise trade instead (Figure 3). These counter-intuitive associations suggest that other determinants may also be important, which would need to be accounted for in more rigorous empirical analysis.

though most other countries reported a decline in their imports of services across sectors but especially in travel and transport. In a world of regional and global value-chains, the decline in services imports not only has an adverse effect on exports but also on economic activity in general, given increasing servicification, with additional implications for post-pandemic recovery (Shingal, 2020b, 2021).

<Insert Figures 2 and 3 here>

Services trade is transacted in different ways and three of the four modes of supply require physical proximity between the buyer and seller for the transaction to be effected; this person-to-person exchange has been the first casualty of travel restrictions and social distancing practices following the virus outbreak. The observed differences in services trade decline are thus likely to be correlated with modal shares in total services trade, generating the following two hypotheses; Figures 4 and 5 provide suggestive evidence in support of both.

PH2: Decline in services trade was directly related to the share of services trade delivered by Modes 2, 3 and 4

PH3: Decline in services trade was inversely related to the share of services trade delivered by Mode 1

<Insert Figures 4 and 5 here>

Exports and imports of travel services, both business and personal travel (tourism), have been the hardest hit by the travel bans. Where these restrictions have been more stringent, the associated decline in travel services trade is expected to be larger in magnitude, leading to PH4; the hypothesis finds support in the correlation between the reduction in travel services exports and the average value of the Oxford stringency index[7] (Hale et al. 2020) during September 2020[8] in Figure 6.

PH4: Decline in travel services trade in particular was directly related to the stringency of government measures imposed in the wake of the pandemic

<Insert Figure 6 here>

Heterogeneity in COVID-19-induced supply and demand shocks and GVC-contagion effects (Baldwin and Freeman, 2020; Friedt and Zhang, 2020) have also led to differences in the

[7]The Oxford Covid-19 Government Response Tracker (OxCGRT) has been assembling publicly available information on different attributes of COVID-19 incidence (cases, deaths, tests) and policy indicators since the onset of this crisis. There are nine indicators, which record information on containment and closure policies, such as school and workplace closures and restrictions in internal and international movement. A stringency index is constructed, on the basis of these indicators, to measure the strictness of "lockdown style" policies. The value of the stringency index ranges from 0 to 100, with higher values associated with more restrictions on individual behaviour and economic activities of a country. In the empirical analysis that follows, the stringency index is rescaled to lie between 0 and 1 for ease of interpretation of coefficient estimates (also see Liu et al. 2021).

[8]The relationship remains qualitatively similar if we use the average value of the stringency index during June or December 2020 or over the period from 16 March to 31 December 2020. This is not surprising given that a 10% increase in COVID-19 cases during 2020 is found to be associated with a 0.7% rise in the value of the stringency index at the mean.

adverse effects that countries have observed on their merchandise trade. This likely explains cross-country differences in the decline of trade in goods-related services, generating PH5. Figure 7 lends prima facie support to this hypothesis for exports.

PH5: Decline in trade of goods-related services was directly related to the decline in merchandise trade observed last year

<Insert Figure 7 here>

Transport services comprise both passenger and freight transport, which are likely to have different determinants explaining the decline in their trade and differences therein. While travel bans are expected to have a direct effect on passenger transport services especially air travel, COVID-19-induced declines in merchandise trade are likely to be associated with reductions in freight transport services via all modes of transport. Thus we have PH6, which is supported by the correlations in Figure 8.

PH6: Decline in transport services trade was directly related to the decline in merchandise trade observed last year and to the stringency of government measures imposed in the wake of the pandemic

<Insert Figure 8 here>

4.2 Secondary hypotheses

Different modes of supply are dominant in delivering trade in different sectors (see Table 3). For instance, insurance, financial, communications and information services are completely delivered cross-border while manufacturing and travel services are completely consumed abroad. Trade in several transport, other business (OBS) and personal, cultural and recreational (PCR) services are also largely transacted online while that in maintenance & repair is largely reliant on Mode 2. Up to a quarter of the services trade in several OBS and audio-visual, health and education services are delivered via Mode 4 while construction, distribution and heritage and recreation services trade relies primarily on commercial presence. These heterogeneities are together responsible for the observed cross-country differences in services trade decline at the disaggregated level. Moreover, the sectoral composition of services trade that determines the use of different modes of supply itself differs significantly across countries, governed by structural determinants of services trade patterns in these sectors that are themselves vastly different from one country to the other, generating the following secondary hypotheses.

<Insert Table 3 here>

SH1: Decline in services trade was directly related to capital-intensiveness though the role of economic size may be indeterminate (economic size and capital-intensiveness are both likely to facilitate Mode 3 trade which is positively associated with the decline but smaller economies are also more reliant on tourism, which is directly related to the decline)

SH2: Decline in services trade was inversely related to geographical remoteness (the latter is likely to promote greater use of Mode 1 trade which is inversely related to the decline; it is also likely to deter Modes 2-4, which are positively associated with the decline)

SH3: Decline in services trade was inversely related to access to ICT via the positive association of the latter with digitalization (which has witnessed a spurt during the pandemic)

SH4: Decline in services trade was inversely related to human capital via the positive association of the latter with trade in complex services[9] *(which are largely transacted online and thus remain amenable to WFH)*

SH5: Decline in services trade was inversely related to institutional quality via the latter's role in managing crises more effectively

SH6: Decline in services trade was directly related to GVC-participation and to countries' upstreamness in GVCs via the role played by complex supply chains in an interconnected world in propagating COVID-19-induced shocks

SH7: Decline in services trade was inversely related to PTA-intensiveness via the role played by binding commitments in liberalizing and harmonizing restrictive services regulation

SH8: Decline in services trade was directly related to the restrictiveness of services (including digital) trade policies via the negative association of the latter with services (including cross-border) trade

5 Empirical methodology and data sources

5.1 Aggregate analysis (services trade data with the world as a partner)

We examine the hypotheses by estimating the following equations using fixed effects specifications on aggregate services trade data sourced from the WTO:

[9]These include a wide range of professional services (accounting, legal, R&D, etc.) as well as insurance and financial services.

$$YoY_{ct}^{SX,k} = \beta_1 ln(Covid_{ct}) + \beta_2 YoY_{ct}^{GX} + \beta_z D_{z_c}.ln(Covid_{ct}) + \alpha_c + \alpha_t + \varepsilon_{ct} \quad (1)$$

$$YoY_{ct}^{SM,k} = \beta_1 ln(Covid_{ct}) + \beta_2 YoY_{ct}^{GM} + \beta_z D_{z_c}.ln(Covid_{ct}) + \alpha_c + \alpha_t + \varepsilon_{ct} \quad (2)$$

where $YoY_{ct}^{SX,k}$ and $YoY_{ct}^{SM,k}$ denote the absolute value of the magnitude of the % YoY decline in services exports and imports of country c in sector k during quarter t of 2020; $Covid_{ct}$ is a vector of three measures - the log[10] of the number of reported cases, the log of the number of reported deaths and the Oxford stringency index - reflecting the supply- and demand-shock emanating from the pandemic in the two equations, respectively; YoY_{ct}^{GX} and YoY_{ct}^{GM} denote the absolute value of the magnitude of the % YoY decline in merchandise exports and imports; α_c and α_t are the country and quarter fixed effects; and ε_{ct} is the error term[11]. The equations are estimated using OLS.

$D_{z_c} = \left\{GDP_c, KL_c, M1_c - M4_c, REM_c, HK_c, ICT_c, GOV_c, GVC_c, GVC_c^{POS}, PTA_c, DTRI_c\right\}$. These variables denote, respectively, dummy variables that are unity when nominal GDP; capital-labour ratio; share of Modes 1-4 in total services exports/imports; geographical remoteness; human capital variables; access to ICT measures; institutional quality; GVC-participation; GVC-position; PTA-intensiveness and measures for restrictiveness of digital trade policies exceed the respective median values for the country sample.

Our identification of the determinants of the heterogeneity in decline thus depends on these variables which were themselves unaffected by the pandemic. Moreover, the variables in D_{z_c} are constructed using data for 2017 in most cases, which are sourced as follows: GDP, gross fixed capital formation, labour force, human capital and ICT measures are taken from the World Bank World Development Indicators; geographical remoteness[12] is computed following Baldwin and Harrigan (2011) as $REM_i = \sum_j GDP_j.d_{ij}^{(-1)}$ using bilateral distance (d_{ij}) data from CEPII (Head et al. 2010); measures of institutional quality (proxied by regulatory quality) are sourced from the Worldwide Governance Indicators (Kaufmann et al. 2010); and

[10]We also experimented with alternative measures of COVID-19 incidence such as the share of the number of COVID-19 cases in population and the share of the number of COVID-19 mortalities in COVID-19 cases; our findings remained qualitatively similar.

[11]Since we are interested in explaining the decline in services trade, we excluded observations where the % YoY change was positive. This reduced the effective sample size for total services exports and imports by 10%. However, our results remained qualitatively similar if we did not exclude these observations, just that the dependent variable was the % YoY change in services trade in that case and the signs of the estimated coefficients on the three $Covid_{ct}$ variables were reversed as expected.

[12]Given the growing servicification of economic activity in countries across the world (WTO, 2019), we prefer using GDP in constructing the measure for geographical remoteness. However, the role of geographical remoteness in explaining the services trade decline and our overall findings remain qualitatively similar if we use services value added instead of GDP in constructing this measure.

modal shares in total services exports/imports are computed using data from WTO Trade in Services by Mode of Supply (TiSMoS) database. Data on digital trade restrictiveness (DTRI) are sourced from ECIPE and pertain to 2016. Measures on country participation[13] and position[14] in GVCs are constructed using the EORA MRIO database (Lenzen et al. 2012, 2013) and pertain to the year 2015. The PTA-intensiveness variable is constructed as the share of a country's services exports/imports covered by "GATS-plus" PTAs (using data on deep trade agreements from Hofmann et al. 2019 and on bilateral services trade from OECD-WTO Balanced Trade in Services database or BaTiS) in its total services exports/imports in the year 2015.

Amongst other controls in equations (1) and (2), % YoY declines in quarterly merchandise trade during 2020 are computed using data from the WTO. Quarterly data on the incidence of COVID-19 cases and mortalities during 2020 are taken from the European Centre for Disease Prevention and Control while the Oxford stringency index is sourced from Hale et al. (2020). The data are organized in a panel comprising 137 countries, reported in Annex Table 1, and four quarters. However, sector-level trade data for 2020 are only available for most countries for the first three quarters, which therefore defines the effective sample size for econometric analysis. Summary statistics are reported in Annex Table 1, along with variable names, descriptions and data sources.

5.2 Bilateral analysis (bilateral services trade data)

We complement the aggregate analysis by estimating an augmented structural gravity model using bilateral services trade data for 2019 and 2020 from the recently released ADB MRIO dataset (Consing et al. 2020)[15] to further examine the secondary hypotheses. The estimating equation takes the following form:

$$X_{ijt}^{k} = exp[\beta_1 ln(Covid_{it}).INTL_{ij} + \beta_2 ln(Covid_{jt}).INTL_{ij} + \beta_3 ln(Covid_{it}).Z_i.INTL_{ij} + \beta_4 ln(Covid_{jt}).Z_j.INTL_{ij} + \beta_5 PTA_{ijt} + \alpha_{ij} + \mu_{it} + \gamma_{jt}] + \epsilon_{ijt} \quad (3)$$

[13] GVC participation is defined as the sum of backward (BP) and forward participation (FP); these terms were constructed using EORA MRIO data for the year 2015 as the share of foreign value added (FVA) and indirect value added (DVX) in gross exports (GX), respectively (for instance see Aslam et al. 2017).

[14] $GVC^{POS} = ln(1+FP) - ln(1+BP)$; the higher the value, the more "upstream" is the country in GVCs.

[15] For the purpose of this analysis, the input-output structure of the data was converted to a panel at the exporter-importer-sector-year level. These data cover 63 reporting and partner countries (of which Rest of the World was excluded from analysis), reported in Annex Table 1, and 17 disaggregated services sectors that were aggregated into 11 broad sectors (including construction; distribution; hotels and restaurants; transport; post and telecommunications; financial intermediation; real estate and other business services; public administration and defense; education; health and social work; and other community, social, and personal services).

where where X_{ijt}^{k} is the value of bilateral services exports in sector k from country i to j at time t (years include 2019 and 2020); the $Covid_{it}$,$Covid_{jt}$ vector includes both the (log of) number of reported cases and the Oxford stringency index in the exporting and importing countries, respectively (with all respective values set to zero during 2019 *a la* Liu et al. 2021); PTA_{ijt} is a binary dummy denoting membership of preferential trade agreements (including those notified under Article V of the WTO's General Agreement on Trade in Services) constructed using information on trade agreements notified to the WTO in its RTA-IS database; the variables in $Z_{i,}Z_{j}$ are as defined in the aggregate analysis but now for both exporting and importing countries; μ_{it} and γ_{jt} are the time-varying exporter and importer fixed effects that proxy the outward and inward multilateral resistance terms in estimation, respectively; α_{ij} is the bilateral fixed effect and ϵ_{ijt} is the error term. Equation (3) is estimated using the Poisson Pseudo-Maximum Likelihood (PPML; Silva and Tenreyro, 2006), which also accounts for heteroskedasticity-related concerns in estimation and is now the preferred choice for estimating structural gravity models (Piermartini and Yotov, 2016).

Recent advancements in the estimation of structural gravity advocate the use of three-way fixed effects to mitigate endogeneity-induced biases in estimation (Baier et al. 2014; Piermartini and Yotov, 2016); the dyadic fixed effects thus subsume bilateral trade costs proxied by geographical and cultural distance (contiguity, common language and colonial antecedents). Recent gravity estimation literature also advocates the inclusion of data on intra-national trade flows in the dependent variable, which are directly available in the ADB MRIO dataset. This not only makes the model theory-consistent (Fally, 2015) but in the context of our analysis also enables us to directly estimate the effect of the COVID-19-induced shock and its heterogeneity in the exporting and importing countries (the respective variables are otherwise collinear with the time-varying exporter and importer fixed effects) using interaction terms with a binary dummy ($INTL_{ij}$) that takes the value one for cross-border trade flows (see Anderson et al. 2018; Benz and Jaax, 2020 for similar applications).

6 Results and analysis

6.1 Aggregate analysis

We began by estimating the baseline specifications of equations (1) and (2) for total (aggregate) services trade and experimented with three different measures that reflect the COVID-19-induced shock: the number of cases ($Covid_{ct}^{C}$), the number of deaths ($Covid_{ct}^{D}$) and the stringency of imposed lockdowns (OSI_{ct}). When used in isolation, each of these measures

was found to be positively associated with the decline in services trade during the pandemic, thereby negating the correlation charts in Figure 2[16] and lending support for PH1, with the stringency measure reporting the largest coefficient estimate in terms of magnitude. Table 4, columns (1)-(3) report these results for total services exports and imports in the top and botton panels, respectively. However, when the stringency index was included together with the number of cases and/or the number of deaths, it swamped the explanatory power of either of/both these variables (see columns 4, 5 and 7). Similarly, when the number of reported cases and number of reported deaths were included together, both of them displayed statistical insignificance (see column 6), likely emanating from the high degree of collinearity between these measures. In the analysis that follows, we prefer using the number of reported COVID-19 cases (because the number of reported mortalities is a subset of the former) along with the stringency index as the imposition/severity of lockdowns is also in response to anticipated, not just actual, COVID-19 outbreak episodes, suggesting that not including the variable could lead to an omitted variable bias (also see Liu et al. 2021).

<Insert Tables 4-5 here>

The baseline OLS estimates across sectors are reported in Table 5. The number of reported COVID-19 cases is found to be positively correlated with the magnitudes of the % YoY decline in the exports of travel, insurance, and charges towards use of intellectual property (IP) at the sector-level. On the import side, a positive correlation is found between the number of COVID-19 cases and the magnitudes of the % YoY decline in insurance, ICT and PCR services. All these estimates control for other confounding influences via the use of country and quarter fixed effects and provide support for PH1. In other results, magnitude of the % YoY decline in merchandise trade is found to be positively correlated with transport, travel and especially OBS on the export side and with transport and travel services for imports. In contrast to the results reported in Table 4 for total services exports, the Oxford stringency index is found to be uncorrelated with services exports at the sector-level, though a positive correlation is observed on the import side for goods-related, transport and travel services (Table 5, bottom panel), providing some support for PH4 and PH6.

OLS estimates from fully-specified equations (1) and (2) are reported in Tables 6 and 7 for exports and imports, respectively. All estimations include country and quarter fixed effects and the standard errors are clustered at the country-quarter level.

<Insert Tables 6-7 here>

[16]Unlike the correlation charts in Figure 2, these estimates control for other confounding influences via the use of country and quarter fixed effects and provide support for PH1.

The number of reported COVID-19 cases is found to be positively correlated with the magnitude of the % YoY decline in travel services exports even for below-median sample countries in Table 6, providing further support for PH1. In contrast, the number of COVID-19 cases is found to be negatively associated with the decline in construction, OBS and PCR exports (Table 6, columns 5, 10,11) in below-median sample countries. Meanwhile, the stringency of lockdowns is found to be positively correlated with the decline in trade in goods-related services in particular in below-median sample countries.

The alleviating role of Mode 1 share in services trade on COVID-19-associated decline in services trade (reflected in PH3) is observed for construction services exports (Table 6, column 5) and OBS imports (Table 7, column 10). The intensifying roles of the Modes 2-4 shares on COVID-19-associated decline in services trade (reflected in PH2) are better observed on the export side for construction (Table 6, column 5 for Modes 3 and 4), OBS (Table 6, column 10 for Mode 4) and PCR services (Table 6, column 11 for Mode 3). Counter-intuitively, though, countries with large shares of Modes 1 and 4 in total services exports and imports, respectively, seem to have witnessed smaller pandemic-induced declines in exports and imports of OBS and PCR services (Table 7, columns 10-11). In contrast, PH2 and PH3 are also supported by the correlations observed for interaction terms with OSI_{ct} in the case of construction services exports in particular.

The magnitude of the % YoY decline in merchandise trade is found to be positively correlated with the magnitudes of the % YoY decline in trade in transport and travel services and imports of total commercial services, providing support for PH6.

The estimates in Table 6 also provide evidence for the role of scale economies in mitigating the adverse effects associated with this health shock. The coefficient of $ln(COVID_{ct}) * D\_GDP_c$ is found to be negative, albeit weakly, for transport and OBS exports, while that of $OSI_{ct} * D\_GDP_c$ is found to be negative for exports of goods-related and transport services and total commercial and PCR services imports. Meanwhile, the coefficients of $ln(COVID_{ct}) * D\_KL_c$ and $OSI_{ct} * D\_KL_c$ are found to be positive for exports of financial and OBS; statistically weak association is also found for PCR services on the import side with the stringency index.Thus, there is some support for SH1 in these results.

The results reported in Table 6 negate SH2; the coefficient on the interaction term between the number of cases and geographical remoteness is positive for exports of financial and OBS but the interaction term, including with OSI_{ct}, lacks statistical significance across all other sectors in Tables 6 and 7. Meanwhile, there seems to be more support for SH3 and SH4 on the services export side in the reported results. Above-median internet usage is found to be inversely related with the YoY decline in exports of transport (weakly via $lnCOVID_{ct}^{C}$) and

goods-related (via OSI_{ct}) services. Meanwhile, countries with above-median human capital seem to have been associated with reduced declines in their travel, IP (weakly) and transport (interaction with OSI_{ct}) services exports and their imports of ICT and insurance services.

The expected role of institutional quality in mitigating the pandemic-induced decline in services trade is only weakly observed for insurance services trade and for exports of goods-related services (via OSI_{ct}). In contrast, countries with above-median regulatory quality seem to have been associated with larger YoY declines in their IP, transport and insurance services exports and in their imports of total commercial and travel services, thus providing little support for SH5.

There is also more, albeit mixed, support for SH6 and SH7 for services exports in the reported results. Countries more integrated in GVCs were found to be associated with larger declines in OBS exports and construction services imports, albeit weakly; for transport and travel services exports, the association was reversed, albeit at the 10% level of significance for the latter. Similarly, countries more upstream in their position in GVCs seemed to have been associated with larger declines in their exports of OBS (via $lnCOVID^{C}_{ct}$) but with smaller declines for total and transport services exports (via OSI_{ct}). Meanwhile, greater PTA-intensiveness was (weakly) associated with alleviating the decline in PCR and insurance services exports via the reported cases and stringency index interaction terms, respectively, and imports of construction services. Finally, as expected, more digitally-trade-restrictive economies were found to be associated with larger declines in their total commercial services imports, though the relationship was found to be weakly significant. Thus, SH8 is also partly supported.

On the whole, the OLS results seem to provide more evidence in support of the primary hypotheses in Section 4.1 than for the secondary hypotheses in Section 4.2.

6.1.1 Alternative estimator

Since the dependent variable in all estimating equations is the absolute value of the magnitude of the services trade decline, we also deployed the PPML as an alternative estimator. The PPML results were found to be qualitatively similar to the OLS results and are available upon request.

6.1.2 The COVID-19 shock in partner countries

Since data for aggregate analysis pertain to a country's services trade with the world as a partner, we also experimented with two different measures to account for the role of COVID-

19 incidence in partner countries. The first was a modified version of geographical remoteness, defined as $ln(Covid_{ct}^{Par}) = \sum_j ln(Covid_{jt}).d_{ij}^{(-1)}$ where j is the set of partner countries for each reporting country included in the CEPII gravity dataset (Head et al. 2010). The second measure, *a la* Liu et al. 2021, was an average of COVID-19 incidence in partner countries weighted by their share in the reporting country's services trade (constructed separately for exports and imports for inclusion in the respective equations). However, the inclusion of either measure did not change the the overall findings reported above. Moreover, the estimated coefficients of these constructed measures were found to be statistically insignificant across sectors for both services exports and imports. This could suggest an averaging out of the individual "effect" across trading partners or the possibility that the constructed variables did not adequately reflect the pandemic-induced shock at the partner-country-level.

6.1.3 Endogeneity

The decline in the value of services trade in 2020 is completely induced by the virus outbreak, which is an exogenous event. However, since the extent of the decline is found to be correlated with the ways in which services trade is transacted in different sectors and the sectoral composition of services trade in turn depends on the fundamental determinants of comparative advantage in services across countries, the relationship specified in equations (1) and (2) can still be subject to endogeneity-related concerns.

For instance, for the same level of COVID-19 incidence, tourism-intensive island economies are more likely to be adversely affected than hubs of IT-enabled services. Moreover, there may be unobserved factors like technological advancements that affect countries' sectoral composition of both merchandise and services trade and the shares of different modes of supply in their total services trade[17]. Some of these advancements may have even facilitated more rapid digitalization during the pandemic, thus having a mitigating influence on the services trade decline observed in 2020, though such advancements cannot be explicitly controlled for in the estimating equations[18]. This may lead to biases in the OLS estimates emanating from both omitted variables and simultaneity (Wooldridge, 2010).

To account for such endogeneity-related concerns in estimation and draw causal inference from analysis, we experimented with GMM (Arellano and Bond, 1991) specifications treating $Covid_{ct}^{C}$ as exogenous and all other controls in equations (1) and (2) as endogenous; the modal shares in total services trade were not included in these estimations as what matters from

[17]Shepherd and Shingal (2021) provide case studies illustrating the fungibility between modes of supply, in particular, the increased move to Mode 1 during the pandemic.

[18]The use of quarterly-fixed effects can do so only partly, if at all.

an endogeneity perspective are the fundamental determinants of comparative advantage in services. The difference GMM estimates are reported in Tables 8 and 9 for services exports and imports, respectively, along with diagnostic statistics on the Sargan test for the validity of the over-identifying restrictions; the latter was not rejected throughout specifications.

<Insert Tables 8-9 here>

Significantly, the decline in the preceding quarter is found to reduce the magnitude of the decline in construction, IP and OBS exports and imports of travel services, corroborating the stylized facts in Figure 1. The coefficients are precisely estimated on the export side and suggest that a 10 percentage point decline in the previous quarter in construction, IP and OBS reduces the decline in these exports by 4.0, 5.0 and 4.0 percentage points in the next quarter, respectively. In contrast, a 10 percentage point decline in ICT services imports in the previous quarter is found to increase the decline in such imports in the following perod by 3.5 percentage points, ceteris paribus and on average.

In other results, a 10% rise in the number of reported COVID-19 cases leads to a 5.5 and 6.4[19] percentage point rise in the decline of construction and insurance services exports in below-sample-median countries. For imports of GRS, transport and insurance services, the effects are in the opposite direction, but weakly estimated. Meanwhile, the decline in merchandise exports is found to enhance that in total and travel services exports while the decline in merchandise imports is found to enhance that in services imports across sectors - total commercial, goods-related, transport and travel services (Table 9, columns 1-4). These results provide strong evidence for both PH5 and PH6.

Economic size is found to reduce the decline in OBS exports (via $lnCovid_{ct}^{C}$) by 1.7 percentage points, ceteris paribus and on average, and the decline in goods-related, OBS and PCR services exports (via OSI_{ct}) by 14.0, 14.4 and 19.1 percentage points, respectively. Thus, the role of economic size manifests itself more via Mode 2 (smaller economies are more tourism-intensive in general) than via Mode 3 in the GMM results. Meanwhile, there is statistically weak evidence for the role of capital intensity in enhancing the decline in transport services exports (via COVID-19 cases) and ICT services imports (via the stringency index). While there is no evidence for the role of geographical remoteness in the GMM results on the export side, it is found to reduce the decline in imports of total commercial, financial and ICT services, thus supporting SH2 unlike in the OLS results. Meanwhile, regulatory quality is found to reduce the decline in transport services exports (weakly) but also enhances it in the case of total commercial services imports, thus, lending little support to SH5.

[19] In a linear-log model, this is calculated as the coefficient estimate times 0.095.

Similar to the OLS results, there is somewhat more support for SH3 and SH4 on the services exports side. Internet access is found to reduce the YoY decline in transport services exports and GRS imports by 0.4 and 15.2 percentage points, respectively, at the 1% level of significance; this is important given that exports across modes of transport are largely transacted via Mode 1 (see Table 3). In contrast, the role of human capital in explaining the trade decline in most complex services is statistically indifferent from zero.

Compared to the OLS results, there is more support for SH6 in the GMM results. Amongst the stronger results, GVC-integration is found to enhance the decline in total commercial services exports and imports, via the reported cases and stringency interactions, respectively. Moreover, upstreamness in GVCs in particular is found to accentuate the YoY declines observed across a range of services exports - total, transport, OBS and PCR.

In contrast to the role of GVCs, there is more evidence, albeit counter-intuitive and mostly weak, for that of PTA-intensiveness, especially on the services imports side. The variable is found to enhance the decline in imports of goods-related and insurance services though it is also found to reduce the YoY decline in financial services imports by 2.9 percentage points, thereby mostly negating SH7. Finally, restrictiveness of digital trade policies is found to enhance the decline in travel services imports by 0.5 percentage points. While one would have expected similar findings in the Mode 1-reliant sectors, the result still provides evidence in support of SH8 and alludes to the possible role of complementarities between different modes of supply in the GMM results.

6.2 Bilateral analysis

As in the aggregate analysis, each of the two COVID-19 incidence variables in the exporting country has a negative effect on bilateral services exports in isolation of each other, confirming support for PH1 (though the estimated elasticities w.r.t. the number of reported cases are marginal), but the stringency of government-imposed measures again swamps the impact of the number of reported cases when the two variables are included together (columns 3, 6 and 9 of Table 10). These findings hold for services exports meeting both intermediate (columns 4-6) and final demand (columns 7-9). The reported coefficient estimates suggest that the stringency of lockdowns imposed by the exporting country decreased total bilateral services exports by 26.8%[20] on its own and by 36.9% when included together with the number of reported COVID-19 cases. Unfortunately, the effect of these variables at the importing-country level could not be estimated as the variables were dropped during estimation due to

[20]This is calculated as $[exp(coefficient\_estimate) - 1] * 100$.

collinearity. In other results, PTA-membership was found to increase intermediate services exports by 7.5% and final services exports by 9.2%, on average.

<Insert Tables 10-11 here>

The negative impact of exporting country lockdown stringency on bilateral services exports varies considerably across services sectors in the results reported in Table 11. Financial services exports seem to have been by far the most adversely affected (see column 7); the estimated coefficient suggests a 57.1% reduction in bilateral exports. In contrast, PCR and transport services exports may have declined by 26% and 30% and construction and public administration (and related services) by 40% and more. For distribution; hotels & restaurants; post and telecoms; real estate and other business; education; health and social services, an increase in the stringency of imposed measures may have reduced bilateral exports by between 32% and 39%. Once again, the effect of COVID-19 incidence in the importing country could not be estimated as the variables were dropped due to collinearity.

<Insert Table 12 here>

Results[21] reported in Table 12 examining the secondary hypotheses in the structural gravity estimates via the effect of the stringency index confirm the inverse relationship between the adverse impact of the pandemic and economic size for construction, health, education and PCR services; the inverse relationship with geographical remoteness (SH2) for all but construction, distribution, hotels & restaurants, and PCR services; both mitigating (distribution, transport) and intensifying (real estate & OBS, public administration, health and PCR services) roles of regulatory quality on pandemic-induced declines; the intensifying role of GVC-integration (hotels & restaurants, post & telecoms, financial) and upstreamness in GVCs (providing support for SH6 for all but distribution, financial, OBS); and the role of access to ICT infrastructure (SH3) in mitigating the decline from the COVID-19-induced lockdowns (hotels & restaurants, post & telecoms, PCR services). Moreover, there is support for SH1 and SH4 in the bilateral analysis via the effect of the number of reported cases for the hypothesized roles of capital-intensity and human capital across several sectors; but more limited support for the role of PTA-intensiveness in SH7 for post & telecoms and health and social services.

[21]Note that the dependent variables in the aggregate (magnitude of the YoY decline) and bilateral analysis (level of services trade) are different so the estimated coefficients also need to be interpreted differently to confirm or reject the secondary hypotheses. Also, the results reported in Tables 11 and 12 remain qualitatively similar if services exports are destined to meet intermediate or final demand or if the data are organized in a panel comprising both intermediate and final demand in the partner countries.

7 Conclusion

The increasing servicification of economic activity (WTO, 2019) in countries across the world suggests that the revival of services trade is crucial for economic recovery in the aftermath of the pandemic. While this renders the implications of our findings salient for all countries, these are even more relevant for small vulnerable economies (SVEs), least developed (LDCs) and developing countries as they have reported much larger percentage declines even as services trade has been very important for them (commercial services exports increased by 108% for LDCs over 2010-2019 compared to 54% globally). Even otherwise, a large body of evidence confirms the positive role of the services sector on productivity, growth, trade, investment, development and GVC-integration[22]. Examining the determinants of the heterogeneous decline in services trade thus assumes significance for policy design to reduce service link costs, given that this heterogeneity alludes to high uncertainty and adjustment costs and to the need for deploying new risk mitigation strategies (Arriola et al. 2021).

Illustratively, recent research (Hoekman and Shingal, 2021) suggests that aid for trade allocated to services sector activities enhances services exports of small value services exporting countries. Since these economies have reported larger percentage declines, understanding the determinants of their decline is likely to improve targeting and implementation of trade finance, thereby also enabling more rapid post-pandemic recovery. Another policy recommendation emanating from our findings relates to diversifying the delivery of services trade towards Mode 1, facilitating WFH and promoting digitalization by (i) addressing demand and supply-side constraints and regulatory bottlenecks to digitalization (for instance see AIIB, 2020); and (ii) bridging the digital divide within and across countries by both enhancing and properly targeting investment in ICT infrastructure (another policy priority identified in our results). Similarly, the restrictiveness of regulatory policy, especially for digital trade, is found to be an important determinant of the services trade decline. Thus, reducing the incidence of restrictive Mode 1 regulation and moving towards common regulatory approaches, mutual recognition and eventual harmonization of services trade policies is also likely to facilitate more rapid post-pandemic economic recovery.

Finally, our analysis highlights the importance of conducting any empirical analysis on services trade at the sector-level. The heterogeneous nature of services means that the importance of determining factors will vary across sectors, rendering both empirical results and policy implications therefrom sector-specific and this must be duly acknowledged.

[22]See Francois and Hoekman, 2010 for an excellent early review and Arnold et al. 2011, 2016; Lodefalk, 2014; Beverelli et al. 2017; Hoekman and Shepherd, 2017; Fiorini and Hoekman, 2018 for more recent analysis.

References

ADB (2020). An Updated Assessment of the Economic Impact of COVID-19. ADB Brief No. 133, Manila. http://dx.doi.org/10.22617/BRF200144-2

AIIB (2020). Unequal Disruptions: The Digital Divide During COVID-19. https://www.aiib.org/en/news-events/media-center/blog/2020/Unequal-Disruptions-The-Digital-Divide-During-COVID-19.html

Anderson, J. E., I. Borchert, A. Mattoo and Y.V. Yotov (2018). Dark costs, missing data: Shedding some light on services trade. *European Economic Review*, 105(June): 193-214.

Arellano, M. and S. Bond (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58: 277–297.

Arnold, J. M., B. S. Javorcik and A. Mattoo (2011). Does services liberalization benefit manufacturing firms?: Evidence from the Czech Republic. *Journal of International Economics*, 85(1): 136-146.

Arnold, J. M., B. S. Javorcik; M. Lipscomb and A. Mattoo (2016). Services Reform and Manufacturing Performance: Evidence from India. *Economic Journal*, Royal Economics Society, 1-39.

Arriola, C., P. Kowalski and F. van Tongeren (2021). The impact of COVID-19 on directions and structure of international trade. OECD Trade Policy Papers, No. 252, OECD Publishing, Paris.

Aslam, A., N. Novta and F. Rodrigues-Bastos (2017). Calculating Trade in Value Added. IMF Working Paper No. 17/178.

Baier, S.L., J.H. Bergstrand, and M. Feng (2014). Economic integration agreements and the margins of international trade. *Journal of International Economics,* 93(2): 339–350.

Baldwin, R. E. (1979). Determinants of trade and foreign investment: Further evidence. *The Review of Economics and Statistics*, 40-48.

Baldwin, R. and R. Freeman (2020). Supply chain contagion waves: Thinking ahead on manufacturing 'contagion and reinfection' from the COVID concussion. VoxEU.org.

Bas, M., A. Fernandes and C. Paunov (2021). The resilience of trade to COVID-19. Mimeo.

Benz, S. and A. Jaax (2020). The costs of regulatory barriers to trade in services: New estimates of ad valorem tariff equivalents. OECD Trade Policy Papers, No. 238, OECD Publishing, Paris.

Benz, S., F. Gonzales and A. Mourougane (2020). The Impact of COVID-19 international travel restrictions on services-trade costs. OECD Trade Policy Papers No.237. OECD Publishing, Paris. Available online at: https://dx.doi.org/10.1787/e443fc6b-en

Berthou, A. and S. Stumpner (2021). Trade Under Lockdown. Mimeo.

Beverelli, C., M. Fiorini and B. Hoekman (2017). Services Trade Restrictiveness and Manufacturing Productivity: The Role of Institutions. *Journal of International Economics,* 104(1): 166-82.

Che, Y., W. Liu, Y. Zhang and L. Zhao (2020). China's Exports during the Global COVID-19 Pandemic. Frontiers of Economies in China, 15(4): 541–574.

Deardorff, A. V. (2001). International provision of trade services, trade, and fragmentation. *Review of International Economics*, 9(2), 233-248.

Dingel, J. and B. Neiman (2020). How Many Jobs Can be Done at Home? Working Paper, No. 26948, National Bureau of Economic Research (NBER). Available online at: https://www.nber.org/papers/w26948

Drake-Brockman, J., C. Findlay, Y. R. Damuri and S. Stephenson (2020). Digital Technologies, Services and the Fourth Industrial Revolutions. PECC Forum. 28 April 2020.

Egger, P. and A. Shingal (2021). Determinants of services trade agreement membership. *Review of World Economics*, 157(1): 21-64.

Espitia, A., A. Mattoo, N. Rocba, M. Ruta and D. Winkler (2021). Pandemic Trade: Covid-19, Remote Work and Global Value Chains. The World Economy, forthcoming.

Fally, T. 2015. Structural Gravity and Fixed Effects. *Journal of International Economics,* 97: 76-85.

Fiorini, M. and B. Hoekman. (2018). Services Trade Policy and Sustainable Development. *World Development*, 112: 1-12.

Francois, J., & Hoekman, B. (2010). Service Trade and Policy. *Journal of Economic Literature*, 48(3): 642-92.

Friedt, F. L. and K. Zhang (2020). The triple effect of COVID-19 on Chinese exports: First evidence of the export supply, import demand and GVC contagion effects. Covid Economics, Vetted and Real time papers, CEPR Press, 53(October 2020): 72-109.

Hayakwa, K. and H. Mukunoki (2021). Impacts of COVID-19 on global value chains. The Developing Economies, forthcoming.

Hoekman, B. and B. Shepherd (2017). Services productivity, trade policy and manufacturing exports. *The World Economy* , 40(3): 499-516.

Hoekman, B. and A. Shingal (2021). Aid for trade and trade in services. *Journal of Development Studies,* published online on 8 February 2021, https://doi.org/10.1080/00220388.2021.1873287.

Kejzar, K.Z. and A. Velic (2020). Covid-19, trade collapse and GVC linkages: European experience. Covid Economics 61, 219-240.

Liu, X., E. Ornelas and H. Shi (2021). The Trade Impact of the Covid-19 Pandemic. CEPR Discussion Paper DP16201.

Lodefalk, M. (2014). The role of services for manufacturing firm exports. *Review of World Economics,* 150(1): 59-82.

Nordås, H. and D. Rouzet (2017). The Impact of Services Trade Restrictiveness on Trade Flows. *The World Economy*, 1155-1183.

OECD (2020). Leveraging Digital Trade to Fight the Consequences of COVID-19. 7 July 2020. Available online at: https://www.oecd.org/coronavirus/policy-responses/leveraging- digital-trade-to-fight-the-consequences-of-covid-19-f712f404/

Pei, J., G. de Vries and M. Zhang (2021). International Trade and Covid-19: City-level Evidence from China's Lockdown Policy. Working Paper, University of Groningen.

Piermartini, R. and Yotov, Y. (2016). Estimating trade policy effects with structural gravity. CESifo Working Paper Series No. 6009.

Sampson, G. P., and R. H. Snape (1985). Identifying the issues in trade in services. *The World Economy*, 8(2), 171-182.

Sapir, A. and E. Lutz (1981). Trade in services: Economic determinants and development-related issues. World Bank Staff Working Paper No. 480. The World Bank Group, Washington DC.

Shepherd, B. and A. Shingal (2021). Services Trade of Commonwealth Member Countries: Response to the COVID-19 Pandemic. International Trade Working Paper 2021/03. Commonwealth Secretariat, London.

Shingal, A. (2020a). Services trade and COVID-19. VoxEU CEPR Policy Portal. Available online at: https://voxeu.org/article/services-trade-and-COVID-19

Shingal, A. (2020b). The Impact of COVID-19 on Commonwealth Services Trade. International Trade Working Paper, No. 2020/08 (August), Commonwealth Secretariat, London.

Shingal, A. (2021). COVID-19 and Services Trade in ASEAN+ 6: Implications and Estimates from Structural Gravity. ERIA Discussion Paper No. 369.

Silva, J. S. and S. Tenreyro (2006). The log of gravity. *The Review of Economics and Statistics*, 88(4): 641-658.

Stephenson, S. and J. Sotelo (2020). Trade in digital services is booming. Here's how we can unleash its full potential. The World Economic Forum COVID Action Platform. 8 June 2020. Available online at: https://www.weforum.org/agenda/2020/06/trade-in-digital- services-is-booming-here-s-how-we-can-unleash-its-full-potential/

UNCTAD (2020a). Coronavirus deals severe blow to services sectors. 14 April 2020. Available online at: https://unctad.org/news/coronavirus-deals-severe-blow-services- sectors

UNCTAD (2020b). The Covid-19 Crisis: Accentuating the Need to Bridge Digital Divides. 6 April 2020. Available online at: https://unctad.org/system/files/official- document/dtlinf2020d1_en.pdf

Van der Marel, E. (2012). Determinants of comparative advantage in services (No. 87). FIW Working Paper.

Villafuerte, J. (2020). Managing the COVID-19 Impact on Trade in CAREC Countries. 3rd CAREC Regional Trade Group Meeting. 10 September 2020. Available online at: https://www.carecprogram.org/uploads/S01-J.-Villafuerte.pdf

Wooldridge, J. M. (2010). Econometric analysis of cross section and panel data. Cambridge, MA: MIT press.

WTO (2019). World Trade Report 2019: The future of services trade.

WTO (2020a). Trade in services in the context of COVID-19. Information Note. 28 May 2020. Available online at: https://www.wto.org/english/tratop_e/covid19_e/services_report_e.pdf

WTO (2020b). E-Commerce, Trade and the COVID-19 Pandemic. 4 May 2020. Available online at: https://www.wto.org/english/tratop_e/covid19_e/ecommerce_report_e.pdf

Data citation

Bilateral services trade data: ADB MRIO database

Consing, R. M. III, M. J. Barsabal, J. T. Alvarez, and M. J. Mariasingham (2020). The Wellness Economy: A Comprehensive System of National Accounts Approach. Manila: Asian Development Bank.

COVID-19 cases and mortalities during 2020: European Centre for Disease Prevention and Control

Available at https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide

Digital trade restrictiveness indices (DTRI): ECIPE

Available at https://ecipe.org/dte/database/

Geographical remoteness

Baldwin, R. and J. Harrigan (2011). Zeros, quality, and space: Trade theory and trade evidence. American Economic Journal: Microeconomics, 3, 60-88.

Head, K., T. Mayer and J. Ries (2010). The erosion of colonial trade linkages after independence. Journal of international Economics, 81(1): 1-14.

GDP, PCGDP, GFKF, labour force, human capital and ICT measures: World Development Indicators. World Bank.

Available at https://databank.worldbank.org/source/world-development-indicators#

Governance indicators: World Governance Indicators. World Bank.

Kaufmann, D., A. Kraay and M. Mastruzzi (2010). The worldwide governance indicators: methodology and analytical issues. Policy Research Working Paper Series 5430, The World Bank.

GVC participation and position: EORA MRIO database.

Lenzen, M., K. Kanemoto, D. Moran and A. Geschke. 2012. Mapping the structure of the world economy. Environmental Science & Technology 46(15): 8374–8381.

Lenzen, M., D. Moran, K. Kanemoto and A. Geschke. 2013. Building Eora: A Global Multi-regional Input-Output Database at High Country and Sector Resolution. Economic Systems Research 25(1):20-49.

Modal shares in total services exports/imports: WTO TiSMoS

Available at https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm

PTA-intensiveness: Hofmann et al. 2019 and OECD-WTO BaTiS

Hofmann, C., A. Osnago and M. Ruta (2019). The Content of Preferential Trade Agreements. World Trade Review, 18(3), 365-398. doi:10.1017/S1474745618000071.

Available at https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm

Quarterly merchandise and services trade data in 2019 and 2020: WTO

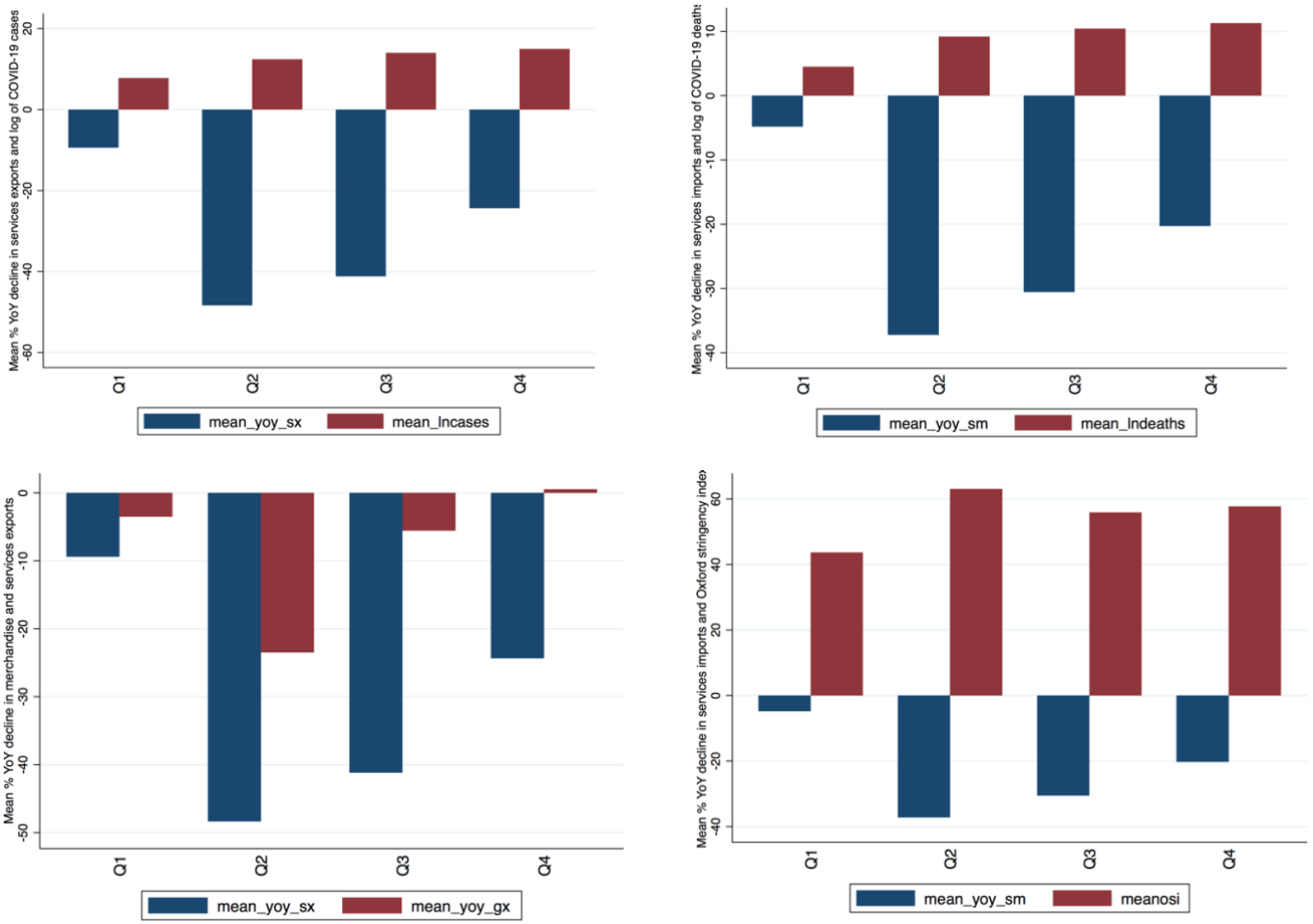
Available at https://data.wto.org/

Stringency of government response: Oxford Stringency Index

Hale, T., A. Petherick, T. Phillips and S. Webster (2020). Variation in government responses to COVID-19. Blavatnik school of government working paper, 31, 2020-11.

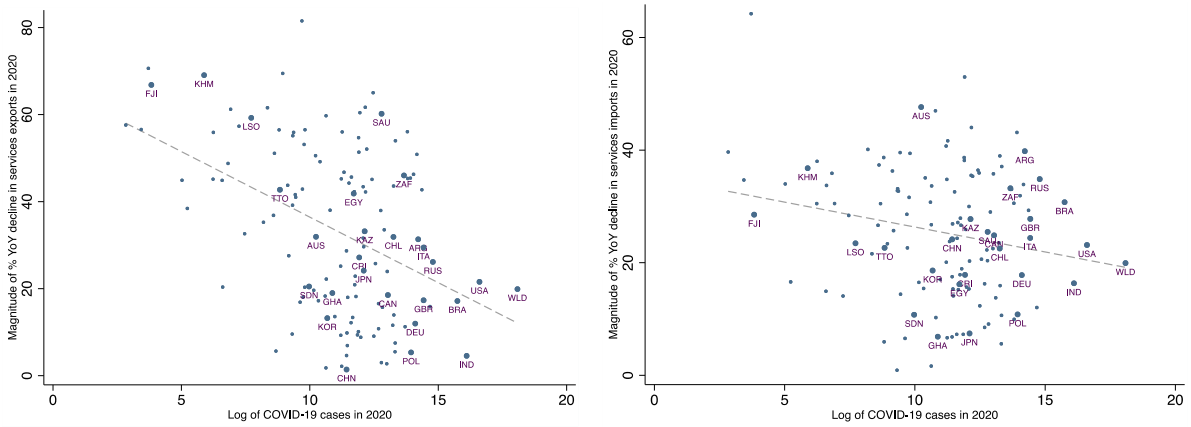
Available at https://www.bsg.ox.ac.uk/research/research-projects/covid-19-government-response-tracker

Figure 1: Evolution of decline in services trade and select covariates during 2020 by quarter



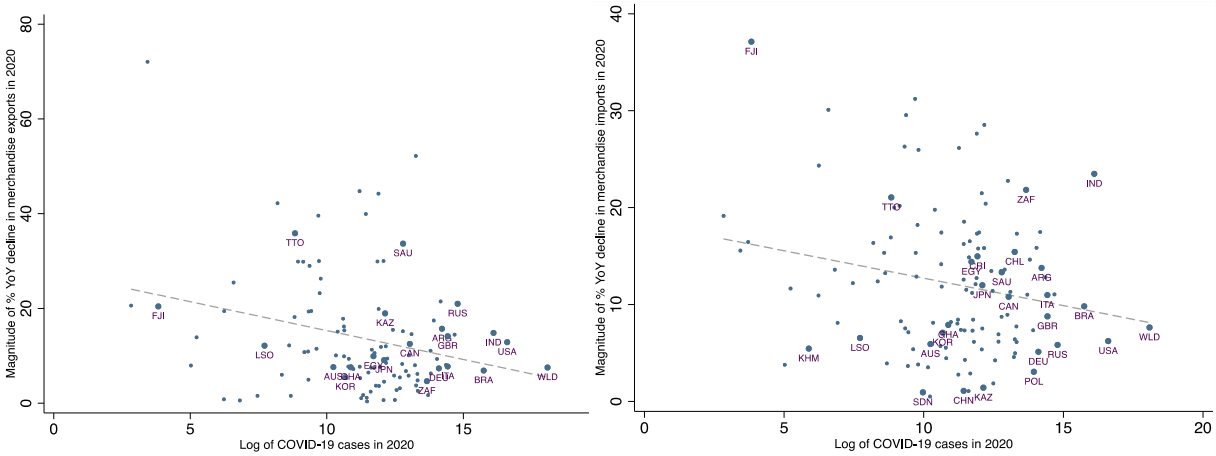
Source: WTO Trade and European Centre for Disease Prevention and Control Databases and Hale et al. (2020); own calculations

Figure 2: Countries with larger incidence of COVID-19 cases associated with smaller declines in services trade



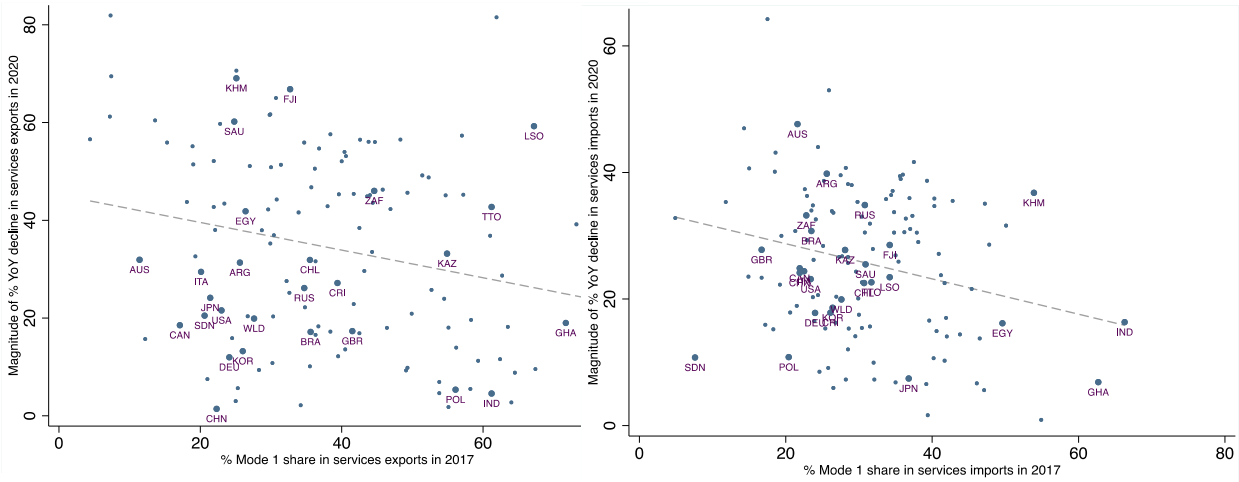
Source: WTO Services Trade and European Centre for Disease Prevention and Control Databases; own calculations

Figure 3: Countries with larger incidence of COVID-19 cases associated with smaller declines in merchandise trade



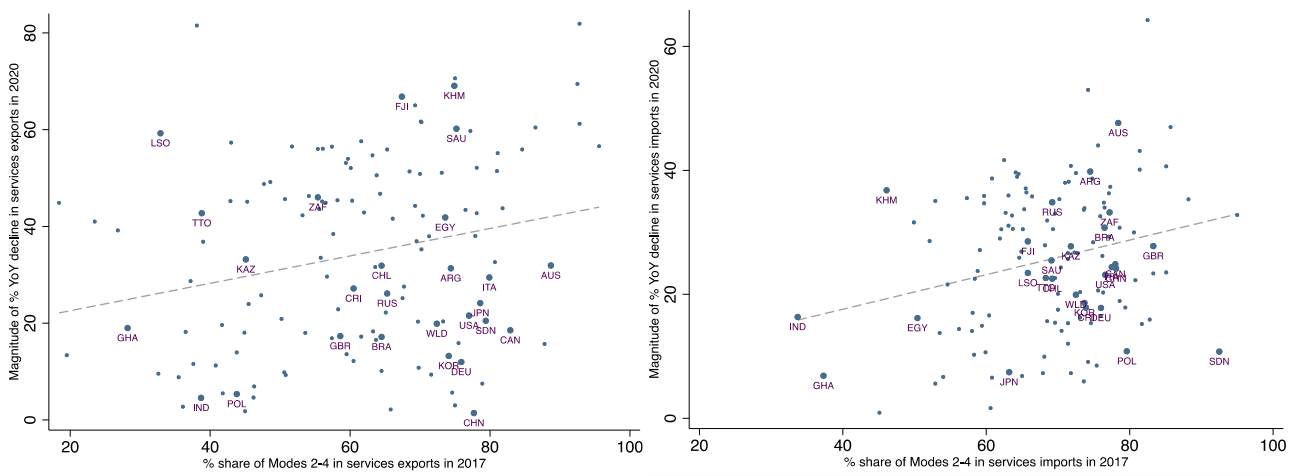
Source: WTO Services Trade and European Centre for Disease Prevention and Control Databases; own calculations

Figure 4: Countries with larger Mode 1 shares associated with smaller declines in services trade



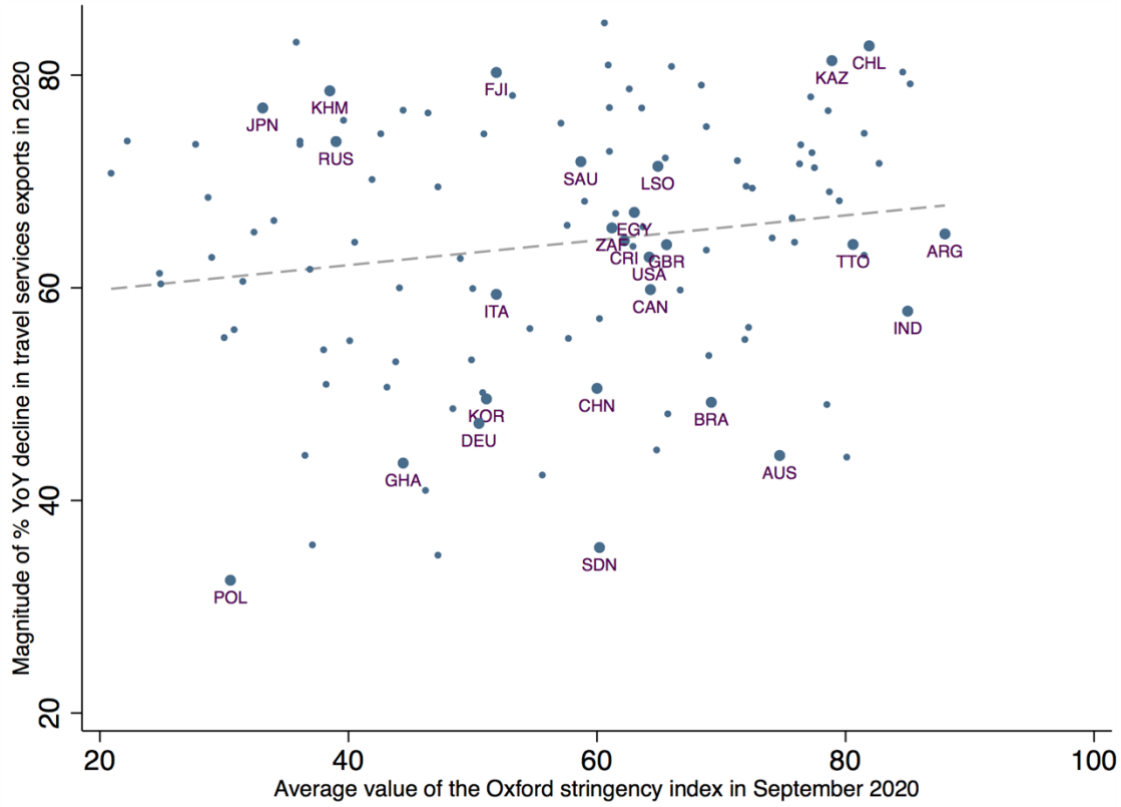
Source: WTO Services Trade and WTO TiSMoS Databases; own calculations

Figure 5: Countries with larger Mode 2-4 shares associated with larger declines in services trade



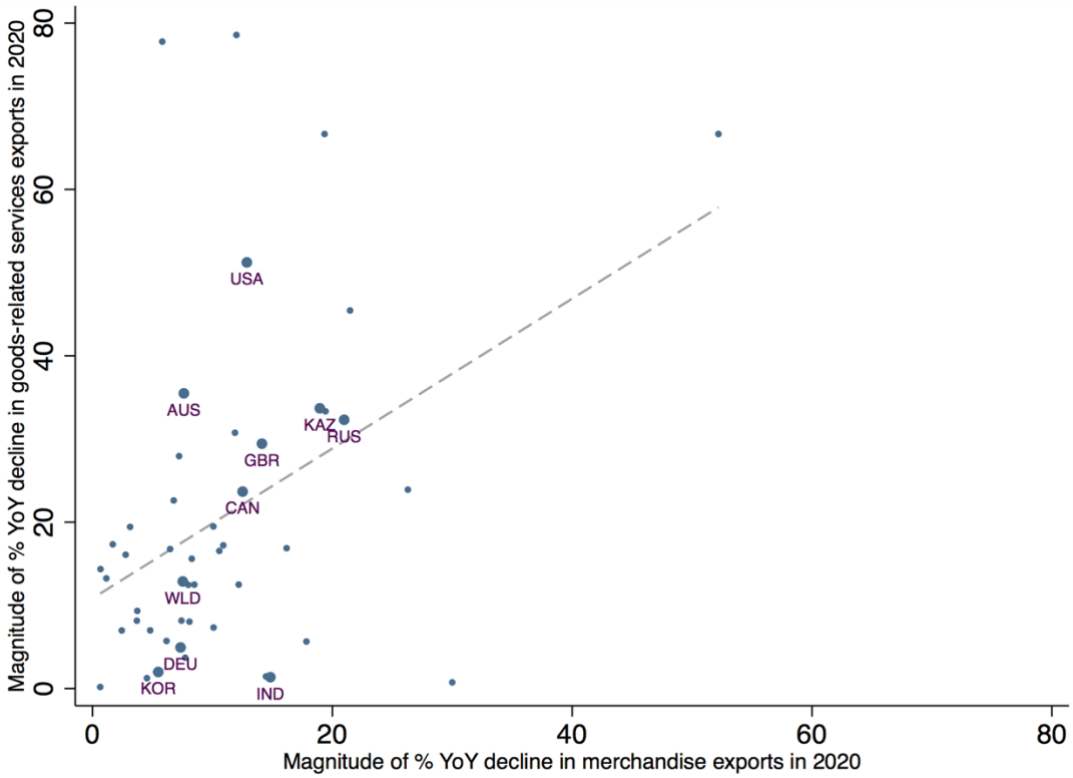
Source: WTO Services Trade and WTO TiSMoS Databases; own calculations

Figure 6: Countries with more stringent lockdowns associated with larger declines in travel services exports



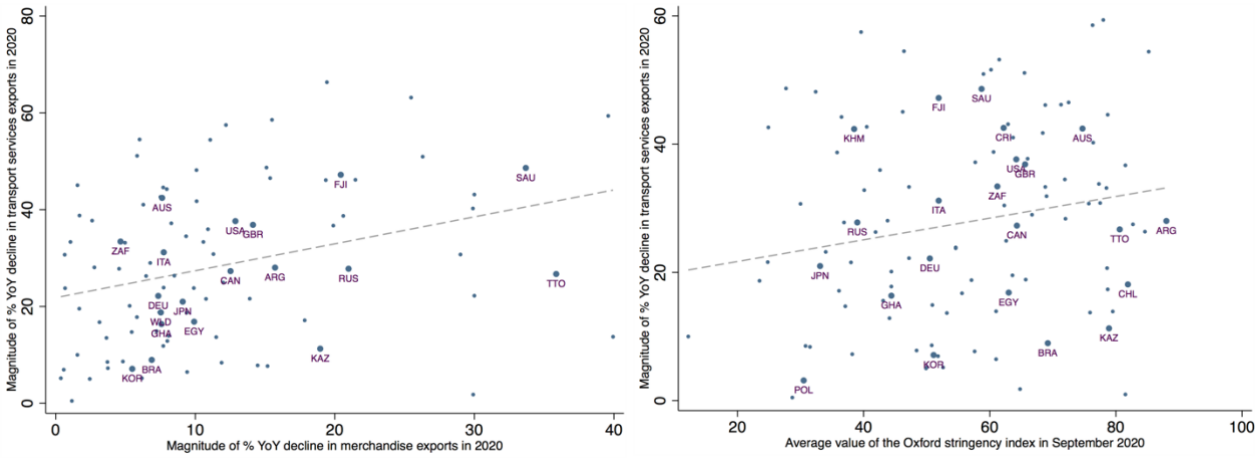
Source: WTO Services Trade Database and Hale et al.(2020); own calculations

Figure 7: Countries with larger declines in merchandise exports associated with larger declines in exports of goods-related services



Source: WTO Trade Database; own calculations

Figure 8: Countries with larger declines in merchandise exports and more stringent lockdowns associated with larger declines in exports of transport services



Source: WTO Trade Database and Hale et al. (2020); own calculations

Table 1: Heterogeneous decline in commercial services trade in 2020 relative to 2019

Sample averages	SX_2019 (USD mln)	SX_YoY (%)	SM_2019 (USD mln)	SM_YoY (%)
OECD	116192	-17.8	101414	-17.0
Non-OECD	16717	-24.2	19058	-25.2
Top 10 traders	332987	-13.8	315952	-17.5
Bottom 10 traders	188	-42.2	344	-27.2
(SX+SM)>$10 bln	75057	-19.2	71145	-19.6
(SX+SM)<$10 bln	1971	-41.3	1844	-28.1
World	**6129480**	**-19.9**	**5834350**	**-19.9**
Above- and below-median distributions of services trade by:				
# of COVID-19 cases	150000	-30.1	137000	-25.3
	22400	-36.1	27000	-25.1
Nominal GDP	169000	-27.0	162000	-23.5
	4330	-38.9	2730	-26.8
Nominal GDP per capita	164000	-28.3	155000	-22.5
	9250	-37.6	9180	-27.8
Remoteness	118000	-34.6	108000	-25.8
	55600	-31.1	57000	-24.4
Merchandise trade	168000	-26.1	160000	-23.1
	5390	-39.8	3810	-27.1
Human capital index	181000	-27.9	170000	-21.7
	11900	-37.0	12500	-27.9
Networked readiness index	145000	-31.0	134000	-23.1
	11800	-35.2	11900	-27.0
GVC participation	134000	-29.2	126000	-22.9
	35800	-37.0	35400	-27.5
GVC position	124000	-34.8	119000	-27.7
	47100	-30.8	42700	-22.2
PTA-intensiveness	169000	-26.6	158000	-22.2
	3720	-39.3	6290	-28.0
Government effectiveness	162000	-29.9	152000	-22.3
	11500	-35.5	12600	-27.9
Digital trade restrictiveness	93000	-36.8	89600	-27.4
	70400	-23.1	63400	-19.2

Source: WTO Merchandise and Services Trade Databases; European Centre for Disease Prevention and Control; World Bank, World Development Indicators; World Economic Forum; EORA MRIO database; OECD-WTO BaTiS; Kaufmann et al. (2011); ECIPE; own calculations
Legend: SX = Services exports; SM = Services imports; YoY = Year on Year

Table 2: Disaggregated services trade and associated decline by geographical region (% share in total in 2019 and % YoY changes in 2020)

	Goods-related services				Other commercial services				Transport services				Travel services			
	Exports		Imports		Exports		Imports		Exports		Imports		Exports		Imports	
Region	**Share (%)**	**YoY (%)**	**Share (%)**	**YoY (%)**	**Share (%)**	**YoY (%)**	**Share (%)**	**YoY (%)**	**Share (%)**	**YoY (%)**	**Share (%)**	**YoY (%)**	**Share (%)**	**YoY (%)**	**Share (%)**	**YoY (%)**
Africa	2.0	-5.4	1.5	-14.4	21.9	-9.0	38.2	-11.2	24.6	-26.1	37.8	-20.6	49.9	-59.7	20.6	-47.3
CISWA	3.1	-10.7	1.0	-8.3	26.9	1.0	30.2	-3.5	31.9	-22.5	35.1	-18.6	38.2	-67.5	33.5	-61.4
Europe	5.2	-5.3	2.9	-9.7	45.3	-1.3	49.8	-0.2	22.6	-20.8	23.5	-17.2	26.4	-56.0	22.7	-54.4
LAC	8.1	32.3	1.7	-16.3	24.5	-2.6	41.6	-11.9	16.1	-27.4	31.7	-24.2	51.5	-67.8	24.7	-66.1
NAM	1.9	-25.0	1.1	-35.6	45.0	0.0	47.4	-3.6	11.3	-33.1	25.7	-29.8	42.8	-59.3	26.0	-67.8
PAC	0.3	-2.5	1.0	-26.5	26.7	-19.8	43.5	-14.3	15.1	-17.9	28.2	-27.6	57.8	-68.7	29.2	-55.6
SA	0.9	51.5	0.5	200.6	56.9	4.3	28.6	-13.9	18.0	-22.2	50.6	-17.4	24.5	-44.7	19.6	-58.2
SEA	3.3	-1.5	3.0	-16.3	34.7	-11.5	39.6	-12.1	19.1	-30.6	24.0	-23.9	43.7	-75.1	33.5	-65.1
WLD	**3.8**	**-12.9**	**2.8**	**-8.6**	**55.7**	**-2.3**	**53.4**	**-2.6**	**16.4**	**-18.8**	**20.7**	**-19.0**	**23.0**	**-63.2**	**24.1**	**-60.0**

Source: WTO Services Trade Database; own calculations

Note: The table reports average sectoral % shares in total commercial services exports and imports in the year 2019 and average % YoY changes in commercial services exports and imports by sector and geographical region. Declines in value exceeding those for the World are marked in red; rises in value exceeding global figures are marked in green. CISWA = Commonwealth of Independent States and West Asia; LAC = Latin America & the Caribbean; NAM = North America; PAC = Australia, New Zealand and Oceania; SA = South Asia; SEA = South-east Asia.

Table 3: Distribution of global services exports and imports by sector and mode of supply (% shares, 2017)

		Exports				Imports			
Sector code	**Description**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**
SA	Manufacturing	0	100	0	0	0	100	0	0
SB	Maintenance & repair	0	93	0	7	0	91	0	9
SC	Transport	47	16	37	0	51	16	33	0
SC1	*Sea*	*72*	*28*	*0*	*0*	*75*	*25*	*0*	*0*
SC2	*Air*	*77*	*23*	*0*	*0*	*77*	*23*	*0*	*0*

SC3	*Road*	*72*	*28*	*0*	*0*	*77*	*23*	*0*	*0*
SD	Travel	0	100	0	0	0	100	0	0
SDA	*Business Travel*	*0*	*100*	*0*	*0*	*0*	*100*	*0*	*0*
SDB1	*Health-related Travel*	*0*	*100*	*0*	*0*	*0*	*100*	*0*	*0*
SDB2	*Education-related Travel*	*0*	*100*	*0*	*0*	*0*	*100*	*0*	*0*
SDB3	*Other Personal Travel*	*0*	*100*	*0*	*0*	*0*	*100*	*0*	*0*
SE	Construction	0	0	92	8	0	0	92	8
SF	Insurance	100	0	0	0	100	0	0	0
SG	Finance	100	0	0	0	100	0	0	0
SH	IP charges	100	0	0	0	100	0	0	0
SI	ICT	82	0	0	18	80	0	0	20
SI1	*Communications*	*100*	*0*	*0*	*0*	*100*	*0*	*0*	*0*
SI2	*Computer*	*76*	*0*	*0*	*24*	*72*	*0*	*0*	*28*
SI3	*Information*	*100*	*0*	*0*	*0*	*100*	*0*	*0*	*0*
SJ	Other business	77	1	0	22	78	1	0	21
SJ1	*Research & development*	*71*	*0*	*0*	*29*	*76*	*0*	*0*	*24*
SJ2	*Professional & management consulting*	*78*	*0*	*0*	*22*	*75*	*0*	*0*	*25*
SJ3	*Tech, trade-related & other business*	*79*	*2*	*0*	*19*	*81*	*2*	*0*	*17*
SK	Personal, cultural & recreational	24	1	66	8	25	2	65	8
SK1	*Audio-visual*	*71*	*10*	*0*	*20*	*71*	*9*	*0*	*20*
SK21	*Health*	*76*	*0*	*0*	*24*	*74*	*0*	*0*	*26*
SK22	*Education*	*65*	*0*	*0*	*35*	*64*	*0*	*0*	*36*
SK23	*Heritage & recreation*	*10*	*0*	*86*	*3*	*10*	*0*	*87*	*3*
SK24	*Other personal*	*13*	*0*	*83*	*4*	*10*	*0*	*87*	*4*
SWSJ34	Distribution	28	0	72	0	30	0	70	0
SOXSW	**TOTAL**	28	10	59	3	28	10	60	3

Source: WTO TiSMoS Database; own calculations

Table 4: Different measures of COVID-19 incidence (OLS estimates)

Aggregate services exports (total)

VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
$YoY\_Goods^{X}_{ct}$	0.101*	0.110*	0.081	0.080	0.088	0.108*	0.088
	(0.058)	(0.061)	(0.061)	(0.059)	(0.062)	(0.061)	(0.062)
$\ln(COVID^{C}_{ct})$	1.735**			0.493		1.300	-0.064
	(0.681)			(0.884)		(1.366)	(1.424)
$\ln(COVID^{D}_{ct})$		2.044**			0.974	0.701	1.028
		(0.824)			(0.979)	(1.640)	(1.624)
OSI_{ct}			25.454***	21.573**	19.088**		19.307**
			(7.168)	(9.382)	(8.588)		(9.172)
Observations	246	242	244	244	240	242	240
R-squared	0.944	0.946	0.944	0.944	0.947	0.946	0.947
Country FE	YES	YES	YES	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES	YES	YES	YES

Aggregate services imports (total)

VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
$YoY\_Goods^{M}_{ct}$	0.388***	0.430***	0.426***	0.380***	0.402***	0.409***	0.397***
	(0.115)	(0.117)	(0.108)	(0.112)	(0.111)	(0.110)	(0.108)
$\ln(COVID^{C}_{ct})$	2.074**			1.286		3.219**	2.177
	(0.837)			(0.808)		(1.496)	(1.458)
$\ln(COVID^{D}_{ct})$		1.579*			0.304	-1.762	-1.539
		(0.808)			(0.589)	(1.262)	(1.244)
OSI_{ct}			23.182***	13.809**	22.022**		15.092**
			(8.586)	(6.544)	(8.506)		(6.386)
Observations	246	241	244	244	239	241	239
R-squared	0.960	0.957	0.959	0.960	0.960	0.961	0.962
Country FE	YES	YES	YES	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES	YES	YES	YES

*Note: Dependent variable is the magnitude of the % YoY decline in total commercial services trade during the first three quarters of 2020, for exports in the top panel and for imports in the bottom panel. Standard errors, clustered by country-quarter, included in parentheses. Levels of significance: *10%, **5%, ***1%.*

Table 5: Baseline OLS estimates by sector

EXPORTS	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
VARIABLES	**GRS**	**Transport**	**Travel**	**Construction**	**Insurance**	**Financial**	**IP**	**ICT**	**OBS**	**PCR**
$YoY\_Goods^{X}_{ct}$	0.058	0.215*	0.196*	0.098	0.024	0.073	-0.091	-0.060	0.133**	0.000
	(0.284)	(0.120)	(0.116)	(0.285)	(0.050)	(0.106)	(0.191)	(0.227)	(0.052)	(0.052)
$\ln(COVID^{C}_{ct})$	-0.451	1.509	2.968***	1.113	5.675*	1.960	3.094**	3.157	-0.038	-0.645
	(1.610)	(1.345)	(0.947)	(2.350)	(2.885)	(1.436)	(1.328)	(1.965)	(0.885)	(1.708)
OSI_{ct}	22.681	7.942	-1.302	13.934	-13.269	-1.323	1.200	1.996	16.019	-0.367
	(15.801)	(10.884)	(8.868)	(21.332)	(31.771)	(17.109)	(17.620)	(21.547)	(11.478)	(16.329)
Observations	141	231	247	116	99	110	96	109	141	149
R-squared	0.909	0.939	0.982	0.906	0.872	0.929	0.956	0.828	0.940	0.938

IMPORTS	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
VARIABLES	**GRS**	**Transport**	**Travel**	**Construction**	**Insurance**	**Financial**	**IP**	**ICT**	**OBS**	**PCR**
$YoY\_Goods^{M}_{ct}$	0.199	0.426***	0.478**	0.493	-0.090	0.173	0.110	-0.653	0.118	-0.011
	(0.305)	(0.110)	(0.188)	(0.509)	(0.347)	(0.280)	(0.217)	(0.427)	(0.200)	(0.265)
$\ln(COVID^{C}_{ct})$	-0.286	-0.072	0.909	3.830	3.960**	1.717	1.954	4.312**	1.011	4.057**
	(1.178)	(0.558)	(0.733)	(2.566)	(1.748)	(1.667)	(1.691)	(1.928)	(1.040)	(1.673)
OSI_{ct}	27.283*	10.971**	15.868*	-24.233	4.745	11.755	-5.500	-19.518	11.463	-7.901
	(14.616)	(5.471)	(8.751)	(24.005)	(14.905)	(21.253)	(14.886)	(17.156)	(11.995)	(15.178)
Observations	154	244	248	111	121	120	134	91	149	137
R-squared	0.913	0.962	0.982	0.915	0.907	0.856	0.933	0.895	0.905	0.943

*Note: Dependent variable is the magnitude of the % YoY decline in sectoral services trade in columns (1)-(10) during the first three quarters of 2020, for exports in the top panel and for imports in the bottom panel. GRS = Goods-related services (manufacturing services + maintenance & repair); IP = Charges towards use of intellectual property; ICT = Communications, computer and information services; OBS = Other business services (R&D, professional, management consulting); PCR = Personal, cultural and recreational services (audio-visual, health, education). All estimations include country and quarter fixed effects. Standard errors, clustered by country-quarter, included in parentheses. Levels of significance: *10%, **5%, ***1%.*

Table 6: Explaining the heterogenous decline in aggregate services exports (OLS estimates)

VARIABLES	(1) Total	(2) GRS	(3) Transport	(4) Travel	(5) Construction	(6) Insurance	(7) Financial	(8) IP	(9) ICT	(10) OBS	(11) PCR
$YoY\_Goods^{X}_{ct}$	0.051	-0.002	0.247**	0.240**	0.048	-0.302	0.022	-0.062	0.063	0.046	0.075
	(0.081)	(0.246)	(0.121)	(0.116)	(0.472)	(0.321)	(0.133)	(0.281)	(0.172)	(0.066)	(0.154)
$\ln(COVID^{C}_{ct})$	-1.082	-2.398	0.851	5.620***	-94.016***	9.788	-2.224	0.249	-2.041	-10.191***	-14.893**
	(2.275)	(3.481)	(2.267)	(1.365)	(19.314)	(6.908)	(3.407)	(4.692)	(4.020)	(3.346)	(5.990)
OSI_{ct}	23.511	196.483***	-1.483	-20.234	-3,811.286***	110.872	15.274	147.371	9.288	-0.268	147.503
	(38.145)	(57.199)	(41.290)	(27.172)	(715.068)	(134.586)	(68.240)	(165.494)	(46.052)	(57.019)	(114.971)
$\ln(COVID^{C}_{ct})*D\_Share^{M1}_{c}$	-0.141		1.155		-85.339***				3.431	4.477**	8.744**
	(1.412)		(1.264)		(15.073)				(2.235)	(2.215)	(3.650)
$\ln(COVID^{C}_{ct})*D\_Share^{M2}_{c}$	1.595	-0.320	-1.237							-0.117	4.450
	(1.489)	(1.112)	(1.126)							(0.994)	(2.813)
$\ln(COVID^{C}_{ct})*D\_Share^{M3}_{c}$	1.102		-0.275		94.793***						8.572**
	(1.054)		(1.154)		(16.027)						(3.664)
$\ln(COVID^{C}_{ct})*D\_Share^{M4}_{c}$	-0.425				89.598***					4.352**	-1.088
	(1.015)				(15.223)					(2.097)	(3.663)
$\ln(COVID^{C}_{ct})*D\_GDP_{c}$	0.209	1.426	-1.793*	-1.224	1.160	-5.424	0.322	-2.351	-2.263	-2.339*	-2.631
	(1.081)	(1.781)	(0.924)	(0.837)	(4.449)	(3.517)	(1.637)	(4.294)	(3.126)	(1.288)	(2.758)
$\ln(COVID^{C}_{ct})*D\_KL_{c}$	-0.196	2.867	1.183	0.266	-3.978	5.724	4.424**	9.571	0.043	-0.429	-1.035
	(1.584)	(2.361)	(1.287)	(1.120)	(3.316)	(4.915)	(2.185)	(5.926)	(2.361)	(1.133)	(2.389)
$\ln(COVID^{C}_{ct})*D\_REM_{c}$	0.527	0.997	0.636	0.051	2.758	2.498	3.165*	0.015	1.594	1.677**	2.022
	(0.765)	(1.211)	(0.843)	(0.723)	(2.341)	(2.534)	(1.606)	(1.718)	(2.431)	(0.805)	(1.659)
$\ln(COVID^{C}_{ct})*D\_REGQUAL_{c}$	1.243	2.099	-1.313	0.703	1.819	-5.253*	-1.005	5.791**	2.121	0.620	4.120
	(1.327)	(1.990)	(1.229)	(0.986)	(6.158)	(2.918)	(2.165)	(2.881)	(1.721)	(1.304)	(2.894)
$\ln(COVID^{C}_{ct})*D\_HK_{c}$	-1.169	0.071	0.023	-2.072**	2.686	-9.754	-0.467	-5.545*	2.639	-1.265	-0.084
	(1.439)	(2.274)	(0.946)	(1.037)	(5.055)	(10.611)	(2.071)	(3.141)	(6.033)	(1.377)	(2.691)
$\ln(COVID^{C}_{ct})*D\_GVC_{c}$	-0.694	-1.629	-2.895***	-1.508*	-2.198	-4.426	0.881	2.276	-0.083	2.418***	3.155

	(1.176)	(2.241)	(0.987)	(0.866)	(2.562)	(2.701)	(3.415)	(2.701)	(2.427)	(0.788)	(2.917)
$\ln(COVID^{C}_{ct})*D\_GVC^{POS}_{c}$	0.512	-0.166	1.547	-0.812	0.240	-1.281	1.332	2.463	0.845	5.429***	4.035
	(1.168)	(2.213)	(1.018)	(0.939)	(5.232)	(2.233)	(2.999)	(2.629)	(3.853)	(1.627)	(4.441)
$\ln(COVID^{C}_{ct})*D\_SXshare^{PTA/Total}_{c}$	-1.243	1.022	1.220	0.212	6.409	9.678*	-1.566	2.576	-2.857	-1.225	-5.052*
	(1.337)	(2.524)	(1.027)	(0.903)	(6.081)	(5.819)	(2.087)	(1.819)	(2.449)	(1.815)	(2.983)
$\ln(COVID^{C}_{ct})*D\_Internet_{c}$	-0.178	-1.624	-1.872*	0.021	-4.593	-0.675	-1.037	-2.389	-0.542	2.390*	-1.009
	(1.251)	(2.764)	(1.010)	(1.047)	(2.918)	(3.569)	(1.652)	(5.238)	(2.736)	(1.271)	(2.816)
$OSI_{ct}*D\_Share^{M1}_{c}$	-18.529		-9.607		-4,170.429***				21.506	52.619	-178.331*
	(22.988)		(27.337)		(739.030)				(37.914)	(50.584)	(93.429)
$OSI_{ct}*D\_Share^{M2}_{c}$	0.215	2.467	5.359							56.172***	-6.348
	(21.996)	(29.558)	(18.937)							(19.290)	(52.931)
$OSI_{ct}*D\_Share^{M3}_{c}$	0.103		-52.903**		3,958.997***						-116.818
	(18.609)		(25.769)		(693.823)						(83.280)
$OSI_{ct}*D\_Share^{M4}_{c}$	-22.659				3,939.223***					7.105	78.607
	(21.562)				(693.492)					(57.031)	(66.934)
$OSI_{ct}*D\_GDP_{c}$	22.557	-111.206**	47.166*	5.805	-112.151	-27.518	88.939	-9.676	-35.233	-32.625	21.173
	(19.097)	(43.341)	(24.142)	(19.166)	(83.915)	(83.816)	(80.955)	(69.369)	(54.567)	(19.939)	(45.396)
$OSI_{ct}*D\_KL_{c}$	-15.829	48.246	-44.534	-2.611	114.597	5.041	-43.432	-39.798	47.634	67.194***	66.380*
	(26.290)	(58.543)	(35.743)	(23.567)	(93.451)	(85.219)	(55.965)	(99.098)	(55.369)	(24.208)	(37.454)
$OSI_{ct}*D\_REM_{c}$	5.379	16.204	-0.188	9.743	2.546	32.053	-34.182	-12.923	-24.685	-12.343	31.856
	(15.720)	(28.379)	(16.983)	(16.099)	(52.966)	(51.298)	(30.460)	(47.607)	(51.178)	(16.281)	(32.662)
$OSI_{ct}*D\_REGQUAL_{c}$	-22.212	-62.656*	82.271***	4.879	-123.477	99.718*	0.534	-106.834	-1.487	-10.466	-65.747
	(26.434)	(37.626)	(26.063)	(20.053)	(111.663)	(54.930)	(37.546)	(87.717)	(32.890)	(19.310)	(60.785)
$OSI_{ct}*D\_HK_{c}$	3.014	17.965	-55.934**	25.162	-104.322	55.267	-0.740	118.910	96.543	-12.761	-32.097
	(26.567)	(50.690)	(22.610)	(21.140)	(148.142)	(143.380)	(41.826)	(100.658)	(67.491)	(20.866)	(47.549)
$OSI_{ct}*D\_GVC_{c}$	-2.785	62.504	7.859	-12.244	63.692	67.596	-85.054	-57.802	-47.124	-1.915	-16.676
	(19.251)	(53.191)	(21.509)	(17.640)	(52.332)	(53.460)	(73.599)	(63.827)	(53.361)	(14.974)	(44.730)
$OSI_{ct}*D\_GVC^{POS}_{c}$	-43.478**	12.161	-51.814**	-23.872	10.217	-143.400	-57.945	-34.815	67.202	-27.189	-92.395
	(20.881)	(40.455)	(23.752)	(18.407)	(90.399)	(104.867)	(70.060)	(65.016)	(63.677)	(18.223)	(77.900)

OSI_{ct}*D_$SXshare^{PTA/Total}_{c}$	26.663	-39.224	-1.112	4.218	19.249	-292.182*	-0.533	-55.695	-48.787	13.555	13.619
	(23.135)	(45.965)	(20.328)	(19.285)	(146.532)	(158.180)	(49.149)	(41.965)	(39.694)	(19.085)	(70.696)
OSI_{ct}*D_$Internet_{c}$	28.005	-138.778***	80.884***	16.246	-4.480	-13.173	29.173	-18.473	-42.380	-18.598	4.839
	(21.010)	(51.974)	(26.560)	(20.951)	(92.300)	(81.942)	(39.861)	(58.875)	(36.021)	(23.388)	(56.233)
Observations	244	141	231	247	116	99	110	96	109	141	149
R-squared	0.958	0.957	0.959	0.985	0.947	0.938	0.963	0.972	0.953	0.981	0.959
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

*Note: Dependent variable is the magnitude of the % YoY decline in total commercial services exports in column (1) and in sectoral services exports in columns (2)-(11) during the first three quarters of 2020. GRS = Goods-related services (manufacturing services + maintenance & repair); IP = Charges towards use of intellectual property; ICT = Communications, computer and information services; OBS = Other business services (R&D, professional, management consulting); PCR = Personal, cultural and recreational services (audio-visual, health, education). KL = Capital intensity (capital-labour ratio). REM = Remoteness (Baldwin and Harrigan, 2011). REGQUAL = Regulatory quality index (World Governance Indicators, Kaufmann et al. 2010). HK = Human capital index; Internet = % internet usage (World Development Indicators). $SXshare^{PTA/Total}$ = Share of services exports covered in PTAs with deep provisions on services trade in total services exports. M1 = Mode 1; M2 = Mode 2; M3 = Mode 3; M4 = Mode 4. Standard errors, clustered by country-quarter, included in parentheses. Levels of significance: *10%, **5%, ***1%. Coefficient estimates inconsistent with the primary and secondary hypotheses are marked in red; those consistent are marked in green.*

Table 7: Explaining the heterogenous decline in aggregate services imports (OLS estimates)

VARIABLES	(1) Total	(2) GRS	(3) Transport	(4) Travel	(5) Construction	(6) Insurance	(7) Financial	(8) IP	(9) ICT	(10) OBS	(11) PCR
$YoY\_Goods^{M}_{ct}$	0.325***	0.203	0.409***	0.471**	0.290	-0.044	0.225	0.207	-0.432	0.131	0.500
	(0.111)	(0.373)	(0.139)	(0.219)	(0.712)	(0.457)	(0.397)	(0.245)	(0.690)	(0.233)	(0.322)
$\ln(COVID^{C}_{ct})$	-1.794	-0.022	-1.494	-0.927	10.323	0.867	-1.377	3.345	3.685	4.001	-7.458
	(1.406)	(4.341)	(1.578)	(1.809)	(16.451)	(4.466)	(4.449)	(3.158)	(14.021)	(3.558)	(10.602)
OSI_{ct}	9.549	137.848*	13.428	26.967	214.349	-30.873	15.538	-15.605	-242.280	118.568*	368.377
	(34.548)	(70.728)	(27.190)	(38.392)	(232.328)	(78.159)	(96.276)	(55.276)	(220.595)	(62.496)	(334.078)
$\ln(COVID^{C}_{ct})*D\_Share^{M1}_{c}$	-0.947		-0.060		22.958				-6.852	-4.809***	17.308**
	(0.747)		(0.911)		(20.529)				(19.529)	(1.731)	(7.103)
$\ln(COVID^{C}_{ct})*D\_Share^{M2}_{c}$	1.357*	-0.843	0.410							1.402	0.492
	(0.689)	(3.086)	(0.575)							(1.255)	(1.726)
$\ln(COVID^{C}_{ct})*D\_Share^{M3}_{c}$	0.432		0.981		-4.457						5.367
	(0.551)		(0.626)		(15.532)						(7.510)
$\ln(COVID^{C}_{ct})*D\_Share^{M4}_{c}$	-0.473	0.035			-2.774				-1.673	-3.958**	-9.195***
	(0.594)	(2.920)			(13.850)				(21.211)	(1.711)	(2.590)
$\ln(COVID^{C}_{ct})*D\_GDP_{c}$	0.597	-0.060	0.453	0.565	-5.728	-2.959	2.124	-0.780	-3.597	0.524	1.844
	(0.527)	(2.040)	(0.602)	(0.844)	(5.753)	(2.329)	(3.985)	(1.557)	(4.883)	(2.107)	(1.461)
$\ln(COVID^{C}_{ct})*D\_KL_{c}$	-1.174	0.123	-0.409	-0.845	4.424	-2.786	-3.236	1.440	4.942	1.003	-4.128
	(1.139)	(3.351)	(0.659)	(1.102)	(7.623)	(2.563)	(5.123)	(2.682)	(7.274)	(2.704)	(3.516)
$\ln(COVID^{C}_{ct})*D\_REM_{c}$	-0.050	2.161	-0.130	0.594	-0.337	3.328	2.551	-2.144	2.496	-1.136	2.267
	(0.509)	(1.734)	(0.425)	(0.696)	(2.984)	(2.402)	(2.142)	(1.334)	(2.127)	(1.176)	(1.610)
$\ln(COVID^{C}_{ct})*D\_REGQUAL_{c}$	1.461*	-0.186	0.681	1.923**	0.461	-6.144*	-2.429	-1.565	1.884	0.693	-0.101
	(0.805)	(2.807)	(0.632)	(0.869)	(5.140)	(3.161)	(3.450)	(1.518)	(2.713)	(1.823)	(2.725)
$\ln(COVID^{C}_{ct})*D\_HK_{c}$	-1.028	-2.045	-0.328	0.135	6.642	3.389	-1.752	-0.349	-8.404*	-0.575	4.535**
	(0.659)	(2.215)	(0.608)	(0.987)	(6.809)	(4.047)	(3.114)	(2.293)	(4.459)	(2.723)	(1.904)
$\ln(COVID^{C}_{ct})*D\_GVC_{c}$	-0.422	-1.769	-0.299	-1.583	5.879*	-0.926	2.710	2.060	4.745	0.502	-1.157

	(0.785)	(2.258)	(0.515)	(1.094)	(3.112)	(2.185)	(4.358)	(1.597)	(5.459)	(1.861)	(1.779)
$\ln(COVID^{C}_{ct})*D\_GVC^{POS}_{c}$	0.787	-0.283	0.399	0.187	3.238	1.195	-0.532	1.619	3.259	0.854	-2.914*
	(0.710)	(2.396)	(0.609)	(1.010)	(3.860)	(2.644)	(4.119)	(1.679)	(3.571)	(1.442)	(1.667)
$\ln(COVID^{C}_{ct})*D\_SXshare^{PTA/Total}_{c}$	0.513	4.019*	-0.686	0.801	-10.468*	1.804	-3.188	0.410	-0.955	-0.580	-0.458
	(0.537)	(2.411)	(0.605)	(0.735)	(5.699)	(2.181)	(3.261)	(2.456)	(2.992)	(1.392)	(2.466)
$\ln(COVID^{C}_{ct})*D\_Internet_{c}$	-0.134	2.030	-0.521	0.520	-0.905	4.279*	4.879	-2.084	-0.830	1.255	0.907
	(0.682)	(2.725)	(0.553)	(0.830)	(7.002)	(2.525)	(3.066)	(1.677)	(8.670)	(1.511)	(2.517)
$\ln(COVID^{C}_{ct})*D\_DTRI_{c}$	1.034*	-0.673	0.366	1.262	-4.656	0.281	-1.391	-1.336	-3.161	-0.354	1.049
	(0.553)	(1.661)	(0.598)	(0.810)	(3.258)	(2.569)	(1.681)	(1.340)	(3.423)	(1.420)	(2.414)
$OSI_{ct}*D\_Share^{M1}_{c}$	19.439		-3.094		-60.892				117.593	42.327	-566.530**
	(16.539)		(16.940)		(143.920)				(195.741)	(28.559)	(275.021)
$OSI_{ct}*D\_Share^{M2}_{c}$	9.111	3.237	-2.621							6.673	-76.531**
	(14.168)	(55.430)	(9.501)							(27.706)	(34.924)
$OSI_{ct}*D\_Share^{M3}_{c}$	-15.641		-6.855		-17.606						-303.240
	(12.667)		(13.046)		(68.942)						(321.105)
$OSI_{ct}*D\_Share^{M4}_{c}$	2.874								150.461	22.247	256.221***
	(12.700)								(224.356)	(30.579)	(71.445)
$OSI_{ct}*D\_GDP_{c}$	-21.220*	-14.757	-11.247	2.784	-14.179	20.748	14.360	-12.825	69.461	-21.308	-93.848***
	(12.567)	(44.114)	(11.447)	(19.032)	(126.355)	(34.534)	(90.038)	(30.829)	(88.426)	(30.184)	(33.330)
$OSI_{ct}*D\_KL_{c}$	26.949	19.729	5.415	2.650	-51.954	18.045	56.851	-18.333	4.121	-47.410	71.834*
	(25.430)	(64.143)	(13.215)	(26.203)	(102.162)	(44.034)	(96.276)	(51.479)	(108.910)	(49.934)	(39.469)
$OSI_{ct}*D\_REM_{c}$	-1.624	27.898	5.028	-2.735	-61.778	-15.694	-39.449	40.775	-10.404	2.685	-32.095
	(13.529)	(41.793)	(9.199)	(17.225)	(62.191)	(43.663)	(40.628)	(25.453)	(42.141)	(26.850)	(29.549)
$OSI_{ct}*D\_REGQUAL_{c}$	5.933	-23.870	-3.264	14.179	94.238	87.939	27.681	36.359	48.322	-32.355	-27.499
	(17.342)	(47.271)	(12.994)	(20.077)	(148.634)	(58.167)	(62.549)	(29.484)	(55.527)	(38.073)	(35.239)
$OSI_{ct}*D\_HK_{c}$	19.555	-6.145	6.864	22.245	-197.919	-126.020*	-27.569	2.870	-49.605	28.243	49.078
	(16.420)	(52.988)	(13.910)	(18.640)	(139.400)	(68.301)	(57.253)	(41.871)	(101.431)	(50.754)	(41.996)
$OSI_{ct}*D\_GVC_{c}$	4.868	-72.267	7.068	-5.034	-74.596	45.240	-80.689	-35.863	-34.295	-9.718	46.003
	(17.322)	(44.227)	(11.779)	(22.543)	(64.719)	(46.199)	(104.798)	(28.447)	(97.665)	(19.287)	(31.320)

OSI_{ct}*$D\_GVC^{POS}_{c}$	3.373	-21.125	-3.146	-18.792	-60.222	34.608	-18.890	-50.457	11.047	-52.980*	47.589
	(16.401)	(42.218)	(13.420)	(21.499)	(116.278)	(52.714)	(88.392)	(36.638)	(68.659)	(28.152)	(35.986)
OSI_{ct}*$D\_SXshare^{PTA/Total}_{c}$	-12.784	27.947	3.579	-25.465	38.640	40.727	35.916	-7.095	28.195	-43.873	-60.081
	(13.081)	(48.431)	(11.147)	(18.336)	(127.428)	(58.561)	(78.715)	(38.288)	(50.429)	(29.276)	(36.628)
OSI_{ct}*$D\_Internet_{c}$	-19.596	-67.223	2.945	-3.403	15.248	-40.940	-71.547	38.897	111.604	-43.206	3.575
	(14.175)	(49.461)	(11.620)	(16.474)	(85.766)	(46.867)	(79.868)	(35.329)	(135.486)	(27.413)	(42.818)
OSI_{ct}*D_DTRI_{c}	-2.355	-48.045	-3.311	-8.356	-45.998	-20.560	20.279	23.402	-18.788	-26.668	28.806
	(12.696)	(41.298)	(12.710)	(18.295)	(77.547)	(46.105)	(41.449)	(34.257)	(65.614)	(30.454)	(49.345)
Observations	244	154	244	248	111	121	120	134	91	149	137
R-squared	0.972	0.935	0.968	0.985	0.952	0.950	0.895	0.951	0.952	0.943	0.969
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

*Note: Dependent variable is the magnitude of the % YoY decline in total commercial services imports in column (1) and in sectoral services imports in columns (2)-(11) during the first three quarters of 2020. GRS = Goods-related services (manufacturing services + maintenance & repair); IP = Charges towards use of intellectual property; ICT = Communications, computer and information services; OBS = Other business services (R&D, professional, management consulting); PCR = Personal, cultural and recreational services (audio-visual, health, education). KL = Capital intensity (capital-labour ratio). REM = Remoteness (Baldwin and Harrigan, 2011). REGQUAL = Regulatory quality index (World Governance Indicators, Kaufmann et al. 2010). HK = Human capital index; Internet = % internet usage (World Development Indicators). $SMshare^{PTA/Total}$ = Share of services imports covered in PTAs with deep provisions on services trade in total services imports. M1 = Mode 1; M2 = Mode 2; M3 = Mode 3; M4 = Mode 4. Standard errors, clustered by country-quarter, included in parentheses. Levels of significance: *10%, **5%, ***1%. Coefficient estimates inconsistent with the primary and secondary hypotheses are marked in red; those consistent are marked in green.*

Table 8: GMM results (aggregate services exports)

VARIABLES	(1) Total	(2) GRS	(3) Transport	(4) Travel	(5) Construction	(6) Insurance	(7) Financial	(8) IP	(9) ICT	(10) OBS	(11) PCR
LDV	0.165*	-0.062	-0.013	-0.095	-0.402**	-0.157	-0.259	-0.508***	-0.181	-0.404**	-0.149
	(0.094)	(0.062)	(0.086)	(0.080)	(0.201)	(0.129)	(0.410)	(0.163)	(0.228)	(0.174)	(0.103)
$YoY\_Goods^{X}_{ct}$	0.527***	0.333	0.089	0.384*	-0.019	-0.325	-0.672	-1.688	0.079	0.033	-0.273
	(0.145)	(0.291)	(0.144)	(0.223)	(0.620)	(1.033)	(1.328)	(1.307)	(0.314)	(0.243)	(0.544)
$\ln(COVID^{C}_{ct})$	-10.580***	-11.587	-2.285	1.624	57.536***	66.781**	61.658	355.633	2.309	-10.591	-2.729
	(3.333)	(10.624)	(3.041)	(4.078)	(18.686)	(33.378)	(68.993)	(319.715)	(8.673)	(9.013)	(15.183)
OSI_{ct}	-28.596	46.842	14.410	-55.827	590.972*	169.926	846.097	2,912.650	18.613	-86.447	345.750
	(44.821)	(103.162)	(36.192)	(51.387)	(331.242)	(735.144)	(1,076.308)	(3,236.218)	(159.297)	(116.029)	(311.406)
$\ln(COVID^{C}_{ct})*D\_GDP_{c}$	3.000*	7.469	0.981	-0.398	-57.719*	-14.308	-3.607	-240.257	7.321	-17.535**	-25.910
	(1.701)	(5.604)	(2.101)	(2.146)	(34.721)	(22.036)	(24.726)	(207.219)	(8.916)	(8.001)	(18.123)
$\ln(COVID^{C}_{ct})*D\_KL_{c}$	0.336	5.288	4.595*	4.516	14.450	-17.818	43.760	-33.087	-5.059	12.692	-1.058
	(3.086)	(25.287)	(2.701)	(3.566)	(34.967)	(19.812)	(43.954)	(109.352)	(9.812)	(8.142)	(14.714)
$\ln(COVID^{C}_{ct})*D\_REM_{c}$	-0.791	-2.363	-1.595	-0.183	-3.705	12.322	-16.476	8.364	-0.358	1.647	-2.821
	(1.643)	(3.902)	(1.735)	(1.925)	(8.862)	(17.708)	(32.767)	(38.452)	(5.204)	(5.218)	(9.610)
$\ln(COVID^{C}_{ct})*D\_REGQUAL_{c}$	-2.119	10.954	-7.012*	-3.556	5.032	-49.033	-15.959	261.087	-5.595	-6.137	9.975
	(4.012)	(18.755)	(4.068)	(4.462)	(35.787)	(33.346)	(47.835)	(398.214)	(19.980)	(8.429)	(13.214)
$\ln(COVID^{C}_{ct})*D\_HK_{c}$	1.094	7.736	-1.198	0.650	-11.348	10.023	28.704	-94.132	9.314	-1.557	-28.585**
	(2.930)	(15.793)	(2.432)	(3.142)	(44.227)	(33.422)	(52.520)	(348.753)	(15.394)	(7.903)	(14.132)
$\ln(COVID^{C}_{ct})*D\_GVC_{c}$	6.695**	0.875	-0.127	-4.877	7.658	-20.539	13.213	32.501	-5.827	17.764*	-11.300
	(3.332)	(7.855)	(2.497)	(3.464)	(19.220)	(25.834)	(56.722)	(43.273)	(7.441)	(9.077)	(15.237)
$\ln(COVID^{C}_{ct})*D\_GVC^{POS}_{c}$	5.732**	2.054	7.041***	0.477	7.734	-28.855	-35.972	41.305	-8.368	22.593***	30.019**
	(2.604)	(6.814)	(2.419)	(3.446)	(21.770)	(28.388)	(40.483)	(48.412)	(8.452)	(7.245)	(12.756)
$\ln(COVID^{C}_{ct})*D\_SXshare^{PTA/Total}_{c}$	0.650	-4.361	1.577	3.239	-9.478	11.426	-72.606	-173.416	3.519	5.485	28.184*
	(3.725)	(8.291)	(3.576)	(4.396)	(17.564)	(28.172)	(58.474)	(172.121)	(9.297)	(8.073)	(16.787)
$\ln(COVID^{C}_{ct})*D\_Internet_{c}$	0.272	-8.362	-4.561**	-5.326*	-2.662	-4.428	-5.529	-131.525	1.931	1.588	17.041
	(2.906)	(23.074)	(2.147)	(3.155)	(23.276)	(21.255)	(57.611)	(119.478)	(17.370)	(7.487)	(11.518)

OSI_{ct}*D_GDP_c	-38.805	-146.536**	16.668	-16.551	-392.196	263.580	121.177	-1,048.910	-15.651	-152.084**	-200.856**
	(23.741)	(66.084)	(24.627)	(30.634)	(341.624)	(240.422)	(430.069)	(1,204.992)	(122.155)	(62.715)	(102.017)
OSI_{ct}*D_KL_c	36.175	114.719	-73.384	45.997	472.813	282.775	427.758	-4,639.090	-25.858	156.427	-258.804
	(54.582)	(103.539)	(47.448)	(50.056)	(467.746)	(403.791)	(724.596)	(12,791.051)	(161.173)	(106.970)	(269.680)
OSI_{ct}*D_REM_c	12.667	83.662	-17.673	24.146	-98.300	-162.689	-627.235	115.080	-64.039	26.727	-38.399
	(23.601)	(54.652)	(22.247)	(27.891)	(124.973)	(398.406)	(631.780)	(540.516)	(81.166)	(56.047)	(123.834)
OSI_{ct}*D_$REGQUAL_c$	-41.630	-102.273	-2.022	-51.147	148.944	-378.150	-158.051	5,723.479	-163.614	-42.346	185.855
	(60.031)	(129.893)	(50.054)	(51.864)	(372.599)	(506.156)	(572.406)	(6,529.854)	(248.157)	(89.696)	(220.088)
OSI_{ct}*D_HK_c	-54.783	71.879	4.891	84.367*	-1.936	-676.506	760.322	1,403.346	100.226	0.129	102.327
	(44.664)	(117.711)	(42.031)	(46.973)	(490.827)	(654.878)	(998.962)	(6,675.327)	(222.404)	(83.721)	(146.581)
OSI_{ct}*D_GVC_c	50.986	100.507	50.337*	42.781	-21.306	-387.146	116.778	-118.923	38.688	127.718	-231.194
	(38.218)	(93.771)	(30.145)	(43.450)	(271.801)	(374.686)	(675.145)	(475.992)	(98.761)	(111.982)	(164.340)
OSI_{ct}*D_GVC^{POS}_c	1.411	51.264	1.456	-11.535	-214.076	-128.609	-354.658	-236.034	93.542	157.695	-23.545
	(42.495)	(88.596)	(32.696)	(50.183)	(287.996)	(445.190)	(658.103)	(749.566)	(124.196)	(105.446)	(215.095)
OSI_{ct}*D_$SXshare^{PTA/Total}_c$	17.676	-118.356	-29.128	20.555	-274.017	443.556	-817.278	-2,975.107	37.689	14.767	29.028
	(45.949)	(121.560)	(43.863)	(48.571)	(195.550)	(883.380)	(752.209)	(2,778.661)	(145.746)	(70.343)	(147.456)
OSI_{ct}*D_$Internet_c$	45.830	-133.466	56.128*	-28.632	-542.614*	380.212	-651.448	-1,172.705	-91.211	-53.501	21.641
	(53.795)	(137.003)	(33.014)	(39.186)	(292.117)	(582.261)	(1,156.615)	(1,838.675)	(273.435)	(89.260)	(212.984)
Observations	124	67	114	128	55	35	42	36	46	57	65
Sargan test Chi-squared	40.38	21.84	49.41	35.27	10.32	4.89	1.26	10.42	4.58	8.97	10.86
p-value	0.409	0.530	0.102	0.759	0.738	0.769	0.996	0.166	0.869	0.705	0.623

*Note: Dependent variable is the magnitude of the % YoY decline in total commercial services exports in column (1) and in sectoral services imports in columns (2)-(11) during the first three quarters of 2020. GRS = Goods-related services (manufacturing services + maintenance & repair); IP = Charges towards use of intellectual property; ICT = Communications, computer and information services; OBS = Other business services (R&D, professional, management consulting); PCR = Personal, cultural and recreational services (audio-visual, health, education). KL = Capital intensity (capital-labour ratio). REM = Remoteness (Baldwin and Harrigan, 2011). REGQUAL = Regulatory quality index (World Governance Indicators, Kaufmann et al. 2010). HK = Human capital index; Internet = % internet usage (World Development Indicators). $SXshare^{PTA/Total}$ = Share of services exports covered in PTAs with deep provisions on services trade in total services imports. LDV = Lagged dependent variable. Standard errors, clustered by country-quarter, included in parentheses. Levels of significance: *10%, **5%, ***1%. Coefficient estimates inconsistent with the primary and secondary hypotheses are marked in red; those consistent are marked in green.*

Table 9: GMM results (aggregate services imports)

VARIABLES	(1) Total	(2) GRS	(3) Transport	(4) Travel	(5) Construction	(6) Insurance	(7) Financial	(8) IP	(9) ICT	(10) OBS	(11) PCR
LDV	0.015	-0.047	0.116	-0.121**	-0.261	0.713	-0.129	-0.163	0.347***	-0.173	0.103
	(0.073)	(0.141)	(0.090)	(0.059)	(0.358)	(0.699)	(0.221)	(0.394)	(0.114)	(0.164)	(0.195)
$YoY\_Goods^{M}_{ct}$	0.452***	0.550*	0.667***	0.368*	-0.129	0.653	0.196	-0.194	0.526	-0.096	0.688
	(0.143)	(0.327)	(0.137)	(0.205)	(1.562)	(1.514)	(0.707)	(0.557)	(0.502)	(0.356)	(0.734)
$\ln(COVID^{C}_{ct})$	-1.065	-18.887*	-5.540*	-2.742	218.104	-89.936*	35.824	13.216	-5.862	-18.011	8.758
	(3.039)	(11.352)	(2.892)	(3.954)	(399.664)	(54.637)	(26.654)	(27.689)	(16.357)	(14.743)	(17.312)
OSI_{ct}	-38.831	-26.377	-72.438	-84.082	1,546.749	-270.340	367.376	-65.247	-90.455	104.544	305.715
	(43.715)	(157.917)	(52.963)	(59.489)	(2,134.123)	(818.139)	(492.104)	(308.204)	(242.281)	(172.850)	(331.288)
$\ln(COVID^{C}_{ct})*D\_GDP_{c}$	1.022	9.642*	1.205	-2.029	-140.258	-9.160	-26.483	7.582	11.860	15.018	19.356
	(1.344)	(4.963)	(1.704)	(1.893)	(281.711)	(60.895)	(30.806)	(16.559)	(24.830)	(20.841)	(20.958)
$\ln(COVID^{C}_{ct})*D\_KL_{c}$	-1.506	-3.668	-2.760	4.166	92.252	-11.542	21.149	-29.169	18.354	8.503	19.953
	(2.695)	(8.017)	(2.484)	(3.286)	(154.001)	(32.066)	(17.374)	(21.896)	(12.267)	(24.072)	(21.157)
$\ln(COVID^{C}_{ct})*D\_REM_{c}$	-3.132***	3.044	-1.668	-0.579	-24.293	39.898	-16.492*	-8.173	-19.270*	-9.030	-7.265
	(1.210)	(3.564)	(1.246)	(1.614)	(23.699)	(24.837)	(9.829)	(9.627)	(10.669)	(8.671)	(10.136)
$\ln(COVID^{C}_{ct})*D\_REGQUAL_{c}$	5.840**	-7.938	1.200	3.772	34.995	-39.747	4.860	16.844	-9.002	2.569	-17.136
	(2.759)	(7.266)	(2.524)	(3.503)	(168.022)	(31.668)	(33.902)	(30.724)	(17.976)	(21.666)	(20.513)
$\ln(COVID^{C}_{ct})*D\_HK_{c}$	-1.474	2.014	2.518	-1.758	46.242	-1.770	16.835	-14.661	4.949	-3.251	16.321
	(2.341)	(7.406)	(2.365)	(3.101)	(123.090)	(38.032)	(45.250)	(30.139)	(28.286)	(8.470)	(13.602)
$\ln(COVID^{C}_{ct})*D\_GVC_{c}$	0.344	0.369	2.824	-3.719	-50.471	1.989	21.373	-12.037	21.160	-2.006	-16.947
	(2.331)	(7.707)	(1.983)	(2.943)	(124.460)	(33.990)	(26.379)	(18.166)	(17.985)	(19.603)	(26.270)
$\ln(COVID^{C}_{ct})*D\_GVC^{POS}_{c}$	-1.219	5.871	0.409	0.648	-64.864	35.668	-1.566	-7.542	4.360	2.143	-36.768
	(2.315)	(6.466)	(2.071)	(2.934)	(123.013)	(27.805)	(36.542)	(20.744)	(9.986)	(23.272)	(30.390)
$\ln(COVID^{C}_{ct})*D\_SXshare^{PTA/Total}_{c}$	-3.470	14.648*	0.818	0.016	-20.823	95.169**	-30.467**	-3.694	-7.186	11.939	4.635
	(2.367)	(8.363)	(2.481)	(3.274)	(27.854)	(39.808)	(12.316)	(19.329)	(9.229)	(8.950)	(11.980)

$\ln(COVID^{C}_{ct})$*D_Internet$_c$	-0.115	5.695	0.697	-2.203	-159.561	15.777	-32.371	23.431	-2.075	-13.110	-21.009
	(2.345)	(6.419)	(1.909)	(2.813)	(265.192)	(29.181)	(32.022)	(22.573)	(27.047)	(9.777)	(16.311)
$\ln(COVID^{C}_{ct})$*D_DTRI$_c$	1.415	1.163	1.687	4.902**	-5.247	48.162	6.750	-9.161	-0.013	5.488	9.325
	(1.670)	(4.943)	(1.509)	(2.208)	(25.865)	(44.243)	(16.093)	(12.698)	(14.117)	(7.327)	(11.460)
OSI$_{ct}$*D_GDP$_c$	-9.928	-47.025	5.211	-58.203**	-828.245	-115.310	-171.695	235.737*	-23.017	-72.582	24.165
	(18.890)	(63.145)	(24.731)	(25.264)	(1,429.264)	(896.407)	(471.165)	(135.123)	(189.299)	(103.041)	(150.027)
OSI$_{ct}$*D_KL$_c$	29.633	-163.752	9.759	69.140	459.214	-336.584	203.343	-558.972	388.528*	-176.671	431.419
	(33.203)	(111.117)	(31.679)	(44.442)	(506.415)	(723.353)	(298.917)	(461.634)	(204.331)	(236.734)	(312.334)
OSI$_{ct}$*D_REM$_c$	-7.933	35.888	0.154	51.713**	-38.404	369.103	-331.161*	-89.494	-106.941	-96.568	72.641
	(17.109)	(50.736)	(18.711)	(23.030)	(385.039)	(264.169)	(200.994)	(123.134)	(116.967)	(90.144)	(153.128)
OSI$_{ct}$*D_REGQUAL$_c$	51.598	160.017	24.412	27.630	665.282	-490.060	270.591	149.653	-190.286	57.048	-409.986
	(34.993)	(97.352)	(34.111)	(46.903)	(1,060.046)	(694.821)	(313.482)	(303.771)	(209.021)	(229.265)	(256.971)
OSI$_{ct}$*D_HK$_c$	-32.162	159.746*	-25.674	37.238	99.474	134.164	446.724	-2.553	21.965	307.482*	-145.852
	(32.923)	(87.741)	(27.767)	(40.566)	(695.020)	(578.628)	(545.747)	(308.748)	(174.868)	(158.636)	(270.433)
OSI$_{ct}$*D_GVC$_c$	64.879**	78.788	26.180	59.209	-424.795	-387.565	78.814	-208.826	219.807	31.366	177.270
	(27.716)	(92.416)	(25.891)	(38.490)	(1,217.687)	(676.100)	(511.304)	(190.961)	(138.956)	(152.764)	(184.355)
OSI$_{ct}$*D_GVC$^{POS}_c$	38.733	71.359	38.705	68.809*	-621.741	241.604	-43.463	-208.256	82.141	-19.072	-285.199
	(29.272)	(76.575)	(29.377)	(40.687)	(1,073.654)	(346.084)	(638.756)	(182.220)	(223.954)	(166.351)	(289.367)
OSI$_{ct}$*D_SXshare$^{PTA/Total}_c$	-47.682*	-32.647	41.358	-39.823	-479.077	666.181*	-331.266	32.014	-161.330	-38.491	-250.160
	(27.401)	(102.324)	(29.641)	(37.615)	(501.019)	(374.499)	(213.622)	(244.072)	(124.406)	(124.795)	(156.250)
OSI$_{ct}$*D_Internet$_c$	-8.065	-160.306**	-7.139	-12.298	-1,004.222	148.832	-617.103	480.253*	-104.625	-209.340*	-181.779
	(29.310)	(80.198)	(23.907)	(35.144)	(951.728)	(367.977)	(480.967)	(265.349)	(165.518)	(117.333)	(141.361)
OSI$_{ct}$*D_DTRI$_c$	-5.287	16.681	-10.695	4.712	-224.269	138.993	13.988	69.285	61.346	92.862	-149.836
	(29.013)	(73.450)	(25.093)	(35.794)	(313.878)	(548.519)	(206.582)	(159.206)	(145.780)	(119.511)	(163.466)
Observations	129	81	125	130	48	49	45	48	35	58	60
Sargan test Chi-squared	40.12	31.47	20.40	35.26	11.03	8.82	10.27	4.31	4.45	7.78	10.25

p-value	0.639	0.392	0.996	0.875	0.441	0.639	0.247	0.890	0.815	0.802	0.673

*Note: Dependent variable is the magnitude of the % YoY decline in total commercial services imports in column (1) and in sectoral services imports in columns (2)-(11) during the first three quarters of 2020. GRS = Goods-related services (manufacturing services + maintenance & repair); IP = Charges towards use of intellectual property; ICT = Communications, computer and information services; OBS = Other business services (R&D, professional, management consulting); PCR = Personal, cultural and recreational services (audio-visual, health, education). KL = Capital intensity (capital-labour ratio). REM = Remoteness (Baldwin and Harrigan, 2011). REGQUAL = Regulatory quality index (World Governance Indicators, Kaufmann et al. 2010). HK = Human capital index; Internet = % internet usage (World Development Indicators). $SMshare^{PTA/Total}$ = Share of services imports covered in PTAs with deep provisions on services trade in total services imports. LDV = Lagged dependent variable. Standard errors, clustered by country-quarter, included in parentheses. Levels of significance: *10%, **5%, ***1%. Coefficient estimates inconsistent with the primary and secondary hypotheses are marked in red; those consistent are marked in green.*

Table 10: Baseline gravity estimates (bilateral services exports, PPML)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	$\mathbf{X_{ijt}^{TOT}}$	$\mathbf{X_{ijt}^{TOT}}$	$\mathbf{X_{ijt}^{TOT}}$	$\mathbf{X_{ijt}^{INT}}$	$\mathbf{X_{ijt}^{INT}}$	$\mathbf{X_{ijt}^{INT}}$	$\mathbf{X_{ijt}^{FNL}}$	$\mathbf{X_{ijt}^{FNL}}$	$\mathbf{X_{ijt}^{FNL}}$
PTA_{ijt}	0.0597***	0.0868***	0.0804***	0.0551***	0.0789***	0.0727***	0.0606**	0.0933***	0.0878***
	(0.0200)	(0.0200)	(0.0210)	(0.0192)	(0.0190)	(0.0200)	(0.0247)	(0.0251)	(0.0255)
$INTL_{ij}*\ln(COVID_{it})$	-0.0000***		0.0000***	-0.0000***		0.0000***	-0.0000***		0.0000***
	(0.0000)		(0.0000)	(0.0000)		(0.0000)	(0.0000)		(0.0000)
$INTL_{ij}*OSI_{it}$		-0.3125***	-0.4609***		-0.3196***	-0.4679***		-0.3383***	-0.4621***
		(0.0130)	(0.0261)		(0.0130)	(0.0274)		(0.0135)	(0.0264)
Observations	7,256	7,256	7,256	6,918	6,918	6,918	7,190	7,190	7,190
Exporter-Importer FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer-Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Exporter-Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pseudo R2	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
Decline in exports due to stringency		-26.8%	-36.9%		-27.4%	-37.4%		-28.7%	-37.0%

*Note: Standard errors, clustered by dyad-year, included in parentheses. Interaction terms between $INTL_{ij}$ and $\ln(COVID^{C}_{jt})$, OSI_{jt} dropped due to collinearity. Levels of significance: *10%, **5%, ***1%. TOT = Total; INT = Intermediate; FNL = Final.*

Table 11: Baseline gravity estimates by sector (bilateral services exports, PPML)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	$X_{ijt}^{CONSTRN}$	X_{ijt}^{DISTBN}	$X_{ijt}^{H\&R}$	X_{ijt}^{TRANS}	$X_{ijt}^{P\&T}$	X_{ijt}^{FIN}	$X_{ijt}^{RE\&OBS}$	$X_{ijt}^{PUB\_AD}$	X_{ijt}^{EDU}	$X_{ijt}^{H\&SW}$	X_{ijt}^{PCR}
PTA_{ijt}	0.0294	0.1529***	0.0109	0.1613***	-0.1014***	-0.0552	-0.0547	-0.1297***	0.0823***	0.0748***	0.0214
	(0.0279)	(0.0421)	(0.0290)	(0.0345)	(0.0379)	(0.0392)	(0.0343)	(0.0483)	(0.0157)	(0.0218)	(0.0218)
$INTL_{ij}$*ln($COVID_{it}$)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000**	0.0000***	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$INTL_{ij}$*OSI_{it}	-0.5817***	-0.4931***	-0.3892***	-0.3541***	-0.4580***	-0.8462***	-0.4652***	-0.5104***	-0.3965***	-0.4835***	-0.2993***
	(0.0674)	(0.0424)	(0.0811)	(0.0330)	(0.0321)	(0.0723)	(0.0287)	(0.0406)	(0.0168)	(0.0182)	(0.0232)
Observations	4,546	5,392	5,740	6,644	5,948	5,472	6,300	3,992	3,834	3,692	5,052
Fixed effects											
Exporter-Importer	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer-Year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Exporter-Year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pseudo R2	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
Decline in exports due to stringency	-44.1%	-38.9%	-32.2%	-29.8%	-36.7%	-57.1%	-37.2%	-40.0%	-32.7%	-38.3%	-25.9%

*Note: Standard errors, clustered by dyad-year, included in parentheses. Interaction terms between $INTL_{ij}$ and $ln(COVID^{C}_{jt})$, OSI_{jt} dropped due to collinearity. Levels of significance: *10%, **5%, ***1%. Legend: CONSTRN = Construction; DISTBN = Distribution; H&R = Hotels & restaurants; TRANS = Transport; P&T = Post & telecoms; FIN = Financial; RE&OBS = Real estate and other business services; PUB_AD = Public administration, defence and social security; EDU = Education; H&SW = Health & social work; PCR = Personal, cultural and recreational services.*

Table 12: Structural gravity estimates explaining the heterogeneous decline (bilateral services exports, PPML)

VARIABLES	(1) X_{ijt}^{TOT}	(2) $X_{ijt}^{CONSTRN}$	(3) X_{ijt}^{DISTBN}	(4) $X_{ijt}^{H\&R}$	(5) X_{ijt}^{TRANS}	(6) $X_{ijt}^{P\&T}$	(7) X_{ijt}^{FIN}	(8) $X_{ijt}^{RE\&OBS}$	(9) $X_{ijt}^{PUB\_AD}$	(10) X_{ijt}^{EDU}	(11) $X_{ijt}^{H\&SW}$	(12) X_{ijt}^{PCR}
PTA_{ijt}	0.0715***	-0.1965**	0.0667***	-0.0559	-0.0005	-0.0293	0.1526***	-0.0261	-0.0589**	0.0278**	0.0440***	0.0192
	(0.0221)	(0.0778)	(0.0258)	(0.0345)	(0.0221)	(0.0261)	(0.0439)	(0.0226)	(0.0287)	(0.0118)	(0.0163)	(0.0174)
$INTL_{ij}$*ln($COVID_{it}$)	0.0002***	0.0004***	0.0000	-0.0004***	0.0001***	0.0002**	-0.0006***	0.0003***	0.0001*	0.0002***	0.0001	0.0002**
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)
$INTL_{ij}$*OSI_{it}	-1.6549***	-6.6906***	-1.4657	7.5059***	-0.8908**	0.0785	9.6754***	-0.1720	2.0673***	-1.8352***	-1.8110***	-2.3040*
	(0.5683)	(2.1503)	(1.7639)	(2.1425)	(0.4503)	(0.6182)	(2.1466)	(0.7004)	(0.6284)	(0.4126)	(0.6346)	(1.2317)
$INTL_{ij}$*ln($COVID_{it}$)*GDP_i	-0.0000***	-0.0000***	-0.0000**	0.0000***	0.0000	-0.0000***	0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$INTL_{ij}$*OSI_{it}*GDP_i	0.0178	0.1613***	0.0381	-0.2570***	-0.0279*	0.0199	-0.4610***	-0.0275	-0.0716***	0.0625***	0.0558***	0.0982*
	(0.0192)	(0.0621)	(0.0562)	(0.0893)	(0.0155)	(0.0147)	(0.0822)	(0.0257)	(0.0257)	(0.0164)	(0.0204)	(0.0534)
$INTL_{ij}$*ln($COVID_{it}$)*KL_i	-0.0000***	0.0000	-0.0000	-0.0000**	-0.0000	0.0000	-0.0000***	-0.0000***	-0.0000	-0.0000***	-0.0000***	-0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$INTL_{ij}$*OSI_{it}*KL_i	0.0000**	-0.0000	0.0000	0.0000	-0.0000	0.0000***	0.0000*	0.0000***	0.0000**	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$INTL_{ij}$*ln($COVID_{it}$)*REM_i	-0.0000***	-0.0000	0.0000	-0.0000	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000**	-0.0000	-0.0000*	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$INTL_{ij}$*OSI_{it}*REM_i	0.1222***	0.0499	0.0079	0.1161	0.0927***	0.0676***	0.2969***	0.0796***	0.0575***	0.0293**	0.0416***	0.0134
	(0.0215)	(0.0590)	(0.0403)	(0.0715)	(0.0231)	(0.0207)	(0.0624)	(0.0242)	(0.0159)	(0.0147)	(0.0156)	(0.0296)
$INTL_{ij}$*ln($COVID_{it}$)*$REGQUAL_i$	-0.0000**	-0.0000*	-0.0000***	0.0000***	0.0000	0.0000	-0.0000	0.0000***	0.0000	-0.0000	0.0000	0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$INTL_{ij}$*OSI_{it}*$REGQUAL_i$	0.0728	0.5375	0.3423*	-0.4156	0.2759***	-0.1857*	-0.5056	-0.4153***	-0.2120***	-0.0174	-0.2198***	-0.2896**
	(0.0778)	(0.3847)	(0.1889)	(0.3373)	(0.0761)	(0.1032)	(0.3600)	(0.0781)	(0.0664)	(0.0492)	(0.0711)	(0.1230)
$INTL_{ij}$*ln($COVID_{it}$)*HK_i	0.0002***	-0.0001	0.0001	0.0001	-0.0001***	-0.0000	-0.0003	0.0002***	0.0001***	0.0002***	0.0002***	0.0001**
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)

$INTL_{ij}$*OSI_{it}*HK_i	-1.8749***	1.5404	-0.1118	-1.9335**	0.9299**	-2.1227***	1.5268	-0.8354	-0.4153	-0.9941**	-0.9251**	-3.3557***
	(0.4660)	(1.2609)	(1.0405)	(0.9127)	(0.4256)	(0.3917)	(1.8735)	(0.5442)	(0.5273)	(0.4090)	(0.4279)	(0.9522)
$INTL_{ij}$*ln($COVID_{it}$)*GVC_i	-0.0000	-0.0003***	0.0000	0.0004***	-0.0002***	0.0000	0.0014***	-0.0002***	0.0001**	-0.0001**	-0.0001	0.0000
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0004)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)
$INTL_{ij}$*OSI_{it}*GVC_i	0.0880	5.9454***	2.0759**	-5.9874**	1.4546***	-2.4613***	-12.198***	-0.6791	-2.5166***	0.5977	1.2552**	-0.5157
	(0.5145)	(2.0097)	(1.0245)	(2.3725)	(0.4503)	(0.6707)	(2.8326)	(0.7176)	(0.4708)	(0.4855)	(0.6380)	(0.9003)
$INTL_{ij}$*ln($COVID_{it}$)*GVC^{POS}_i	-0.0001**	0.0001	0.0000	0.0001*	-0.0001***	0.0001*	0.0005	-0.0003***	-0.0001*	-0.0000	-0.0000	0.0000
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0003)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)
$INTL_{ij}$*OSI_{it}*GVC^{POS}_i	-0.1848	-3.4498***	-0.9367	-4.3537***	-0.5579*	-2.6959***	1.5120	-0.0111	-0.6473**	-1.9121***	-0.7972*	-1.9564***
	(0.3906)	(1.1891)	(0.8857)	(0.6254)	(0.3018)	(0.5042)	(1.5100)	(0.5174)	(0.3154)	(0.3789)	(0.4639)	(0.5420)
$INTL_{ij}$*ln($COVID_{it}$)*$SXshare^{PTA/Total}_i$	-0.0000	-0.0000	-0.0000	-0.0000**	-0.0000	0.0000***	-0.0000***	-0.0000	0.0000	-0.0000***	0.0000**	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$INTL_{ij}$*OSI_{it}*$SXshare^{PTA/Total}_i$	-0.0062***	-0.0168***	-0.0087**	-0.0087	-0.0073***	-0.0135***	0.0240***	-0.0042	-0.0129***	-0.0067***	-0.0184***	-0.0001
	(0.0022)	(0.0053)	(0.0036)	(0.0079)	(0.0017)	(0.0021)	(0.0070)	(0.0026)	(0.0021)	(0.0022)	(0.0026)	(0.0031)
$INTL_{ij}$*ln($COVID_{it}$)*$Internet_i$	0.0000	0.0000***	0.0000***	-0.0000*	0.0000***	-0.0000	0.0000	0.0000	-0.0000	0.0000**	0.0000*	-0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$INTL_{ij}$*OSI_{it}*$Internet_i$	-0.0038	-0.0356***	-0.0165***	0.0116**	-0.0230***	0.0070**	0.0011	-0.0049	0.0034	-0.0062**	-0.0027	0.0141**
	(0.0028)	(0.0123)	(0.0056)	(0.0052)	(0.0031)	(0.0033)	(0.0101)	(0.0033)	(0.0027)	(0.0024)	(0.0029)	(0.0062)
Observations	5,504	3,482	4,420	4,628	5,260	4,804	4,552	5,154	3,270	3,062	3,026	4,252
Exporter-Importer FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer-Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Exporter-Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pseudo R2	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999

*Note: Standard errors, clustered by dyad-year, included in parentheses. Interaction terms between $INTL_{ij}$ and ln($COVID^C_{jt}$), OSI_{jt} and other covariates dropped due to collinearity. Levels of significance: *10%, **5%, ***1%. Sector descriptions as in Table 11. Coefficient estimates inconsistent with the primary and secondary hypotheses are marked in red; those consistent are marked in green.*

Annex table 1: Country sample

Aggregate analysis

Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Bahamas, Bangladesh, Belarus, Belgium, Belize, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Cape Verde, Cambodia, Canada, Chile, China, Chinese Taipei, Colombia, Costa Rica, Croatia, Curaçao, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Eswatini, Ethiopia, Fiji, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyz Republic, Laos, Latvia, Lesotho, Lithuania, Luxembourg, Macao, Madagascar, Malaysia, Malta, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Nigeria, North Macedonia, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Saint Martin, Sao Tomé and Principe, Saudi Arabia, Serbia, Seychelles, Singapore, Slovak Republic, Slovenia, Solomon Islands, South Africa, South Korea, Spain, Sri Lanka, Sudan, Suriname, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Timor-Leste, Tonga, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States, Uruguay, Uzbekistan, Vietnam, Zambia, and Zimbabwe.

Bilateral analysis

Australia, Austria, Bangladesh, Belgium, Bhutan, Brazil, Brunei Darussalam, Bulgaria, Cambodia, Canada, China, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Fiji, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Italy, Japan, Kazakhstan, Kyrgyz Republic, Laos, Latvia, Lithuania, Luxembourg, Malaysia, Maldives, Malta, Mexico, Mongolia, Nepal, Netherlands, Norway, Pakistan, Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovak Republic, Slovenia, Spain, South Korea, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Kingdom, United States, Vietnam and Rest of the World.

Annex table 2: Variable names, descriptions, data sources and summary statistics

Dependent variables	Description	Source	Obs.	Mean	Std. Dev.	Min	Max
$YoY\_SX^{Tot}_{ct}$	% YoY decline in total commercial services exports	WTO Trade Database	496	-31.5	29.2	-95.3	75.3
$YoY\_SX^{GRS}_{ct}$	% YoY decline in goods-related services exports	WTO Trade Database	307	-0.2	73.5	-87.9	700.0
$YoY\_SX^{Trans}_{ct}$	% YoY decline in transport services exports	WTO Trade Database	469	-25.1	30.4	-97.0	150.0
$YoY\_SX^{Tvl}_{ct}$	% YoY decline in travel services exports	WTO Trade Database	466	-56.6	35.1	-99.8	56.8
$YoY\_SX^{Cons}_{ct}$	% YoY decline in construction services exports	WTO Trade Database	278	4.4	113.9	-94.4	1250.0
$YoY\_SX^{Ins}_{ct}$	% YoY decline in insurance services exports	WTO Trade Database	300	2.8	42.6	-197.8	264.4
$YoY\_SX^{Fin}_{ct}$	% YoY decline in financial services exports	WTO Trade Database	336	13.8	74.9	-83.3	700.0
$YoY\_SX^{IP}_{ct}$	% YoY decline in IP services exports	WTO Trade Database	238	2.6	54.9	-133.3	500.0
$YoY\_SX^{ICT}_{ct}$	% YoY decline in ICT services exports	WTO Trade Database	379	3.8	34.8	-84.5	325.0
$YoY\_SX^{OBS}_{ct}$	% YoY decline in other business services exports	WTO Trade Database	369	3.9	77.1	-83.3	1114.3
$YoY\_SX^{PCR}_{ct}$	% YoY decline in personal, cultural and recreational services exports	WTO Trade Database	277	-12.5	51.1	-92.3	400.0
$YoY\_SM^{Tot}_{ct}$	% YoY decline in total commercial services imports	WTO Trade Database	495	-23.4	22.1	-86.6	80.0
$YoY\_SM^{GRS}_{ct}$	% YoY decline in goods-related services imports	WTO Trade Database	341	9.3	304.7	-95.6	4880.0
$YoY\_SM^{Trans}_{ct}$	% YoY decline in transport services imports	WTO Trade Database	487	-20.4	19.9	-87.2	76.0
$YoY\_SM^{Tvl}_{ct}$	% YoY decline in travel services imports	WTO Trade Database	477	-52.1	36.1	-99.1	163.9
$YoY\_SM^{Cons}_{ct}$	% YoY decline in construction services imports	WTO Trade Database	298	-1.4	72.3	-96.8	600.0
$YoY\_SM^{Ins}_{ct}$	% YoY decline in insurance services imports	WTO Trade Database	381	2.5	49.4	-99.3	566.7
$YoY\_SM^{Fin}_{ct}$	% YoY decline in financial services imports	WTO Trade Database	359	6.2	55.9	-87.8	500.0
$YoY\_SM^{IP}_{ct}$	% YoY decline in IP services imports	WTO Trade Database	325	2.4	79.2	-88.9	962.5
$YoY\_SM^{ICT}_{ct}$	% YoY decline in ICT services imports	WTO Trade Database	383	5.8	50.2	-86.5	700.0
$YoY\_SM^{OBS}_{ct}$	% YoY decline in other business services imports	WTO Trade Database	391	-6.1	29.0	-85.1	167.5
$YoY\_SM^{PCR}_{ct}$	% YoY decline in personal, cultural and recreational services imports	WTO Trade Database	280	-16.4	31.1	-85.7	100.0

Control variables	Description		Obs	Mean	Std. Dev.	Min	Max
$COVID^{C}_{ct}$	Number of COVID-19 cases (millions)	ECDC; Hale et al. (2020)	585	12.8	68.6	0.0	1120.0
$COVID^{D}_{ct}$	Number of COVID-19 deaths (thousands)	ECDC; Hale et al. (2020)	585	395.4	1716.6	0.0	24000.0
$YoY\_Goods^{X}_{ct}$	Decline in goods exports	WTO Trade Database	373	-8.0	20.9	-68.6	237.4
$YoY\_Goods^{M}_{ct}$	Decline in goods imports	WTO Trade Database	369	-10.6	13.2	-57.1	19.3
OSI_{ct}	Stringency index	Hale et al. (2020)	524	55.1	17.9	4.8	97.2
GDP_{c}	Economic size (GDP in USD billion)	WDI	540	583.0	2060.0	0.4	19500.0
KL_{c}	Capital intensity (USD per labour)	WDI	484	7806.7	9293.6	183.7	44942.3
HK_{c}	Human capital index	WDI	492	0.6	0.1	0.3	0.9
ICT_{c}	Internet usage (%, population)	WDI	528	60.8	25.1	7.5	98.3
$REGQUAL_{c}$	Regulatory quality	WGI, Kaufmann et al. (2010)	540	0.2	0.9	-1.6	2.2
GE_{c}	Government effectiveness	WGI, Kaufmann et al. (2010)	540	0.2	0.9	-1.4	2.2
REM_{c}	Geographical remoteness (logged)	WDI, Head et al. (2010)	540	18.9	20.0		22.4
GVC_{c}	GVC participation	EORA-MRIO	520	0.4	0.1	0.2	0.8
GVC^{POS}_{c}	GVC position	EORA-MRIO	520	0.0	0.1	-0.4	0.3
$SXshare^{PTA/Total}_{c}$	PTA-intensiveness (exports)	OECD-WTO BaTiS; Hofmann et al. (2019)	544	37.4	34.4	0.0	96.5
$SMshare^{PTA/Total}_{c}$	PTA-intensiveness (imports)	OECD-WTO BaTiS; Hofmann et al. (2019)	521	39.5	34.2	0.5	94.6
$DTRI_{c}$	Digital trade restrictiveness	ECIPE	256	0.2	0.1	0.1	0.7
BILATERAL							
X_{ijkt} ($ mln)	Bilateral services exports*	ADB MRIO	93713	124.5	1131.6	0	100994.4
PTA_{ijt}	PTA-membership dummy*	WTO RTA-IS	90737	0.43	0.50	0	1
$INTL_{ij}$	Dummy for cross-border flows	Author	95256	0.98	0.12	0	1

*Note: ECDC = European Centre for Disease Prevention and Control; WDI = World Development Indicators, World Bank; WGI = World Governance Indicators, World Bank. * summary statistics are only reported for cross-border bilateral services exports.*

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