CHAPTER

3 FACTORS AFFECTING THE COMPETITIVENESS OF DIGITAL SERVICES TRADE

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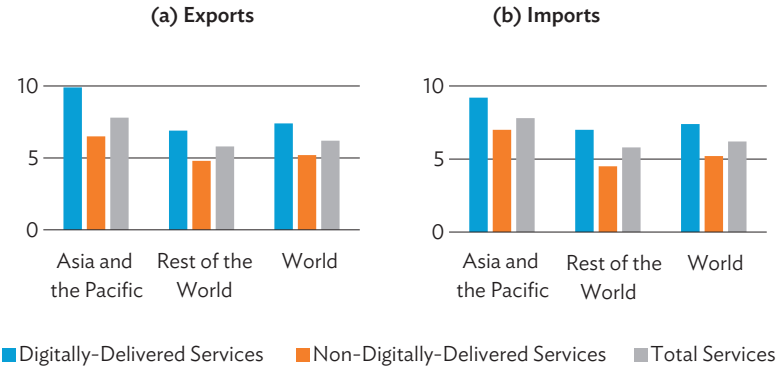
3.1 Introduction

Growth of trade in digital services has exceeded that of non-digitally deliverable services and total services over the past 15 years. Digital services growth in that time has been faster in Asia and the Pacific than in any other region of the world (Figure 3.1). As an example, exports and imports in digitally deliverable services in the region grew at an average annual rate of 9.9% and 9.2%, compared with a 7.4% global average.

Figure 3.1: Average Annual Growth Rate, 2005–2019
(%)



Source: Authors' calculations based on WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm (accessed July 2021).

The Asia and Pacific region's lead in digital services trade growth may not necessarily indicate increasing competitiveness. One metric to assess the competitiveness at the economy or regional level is revealed comparative advantage (RCA). RCA, although having drawbacks in accurately assessing an economy's status of competitiveness, can provide a snapshot of an economy's and region's trade performance relative to the world. RCA is based on the share of an economy's digitally deliverable services exports out of its total goods and services exports with respect to the share of digitally deliverable services exports out of total exports for the world. Formally, it is defined by

$$RCA_{it}^{DST} = \frac{\frac{X_{iwt}^{DST}}{X_{iwt}}}{\frac{X_{wwt}^{DST}}{X_{wwt}}} \tag{3.1}$$

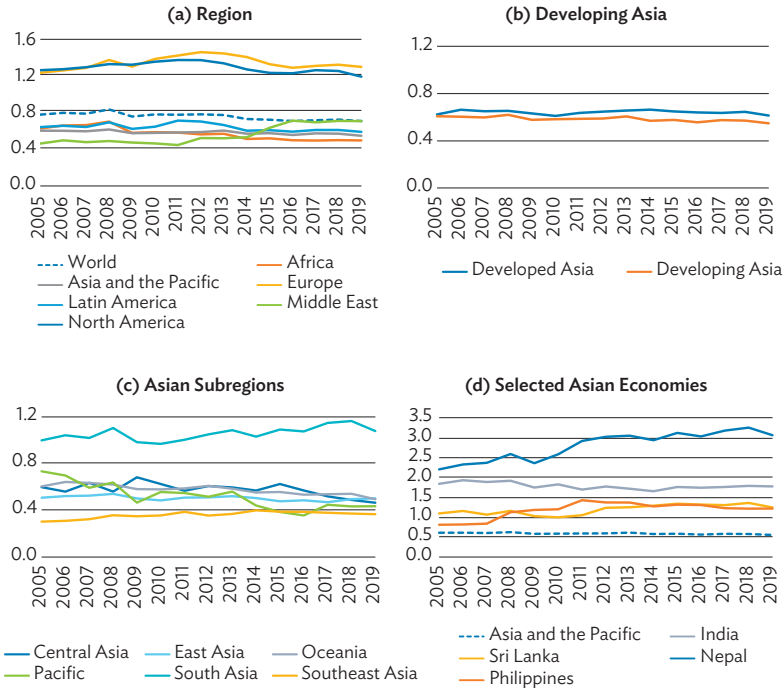
where X_{iwt}^{DST} is economy i's digitally deliverable services exports to the world at time t,
X_{iwt} is economy i's total good and services exports to the world at time t,
X_{ww}^{DST} is the world's digitally deliverable services exports at time t, and
X_{wwt} is the world's total goods and services exports at time t.

An economy's share of digitally deliverable services exports is greater than the global share if its RCA index exceeds 1.

Figure 3.2a shows that Asia and the Pacific—along with Latin America, Africa, and the Middle East—does not have RCA in digital services trade. Europe and North America display RCA in digitally deliverable services, with RCA indexes greater than 1 for 2005 to 2019. The Middle East had the lowest RCA across all regions from 2005 to 2014 but, in subsequent years, overtook Asia and the Pacific, Latin America, and Africa to approach the world average. Given that the development of digital technologies and complexity of production are also correlated with economic development, a higher RCA for richer economies seems natural.

Within Asia and the Pacific, developed economies have a somewhat higher RCA than developing economies, at 0.65 compared with 0.59 (Figure 3.2b). South Asia emerges as the sole subregion with an RCA greater than 1 at 1.06 over the 15-year period, 2005–2019 (Figure 3.2c). As shown in Figure 3.2d, some South Asian economies, along with Southeast Asian economy the Philippines, lead the entire region. Of these, Nepal consistently held the highest RCA of digitally deliverable services exports. Nepal specializes in services exports, which contributed 60% of GDP in 2019 (ADB 2021), and it is very competitive in telecommunications exports (Sáez et al. 2015).

Figure 3.2: Revealed Comparative Advantage for Digitally Deliverable Services



Sources: Authors' calculations using WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm (accessed May 2021); and World Bank. World Development Indicators. https://databank.worldbank.org/source/world-development-indicators (both accessed July 2021).

3.2 Factors Affecting Digital Services Sector Competitiveness

One benchmark to assess a country's competitiveness in digital services is their export performance, given that competitiveness reflected into high productivity could translate into larger outputs, and further into better export performance. In explaining trade flows based on comparative advantage, the literature has identified factor endowments such as human and physical capital, and country institutions and policies (Chor 2010). Among the inputs affecting competitiveness, traditional factors of production, digital infrastructure, and the policy environment are the most important. In other words, assessment of competitiveness in digital services,

as in this chapter, must examine the factors of (i) human capital, (ii) digital connectivity, (iii) investment in information and communication technology (ICT), and (iv) the policy and regulatory environment.

Human Capital

Keeping up with the fast-changing technological landscape entails making transformative shifts in human capital development strategies. Digital services production requires human capital equipped with technical skills, including for human–machine interaction (Grigorescu et al. 2021). Improved productivity in digital services requires improvements in education to equip people with new and relevant competencies.

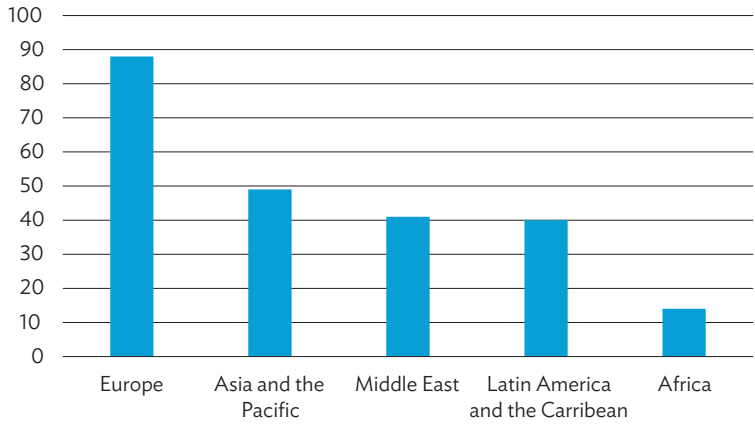
In the 21st century, digital literacy programs embedded in grades K-12 are essential, so that children can engage in responsible technology usage and learn the tools needed to thrive in an ever-changing digital world (Loveless n.d.). However, in a study by Learning.com, 75% of fifth and eighth grade students lacked proficiency in technological skills (Robacker 2017). It is now more important than ever to integrate digital literacy in the educational curriculum.

Digital competency underpins the bedrock of digital economy and characterizes how inclusive a society can be in helping people gain the benefits of digital services and digital services trade. Investing in improving digital skills is often recommended for raising economic growth and competitiveness (Froy, Giguère, and Meghnagi 2012; Spante et al. 2018). The Asia and Pacific region saw a substantial growth in hiring workers with digital skills recently, according to a report from the Asia-Pacific Economic Cooperation (APEC 2021). The report highlights the gap between workforce supply and demand and stresses the urgent need for economies in the region to invest in digital upskilling and reskilling of their workforce.

Data from the United Nations Children's Fund (UNICEF) point to Europe leading the way in internet accessibility for students by a large margin (Figure 3.3). Eighty-eight percent of children in school attendance age (of about ages 3–17, depending on the country) have an internet connection at home. This trend is followed by Asia and the Pacific (49%), the Middle East (41%), and Latin America and the Caribbean (40%). Meanwhile, Africa falls behind in making the internet a viable resource to its students, with a penetration rate of only 14%.

The overall level of education is still the key metric of human capital development, and a vast body of literature links digital adoption to education. Caselli and Coleman (2001) include educational attainment as a significant determinant of personal computer adoption. Chinn and Fairlie (2007) find that after controlling for the effects of income, differences in years of education explain more than a tenth of the gap in computer literacy among countries.

Figure 3.3: School-Age Digital Connectivity by Region
(% of children in school attendance age, latest available data)



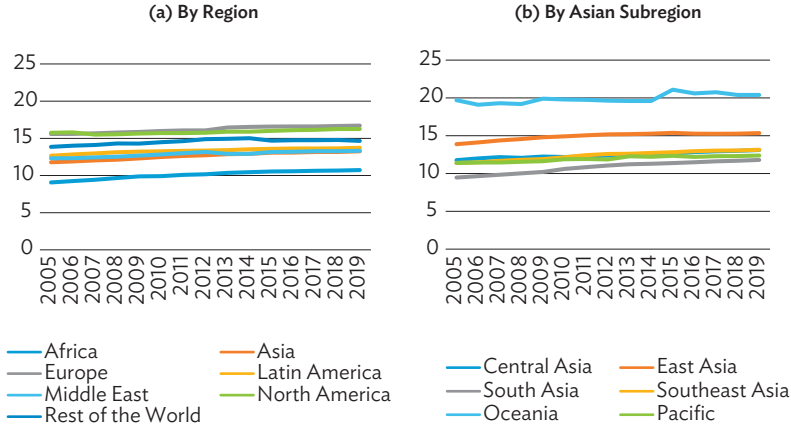
Source: Authors' calculations using United Nations Children's Fund (UNICEF). Education Overview. https://data.unicef.org/topic/education/overview/ (accessed July 2021).

The International Labour Organization (ILO) surveys of crowd workers in 2015 and 2017 also find that more educated people are more likely to participate in digital contract work (Berg et al. 2018).

Expected years of schooling have increased steadily across all regions of the world, with an annual global average growth rate of 0.7% (Figure 3.4a). Growth in Africa stands out, where expected schooling increased from 9.1 years in 2005 to 10.7 years in 2019. That annual average growth rate of 1.2% compares with 0.9% in Asia and the Pacific, where expected schooling rose from 11.8 years in 2005 to 13.3 years in 2019.

Within Asia and the Pacific, there are varying degrees of progress (Figure 3.4b). Oceania (Australia and New Zealand) is an obvious outlier with 20.4 expected years of schooling. Both countries are among those with the highest number of years of education in the world. Next to Oceania, East Asia has the highest expected schooling years, at 15.4 years in 2019. On the other hand, South Asia has the shortest expected schooling but biggest improvement in the past 15 years. The subregion recorded an average annual growth of 1.6%, well above the average for the Asia and Pacific region of 0.9%. Expected schooling improved from 9.5 years in 2005 to 11.8 in 2019. Pakistan's case is notable, as it increased its schooling from 5.7 to 8.3 expected years over 2005–2019. Its annual average growth in expected years of schooling was 2.8%, well above the subregion's 1.6%.

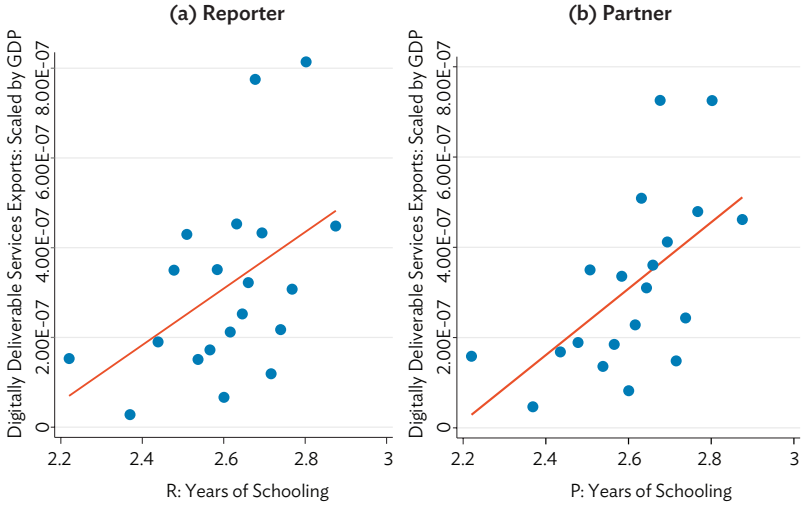
Figure 3.4: Expected Years of Schooling



Note: Economy groupings follow ADB's Asian Economic Integration Report classification. All economies not included in the integration indicators groupings are classified as "Rest of the World."

Source: ADB calculations using United Nations Development Programme. Human Development Data Center. http://hdr.undp.org/en/data (accessed July 2021).

Figure 3.5: Binned Scatterplots for Expected Years of Schooling, 2019



GDP = gross domestic product, P = partner, R = reporter.

Sources: Authors' calculations using WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; and United Nations Development Programme. Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi (both accessed July 2021).

Figure 3.5 plots binned scatterplots for the expected years of schooling for reporters and partners. For both entities, longer-schooling years are associated with an increase of digital services exports.

Digital Connectivity

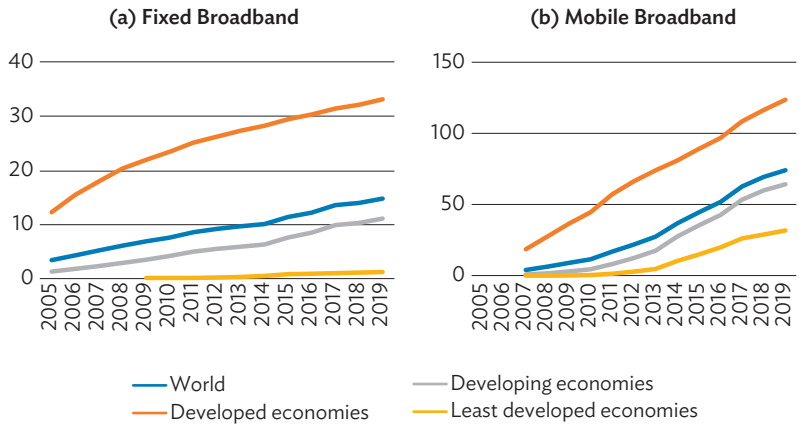
Enabling firms to bring services to large numbers of connected customers across the globe is a prerequisite for increasing the scale, scope, and speed of digital services trade. According to the Organisation for Economic Co-operation and Development (OECD), rapid technological developments facilitate the rise of services in international cross-border trade. This is associated with being able to deliver more rapidly and "on demand," so that consumers can access services instantly. The availability, quality, and cost of telecommunications infrastructure, internet and mobile penetration and accessibility, along with the adoption of digital and mobile technologies, play major roles in determining patterns of digital services trade. In some developing countries, lack of availability, high cost, and uneven quality of broadband and internet services remain significant challenges.

Internet Penetration. Literature links broadband and internet adoption to increased productivity, where the internet is seen as a tool that can support businesses to flourish and hire employees (OECD 2012, 2016). According to Haltenhof (2019), internet connectivity and exports of services are positively correlated. Consequently, improving bilateral internet connections promotes bilateral services trade in data-intensive sectors. The study claims that the greatest effects are observed for services sectors in finance, computers and information, and other business services. Moreover, higher internet penetration in developing countries is correlated with higher level of exports to developed countries, suggesting that access to the internet affects the export performance of firms in developing countries (Clarke and Wallsten 2004). A study of 151 countries from 1990 and 2006 showed that a doubling of internet usage led to a 2% to 4% increase in services trade (Choi 2009).

For the past years, broadband subscriptions have been increasing steadily. This was more pronounced in mobile-broadband subscriptions. According to the International Telecommunication Union (ITU), fixed broadband subscription increased from 5.2% in 2007 to 14.8% in 2019, while mobile-broadband subscription grew from 4.0% in 2007 to 74.2% in 2019. While Figure 3.6 indicates that the number of subscriptions has been consistently growing, it also displays the digital divide across the three economy groups.

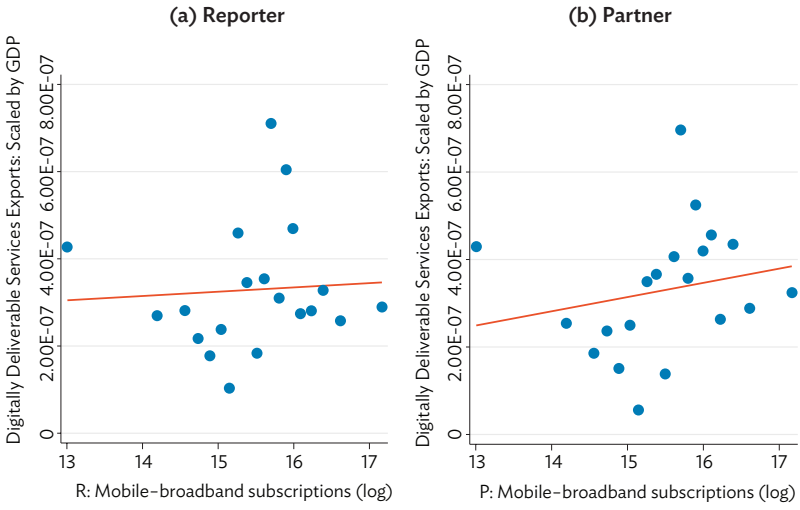
Higher levels of internet penetration are positively associated with digital services trade (Figure 3.7).

Figure 3.6: Broadband Subscriptions per 100 Inhabitants



Source: International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx (accessed July 2021).

Figure 3.7: Binned Scatterplots for Mobile-Broadband Subscriptions, 2019



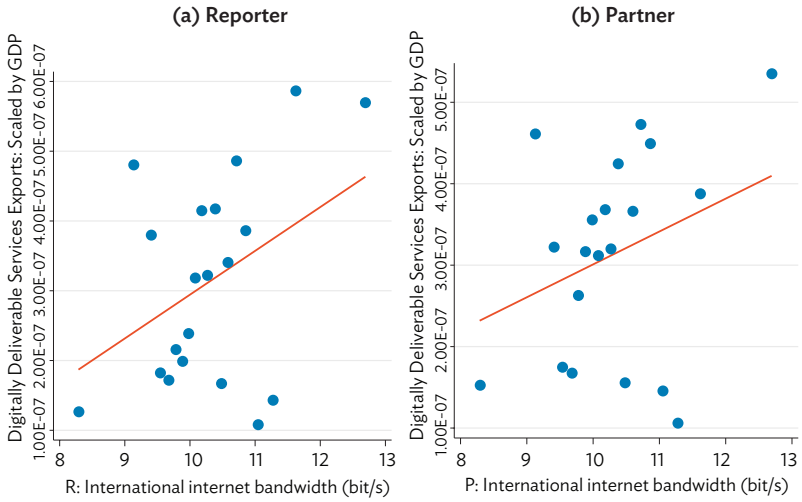
GDP = gross domestic product, P = partner, R = reporter.

Sources: Authors' calculations using WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; and International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx (both accessed July 2021).

Internet Speed. A reliable internet with high-speed connection increases productivity. Switching from normal speed to fast broadband substantially improves both firm and labor productivity (Dalgic and Fazlioglu 2020; Grimes, Ren, and Stevens 2012). For businesses using technologies such as videoconferencing, online payments, and other e-commerce functions, a high-speed connection is necessary (DataKom 2016). This is particularly true of firms that consume large volumes of data and for which greater bandwidth is essential.

Actual internet speed and usage are also important. Some may have internet access, but not at a usable speed. Figure 3.8 illustrates the positive relationship between digital services exports and the digital services trade and international internet bandwidth per user. It is also of note that international bandwidth capacity is more strongly related with digital services exports than with the mobile-broadband subscription level. This suggests that internet speed and quality should be more important as a factor in the expansion of digital services trade than simple internet availability.

Figure 3.8: Binned Scatterplots for International Bandwidth per Internet User, 2019



bit/s = bits per second, GDP = gross domestic product, P = partner, R = reporter.

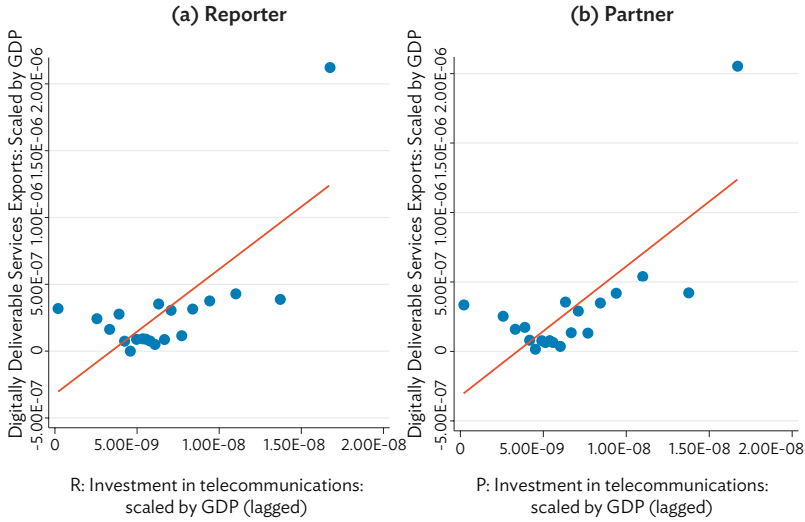
Sources: Authors' calculations using WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; and International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx (both accessed July 2021).

Investments

Digital solutions are defined as "other internet-based players and digital enablers, such as electronic and digital payment operators, cloud players and other service providers" (UNCTAD 2017). With increasing digitalization of industries, it is important to adopt digital solutions that cater to the needs of businesses. Firms that invest in and apply ICT are generally in a better position to become more productive, competitive, and profitable (UNCTAD 2011). As a result, new digital solutions are opening doors for companies of all sizes to engage in domestic and international trade (UNCTAD 2019).

Investments in telecommunications, ICT infrastructure, and digital payments enable digitally deliverable businesses to thrive. Figure 3.9 shows that investments in telecommunication infrastructure are positively associated with digital services trade.

Figure 3.9: Binned Scatterplots for Investments in Telecommunications, 2019



GDP = gross domestic product, P = partner, R = reporter.

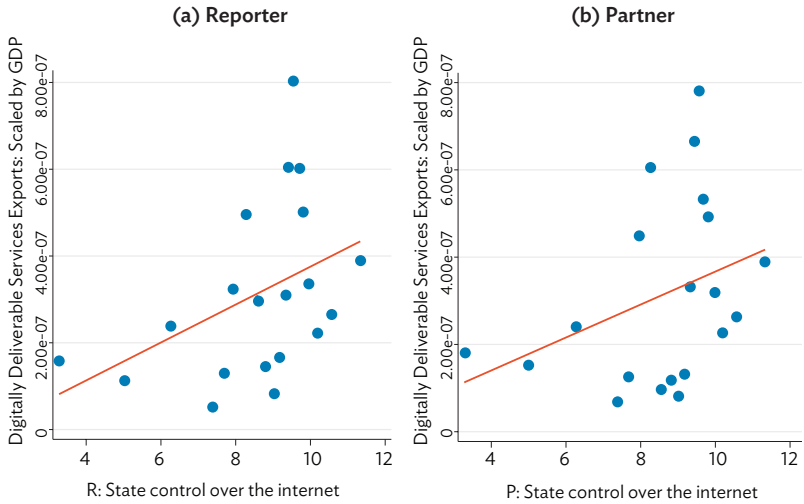
Sources: Authors' calculations using WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; and International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx (both accessed July 2021).

Policies and Regulatory Environment

The ecosystem for digital services trade requires a conducive overall business and regulatory environment. Stakeholders typically highlight the importance of transparency in regulations, the ease of data transfers, an open trade and investment regime, and supporting incentives for innovation. Many countries are also making efforts to build trust in supporting data flows. Creating trust should come with regulatory cooperation between countries and developing trade agreements or other arrangements that bolster privacy and consumer protection.

Internet freedom, or the ability of individuals to access the internet without state surveillance, censorship, or other barriers, could foster digital services trade. Hindley and Smith (1984) propose that services trade is constrained by government control over communications, media, and broadcasting. In the digital sphere, Topornin, Pyatkina, and Bokov (2021) characterize barriers to international data transfers, restrictions on digital payment systems, and many unique and opaque standards of filtering and blocking as potential tools of digital protectionism.

Figure 3.10: Binned Scatterplots for State Control Over Internet Access, 2019



GDP = gross domestic product, P = partner, R = reporter.

Sources: Authors' calculations based on WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; and CATO Institute. Human Freedom Index. https://www.cato.org/human-freedom-index/2020 (both accessed July 2021).

Figure 3.10 shows how freedom of information positively influences digital services trade outcomes for both reporter and partner. It uses the CATO Institute's measure of "state control over internet access," which is a component from the Institutional Profiles Database question: "Freedom of information: Freedom of access, navigation, and publication on the internet (0 = no freedom of internet access; 10 = complete freedom of navigation and publication)."

3.3 Empirical Analysis

The impact of various factors affecting digital services trade can be tested empirically. Using the factors affecting digital services trade competitiveness that were identified in Section 3.2, we run a gravity model to determine the relationship between the dependent and various independent variables. Table 3.1 shows the selected variables and their sources.

Table 3.1: Data and Sources

Category	Variable	Notes	Source
Dependent variable	Digital services trade exports	Sum of all digitally deliverable items (SF, SG, SH, SI, SJ, SK).	BaTIS
Independent (human capital)	Expected years of schooling	Number of years of schooling that a child of school-entrance age can expect to receive if prevailing patterns of age-specific enrollment rates persist throughout the child's life. Log-transformed.	UNDP
Independent (infrastructure)	Mobile-broadband subscriptions	Active mobile-broadband subscriptions; scaled to population. Interpolated using nearest-neighbor algorithm. Log-transformed.	ITU
	International internet bandwidth per internet user	Expressed in bit/s. Log-transformed.	ITU
Independent (investment)	Annual investment in telecommunication services	Expressed in $, log-transformed; annual investments made by entities providing telecommunication networks and/or services in the country. Log-transformed. Lagged.	ITU

continued on next page

Table 3.1 *continued*

Category	Variable	Notes	Source
Independent (policies)	State control over the internet	Freedom of information: Freedom of access, navigation, and publication on the internet (10 = complete freedom of internet access; 0 = no freedom of navigation and publication). Interpolated using nearest-neighbor algorithm.	Cato Institute

BaTIS = WTO–OECD Balanced Trade in Services dataset; bit/s = bits per second; ITU = International Telecommunication Union; n.i.e. = not included elsewhere; OECD = Organisation for Economic Co-operation and Development; SF = insurance and pension services; SG = financial services; SH = charges for the use of intellectual property n.i.e.; SI = telecommunications, computer, and information services; SJ = other business services; SK = personal, cultural, and recreational services; UNDP = United Nations Development Programme; WTO = World Trade Organization.

Sources: Authors' compilation from WTO–OECD Balanced Trade in Services Dataset (BATIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; CATO Institute. Human Freedom Index. https://www.cato.org/human-freedom-index/2020; International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx; and United Nations Development Programme. Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi (all accessed July 2021).

Table 3.1 lists the variables used in the regression. Each category was represented by at least one time-varying independent variable. Besides the variables of interest, we include economy-pair fixed effects that absorb classical gravity model controls, such as the log-transformed simple distance between the bilateral economies, contiguity, common official language, colony, time difference, common currency, common religion, and others. We do, however, include separate runs for the baseline regression without bilateral fixed effects, while including these traditional gravity variables in Appendix Table A3.1. We include reporter-time and partner-time fixed effects to account for factors such as economic size that vary by the economy and time dimensions. A regional trade agreement (RTA) indicator variable from the World Trade Organization's RTA database is also added.

Model Specification

The dataset covers a total of 235 reporter (exporter) economies and 236 partner (importer) economies. For the dependent variable, we use digitally deliverable services exports. Equation 3.2 below shows the model specification. Each variable of interest is interacted by an economy pair, transforming them into bilateral values to better account for pairwise synergy effects.

$$DDS_{ijt} = \alpha + I_{it} + I_{jt} + I_{ij} + \gamma_1 \ln(Educ_{it} * Educ_{jt}) + \delta_1 \ln(Infra_{it} * Infra_{jt}) + \zeta_1 \ln(Inv_{it} * Inv_{jt}) + \eta_1 (Pol_{it} * Pol_{it}) + \varepsilon_{ijt} \quad (3.2)$$

where $i = 1,..,235$, and i refers to reporter (exporter) economy i,
$j = 1,..,236$, and j refers to partner (importer) economy j,

t = 2005,..,2019, and t refers to year t,
I_{it} are reporter-time fixed effects,
I_{jt} are partner-time fixed effects,
I_{ij} are time-invariant bilateral fixed effects,
Educ refers to the vector of human capital variables,
Infra refers to the vector of infrastructure variables,
Inv refers to the vector of investment variables, and
Pol refers to the vector of policy variables.

We employ the Poisson pseudo-maximum likelihood (PPML) as the primary estimation method for equation 3.2. Santos Silva and Tenreyro (2006) posit that PPML may be used in the presence of zero trade flows. As a Poisson estimator, it directly applies the multiplicative form of the equation, hence resolving Jensen's inequality. Additionally, this method remains robust against heteroscedasticity, which is endemic in trade research. These characteristics make PPML particularly suited to gravity model estimation, and its use has been documented extensively in the literature (Head and Mayer 2014).

We use the *ppmlhdfe* package by Correia, Guimarães, and Zylkin (2019). This package accelerates the estimation of parameter values in PPML models with high-dimensional fixed effects, as in gravity models. This is achieved with improvements to the iteration algorithm of the least-squares estimation and with deletions to separated observations, which do not add additional information to the estimation. The Ramsey regression equation specification error test (RESET) is used post-estimation to check the robustness of the PPML specification.

To obtain information on patterns across different regions and sectors, several iterations of the baseline model have been estimated. Aside from digital services trade, non-digital services trade was used as a dependent variable. Moreover, regressions were run across Asian and non-Asian regional groupings, with various interaction variables to gauge disparities. Besides regional analysis, several interaction effects were estimated to examine the nuances in digital services determinants for different Asia trade flows and developing Asia. As a diagnostic measure, regressions were run for observations in the BaTIS dataset, which were not derived from the gravity model.

Results

For all results, only variables of interest are reported. For iterations on the baseline regression, such as those including interactions effects, all standard variables are shown in the full tables in Appendix Table A3.2 for Asia and Table A3.3 for developing Asia. All pseudo R-squared values indicate that the model explains over 90% of the variation in digital services trade, which is within the typical range of gravity models. Moreover, all Ramsey test statistics are insignificant (do not reject the null hypothesis), indicating no evidence of specification error.

Results of the baseline regression for digital services exports are shown in the first column of Table 3.2. Consistent with expectations, nearly all variables of interest appear to positively drive digital services trade. Human capital, as measured in expected years of education for the adult population, seems to bolster digital services trade at a 1% significance level. The parameter values for this factor imply that a 1% increase in average education years in the bilateral level of education boosts digital services trade by about 0.122%, all else equal.[1]

Table 3.2: Baseline Regression Results

Dependent Variable:	(1) Digitally Deliverable Services Exports	(2) Non-Digitally Deliverable Services Exports
Mean years of schooling	0.1221***	0.0486
	(0.0265)	(0.0193)
Mobile-broadband subscriptions	0.0015***	0.0026
	(0.0003)	(0.0003)
International internet bandwidth (bit/s)	0.0027***	0.0021***
	(0.0004)	(0.0005)
Investment in telecommunications, lagged (log)	0.0018***	0.0028***
	(0.0004)	(0.0003)
State control over the internet	0.0027***	0.0018***
	(0.0003)	(0.0004)
RTA dummy variable	0.0101	0.0062**
	(0.0160)	(0.0153)
Constant	5.3189***	4.6169***
	(0.2350)	(0.2731)
Exporter-year fixed effects	Yes	Yes
Importer-year fixed effects	Yes	Yes
Bilateral fixed effects	Yes	Yes
Observations	112,540	112,540
Pseudo R-squared	0.993	0.989
Ramsey test: Prob > chi2	0.747	0.162

bit/s = bit per second, RTA = regional trade agreement.

Note: Numbers in parentheses are robust standard errors, clustered by economy pair: *** p < 0.01, ** p < 0.05, * p < 0.10.

Sources: Authors' calculations using data from WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; CATO Institute. Human Freedom Index. https://www.cato.org/human-freedom-index/2020; International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx; United Nations Development Programme . Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi (accessed July 2021).

[1] Coefficients of continuous variables, which are log-transformed, are interpreted as elasticities in the PPML model.

Results also indicate that mobile-broadband subscriptions have a highly significant positive association to digital services exports, on the exporter side. This is statistically significant at the 1% level. Furthermore, faster international internet bandwidth also appears correlated with greater digital services trade, highlighting the importance of digital infrastructure in fostering trade.

Similarly, investments relating to digital services, as measured by the annual investment in telecommunications, has a positive relationship with digital services trade. This covariate may reflect the government's priority on investing in digital infrastructure.

Moreover, it appears that more internet freedom is conducive to trade, showing a positive and highly significant association. This is consistent with the literature on services trade, where enhanced freedom of information supports a thriving trade environment.

Finally, we examine the regional trade agreement dummy, which appears to hold no statistical significance once accounting for the rich array of fixed effects employed in the model.

As a comparison, the results for non-digital services trade are also examined in the second column of Table 3.2. As seen, while non-digital services exports seem to benefit from internet bandwidth and telecommunications investment, it is notable that the covariates on schooling and mobile-broadband subscriptions uniquely enhance digital trade. Moreover, in direct contrast to digital services, the existence of an RTA between the two nations seems to drive non-digital services trade at a statistically significant level in line with expectations. Intuitively, digitally deliverable services are not as dependent on traditional economic arrangements and are subject to different rules and barriers. Nonetheless, an existing economic relationship does appear to foster services trade for certain sectors.

From the first two columns of Table 3.3, there is clear heterogeneity in the determinants of digital services trade across Asian and non-Asian economies. On human capital, the years of education of a nation's populace seem to bolster trade, although to a slightly greater magnitude and level of significance outside of Asia.

On the infrastructure aspect, Asian economies notably benefit at a 1% significance level from mobile-broadband subscriptions, which indicates that greater access to the internet is a driving factor of digital trade. In contrast, non-Asian economies show a positive but insignificant parameter value. Also, internet speed does not appear to universally drive exports, remaining statistically insignificant for Asia, while positive for digital services trade from non-Asian nations.

On investment, this again appears to significantly bolster trade of both Asian and non-Asian digital services. However, it appears to have a greater magnitude for non-Asian economies (0.0024 against 0.0012), which may highlight the relative maturity of Asian telecommunications infrastructure.

Table 3.3: Digitally Deliverable and Non-Digitally Deliverable Services Determinants by Region

Dependent Variable:	(1) Digitally Deliverable Services		(2) Non-Digitally Deliverable Services	
Region:	Asia	Non-Asia	Asia	Non-Asia
Mean years of schooling (log)	0.1536***	0.3389***	0.0185	0.0437
	(0.0479)	(0.0557)	(0.0830)	(0.0438)
Mobile-broadband subscriptions (log)	0.0019*** (0.0003)	0.0003 (0.0004)	0.0035*** (0.0004)	0.0041*** (0.0005)
International internet bandwidth (bit/s)	0.0007 (0.0007)	0.0028*** (0.0005)	0.0036 (0.0016)	0.0015*** (0.0005)
Investment in telecommunications, lagged (log)	0.0012*** (0.0003)	0.0024*** (0.0004)	0.0020 (0.0006)	0.0005* (0.0003)
State control over the internet	0.0027***	0.0025***	0.0004	0.0029
	(0.0004)	(0.0004)	(0.0009)	(0.0006)
RTA dummy variable	0.0130	0.0004	0.0231	0.0095
	(0.0306)	(0.0179)	(0.0428)	(0.0123)
Constant	5.2891***	4.3834***	5.0767***	5.8115***
	(0.2926)	(0.3810)	(0.4702)	(0.2106)
Exporter-year fixed effects	Yes	Yes	Yes	Yes
Importer-year fixed effects	Yes	Yes	Yes	Yes
Bilateral fixed effects	Yes	Yes	Yes	Yes
Observations	20,893	91,647	20,893	91,647
Pseudo R-squared	0.992	0.993	0.990	0.989
Ramsey test: Prob > chi2	0.786	0.934	0.772	0.784

bit/s = bit per second, RTA = regional trade agreement.

Notes:
(i) Non-Asia = all economies outside of the Asia and Pacific region.
(ii) Numbers in parentheses are robust standard errors, clustered by economy pair: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Sources: Authors' calculations using data from WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; CATO Institute. Human Freedom Index. https://www.cato.org/human-freedom-index/2020; International Telecommunication Union. ICT Statistics https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx; and United Nations Development Programme. Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi (accessed July 2021).

On the policy aspect, increased freedom to navigate the internet is a positive determinant of digital services everywhere, and it is significant at the 1% level. This highlights the continuing importance of the level of state control or censorship of the internet in digitally deliverable services trade.

The third and fourth columns of Table 3.3 regress the same functional equation on services trade that is other than digital services (non-digital services trade) for each region. Compared with the results in the first two columns, education, digital infrastructure, investment, and internet freedom appear to follow the same overall directions, though to a much-diminished scale and statistical significance. For instance, mean years of schooling does not appear to significantly drive non-digitally deliverable services for Asian economies. It is also weakly significant for non-Asian economies, although with a coefficient that is less than half of that for digitally deliverable services. On the other hand, mobile internet users, a factor that was significant for Asia and the Pacific, remains significant for non-digital services trade. Similarly, both internet bandwidth and investment remain positive and significant for non-Asian economies.

A further point of contrast is in the index of state control over the internet, which is statistically insignificant for Asia and Pacific trade in non-digitally deliverable services. These findings underscore the unique nature of digitally deliverable services trade over more traditionally delivered services, with digital services trade in the region being more strongly driven by education, internet access (as measured by mobile internet users), and internet freedom, as compared to non-digital services trade.

The nexus of financial access, technological progress, and development in digitally deliverable progress cannot be ignored. Table 3.4 analyzes the correlation of digital payments on trade in digital services within and outside Asia and the Pacific. To obviate the problem of multicollinearity, the infrastructure variables (mobile-broadband and internet speed) are dropped. Variables besides digital payments such as education, investment, and internet policy generally follow the directions and magnitudes reported in Table 3.3. The results indicate that the greater the usage of digital payments, the greater the volume of digitally deliverable services exports, more so for Asian economies.

Robustness Check

To further test the robustness of the data and specification, considering that most observations (over 70%) in the BaTIS database were derived using gravity modeling, we regressed the same equation with only the data points that were reported by the observing economies excluding those estimated. Full results can be found in Table 3.5. Overall, the directions of all variables are generally similar to the baseline model using all the balanced values of the BaTIS database; although, the level of significance is slightly lessened for the truncated dataset. Nonetheless, no wild swings are seen in relationships or scale, especially for digital services trade. This may point to the robustness of the full dataset for analysis.

Table 3.4: Digital Payments and Digitally Deliverable Services

Dependent Variable:	Digitally Deliverable Services	
Region:	Asia	Non-Asia
Mean years of schooling (log)	0.1152*** (0.0745)	0.3157*** (0.0921)
Digital payments	0.3449*** (0.1086)	0.1854*** (0.0521)
Investment in telecommunications (log) (lag)	0.0034*** (0.0007)	0.0062*** (0.0010)
State control over the internet	0.0018* (0.0011)	0.0026* (0.0014)
RTA dummy variable	0.0316 (0.0316)	0.0249 (0.0215)
Constant	6.3511*** (0.6129)	4.9348*** (0.7642)
Exporter-year fixed effects	Yes	Yes
Importer-year fixed effects	Yes	Yes
Bilateral fixed effects	Yes	Yes
Observations	14,470	61,406
Pseudo R-squared	0.993	0.995
Ramsey test: Prob > chi2	0.213	0.167

RTA = regional trade agreement.

Notes:
(i) Non-Asia = all economies outside of the Asia and Pacific region.
(ii) Numbers in parentheses are robust standard errors, clustered by economy pair: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Sources: Authors' calculations using data from WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; CATO Institute. Human Freedom Index. https://www.cato.org/human-freedom-index/2020; International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx; and United Nations Development Programme. Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi; World Bank (accessed July 2021 and September 2021).

Table 3.5: Diagnostics on BaTIS Dataset

	(1)	(2)	(3)	(4)
Dependent Variable:	**Digitally Deliverable Services Exports**	**Non-Digitally Deliverable Services Exports**	**Digitally Deliverable Services Exports**	**Non-Digitally Deliverable Services Exports**
Mean years of schooling (log)	0.1720*** (0.0353)	0.1743*** (0.0305)	0.1386*** (0.0330)	0.0692** (0.0314)
Mobile-broadband subscriptions (log)	0.0017*** (0.0005)	0.0045*** (0.0009)	0.0015*** (0.0004)	0.0032*** (0.0006)
International internet bandwidth (bit/s)	0.0025*** (0.0005)	0.0030*** (0.0007)	0.0022*** (0.0005)	0.0022*** (0.0007)
Investment in telecommunications, lagged (log)	0.0023*** (0.0008)	0.0033*** (0.0006)	0.0016*** (0.0006)	0.0031*** (0.0006)
State control over the internet	0.0021*** (0.0005)	0.0045*** (0.0007)	0.0022*** (0.0004)	0.0027*** (0.0007)
RTA dummy variable	0.0140 (0.0247)	-0.0583** (0.0291)	0.0335 (0.0214)	-0.0098 (0.0217)
Constant	5.0819*** (0.4912)	2.9399*** (0.4877)	5.7491*** (0.3432)	4.5308*** (0.5112)
Exporter-year fixed effects	Yes	Yes	Yes	Yes
Importer-year fixed effects	Yes	Yes	Yes	Yes
Observations	17,892	20,589	28,697	31,464
Pseudo R-squared	0.991	0.988	0.993	0.990
Ramsey test: Prob > chi2	0.666	0.128	0.339	0.326
Mean years of schooling (log)	0.1720***	0.1743***	0.1386***	0.0692**

BaTIS = WTO–OECD Balanced Trade in Services dataset, bit/s = bits per second, RTA = regional trade agreement.

Note: Numbers in parentheses are robust standard errors, clustered by economy pair: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Sources: Authors' calculations using data from WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; CATO Institute. Human Freedom Index. https://www.cato.org/human-freedom-index/2020; International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx; and United Nations Development Programme. Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi (accessed July 2021).

3.4 Conclusions and Recommendations

Digital services trade is influenced by an economy's human capital, digital connectivity, investment, and policy and regulatory environment. Asia and the Pacific, while growing rapidly in digital services trade, still lag advanced economies in competitiveness. To shed light on where policy makers in the region can focus on to drive the development of digital services and digital services trade, this chapter illustrates the reasoning behind the key determinants of digital services trade. Further, we test empirically the impact of the potential determinants of digital services trade utilizing the BaTIS database and standard indicators for digital infrastructure and gravity controls.

Employing the best practice of PPML estimation, we find that all relevant pillars such as human capital, digital connectivity, investment, and policy environment are significant and positively associated factors for driving digital services trade development among all economies. This finding is robust against various specifications and for regional subsamples. These results are particularly relevant to digital services trade, with non-digital services trade in Asia not being significantly impacted by education or mobile-broadband subscriptions.

As digital services trade becomes increasingly important, several policy considerations are important to ensuring that all nations stand to benefit.

In the era of COVID-19 and after the pandemic, the value of upskilling and reskilling the workforce is paramount, especially considering existing skill-based barriers to the uptake of digital technology. As can be seen from the analysis in this chapter, the length of education is associated with greater trade in digitally deliverable services, suggesting that economies should strengthen national education systems. It is also becoming imperative to integrate digital literacy into the core curriculum to ensure that the youth are equipped with necessary digital tools to thrive amid rapid digital transformation.

As evident in the analysis, the value of digital services exports benefits to a larger extent from more broadband users and internet speed. Consequently, investing in digital connectivity and ICT infrastructure can help reap the great economic benefits offered by digital services trade. This highlights that governments and the private sector need to make further effort to narrow the gaps between frontier and other economies on this front.

The policy environment also affects the performance of digital services trade. Although this chapter has shown that internet freedom can be conducive to digital services trade, other policy measures, such as those on data flows, data protection, trade restrictiveness, and domestic regulations, can exert no less impact on digital services trade, calling for policy makers to ensure a fine balance between diverse policy objectives, including economic welfare, national security, and digital privacy.

Although this chapter's analysis shows that cross-border agreements are not yet significant in fostering digitally deliverable services trade, this might change as more and more international agreements enter into force, affecting the digital services trade landscape. The General Agreement on Trade in Services has general provisions that may support digital trade, such as market access, legal considerations, and most-favored treatment. However, many opportunities exist for nations to further improve cooperation in this sphere. Recently, the Digital Economy Partnership Agreements among Asian economies have risen to prominence, most notably in Singapore, Thailand, Australia, and the Republic of Korea (Government of Singapore, Ministry of Trade and Industry 2021). These agreements foster cooperation in digital payment systems, cross-border data flows, digital identity, and more—all of which promote multilateral digital economic trade. These nascent initiatives address the limitations of traditional regional trade agreements by establishing provisions that streamline processes, modernize payments systems, and harmonize data protection policies.

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APPENDIXES

Table A3.1: Base Model with Gravity Variables

Dependent Variable:	(1) BaTIS DST Exports Balanced Value	(2) BaTIS Non-DST Exports Balanced Value
Mean years of schooling (log)	0.1757**	0.0924
	(0.0734)	(0.0588)
Mobile-broadband subscriptions (log)	0.0017***	0.0031***
	(0.0006)	(0.0006)
International internet bandwidth (bit/s) (log)	0.0006	0.0014
	(0.0012)	(0.0010)
Investment in telecommunications (log) (lag)	0.0028***	0.0028***
	(0.0008)	(0.0007)
State control over the internet	0.0010	-0.0009
	(0.0007)	(0.0007)
RTA dummy variable	0.1381***	0.2530***
	(0.0257)	(0.0193)
Distance	-0.3065***	-0.4255***
	(0.0164)	(0.0136)
Colonial relationship	0.0014	0.3938***
	(0.0324)	(0.0291)
Contiguity	0.0621*	0.4658***
	(0.0368)	(0.0260)
Common language	0.4597***	0.3160***
	(0.0348)	(0.0253)
Hours difference	-0.0462***	-0.0508***
	(0.0038)	(0.0030)
Common currency	0.3138***	0.1045***
	(0.0466)	(0.0295)
Common religion	0.3894***	0.2197***
	(0.0435)	(0.0296)
Constant	7.0649***	7.8384***
	(0.7195)	(0.6227)
Exporter-year fixed effects	Yes	Yes
Importer-year fixed effects	Yes	Yes
Bilateral fixed effects	No	No
Observations	119,368	119,368
Pseudo R-squared	0.958	0.935

BaTIS = WTO–OECD Balanced Trade in Services dataset, bit/s = bits per second, DST = digital services trade, RTA = regional trade agreement.

Note: Numbers in parentheses are robust standard errors, clustered by economy pair: *** p < 0.01, ** p < 0.05, * p < 0.10.

Sources: Authors' calculations using data from WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; CATO Institute. Human Freedom Index. https://www.cato.org/human-freedom-index/2020; International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx; and United Nations Development Programme. Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi (accessed July 2021).

Table A3.2: Asia Trade Interactions

Dependent Variable:	Digitally Deliverable Services			
Interaction Variable:	Mobile Broadband	Internet Bandwidth	Telecom Investment	Internet Regime
Mean years of schooling (log)	0.1159***	0.1261***	0.1219***	0.1221***
	(0.0264)	(0.0265)	(0.0263)	(0.0264)
Mobile-broadband subscriptions (log)	0.0006*	0.0014***	0.0015***	0.0015***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
International internet bandwidth per internet user (bit/s) (log)	0.0022***	0.0020***	0.0027***	0.0027***
	(0.0004)	(0.0005)	(0.0004)	(0.0004)
Investment in telecommunications, lagged (log)	0.0017***	0.0018***	0.0018***	0.0018***
	(0.0004)	(0.0004)	(0.0005)	(0.0004)
State control over the internet	0.0025***	0.0027***	0.0027***	0.0027***
	(0.0003)	(0.0003)	(0.0003)	(0.0004)
RTA dummy variable	-0.0010	-0.0003	0.0099	0.0100
	(0.0156)	(0.0159)	(0.0160)	(0.0165)
Asia Trade * Interaction Variable (Reference group: non-Asia trade)				
Asia intraregional	0.0008**	-0.0002	-0.0007	-0.0022***
	(0.0004)	(0.0008)	(0.0009)	(0.0008)
Asia outward	0.0015***	0.0021***	-0.0005	-0.0014**
	(0.0003)	(0.0006)	(0.0006)	(0.0007)
Asia inward	0.0018***	0.0028***	0.0012	-0.0019**
	(0.0003)	(0.0007)	(0.0008)	(0.0008)
Constant	5.6630***	5.3678***	5.2973***	5.4515***
	(0.2430)	(0.2339)	(0.2574)	(0.2268)
Exporter-year fixed effects	Yes	Yes	Yes	Yes
Importer-year fixed effects	Yes	Yes	Yes	Yes
Bilateral fixed effects	Yes	Yes	Yes	Yes
Observations	112,540	112,540	112,540	112,540
Pseudo R-squared	0.993	0.993	0.993	0.993
Ramsey test: Prob > chi2	0.527	0.527	0.809	0.774

bit/s = bits per second, RTA = regional trade agreement.

Notes:
(i) Non-Asia = all economies outside of the Asia and Pacific region.
(ii) Numbers in parentheses are robust standard errors, clustered by economy pair: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Sources: Authors' calculations using data from WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; CATO Institute. Human Freedom Index. https://www.cato.org/human-freedom-index/2020; International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx; and United Nations Development Programme. Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi (accessed July 2021).

Table A3.3: Developing Asia Interactions

Dependent Variable:	Digitally Deliverable Services			
Developing Asia Interaction:	Mobile Broadband	Internet Bandwidth	Telecom Investment	Internet Regime
Mean years of schooling (log)	0.1096***	0.1209***	0.1208***	0.1216***
	(0.0261)	(0.0263)	(0.0264)	(0.0264)
Mobile-broadband subscriptions (log)	0.0007**	0.0015***	0.0014***	0.0015***
	(0.0004)	(0.0003)	(0.0003)	(0.0003)
International internet bandwidth per internet user (bit/s) (log)	0.0023***	0.0026***	0.0027***	0.0027***
	(0.0004)	(0.0005)	(0.0004)	(0.0004)
Investment in telecommunications, lagged (log)	0.0016***	0.0018***	0.0016***	0.0018***
	(0.0004)	(0.0004)	(0.0005)	(0.0004)
State control over the internet	0.0025***	0.0027***	0.0026***	0.0026***
	(0.0003)	(0.0003)	(0.0003)	(0.0004)
RTA dummy variable	0.0063	0.0093	0.0092	0.0106
	(0.0159)	(0.0160)	(0.0160)	(0.0163)
R: Developing Asia * Interaction Variable	0.0009***	-0.0000	-0.0004	0.0005
	(0.0003)	(0.0006)	(0.0006)	(0.0006)
P: Developing Asia * Interaction Variable	0.0010***	0.0004	0.0017***	-0.0003
	(0.0003)	(0.0006)	(0.0006)	(0.0006)
Constant	5.7392***	5.3520***	5.3438***	5.3233***
	(0.2477)	(0.2373)	(0.2566)	(0.2320)
Exporter-year fixed effects	Yes	Yes	Yes	Yes
Importer-year fixed effects	Yes	Yes	Yes	Yes
Bilateral fixed effects	Yes	Yes	Yes	Yes
Observations	112,540	112,540	112,540	112,540
Pseudo R-squared	0.993	0.993	0.993	0.993
Ramsey test: Prob > chi2	0.527	0.405	0.809	0.774

bit/s = bits per second, P = partner, R = reporter, RTA = regional trade agreement.

Note: Numbers in parentheses are robust standard errors, clustered by economy pair: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Sources: Authors' calculations using data from WTO–OECD Balanced Trade in Services Dataset (BaTIS)—BPM6. https://www.wto.org/english/res_e/statis_e/trade_datasets_e.htm; CATO Institute. Human Freedom Index. https://www.cato.org/human-freedom-index/2020; International Telecommunication Union. ICT Statistics. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx; and United Nations Development Programme. Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi (accessed July 2021).