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Growing Trade in Electronic Transmissions: Implications for the South

Abstract

Growing trade in digitizable products is posing new challenges for the South. Digitizable products are those products which are traded both in the physical form as well as 'online' i.e., downloaded from the internet, e.g., music, e-books, software etc. The online trade of digitizable products is termed as electronic transmissions. Digital technologies like 3D printing, robotics and Big Data analytics depend heavily on electronic transmissions and can therefore lead to exponential growth in this trade. This can have serious implications for the South as most of the developing countries are net importers of electronic transmissions. The paper identifies digitizable products and estimates their trade in physical form and their electronic transmissions. Impact of growing trade in electronic transmissions on tariff revenues of the governments is estimated along with its broader implications for industrialization in the South.

Key words: Electronic Transmissions, WTO Moratorium, 3D Printing, Custom Duties on E-Commerce Moratorium, Tariff Revenue Loss



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1. Introduction

With the advent of Industry 4.0 and the associated technological advancements, the scope of digital trade is expanding much faster than what anyone could have imagined two decades ago. Growing digital trade has been accompanied by a rapidly growing trade in electronic transmissions (ET), which are on-line deliveries, e.g., of music, e-books, films, softwares and video games. Trade in ET differs from cross-border e-commerce as it excludes those products which are ordered online but delivered physically. Growing digitalization is expected to give further boost to trade in ET as the core resources of digital economy like data, software and computer-aided (CAD) files used in 3D printing, need to be transmitted electronically. Most of the digital technologies like Big Data analytics, 3D printing (Remote Additive Manufacturing), Robotics, Artificial intelligence, Internet-of-Things, etc. require softwares to operate, which are increasingly leaving their physical “carriers” when they cross borders.

While 3D printing is still considered to be catering niche markets, its market has grown annually by 22% in the period 2014-2018¹. It is estimated that if current growth of investments in 3D printing continues, 50% of the manufactured goods will be ‘printed’ in 2060 and if investments in 3D printing doubles, this target will be achieved in 2040 (ING, 2017)². This will wipe out almost 40% of cross-border physical global trade. Intermediary goods will be replaced by Computer-Aided Design files (CAD-Files), which will become the central digital input to this process. These CAD-files will be electronically transmitted from one country to the other and will be used to print many of the currently manufactured products.

This growth of 3D printing is being facilitated by Big Data analytics, which helps to increase safety in 3D printing as well as minimizes its wastage. The Big Data is electronically transmitted across borders. According to Mckinsey (2016)³ “cross-border data flows now generate more economic value than traditional flows of traded goods.” These cross-border data flows, which are electronically transmitted, include textual content as well as multimedia content. According to the Report, the flows of goods and finance have lost momentum over the past two decades, while cross-border bandwidth has grown 45 times since 2005 and is projected to grow nine times in the next five years. Further, it is expected that Internet of Things (IoT) will increase the uses of 3D printing, allowing remote printing and print sharing, which will also require electronic transmissions. The Report labels this phenomenon as ‘digital globalization’.

Given these advancements in technology, the trade which can happen through ET has become ever-evolving, making it extremely difficult to define its scope. This is giving rise to new challenges in the rule-making at the global level, especially with respect to custom duties on ET in the WTO. In 1998, on the basis of a proposal submitted by the United States, WTO members adopted a Declaration on global electronic commerce, which included a two-year moratorium stating that “Members will continue their current

¹ Statista (<https://www.statista.com/statistics/796237/worldwide-forecast-growth-3d-printing-market/>)

² ING (2017), “3D printing: a threat to global trade” https://www.ing.nl/media/ING_EBZ_3d-printing_tcm162-131996.pdf

³ McKinsey (2016), “Digital Globalization: The New Era of Global Flows” Available at <http://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/digital-globalization-the-new-era-of-global-flows>.

practice of not imposing customs duties on electronic transmissions”. Since 1998, this Moratorium has been renewed every two years (except for 2003-2005 when the members failed to reach a decision in Cancun). However, because of the difficulties in limiting the scope of ET, the debate on the Moratorium on custom duties has continued without reaching any consensus. Even after twenty years of discussions in the WTO, the understanding of the scope and definition of ET remains limited and the questions that were raised in 1999 remain the same in 2018. Among other issues, three important issues which have been continuously debated are: (a) characterization of ET as goods, services, or IP? (b) revenue implications of the Moratorium; and (c) technological feasibility of levying custom duties on ET.

On characterization of ET, the debate since 1998 has focused on whether ET should be treated as ‘goods’ and be exposed to custom duties as defined under Article II of GATT 1994 or as services where GATS schedules apply? ⁴ If digitizable products are characterized as ‘goods’ and their ‘online’ trade as services, then it further complicates the debate as it implies exempting one mode of delivery from customs duties while other is continued to be taxed. Further, questions have been raised in terms of whether custom duties should be applied on the ‘content’ of the transmitted goods or just the ‘carrier’? The issue of ‘content’ being an intellectual property has also been raised.

On revenue implications, the existing literature has estimated the revenue implications of removal of custom duties on digitizable products (i.e., those products which were earlier delivered in tangible form but can now also be delivered in electronic form via internet download). However, questions have been raised on the appropriateness of estimating revenue loss based on existing custom duties on the ‘physical’ imports of digitizable products and not on their ‘online’ imports or electronic transmissions, which are the subject of the Moratorium. Some doubts have also been raised on whether it is technologically feasible to levy custom duties on ET and whether the associated costs of levying such duties, whenever technologically feasible, would be higher than the actual revenue collected?

This paper contributes to the existing literature by providing estimates of both tangible as well as intangible or ‘online’ trade in digitizable products i.e., ET, using harmonized system of codes. Trade in ET is estimated at the global and regional level as well as for the 95 identified countries in 2017. Net exports of digitizable products and the share of developed and developing countries are reported. The paper further estimates, at the global, regional and country-level, physical as well as electronic transmissions of digitizable products and the associated potential tariff revenue loss due to the Moratorium on custom duties on ET. Along with the fiscal implications of the Moratorium, the paper examines the issue of technological feasibility of imposing custom duties on ET and the associated issue of what is covered by the Moratorium, i.e., ‘carrier’ or ‘content’. Some related Agreements in the WTO like Information Technology Agreements and Decision on Custom Valuation are also discussed in the context of the Moratorium. The broader implications of the Moratorium on developing countries’ digital industrialization are examined.

⁴ Chairman’s Summary (G/C/W/158);

2. Review of Existing Literature on Implications of Moratorium on Electronic Transmissions

The existing literature on implications of a Moratorium on custom duties on ET mainly focuses on the issue of tariff revenue losses for the developing countries. This literature includes studies by Pérez-Esteve and Schuknecht (1999), Mattoo and Schuknecht (2000), UNCTAD (2000) and Mattoo, Pérez-Esteve and Schuknecht (2001), WTO (2016) and UNCTAD (2017). However, these studies agree that they capture the implications of only physical trade of digitizable products and not their ‘online’ trade, which represents ET.

According to Pérez-Esteve and Schuknecht (1999), digitizable products cover software and media products, including films, various types of printed material, video games and various recorded information on carrier media such as tapes, CDs, CD-ROMs and diskettes. World trade in these digitizable products amounted to US\$ 44 billion in 1996, which was less than 1% of total world trade. However, the study highlighted that the growth in trade of these products was much higher than growth in world trade. The average annual growth of trade for digitizable media products in the period 1990 to 1996 was 10%, i.e., 1.5 times faster than total world merchandise trade. The study further states that the average applied tariff was below 10 per cent in most countries, only Thailand, Morocco, Korea and India applied tariff rates above 20 per cent. According to the study, “total estimated tariff revenue, therefore, adds up to only about US\$ 850 million for the whole world. The EU, China and Korea are estimated to collect half of the total. No other country collects more than US\$ 100 million, and many below US\$ 10 million”.

Mattoo and Schuknecht (2000) reached a similar conclusion with respect to the revenue loss, however, they highlight that “it is important to emphasize that the estimates presented above capture only one implication of the WTO decision: the loss in actual tariff revenue if trade were to shift from physical to electronic means of trading. The estimates do not capture the loss in potential tariff revenue, i.e. the revenue that could have been raised if (i) all electronically delivered media-products were subject to duties like their physical counterparts, and (ii) all electronically delivered services were subject to duties”.

UNCTAD (2000) highlighted another aspect of this debate which pertains to ET to be treated as ‘data’. According to the study, ET are ‘digits’ transmitted over the internet, i.e., ‘data’ which have physical counterpart, e.g., books, music, video material and softwares. In the past these data were physically shipped via “carrier” media such as CDs, diskettes, tapes, etc. and therefore were subject to custom duties. However, increasingly these data are being transmitted via data files through virtual networks and then downloaded onto a carrier medium. Are these ‘data’ or ‘content’ equivalent to a hard copy of a book, catalogue or a CD or video tape and therefore need to be subject to custom duties? Further, the study raises the question whether these ‘content’ are ‘intellectual property’? For example, in the case of software it is not the value of the actual product but rather the licensing fee paid to the manufacturer.

Irrespective of the classification of ET, UNCTAD (2000) emphasizes that the technology is fast changing and leading to a rapid rise in the growth of online trade of digitizable products. Identifying a list of digitizable products, the study estimates that developed countries account for 91 per cent of global exports of digitizable products, while the

developing countries' share is only 9 per cent. Only a few developed countries largely dominate trade in digitizable products, particularly on the export side while developing countries are net importers of digitizable products. Comparing the tariff structures of digitizable products, the study finds that developing countries have higher tariffs than developed countries in all the digitizable products, with the top ten countries being, namely- Bangladesh, India, Pakistan, the Solomon Islands, Egypt, Burkina Faso, Morocco, Tunisia, Congo, and Thailand. The study finds that a moratorium on custom duties on digitizable products will lead to a much higher tariff revenue loss for developing countries, which is almost double than that of the developed countries. The ten countries most affected by fiscal losses are India, Canada, Mexico, Brazil, China, the Russian Federation, Poland, Argentina, Thailand and the EU.

UNCTAD (2000) further points out that apart from the applied tariffs, there are several duties and taxes levied on imports by all countries, which need to be taken into consideration while estimating tariff revenue loss. The results of the study show that compared to the tariff rates, the rates for additional duties are significantly higher. Custom surcharges were also found to be higher in developing countries (8.7 per cent) as compared to developed countries (6.1 per cent). Including the tariffs and custom surcharges, the results of the study show that the tariff revenue loss to the developing countries amounts to around 3 per cent of total import revenue as compared to 0.9% if only tariffs are considered. The study concludes that the fiscal losses to developing countries of a Moratorium will be much more than just tariff revenue losses as additional duties levied by almost all countries exceed tariffs, and both are lost if products are delivered digitally without custom duties.

The WTO Note (2016)⁵ was prepared on the request of the member states to provide fiscal implications of a custom moratorium. However, unlike UNCTAD (2000) the Note focuses only on the revenue losses from removal of tariff duties following the moratorium, ignoring the loss of additional duties and taxes that are levied on the digitizable products. The Note highlights that the share of digitizable goods in total trade in both developed and developing countries is less than 1 per cent of total merchandise trade and the MFN duties were on an average 6.7 per cent in 2014, as a result, the estimated tariff revenue collected from these digitizable goods is small, averaging to about a quarter of one per cent of total tariff revenue.

The Note identifies the list of digitizable products which includes cinematograph film; books, pamphlets, maps; newspapers, journals and periodicals; postcards, personal greeting message or announcement cards; other printed matter; video games; computer software; musical records, tapes and other sound or similar recordings; and other recorded media. The global imports of these products amounted to US\$ 94 billion in 2014, with imports of developing countries at US\$ 50.5 billion. However, it is highlighted that trade in digitizable products has been falling at an annual rate of -2.7% since 2000. The study also reports that the total exports of these products were US\$ 83 billion, and excluding intra-EU trade, developing countries exports stood at US\$ 52.8 billion while developed countries exports were US\$ 30.3 billion in 2014. Consequently, developed countries share in global exports of these products is estimated to be around 41%. The Note emphasizes that the average MFN duty on these products has fallen from 8.8% in 2000 to 6.7% in

⁵ WTO,2016-JOB/GC/114

2014 in developing countries, which implies a fall in the revenue loss from tariffs. However, the average tariff duty for developed countries is 0.9%, implying a much lower tariff revenue loss. The Note acknowledges that tariffs of digitizable products are still high among some countries in Africa, i.e., 21.4% for Djibouti, 16.3% for Democratic Republic of the Congo and 17.8% for members of Economic and Monetary Community of Central Africa (CEMAC).

The loss of tariff revenue, according to the Note, is estimated using actual applied rates and is found to be US\$ 756 million, of which 92% is lost by the developing countries and only 8% is the revenue loss to the developed countries. It is highlighted that this loss is a minor share of custom revenues from all imports, which is 0.26% and even lower if taken as a share in total government revenues. The share of tariff revenue from digitizable products in government revenues in developing countries is found to be 60% higher than that of developed countries.

However, the analyses undertaken in the WTO Note suffers from the following limitations:

1. A conceptual limitation of the analysis undertaken by the WTO (2016) is that although it aims at estimating the fiscal implications of the Moratorium on electronic transmissions, it does not even attempt to estimate the imports in ET or 'online' imports of digitizable products. It provides estimates of the impact of Moratorium on physical imports of digitizable products, which are not part of the Moratorium. The growing online trade of digitizable products automatically implies falling trade in their physical counterparts, e.g., growing online imports of books or music will lead to fall in their physical imports and thereby will lower the estimated revenue loss of the Moratorium on their custom duties.
2. Even with respect to the physical imports of digitizable products, although the Note asserts to have used the same list of digitizable products as previous studies, there are some important digitizable products which have been excluded. For example, while cinematographic films have been included, photographic films have been excluded, which were included in UNCTAD (2000). Global imports of these films⁶ amounted to \$ 1.2 bn in 2015, with share of developing countries in total imports being much higher than that of the developed countries.
3. Some important tariff lines of software, which are increasingly being digitalized have also been excluded. For example, HS2007- 8523.52- semi-conductor media, smart cards for the recording of sound/of other phenomena. Moratorium on custom duties on these products would imply greater tariff revenue loss for developing countries as compared to developed countries, which are mostly net exporters and have almost nil tariff duties on these products.
4. Further, the analysis of tariff revenue loss has been undertaken using actual applied tariffs rates while bound rates should be considered for estimating tariff revenue loss from the moratorium, as any Member country can increase its applied tariffs to its bound rates at any time. Also, the negotiations at the WTO are on Bound rates and not applied rates. To that extent, the results are under-estimated.
5. The Note also ignores the revenue loss which will incur from the loss of additional duties and surcharges that the countries will be unable to impose due to the

⁶ 3705.10- Photographic plates & film, exposed & developed, for offset reproduction; and 3705.90- Photographic plates & film, exposed & developed (in HS2007).

Moratorium. As pointed out by UNCTAD (2000) the additional duties and taxes levied on digitizable products were found to be on an average 23 per cent, as compared to 6.9 per cent of tariffs duties. The internal taxes like value-added and sales tax can still be levied post Moratorium, but countries will not be able to levy these additional duties and surcharges which include undefined customs fees and uplifts or taxes such as statistical taxes, stamp taxes or port taxes, which are related to the custom duties.

6. It is important to highlight that China has risen to be a large importer as well as exporter of digitizable products, so any estimations for developing countries as a group may not provide a realistic impact on developing countries. For example, according to the WTO, developing countries exports of digitizable products were higher than those of the developed countries and stood at \$52.8 billion, while developed countries exports were valued at \$30.3 billion in 2014. However, excluding China, developing countries' exports are only \$ 15.2 billion, which were half of the exports of the developed countries. The fiscal implications of moratorium therefore need to be estimated at the country-level to provide more accurate estimations.
7. According to WTO (2016)- "It is important to point out that there are likely to be significant beneficial effects from the customs moratorium as it makes possible wider adoption of e-commerce.... To the extent that e-commerce reduces the costs of market transactions, they also reduce the cost of cross-border dealings (i.e. trade costs) and therefore increase international trade and enable governments to collect more revenues". However, according to Agarwal and Fox, (2017)⁷ "it is difficult to define the location of consumption and the location of sale for digital products and imperfect enforcement capacity allows many transactions from remote vendors to effectively escape taxation because they are not taxed at origin or destination". Growth in e-commerce therefore does not necessarily imply growth in tax revenues for the Governments in developing countries. In fact, it can be argued that zero custom duties on electronic commerce, by making wider adoption of e-commerce possible, can lower government revenues. Firstly, governments lose out on custom tariffs and associated additional duties and taxes and secondly, rising cross-border e-commerce may lead to erosion of domestic market shares for domestic producers in developing countries, as they are unable to compete with better-quality products at lower costs. Given that developing countries are less competitive in selling cross-border e-commerce products as compared to developed countries (UNCTAD 2017), growth in cross-border e-commerce would imply that developing countries will give higher domestic market access to developed countries. This can further reduce the amount of internal taxes that the governments could have collected domestically if the products were sold by the domestic producers to their consumers. Taxing the super platforms is also beyond the capacity of many developing countries.
8. The Note emphasises 56 RTAs include at least one provision referring to the non-imposition of customs duties on electronic transmissions. However, these are only 27 per cent of existing RTAs (56 out of 204). The remaining 73 per cent of RTAs do not include this moratorium. Also, many of these RTAs include the language "each party shall maintain its current practice of not imposing customs duties on

⁷ Aggarwal and Fox (2017, *International Tax and Public Finance*: Volume 24, Issue 5 (2017), Pages 903-926

electronic transmissions between the parties”. If the current WTO practice changes this may become negotiable in the existing as well as in future RTAs.

Another study which estimates the revenue implications of Moratorium is UNCTAD (2017). The study emphasises that with the advent of Industry 4.0, the number of products being digitalised have increased and will substantially increase further in future, especially with the mainstreaming of 3D printing and growing use of Big Data analytics and Artificial Intelligence. Using the list of 38 digitizable products identified by UNCTAD (2000), the study estimates the impact of moratorium at the country level. The study highlights that most of the developing countries (101 countries) are net importers of digitalized products. Using SMART simulations for identified countries, the results of the study show that the imports of digitizable products will rise further in most of the developing countries making them net importers with growing tariff revenue losses. However, the moratorium will not impact the imports of the developed countries as their custom duties are already near zero. A permanent moratorium on custom duties for electronic transmissions would therefore imply that developing countries would be trading-off their future tariff revenues without even knowing what products will be digitalised in the future. However, this study also estimates the tariff revenue loss associated with the physical imports of the digitizable products and not their electronic transmissions.

The above literature review highlights the contributions as well as the limitations of the existing studies on implications of Moratorium on custom duties on ET. This study attempts to contribute to the existing literature by undertaking estimates of both physical and the electronic transmissions of digitizable products at the global, regional as well as at the country level. It estimates per annum revenue losses due to the Moratorium for 91 countries using the latest available custom duties and imports in 2017. Many unresolved issues with respect to the Moratorium are discussed and broader implications of growing trade in ET on industrialization in developing countries are examined.

3. Estimated Global Trade in Electronic Transmissions

There is a growing cyclic relationship between emerging digital technologies. For example, Big Data and 3D printing are feeding into each other’s growth. Big Data is helping companies to understand customers and use the information to 3D print customized products and in turn, 3D printing is creating visual depiction of Big Data to help organizations compare solutions and is also printing storage devices to store Big Data. As this phenomenon grows and gets support from Internet of Things and artificial intelligence, the world is likely to witness an exponential growth in digital transmissions of Computer-aided Design (CAD) files, software and Big Data to support digital technologies like 3D printing, artificial intelligence and robotics. In this scenario, it is extremely difficult to estimate the future growth of cross-border trade in ET. It will also become more and more difficult in future to distinguish between goods, e-services and data delivered via ET. This Section discusses the methodology used in the paper to estimate the physical trade of digitizable products and provides a way of estimating their ET in the period 2011-2017.

3.1 Methodology Adopted

The study adopts a three-step methodology to estimate the physical trade and ‘online’ trade or ET of digitizable products. ***In the first step the study identifies those products which are digitizable*** i.e., which were earlier traded only in physical form but with advancement in technology are increasingly being traded both in physical form as well as electronically.

49 digitizable products have been identified in the Harmonised System (Combined HS codes). The list of these 49 identified products includes those products which have been identified as digitizable products by UNCTAD (2000) and WTO (2016). These fall under the categories of Photographic films, Cinematographic films, Printed matter, Music, Media, Software and Video games. A few new products which are increasingly being digitalized due to advancing technological developments have been added. These includes ‘other games’ like Playing cards; and Smart Cards⁸. This list of 49 digitalized products at HS combined nomenclature is reported in Appendix Table A.1.

In the second step the study estimates the physical trade in each of these identified 49 digitizable products in the period 1998-2017, using the correlation tables and concordance matrices of HS HS1996, HS2007, HS2012 and HS 2017. The analysis is undertaken for each of the 49 identified digitizable products in all countries for which the data is available.

In the third step the study estimates the global ‘online’ imports or electronic transmissions of the 49 identified digitizable products. This is done by estimating what the global physical imports of digitizable products would have been without digitalization in the period 2011-2017 and what the actual global imports are with digitalization in this period. The difference between the two gives estimates of global online imports or ET in this period. The global physical imports of digitizable products in the period 2011-2017 is estimated applying the average annual growth rate of global imports of these products over the period 1998-2010. The difference between the estimated physical imports and the actual physical imports provides the estimates of ‘online’ imports i.e., ET.

This approach assumes that the imports of digitizable products in the period 2011-2017 have grown at the same rate as in the period 1998-2010. This is a very reasonable assumption and provides conservative estimates of imports of digitizable products since with technological advancement imports, via downloading, have become much easier and therefore global imports would have grown at a much higher rate. Along with the global level, the estimates of ET are also undertaken at the regional and country level based on their actual imports and estimated imports. The year 1998 is chosen depending on the availability of consistent and comparable data for larger number of countries.

While digitalization of products has been taking place since 1990s, Industry 4.0 triggered higher use of digital technologies in industrial production leading to rapid digitalization of products. This has led to fall in growth of physical imports of digitizable products and rise in their online imports. It can be argued that the Great Trade Collapse following the financial crisis of 2008 may have impacted the fall in physical imports of digitizable

⁸ Virtual Smart Cards are increasingly replacing physical Smart Cards. <https://docs.microsoft.com/en-us/windows/security/identity-protection/virtual-smart-cards/virtual-smart-card-understanding-and-evaluating>

products in the period post 2008. However, it is found that global merchandise imports increased by an average annual growth rate of 1.08 % in the period 2011-2017, while physical imports of digitizable products declined by -3.1%, indicating that the fall in physical imports of digitizable products was caused by other factors like increase in online imports than just global slowdown. Similar conclusions have been arrived at by other studies. According to Cruz et al (2017), while world trade increased by 92% (8% annual growth) during the period 2004-2012, cross-border online trade grew seven times faster and did not seem to be affected by the Great Trade Collapse. This is also corroborated by the World Trade Report (2018), which reports that because of digitalization there has been a decline in physical trade of digitizable goods (e.g. CDs, books and newspapers) from 2.7 per cent of total goods trade in 2000 to 0.8 per cent in 2016 and this trend is likely to continue with the advent of 3D printing technology.

The study uses bilateral trade data and tariff data from World Integrated Trade Solutions (WITS) database, which is published by World Bank and UNCTAD.

3.2 Estimated Global Imports of Electronic Transmissions: Results

Figure 1 reports the estimates of physical and online imports of digitizable products at the global level using average annual growth rates for the period 1998-2010. It is found that the actual physical global imports of these 49 digitizable products in 2017 were \$116 billion⁹. Using the average annual growth rates (AAGR) of physical imports in the period 1998-2010 (8%) and applying it to the period 2011-2017, the global physical imports in 2017 is estimated at \$255 billion. The difference between the estimated physical global imports and the actual physical global imports gives an estimate of the 'online' global imports. The 'online' global imports or **ET is estimated to be \$139 billion using average annual growth rate of 1998-2010**. This implies that 55% of global imports of the identified digitizable products are electronic transmissions, which escape custom duties, while 45% are physical imports. If the total imports of digitizable products continue to grow at the same rate as in the period 1998-2010 then by 2026 the market for digitizable products is estimated to be around half a trillion dollars, i.e., \$ 507 billion.

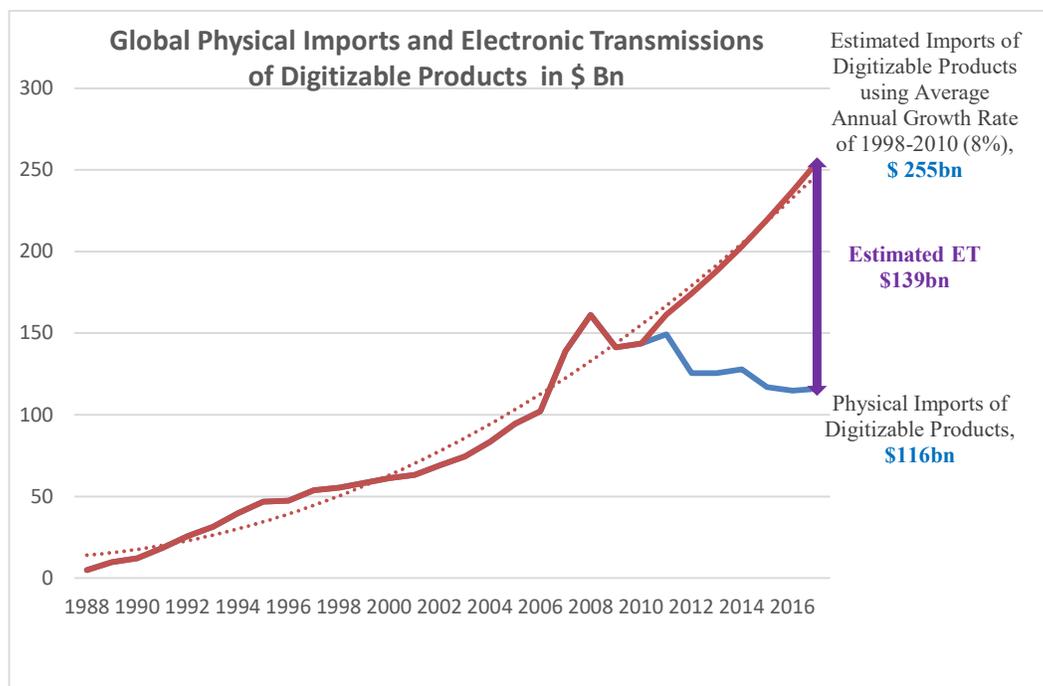
As pointed out earlier, these are conservative estimates of ET since given the ease of downloading electronically, growth of imports via ET would be much higher than their physical imports. To illustrate this, growth rates of global revenues of some of the providers of ET are considered. It is estimated that in the period 2011-2017, the global revenue of Netflix (films) grew on an average by 37% annually; music streaming by 50%; e-books by 44%; video games by 10%; and global revenue of Microsoft by 10%¹⁰. While these are global revenues and do not differentiate between domestic revenue and revenue from international trade, Amazon's revenue from international markets grew on an average by 28% per annum in the period 2010-2016¹¹. These figures also do not capture the extent of piracy that takes place in eBooks, music, films and video games.

⁹ In 2014, the global imports of digitizable products was \$128 billion compared to \$ 94 billion as estimated by WTO (2016).

¹⁰ Sources: Statista, <https://www.statista.com/statistics/587216/music-streaming-revenue/>; <https://www.macrotrends.net/stocks/charts/NFLX/netflix/revenue>; <https://www.macrotrends.net/stocks/charts/MSFT/microsoft/revenue>; <https://lpsports.com/e-sports-news/the-video-games-industry-is-bigger-than-hollywood>

¹¹ Source: Amazon Inc., annual reports. Analysis by RWCC. Also available at <https://www.buchmesse.de/files/media/pdf/whitepaper-the-business-of-books-frankfurter-buchmesse.pdf>

Figure 1: Global Physical Imports and Electronic Transmissions (Online Imports) of Digitizable Products: 1998-2017



Source: Author's estimates based on World Integrated Trade Solutions (WITS).

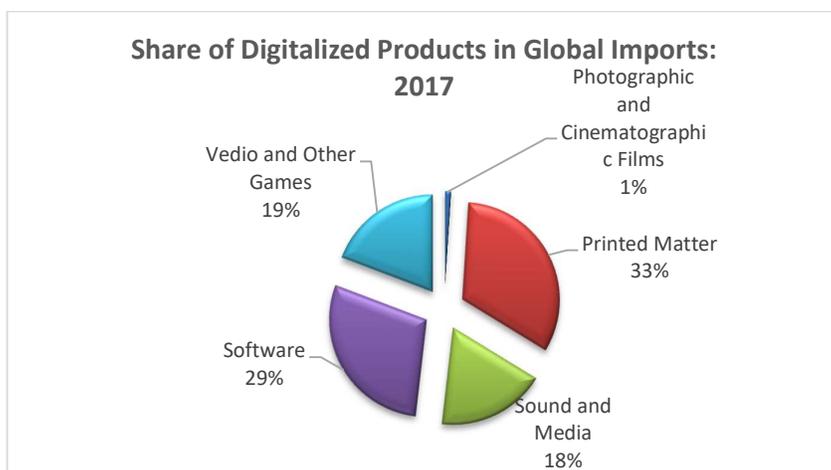
Table 1 reports the estimated 'online' global imports of digitizable products in the period 2011-2017 using average annual growth rates for the period 1998-2010. It is found that the estimated 'online' global imports have grown much faster than physical global imports over the years. In 2011, the 'online' global imports were found to be around 7% of total imports, which grew to 55% in 2017. Alternatively, if average annual growth rate of global imports of digitizable products for a longer period is used, i.e., 1990-2010 (which is 15%), the online global imports are estimated to be 70% of the global physical imports in 2017. The study therefore uses the most conservative estimates.

Table 1: Percentage of 'Online' Global Imports or ET of Digitizable Products

	Physical Imports of Digitizable Products (\$Bn)	Estimated Total Imports of Digitizable Products using Average Annual Growth of 1998-2010 (\$Bn)	Estimated Online Imports or Electronic Transmissions using Average Annual Growth of 1998-2010 (\$Bn)	Percentage of 'online' imports or ET in Total Imports of Digitizable Products
2011	149	161	12	7
2012	126	174	48	28
2013	126	188	62	33
2014	128	203	75	37
2015	117	219	102	46
2016	115	236	121	51
2017	116	255	139	55%

Source: Author's estimates based on World Integrated Trade Solutions (WITS).

Disaggregating global imports of digitizable products in 2017 into different categories shows that actual physical global imports of digitizable products in 2017 was highest for Software (29%), followed by Printed matter and Video & other games; Sound and Media; and Films (Figure 2).

Figure 2: Share of Digitizable Products in Global Imports: 2017

Source: World Integrated Trade Solutions (WITS).

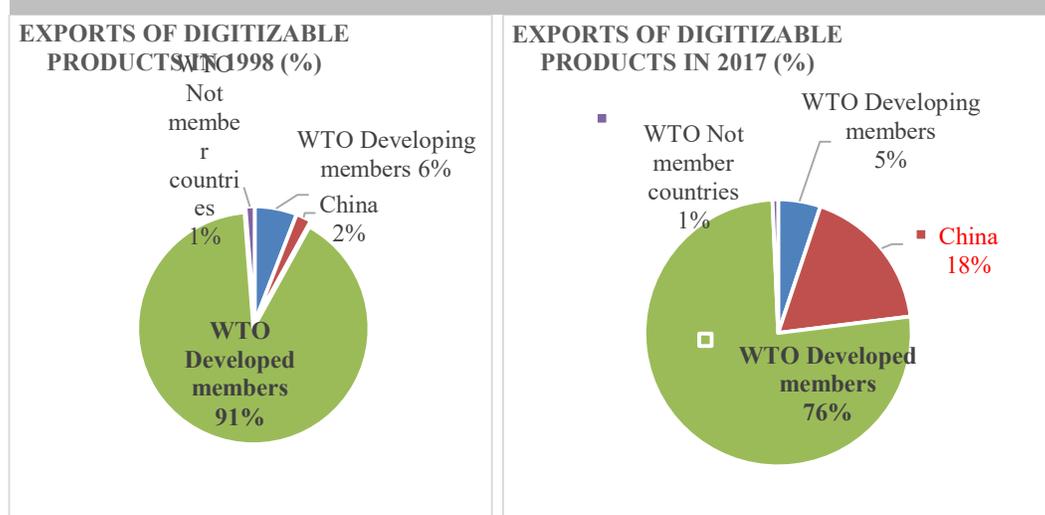
4. Country-Wise Results of Trade in Electronic Transmissions

This Section presents the results at the aggregated level as well as at the country-level of physical trade in digitizable products and estimated ET in 2017, using the average annual growth rate of physical imports in the period 1998-2010. This period is used since comparable data for a larger number of countries is available for this period.

4.1 Actual Physical Imports of Digitizable Products

The analysis with respect to trade in digitizable products in physical form is carried out at the aggregate level and at the country-level. The results show that in 1998, the share of WTO High Income members (as defined by WITS) in global exports of digitizable products was 91%, while the share of WTO developing members was 8% with China's share being 2%. In 2017, share of developed countries in global exports of digitizable products declined from 91% to 76% with share of China rising from 2% to 18% and the share of developing countries (except China) declined from 6% to 5% (Figure 3).

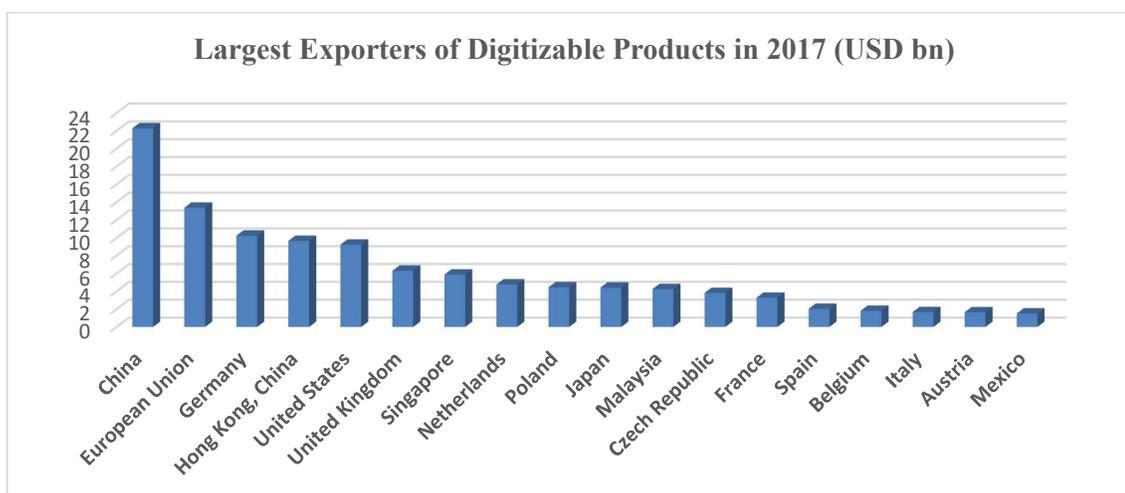
Figure 3: Share in Exports of Digitizable Products: 1998 and 2017



Source: World Integrated Trade Solutions (WITS).

Due to the dramatic rise in China's share, China has become the biggest exporter of digitizable products in 2017, followed by Germany, Hong Kong China, USA and Singapore. European Union also has higher exports of digitizable products as compared to USA (Figure 4).

Figure 4: Largest Exporters of Digitizable Products in 2017



Source: World Integrated Trade Solutions (WITS).

Table 2 reports the net physical exports of digitizable products in 95 developing countries in 2017. It is seen that out of 95 developing countries, 86 developing countries were net importers of physical digitizable products in 2017, with top three net importers being Thailand (\$1.8 billion) followed by India (\$1.7 billion) and Mexico (\$1.1 billion). Net exporters of Digitizable products with net exports higher than \$100 million include China, Singapore, Malaysia, Hong Kong China, and UAE.

Table 2: Net Exports of Physical Digitizable Products in 2017: Developing Countries

S.No	Developing Countries	Net Exports of Digitizable Products in 2017 (\$ Mn)	S.No	Developing Countries	Net Exports of Digitizable Products in 2017 (\$Mn)
1	Thailand	-1 866	48	Senegal	-31
2	India	-1 774	49	Macedonia, FYR	-29
3	Mexico	-1 101	50	Honduras	-28
4	South Africa	-693	51	Botswana	-27
5	Indonesia	-484	52	Tanzania	-27
6	Paraguay	-332	53	Rwanda	-26
7	Turkey	-317	54	Azerbaijan	-26
8	Peru	-297	55	Zimbabwe	-24
9	Portugal	-293	56	Belarus	-23
10	Vietnam	-290	57	Lebanon	-21
11	Russian Federation	-253	58	Nepal	-21
12	Macao	-247	59	Occ.Pal.Terr	-19

13	Ghana	-244	60	Fiji	-19
14	Pakistan	-225	61	Kyrgyz Republic	-18
15	Kuwait	-218	62	Montenegro	-18
16	Brazil	-211	63	Moldova	-17
17	Colombia	-199	64	Congo, Rep.	-16
18	Romania	-198	65	Maldives	-16
19	Kazakhstan	-178	66	Albania	-15
20	Nigeria	-177	67	Bosnia and Herzegovina	-14
21	Guatemala	-173	68	Burundi	-14
22	Morocco	-153	69	Brunei	-13
23	Dominican Republic	-146	70	Burkina Faso	-12
24	Algeria	-128	71	Tunisia	-11
25	Egypt, Arab Rep.	-99	72	Armenia	-11
26	Cambodia	-98	73	Mali	-11
27	Ecuador	-97	74	Solomon Islands	-10
28	Costa Rica	-90	75	Togo	-10
29	Bermuda	-88	76	Belize	-9
30	Nicaragua	-81	77	Mauritius	-7
31	Jordan	-73	78	Niger	-7
32	Oman	-71	79	Serbia, FR(Serbia/Montenegro)	-6
33	Bahrain	-66	80	Benin	-6
34	Sudan	-65	81	St. Lucia	-6
35	El Salvador	-64	82	Mauritania	-3
36	Bolivia	-62	83	Lao PDR	-3
37	Croatia	-60	84	Samoa	-2
38	Kenya	-59	85	Palau	-1
39	Uruguay	-52	86	Kiribati	-0.65
40	Namibia	-49	87	Panama	3
41	Madagascar	-49	88	Ukraine	17
42	Jamaica	-49	89	Bulgaria	62
43	Myanmar	-47	90	Zambia	64
44	Uganda	-45	91	United Arab Emirates	394
45	Cameroon	-41	92	Hong Kong, China	735
46	Sri Lanka	-35	93	Malaysia	3 274
47	Mongolia	-31	94	Singapore	3 863
			95	China	15 655

Source: World Integrated Trade Solutions (WITS).

4.2 Electronic Transmissions or Online Trade in Digitizable Products

Following the above discussed methodology, Appendix Table A.2 reports the actual physical imports of digitizable products, the estimated ET (using average annual growth rate of 1998-2010) and the total imports of digitizable products, i.e., physical and online imports of digitizable products for 91 countries in 2017. The results show that the imports via ET of digitizable products is highest for China among developing countries followed by Singapore, Mexico, Thailand and India. Thus, although China is the highest exporter of physical digitizable products, it is also one of the biggest importers of ET.

5. Moratorium and Estimated Tariff Revenue Loss of Developing Countries

The fall in the physical global imports of digitizable products over the years indicates that with the advancement of technology more and more trade in these products is being transferred to 'online' trade. It is much simpler to download an e-book or music from the internet than import these digitizable products in physical form. However, fall in physical imports of digitizable products also implies that the tariff revenues of the governments in developing countries is falling to that extent, which is not being compensated by rising imports of these products through electronic transmissions due to the Moratorium on custom duties on ET. For any indication of the fiscal implications of the moratorium for the developing countries, it therefore becomes important to estimate the extent of physical as well as 'online' imports of these digitizable products and their associated tariffs. This section presents the results of potential tariff revenue loss of Moratorium on ET at the aggregated level and at the country-level.

5.1 Tariff Revenue Loss: Aggregate Level

Table 3 reports the actual physical imports of digitizable products, the estimated ET and associated average Bound Tariffs and average MFN Tariffs for WTO Developing members (59) excluding LDCs; WTO LDC members (31); WTO High-Income countries (21); Sub-Saharan Africa; and Middle East and North Africa. The simple averages of Bound and MFN duties are 12.6% and 6.5% for WTO developing countries while they are much higher for WTO LDCs and Sub-Saharan African countries as a group. The WTO High-Income countries have the lowest duties at 0.02%.

Following the Moratorium on custom duties of ET, the potential tariff revenue loss is estimated at the aggregate level in 2017. The physical imports and imports via ET of digitizable products are reported. The results presented in Table 3 show that using Bound rates, the potential tariff revenue loss to developing countries is estimated at \$10 billion. Tariff revenue loss to WTO LDCs is estimated at \$1.5 billion while African countries loss is around \$ 2.6 billion. Using average MFN applied rate, the potential tariff revenue loss of a Moratorium on ET is estimated \$5.1 billion for developing countries. WTO high-income countries will experience a tariff revenue loss of \$289 million. It is interesting to note that the potential tariff revenue loss to Sub-Saharan African countries is twice that of the WTO High Income countries. Potential tariff revenue loss for the WTO LDC member countries is also found to be higher than that of the developed countries. Using Bound rates, WTO LDCs can generate five times more tariff revenue than the developed countries. It should be noted that the estimated potential tariff revenue losses do not

include the revenue losses accruing from loss of custom surcharges and additional duties, which according to UNCTAD (2000) were on an average 20% as compared to average tariffs of 7.7%.

Table 3: Estimated Per Annum Tariff Revenue Loss due to Moratorium on ET

	Physical Imports of Digitizable Products (\$Mn)	Estimated On-Line Imports or ET of Digitizable Products (\$Mn)	Estimated Total Imports of Digitizable Products (\$Mn)	Simple Average of Bound Duties in 2017 (%)	Simple Average of MFN Duties in 2017 (%)	Potential Tariff Revenue Loss using Average Bound Duties (\$Mn)	Potential Tariff Revenue Loss using Average MFN Duties (\$Mn)
WTO Developing members (excluding LDCs)	28 399	51 558	79 957	12.6	6.5	10 075	5 197
WTO High-Income	81 604	62 962	144 566	0.2	0.2	289	289
Sub-Saharan Africa	1195	4474	5669	46.4	10.9	2 630	618
Middle East - North Africa	1 011	4 360	5 371	18.9	8.43	1 015	453
WTO LDC members (31)	191	2 804	2 995	50.3	11.5	1 506	344

Source: Author's estimates based on World Integrated Trade Solutions (WITS).

Note: List of countries in the aggregated groups is provided in Annex Table A.5

5.2 Tariff Revenue Loss: Country - Level

Similar exercise is undertaken for 91 countries for the year 2017. The physical imports and estimated ET of digitizable products for these countries are reported in Appendix Table A.2. It is found that using conservative estimates (i.e., using average annual growth rate for the period 1998-2010 for each country), around 50% of total imports of digitizable products are ET.

Appendix Table A.3 reports the average Bound Duties, average MFN Duties and average Effectively Applied Duties (the lowest available tariff which takes into account the preferential duties) for digitizable products for 91 countries, including EU. It is found that 14 countries have average Bound duties higher than 20%. Average Bound duties are as high as 92% in Rwanda, followed by Nigeria (80%), Pakistan (62%), Jamaica (50%), Malawi (45%) and Tunisia and Guatemala (40%), while average Bound tariffs on Digitizable products is 0.09% in EU countries, followed by USA (0.02%) and Switzerland (0%).

The estimates of potential tariff revenue losses of Moratorium are reported using three types of custom duties, i.e., Bound tariffs, MFN Applied tariffs and Effectively Applied tariffs in 2017. It is important to note that any potential revenue losses should be estimated using Bound tariffs as any Member country can raise its tariffs to the Bound rates at any time. WTO tariff negotiations are also based on the Bound tariffs. Some countries have signed ITA and other trade agreements which may not allow them to impose duties on some of the digitizable products, especially in the software category. Effectively Applied

tariffs consider all such preferential tariffs offered by the countries in different FTAs including Information Technology Agreements and reports the lowest applied tariff by the country. However, as discussed earlier, not many developing countries have signed FTAs which cover electronic transmissions. Further, ITAs covers very few digitizable products¹².

Potential tariff revenue loss from the Moratorium is estimated assuming that countries apply the same custom duties on ET as on their physical imports. In case of ET, according to the current practice, countries do not apply any custom duties. This revenue loss can therefore be considered as a potential source of revenue generation for the countries, if they begin applying custom duties on ET. Table 3 column (1) reports the potential tariff revenue loss on physical imports of digitizable products using Bound duties in 58 developing countries in 2017. The total potential tariff revenue loss on physical imports of digitizable products amounts to \$ 3.5 billion. Table 4 column (1) reports the corresponding potential tariff revenue loss on physical imports of digitizable products in 33 developed countries, which amounts to \$108 million.

The estimated potential tariff revenue loss from Moratorium on ET for developing countries is reported in column (2) of Table 4. This is estimated using the average Bound tariffs on ET. The results show that tariff revenue loss to developing countries is of \$ 4.4 billion per annum. Tariff revenue loss from ET is therefore 1.2 times the amount of tariff revenue loss from physical imports of digitizable products. Conversely, this tariff revenue loss can be considered as the tariff revenue which can be generated if the Moratorium is removed. This is a source of revenue which will grow in the coming years as more and more products are digitized due to digital revolution.

The top five countries which will face the maximum tariff revenue loss from the Moratorium using Bound rates are Mexico followed by Thailand, Nigeria, India, China and Pakistan. Using MFN applied duties, the potential tariff revenue loss is found to be highest for India followed by China, Thailand, Mexico and Paraguay. **The total potential tariff revenue loss (including physical imports and ET) for the identified developing countries of Moratorium will therefore be \$ 8 billion. The corresponding loss of revenue for the developed countries is \$212 million¹³**

Alternatively, if average MFN duties are used, the potential tariff revenue loss is estimated to be \$3.4 billion. If Effectively Applied Duties are considered in place of MFN duties, the potential tariff revenue loss amounts to \$ 2.7 billion. Correspondingly, the tariff revenue loss for developed countries amounts to \$ 212 million and \$ 123 million respectively (Table 5).

Tariff revenue loss of moratorium on custom duties on physical imports of digitizable products for developing countries is 30 times more than that for the developed countries. While developing countries can generate 40 times more revenue by imposing custom

¹² In terms of the digitizable products identified by this study, four tariff lines are included in ITA –under software - 852351, 852352, 852359 and under sound and media-852380

¹³ These figures are lower than those estimated at the aggregate level as latest available data are used at the country level. For some countries, data on trade and tariff used are for 2016/2015. At the aggregate level, average duties in 2017 are used.

duties on ET as compared to the developed countries, many of which have almost zero bound duties on physical imports of digitizable products. Even by using effectively applied duties, the tariff revenue loss for developing countries is 20 times more than that of the developed world. The estimates show that 95% of world's total tariff revenue loss due to Moratorium using Effectively Applied Duties will be borne by the developing countries.

Table 4: Tariff Revenue Loss from Moratorium on Custom Duties on ET in Developing countries

		Potential Tariff Revenue Loss on Physical Imports of Digitizable Products using Bound Duties (USD 1000)	Potential Tariff Revenue Loss on Electronic Transmissions (ET) using Bound Duties (USD 1000)	Total Tariff Revenue Loss from Moratorium using Bound Duties (USD 1000)	Total Tariff Revenue Loss from Moratorium using MFN Duties (USD 1000)	Total Tariff Revenue Loss from Moratorium using Effectively Applied Duties (USD 1000)
1	Albania	21	263	283	283	0
2	Algeria	30 312	49 012	79 324	79 324	47 926
3	Argentina	151 440	34 801	186 241	56 636	50 461
4	Armenia	453	534	986	986	942
5	Belarus	3 250	14 822	18 073	18 073	16 114
6	Bolivia	6 323	5 244	11 567	11 567	10 867
7	Brazil	40 134	69 356	109 489	109 489	106 943
8	Cambodia	21 875	6 509	28 384	14 905	11 062
9	Chile	28 746	20 673	49 419	49 419	9 024
10	China	147 702	345 296	492 999	492 999	453 205
11	Colombia	23 039	11 666	34 705	34 705	25 605
12	Congo, Rep.	1 944	52 167	54 111	54 111	53 012
13	Cote d'Ivoire	8 077	3 414	11 491	11 491	11 307
14	Dominican Republic	14 167	4 442	18 609	18 609	14 627
15	Ecuador	25 978	7 786	33 764	19 266	15 942
16	El Salvador	3 642	1 028	4 669	4 669	3 334
17	Ethiopia(excludes Eritrea)	2 919	5 091	8 010	8 010	7 590
18	Fiji	41 256	71 852	113 108	113 108	105 939
19	French Polynesia	1 994	1 127	3 121	3 121	2 336
20	Guatemala	114 734	45 747	160 480	24 680	15 816
21	Honduras	19 777	20 326	40 103	8 724	5 972
22	India	173 757	323 432	497 189	497 189	467 476
23	Indonesia	26 378	27 765	54 143	54 143	40 607
24	Jamaica	51 597	27 806	79 403	13 006	17 786

25	Jordan	11 882	19 933	31 815	31 815	10 517
26	Kazakhstan	7 119	47 849	54 968	54 968	48 401
27	Korea, Rep.	28 041	118 266	146 307	146 307	49 689
28	Kyrgyz Republic	766	187	953	953	688
29	Macedonia, FYR	541	1 564	2 105	2 105	1 528
30	Madagascar	7 414	5 991	13 405	13 405	5 419
31	Malawi	57 876	40 124	98 000	20 384	12 871
32	Maldives	259	22	280	280	0
33	Mauritius	521	337	858	858	668
34	Mexico	893 927	971 809	1 865 737	311 502	123 291
35	Nicaragua	4 311	1 860	6 172	6 172	4 341
36	Niger	1 139	245	1 385	1 385	1 370
37	Nigeria	489 046	91 872	580 917	85 831	85 758
38	Pakistan	278 091	89 149	367 240	51 043	48 880
39	Panama	48 846	122 984	171 830	46 586	50 675
40	Paraguay	28 878	232 022	260 900	260 900	223 413
41	Peru	12 162	3 922	16 084	16 084	8 113
42	Russian Federation	40 283	72 938	113 221	113 221	102 345
43	Rwanda	30 235	39 774	70 009	8 486	8 350
44	Saudi Arabia	22 868	16 038	38 906	38 906	33 779
45	Senegal	7 889	2 586	10 475	10 475	10 466
46	Serbia, FR(Serbia/Montenegro)	7 004	15 809	22 813	22 813	11 406
47	Singapore	16 660	13 924	30 584	0	0
48	South Africa	23 755	13 074	36 829	36 829	24 962
49	Sri Lanka	7 717	2 299	10 017	10 017	9 260
50	Tanzania	4 018	7 334	11 352	11 352	11 091
51	Thailand	498 328	1 246 614	1 744 942	365 220	300 770
52	Togo	1 723	2 842	4 565	4 565	4 497
53	Tunisia	48 332	98 082	146 414	21 868	28 010
54	Turkey	1 994	3 167	5 161	5 161	2 520
55	Uganda	6 598	10 809	17 408	17 408	17 100
56	Uruguay	5 652	1 175	6 827	6 827	6 364
57	Vietnam	44 998	6 590	51 588	46 463	39 874
58	Zimbabwe	7 353	6 820	14 173	14 173	8 166
		3 585 741	4 458 170	8 043 911	3 482 875	2 788 475

Source: Author's estimates based on World Integrated Trade Solutions (WITS).

Note: Latest available tariffs and trade data have been used. MNF applied tariffs are used for countries where Bound duties were not available.

Table 5: Tariff Revenue Loss from Moratorium on Custom Duties on ET in Developed countries

		Potential Tariff Revenue Loss using Bound Duties on Physical Imports of Digitizable Products (USD 1000)	Potential Tariff Revenue Generation from Imports via Electronic Transmissions (ET) using Bound Duties (USD 1000)	Total Tariff Revenue Loss from Moratorium using Bound Duties	Total Tariff Revenue Loss from Moratorium using MFN Duties (USD 1000)	Total Tariff Revenue Loss from Moratorium using Effectively Applied Duties (USD 1000)
		(1)	(2)	(3)	(4)	(5)
1	Australia	37 813	40 094	77 907	77 907	70 327
2	Austria	1 925	2 316	4 241	4 241	1 885
3	Belgium	1 722	979	2 701	2 701	1 200
4	Bulgaria	153	90	242	242	108
5	Canada	18 375	19 398	37 772	37 772	9 443
6	Croatia	167	47	214	214	95
7	Cyprus	37	69	106	106	47
8	Czech Republic	2 426	852	3 278	3 278	1 457
9	Denmark	978	914	1 892	1 892	841
10	Estonia	125	62	188	188	83
11	Finland	176	368	544	544	242
12	France	4 803	3 332	8 135	8 135	3 616
13	Germany	7 955	5 697	13 653	13 653	6 068
14	Greece	343	264	607	607	270
15	Hungary	622	391	1 013	1 013	450
16	Ireland	910	274	1 184	1 184	526
17	Italy	1 903	2 352	4 255	4 255	1 891
18	Japan	4 866	5 116	9 982	9 982	6 987
19	Latvia	82	4	86	86	38
20	Luxembourg	146	238	384	384	171
21	Malta	46	7	53	53	24
22	Netherlands	3 649	4 950	8 599	8 599	3 822
23	New Zealand	3 425	4 171	7 596	7 596	4 683
24	Norway	724	949	1 673	1 673	744
25	Portugal	385	482	867	867	385
26	Romania	366	885	1 251	1 251	556
27	Slovak Republic	449	237	685	685	305
28	Slovenia	152	172	325	325	144

29	Spain	2 566	868	3 434	3 434	1 526
30	Sweden	996	1 125	2 121	2 121	943
31	Switzerland	0	0	0	0	0
32	United Kingdom	5 926	5 136	11 062	11 062	4 917
33	United States	4 610	1 583	6 193	6 193	0
		108 821	103 422	212 243	212 243	123 794

Source: Author's estimates based on World Integrated Trade Solutions (WITS).

5.3 Custom Surcharges and Additional Duties

Custom tariffs and other additional duties are an important source of revenue for developing countries. 20 countries report the share of custom and other duties as high as 10% or above. The share is as high as 67% in Kuwait followed by The Bahamas (38%) and Jamaica (35%) (Table 6). Rising digitalization of products and shift of imports from physical imports to 'online' imports with moratorium on ET can have serious implications on government budgets, especially in these countries.

Table 6: Customs tariffs and other import duties (% of tax revenue): 2017/2016

S. No	Country Name	Customs and other import duties (% of tax revenue)
1	Kuwait	67
2	Bahamas, The	38
3	Jamaica	35
4	Bangladesh	28
5	Micronesia, Fed. Sts.	25
6	Sri Lanka	25
7	Togo	20
8	Philippines	20
9	Solomon Islands	20
10	Nepal	20
11	Kyrgyz Republic	17
12	Cambodia	16
13	Burkina Faso	15

Source: World Development Indicators, World Bank

Custom tariffs are mostly accompanied by other duties and surcharges on imported products. There are two types of additional duties levied on imported products, i.e., (i) custom surcharges that are levied only on imports and (ii) internal taxes that are levied on imports as well as domestic products. Importers are expected to pay both types of additional duties. Custom surcharges are levies added to the normal custom duties and consist of mixture of duties including tax on foreign exchange transaction, stamp tax, import license fee, consular invoice fee, statistical tax, tax on transport facilities, port tax and additional taxes (not else specified include various taxes such as taxes for special funds, municipal taxes, registration fees on imported motor vehicles, customs formality

taxes, etc.). These are levied on the import value of the product (either f.o.b value or c.i.f value).

Each country has its own regulations with respect to these additional custom duties. Digitalization and moratorium on custom duties of ET would include loss of revenue from these custom surcharges and additional duties as well. Internal taxes which are also levied on imported products include general sales taxes; the turnover tax; or multiple sales tax; and value added tax (VAT). The excise tax levied on imports is equivalent of excise tax levied on domestic products. While Moratorium may not impact internal taxes on digitizable products, the countries will still need to record the imports of digitizable products to levy internal taxes. It is also important to note internal taxes on ET importers provide a level playing field to the domestic producers, who must pay these taxes.

The tariff revenue losses estimated are underestimated to the extent that they do not cover custom surcharges and additional duties, which developing countries will also lose due to the Moratorium. According to UNCTAD (2000), the additional duties and taxes levied on digitizable products in 120 countries were found to be much higher than the tariffs on digitizable products, i.e., they amounted to 23 % on an average compared to the average 6.9% for the tariffs. Custom surcharges in developing countries are found to be on an average around 8.7%. Each country therefore needs to estimate its tariff revenue loss from the Moratorium by adding to the estimated revenue loss, the loss of custom surcharges and additional duties that it levies along with custom duties on the imported products.

5.4 Technical Feasibility of Levying Custom Duties on ET

ET are intangible imports and currently all intangible imports in most of the countries enter without any custom duties or tariffs. However, technological advancement has made it possible to apply taxes and tariffs to intangible imports. As more and more products get digitalized, if governments want to retain their tariff revenues, it will be important for them to initiate tariffs on digital products and services. This Section shares some examples of countries where taxes and tariffs are being collected from intangible imports, which shows that it is technically feasible to impose custom duties and additional taxes on ET.

New laws have been framed to tax imports of digital products and services in Australia and New Zealand. In July 2017, the Australian government introduced GST on imports of digital products and services¹⁴. Under this law, supplies to Australian consumers of digital products and services from non-Australian suppliers are to be charged Goods and Services Tax, provided these supplies are above 75,000 Australian Dollar. This includes supplies from non-Australian electronic distribution platforms. This implies that all non-Australian suppliers (of digital products or services) have to register for GST electronically, via a simplified registration regime. From 2018 onwards, these apply to B2C as well as B2B businesses.

New Zealand changed its GST law in 2016¹⁵. Under this law all supplies of remote services and intangibles carried out by suppliers outside New Zealand are subjected to GST. Suppliers outside New Zealand need to register for GST if the total value of supplies

¹⁴ Australia, *A New Tax System (Goods and Services Tax) Act 1999*, Division 9-25

¹⁵ New Zealand, *Taxation (Residential Land Withholding Tax, GST on Online Services, and Student Loans) Act 2016*

exceeds 60,000 NZ Dollar. But unlike Australia, GST is imposed only on B2C businesses while like Australia electronic platforms are also liable to pay GST.

EU has also initiated a two-stage process for taxing the intangible imports of goods and services (mainly online) from outside EU. The first stage was implemented in 2015 where VAT obligations covered all companies outside EU carrying out cross-border online sales of goods and services to final consumers within EU, in line with the principle of taxation in the Member State of destination. The second stage will enter into force in 2021 which is known as ‘VAT e-commerce package’.¹⁶

The technological feasibility of levying tariffs and additional duties on intangible imports, including digital products and services, has encouraged countries to impose custom duties on ET to generate additional revenue. Indonesian government amended its law¹⁷ in 2018 bringing electronic transmission into the ambit of custom duties¹⁸. Regulation 17 became effective from March 2018 which provided a new Chapter 99 covering intangible goods (i.e., software and other digital products) that were previously not covered under Indonesia’s tariff system.

In 2017, India also initiated compulsory registration under GST for foreign companies providing Online Information Database Access and Retrieval services (OIDAR services) irrespective of their size or value of the services being supplied and also applies OADR on cross border electronic transactions.

The number of countries which are now bringing electronic transmissions under their tax regime is growing. If the Moratorium is removed, countries need to first have a law/regulation in place; decide the entity who will be liable to pay the duties and taxes; and then impose the custom duties and other indirect taxes on electronic transmissions in order to generate revenue. More importantly, such taxes are applied to give a level playing field to domestic sellers who have to pay taxes like VAT and GST. It can be argued that the Moratorium on ET does not stop countries from levying internal taxes like GST and VAT, however given the fast growth in ET and rising product digitalization aided by new technologies, online imports can provide new source of tax revenue for the governments and make it easier for the governments to link direct and indirect taxes.

6. Moratorium on “Carrier” or “Content”?

At the heart of the digital revolution lies the rising use of software in manufacturing and selling products. Use of softwares is rising in all stages of production, i.e., from pre-production stage (use of software in Big data analytics) to production stage (computer aided manufacturing, higher use of software in robots and artificial intelligence) and post production stage (e-commerce and software maintenance support). Software is also an enabler for the growth of 3D printing. Digitalization is therefore being accompanied by high growth in cross-border trade in software via ET, both as a digital product and a digital

¹⁶ https://ec.europa.eu/taxation_customs/business/vat/digital-single-market-modernising-vat-cross-border-e-commerce_en

¹⁷ Regulation No. 17/PMK.010/2018 on the Second Amendment of Regulation No. 6/PMK.010/2017 on Stipulation of Goods Classification System and Import Duty on Imported Goods (Regulation 17).

¹⁸ <https://www.thejakartapost.com/academia/2018/01/10/welcoming-import-duties-on-intangible-goods.html>

service This growth in software trade will intensify as ‘mass production’ gives way to ‘customized production’ bringing 3D printing into mainstream manufacturing and as Big Data analytics becomes necessary for business operations.

Growth in cross border trade in software will have to be supported by high volume of cross border data flows. According to EY (2016) world’s total digital data volume is doubling every two years. This data will need to cross borders many times along with the softwares to build efficient solutions using artificial intelligence. As the trade in ET grows with progressing digitalization, the implications of Moratorium will increase in importance. The implications of the Moratorium will go much beyond loss of tariff revenue. With no custom duties on the imports of software, which will be increasingly used in almost all manufacturing industries, the dependence of manufacturing sectors in developing countries on imported softwares from the developed countries can considerably increase. The foremost question to be addressed is- if the Moratorium is made permanent then in future will the countries be able to regulate the extent and kind of imports of software into their countries or not? This brings to the forefront the issue of whether the Moratorium on custom duties on ET covers the “carrier” of the software or the “software” itself, i.e., just the carrier or the content of the carrier as well.

The debate on the “carrier” or “content” is closely related to the debate on whether the digital content that is not fixed on carrier medium should be classified as a ‘good’ or a ‘service’. For example, should music on the CD be classified as a good or a service? Same applies to the software in CDs and other carriers. The fact that music and software can be sent electronically implies that the carrier remains the good but the music and software in it are intangibles and therefore similar to services. Films and books also fall in this category as they can be transmitted electronically, distinguishing them from their carriers.

There has been a stalemate in the WTO on the issue of whether ‘digital content’ should be treated as a good and its trade be disciplined under the GATT or should it be considered as a service and therefore be disciplined under GATS. US has been the primary advocate of the position that digital content should be treated as goods and its trade be disciplined under GATT. To clarify its stand on the issue, in 2005 USA suggested replacing the term “electronic transmissions” with the term “products that are transmitted electronically” and it emphasized ensuring liberalized trade treatment of electronically delivered software¹⁹. USA has been the founder of the idea of continuing the existing practice of not imposing custom duties on electronic transmissions.

EU, on the other hand, has advocated for categorizing electronic transmissions as services, to be disciplined under services commitments of countries under GATS²⁰. According to EC, many services earlier needed physical support to allow transmissions to the customers, e.g., architecture designs or a health reports like x-rays, but now these services can be transmitted without a physical support and therefore electronic transmissions should be classified as services. They further argue that GATT has been designed only for physical products. EC emphasizes that the definition of software is “sets of instructions required to make computers work and communicate” and since consumers have a choice of using readymade programs off the shelf or using specifically developed programs, so these

¹⁹ WT/GC/W/556

²⁰ WTO Work Programme on Electronic Commerce – Classification Issue- Submissions from the European Communities (WT/GC/W/497)

transmissions should be covered under “software implementation services” under GATS which encompasses production, distribution, marketing, sale and delivery of a service.

Another issue added to this debate is the inconsistency of the Moratorium with the principle of ‘technological neutrality’ as ‘digital content’ are treated differently if delivered using different technologies, i.e., they are subjected to custom duties if they are delivered physically but have no custom duties if delivered electronically. This puts the physical trade of these digitizable products at a disadvantage, which is against the principles of technological neutrality.

The debate on classification of digital content as goods or services has been further complicated by some arguing that digital content is neither good nor a service but ‘ideas and content’ which are protected under intellectual property rights²¹. It is argued that when digital content crosses border, the program itself remains in the possession of the intellectual proprietor but the buyer has the limited license to use the program or the digital content and therefore these should be treated under the TRIPS.

Without the resolution of these issues, a temporary Moratorium was agreed upon in 1998 as both USA and EU agreed that the existing practice of no custom duties should continue on electronic transmissions and the related issues on classification can continue to be discussed under the Work Program on E-Commerce. Whether digital content is treated as goods or services can have important implications. If they are treated as goods, it would imply that custom duties can be imposed on them along with principles of MFN and national treatment including other disciplines like rules of origin, custom valuation, etc. but if they are treated as services then Members will be able to impose domestic regulations on them and liberalize their trade through a positive list and have the flexibility of undertaking different commitments for different Modes of trade.

Lack of resolution of the debate on classification of ‘digital content’ as a good or a service or an IP has been the reason behind the lack of clarity on the issue of what is covered by the Moratorium- the “content” or the “carrier”? However, the existing literature on this issue supports the view that “the Moratorium would apply to the transmission itself – not to the value of its content. This is sometimes referred to as a “bit tax.”²². It has also been observed that GATT WTO members determine custom duties on digitizable products by the value of the ‘carrier’ medium and not by the much higher valued “content”.²³ Also, except for the software, nothing prevents the Members from imposing custom duties on the “content”.

²¹ WT/GC/W/247, July 9, 1999, contribution by Indonesia and Singapore.

²² JETRO (2015), “US & Multilateral Trade and Policy Developments” , pp 23.

“https://www.jetro.go.jp/ext_images/theme/wto-fta/news/pdf/w_c_monthly_report-201503.pdf”

²³ Wunsch-Vincent, Sacha. 2006a. *The WTO, the internet and trade in digital products: EC-US perspectives*, Oxford: Hart

7. Related WTO Agreements

7.1 Decision on the Custom Valuation

In the case of software, in 1984, according to the Committee on Customs Valuation, Members were permitted to levy duties on the physical imports of software either according to the cost of the “carrier” only e.g., diskettes or according to the value of the “content” i.e., the software content in the diskettes²⁴. In 1995, Committee on Custom Valuation adopted the following decision: “In determining the Customs value of imported carrier media bearing data or instructions, only the cost or value of the carrier medium itself shall be taken into account”.²⁵ However, not all members agreed to apply the custom duties only on the carrier and not the content, i.e., not on the software but on the diskette or CDs on which the software was imported²⁶. It was reiterated in 1998 that “As there is an option to apply or not to apply paragraph 2 of the decision, countries which choose to apply that decision should interpret this paragraph in the widest possible terms so as not to negate the intention of the decision”. Members agreed to notify WTO of their decision and apply it on MFN basis. Those Members who are not committed to zero duties on software (not members of Information Technology Agreement) therefore have the flexibility of applying custom duties on the software. However, this Decision does not extend to electronic transmissions due to the absence of a physical carrier medium during the electronic transmissions.²⁷

7.2 Information Technology Agreement (ITA)

ITA was signed in 1996 with initially 29 participants covering 90% of world trade in information technology products, where the signatories agreed to eliminate custom duties and other duties and charges on selected IT products on MFN basis. In 2017, the number of participants increased to 82, representing 97% of world trade in IT products²⁸. The IT products cover broadly a large number of high technology IT physical products including computers, monitors and flat panel displays (but not televisions); computer network equipment and storage devices; telephones, wireless telephones and pagers; photocopiers; semiconductors, printed circuits and electronic components; semiconductor manufacturing equipment; capacitors; and a significant number of other products. However, ITA did not include electronic transmissions but covered only the software on traditional carrier media²⁹.

In 2015, at the Nairobi Ministerial Conference, over 50 members concluded the expansion of the ITA (ITA-2), which was signed by 24 participants (53 countries) including US, EU and China. The participants agreed to remove tariff on 201 ICT products by 2024. These products include many products which are used for producing, transmitting, or consuming digital content, such as touch screens, sound equipment, telecommunications satellites,

²⁴ Committee on Custom Valuation, Minutes, VAL/M/10 (1984), PARA 7.

²⁵ Committee on Custom Valuation, Decisions adopted by the Tokyo Round on Custom Valuation, G/VAL/W/1 (1995)

²⁶ See G/C/W/128 (1998) and G/VAL/W/15/Rev 4 (2004)

²⁷ CTG, E-Commerce Report, para 6.2. Also see Wunsch-Vincent, Sacha. 2006a. *The WTO, the internet and trade in digital products: EC-US perspectives*, Oxford: Hart: pp 45.

²⁸ 20 Years of Information Technology Agreement, WTO (2017).

²⁹ Cannistra and Cuadros (2010), ‘Digital Convergence and Electronic Commerce: Customs and Trade Implications’, *Global Trade and Customs Journal*. Vol 5, Issue 4: pp 137

video game hardware, all digital cameras, all software, and all recorded or unrecorded media (all of the 6-digit subheadings within HS 8523). ITA-2 therefore can have important implications for Moratorium on ET. The signatory countries will not be able to levy any custom duties or other duties and charges on identified electronic transmissions in ITA-2. These include digitizable products which are categorized in 5 broad HS chapters, i.e., chapter 37-photographic or cinematographic products; chapter 84- machinery and mechanical appliances; chapter 85- electric machinery items; chapter 88- parts of telecommunication satellites; and chapter 90- measuring devices. These include touch screens, GPS navigation equipment, video game consoles, portable interactive electronic education devices, etc.

ITA expansion list includes some of the identified digitizable products where cross-border trade is expected to rise considerable with progressing digitalization. This includes digitizable products in chapter 85 like smart-cards; storage devices; video games, etc. But more importantly the ITA expansion also covers new age products which do not yet have six-digit HS classification like Multi-component integrated circuits (MCOs); Light-Emitting Diode (LED) Backlights modules; Touch-Sensitive Data Input Devices (so-called touch screens) ; Printed matter which grants the right to access, install, reproduce or otherwise use software (including games), data, internet content (including in-game or in-application content) or services, or telecommunications services (including mobile services); Portable interactive electronic education devices; etc.

It is extremely difficult for the developing countries to understand the implications of ITA expansion agreement as there is no way of estimating the existing or future imports in the new products which do not yet have HS classification. According to USITC, demand for MCOs is going to be high in coming years and US headquartered companies like Intel, Texas, Broadcom, etc are among the leaders in this market³⁰.

³⁰ Platzer, Michaela D. & Sargent, John F., Jr. U.S. Semiconductor Manufacturing: Industry Trends, Global Competition, Federal Policy, report, June 27, 2016; Washington D.C.. (digital.library.unt.edu/ark:/67531/metadc855842/m1/1/; accessed January 21, 2019), University of North Texas Libraries, Digital Library, digital.library.unt.edu; crediting UNT Libraries Government Documents Department.

8. 3D Printing and Future ET: Implications for Digital Industrialization

To progress on digital industrialization countries will need to develop their digital infrastructure, which includes broadband infrastructure and data infrastructure along with building digital skills. Developing software skills and building data analytical skills will become as crucial in the digital industrial revolution as developing ICT infrastructure and improving internet access were during the ICT revolution. Building digital skills will also become crucial in order to learn to use and develop new digital technologies like 3D printing.

3D printing or Remote Additive Manufacturing (RAM) is the digital technology which allows manufacturing of products to take place remotely using a 3D printer which adds different materials layer-by-layer to create products. These printers use a special type of file known as Computer-Aided Design (CAD) file. 3D printers can be used to print any three-dimensional products, i.e., anything from consumer products- like toys, clothes, footwear; to medical products like human kidneys, prosthetics legs; to industrial applications like tools, machinery, jet engines; as well as houses.

The use of 3D printing is no longer a niche area in international trade. It is experiencing exponential growth to become one of the mainstream manufacturing technologies leading to formation of new trade flows, production networks, supply chains and capabilities. It is often argued that 3D printing cannot assist mass production and therefore will not be able to capture substantial market share, however recent technological advances, namely high-speed sintering, indicate that high speed and mass production is becoming possible with 3D printers where mass-producing up to 100,000 (smaller) components in a day will be possible at a speed which is 100 times faster³¹. While developed countries are fast developing this technology, developing countries are still at nascent stage. 3D printing allows remote manufacturing i.e. products can be manufactured by foreign firms within the national boundaries of countries without their physical presence and without international trade. This can have serious implications for future industrialization in the developing countries.

An important implication of growth of 3D printing is the accompanied rise in the growth of ET since cross-border transfers of CAD files will be done electronically to aide remote printing. While WTO rules are clear in terms of 3D printers crossing borders as physical products, the transfer of CAD files will raise complex classification issues, i.e., whether ET of CAD files should be covered under GATT or GATS?³² Three challenges which will arise in this area are:

1. 3D printing will move production in the same location as consumption, but this production is done remotely. Should 3D printed products be considered under cross-border trade or not?
2. Digital transfers of data and CAD files will supersede cross-border physical transfer of intermediate products, especially as intermediate products used in 3D

³¹ Ing (2017), "3D printing: a threat to global trade" (https://www.ing.nl/media/ING_EBZ_3d-printing_tcm162-131996.pdf)

³² Kommerskollegium, National Board of Trade (2016), "Trade Regulation in a 3D Printed World First Edition. ISBN: 978-91-88201-12-6.

- printing are not the same as those traditionally used. Should these transfers of data and CAD files be classified as intermediate products and classified as goods or are they services?
3. If the principle of technology neutrality is applied to 3D printing, then should the negotiated tariffs under GATT on physical products also be applicable on 3D printed products?

Growth of 3D printing can also jeopardize two decades of negotiated tariffs on industrial products under Uruguay Round. 3D printers and electronic transmissions of CAD files can be used to 'print' manufactured products in any country, irrespective of the protection given by the governments to the sectors in the developing countries through their custom duty regime. For example, if a country is protecting its footwear industry by having relatively higher custom duties on shoes then with the use of 3D printer and electronically transmitted CAD files, a foreign firm can have mass production of shoes within the national boundary of the country, without exporting shoes or having a physical presence. Anti-dumping measures may also not help as it will be difficult to prove that 3D printed products are imports since they have not crossed borders, and it will be difficult to categorize them as 'like' products with different cost structures.

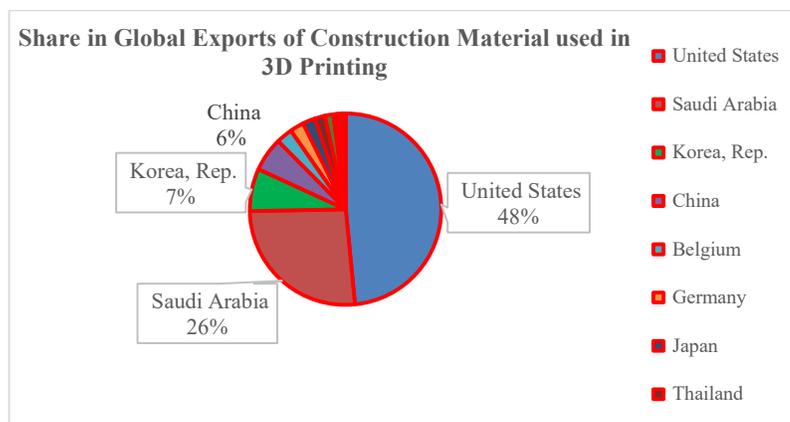
Further, the protection given by developing countries to some of their services sectors under GATS may also be lost. For example, if some country has protected its construction services by not allowing FDI in the sector, 3D printing technology can enable a foreign firm to print a house in the country by using a 3D printer and electronically transmitting a CAD file, with no foreign presence in the country and no services provided by foreign firms.

The decision on the Moratorium on ET can have serious implications given the above challenges. If Moratorium on custom duties on ET is made permanent, then in future the policy space to address the above challenges raised by 3D printing will be severely limited. Developing countries, who are currently net importers of ET, by agreeing to never impose custom duties on ET will be effectively agreeing to remove custom duties on all industrial products which may be 3D printed in the future and will also be giving away their rights to protect their services sectors where services can be delivered electronically.

The growing use of 3D printing has the potential to significantly shift the existing trade competitiveness and associated trade flows. Apart from dominating the trade in ET, developed countries are also found to be more competitive in building 3D printers and supplying the 'ink' of the printers or associated inputs in 3D printing.

To give an example, the main methods used for construction in 3D printing are extrusion (using concrete, cement, wax, foam and polymers), powder bonding (using polymer bond, reactive bond, sintering) and additive welding. Some of the inputs of 3D printing in construction and plastics are identified and reported in Appendix Table A.4 along with their HS codes. In the identified inputs, which are used in 3D printing in the construction sector, global exports of top 10 exporters in 2017 amounted to \$ 32 billion, of which 48% was exported by the USA (Figure 5). In exports of plastics as inputs for 3D printing, the top 5 global exporters are found to be USA, Japan, China, Germany and Belgium with a total share of 97%.

Figure 5: Global Exports of Inputs of 3D printing in Construction



Source: Author's estimates using inputs reported in appendix Table A.4

UNCTAD (2018) highlighted the growing digital divide between developing and developed countries in terms of value added by digital services in manufacturing products. This digital divide along with the growth of 3D printing accompanied by growing trade in ET pose serious threats to industrialization efforts of the developing countries. Developing countries need to protect their industries and build their own infant digital and software sectors to be able to use the digital technologies. A direct policy tool that can help protect their industries, services and infant digital sector, and provide level playing field to their domestic producers, is regulating the trade in ET at the WTO. This will imply resolving the classification issues with respect to digital content and until this issue is resolved it will be important to control the trade in ET through their custom duty regimes. Flexibility and policy space are needed by the countries at different stages of their digital development to enable them to build their digital capacities.

9. Summary and Conclusions

9.1 Summary

This paper addresses the issue of rising trade in electronic transmissions and its implications for the developing countries. Literature has identified electronic transmissions as being closely related with digitizable products which are traded physically as well as digitally, i.e., delivered online. These product categories include Photographic films, Cinematographic films, Printed matter, Music, Media, Software and Video games. With advancing technologies in the fourth digital industrial revolution, online trade or electronic transmissions of these digitizable products is fast replacing their physical trade. Digital technologies like 3D printing and Big Data analysis need electronic transmissions for their operations. For example, a core resource for 3D printing is computer-aided designs or CAD files which provide the blueprint for 3D manufacturing. It is predicted that with the current growth in investments in 3D printing, 50% of the manufactured products will be printed in 2060, which will wipe out 40% of cross-border trade. Physical trade is therefore expected to be rapidly replaced by rising trade in

electronic transmissions in the digital era. This can have serious implications for the existing trade flows and trade competitiveness of the developing countries.

In this context, the paper estimates the existing physical trade of the digitizable products and estimates their trade via electronic transmissions. This is done by first identifying 49 digitizable products (with HS codes). The global imports of these products are estimated for the period 1990-2017, using various concordance and correlation matrices. The analysis is undertaken at the global level; and at the country-level.

At the country level, it is found that in 2017, 86 out of 95 developing countries were net importers of physical digitizable products. The top three net importers were namely Thailand (\$1.8 billion), followed by India (\$1.7 billion) and Mexico (\$1.1 billion). Net exporters of digitizable products include China, Singapore, Malaysia, Hong Kong China, and UAE. The share of developing countries (excluding China) in global exports of physical digitizable products declined from 6% in 1998 to 5% in 2017, while China's share increased from 2% to 18% making China one of the largest exporters of digitizable products. However, China is also found to be one of the major importers of electronic transmissions among developing countries along with Thailand, India and Nigeria.

In 1998, WTO adopted a Declaration on global electronic commerce, which included a two-year Moratorium on custom duties on electronic transmissions. Since then the Moratorium has been renewed every two years (except for 2003-05) with some Members demanding to make it permanent. However, there are many unresolved issues with respect to the Moratorium which makes it difficult to assess the impact of Moratorium specifically on trade and more broadly on the industrialization efforts of the developing countries. Three main issues of debate with respect to the Moratorium are the (a) lack of clarity about the scope of the Moratorium, i.e., what is covered under electronic transmissions (b) technological feasibility of the Moratorium, i.e., can custom duties be applied to electronic transmissions; and (c) revenue implications of the Moratorium.

The ever-evolving technologies in the Industry 4.0 makes it extremely difficult to limit the scope of electronic transmissions. Even after two decades, the question raised about whether electronic transmissions should be treated as 'goods' or 'services' or 'IP' remains unanswered. This is an important issue as it determines whether electronic transmissions should be governed under GATT or GATS, which in turn determines its extent of trade liberalization. While some developed countries like the USA want to categorize them under GATT and replace the term 'electronic transmissions' as 'products that are transmitted electronically', other developed countries like the EU want to categorize them under GATS as they find electronic transmissions comparable to services which do not need physical support for trading, like the health reports or X-rays or architectural designs, which can be sent electronically. While there are others who argue that electronic transmissions are neither good nor services but 'digital contents' which are protected under the TRIPS.

Without the resolution of the debate on the nature of electronic transmissions, WTO members agreed to the Moratorium on the custom duties. This further lacked clarity whether custom duties were exempted for the 'carrier' or also included the 'content' i.e., whether the carrier of the software is exempted from custom duties like CDs or diskettes or the content like software or music is also exempted from custom duties.

The paper discusses the above issues and based on the existing literature argues that although the issue of whether electronic transmissions are ‘good’ or ‘services’ or ‘IP’ has not been resolved, the existing literature on this issue supports the view that the Moratorium applies to the transmission itself – not to the value of its content. It has also been observed that GATT WTO members determine custom duties on digitizable products by the value of the ‘carrier’ medium and not by the much higher valued “content”.

The paper also discusses other related WTO Agreements like Information Technology Agreement (ITA) and ITA expansion and their implications on trade in electronic transmissions and concludes that while ITA did not include electronic transmissions but covered only software on traditional carrier, ITA expansion includes some digitizable products and their electronic transmissions like all software, photographic or cinematographic products, touch screens, GPS navigation equipment, video game consoles, portable interactive electronic education devices, etc. Further it also includes digital content which do not yet have corresponding HS codes. Countries which have signed ITA expansion therefore will not be able to apply custom duties to digital content of the included digitizable products.

On the issue of revenue implications, the paper presents a critical review of the existing studies and argues that the existing literature considers custom duties only on the physical imports of the digitizable products and not on electronic transmissions and therefore does not provide potential revenue losses of the Moratorium, which applies only to the electronic transmissions.

Using the average annual growth rate of physical imports of digitizable products in the period 1998-2010, physical imports of these products are estimated for the period 2011-2017. It is assumed that the average annual growth rate of imports remains the same in the period post 2010. This provides conservative estimates of physical imports of digitizable products since with digital revolution it is easy to download digitizable products like movies, music and eBooks than physically import them. The difference between estimated physical imports and actual physical imports of these digitalized products provides the estimates of online imports or imports via electronic transmissions.

The results using average annual growth rate of 1998-2010 show that the global physical imports of the identified 49 digitizable products in 2017 were \$116 billion, while the estimated physical imports were \$255 billion. The ‘online’ global imports or global imports via electronic transmissions of these digitizable products is therefore estimated to be \$139 billion. The estimates show that total global imports of digitizable products comprises 55% in electronic transmissions. The electronic transmissions are found to have grown much faster than the physical global imports.

To estimate the potential tariff revenue loss from the Moratorium, the paper reports the physical imports and electronic transmissions of digitizable products for 91 countries along with their MFN Duties, Bound Duties and Effectively Applied Duties. It is argued that Bound duties are better indicators of potential revenue loss of the moratorium as any country can raise its tariffs to its Bound levels anytime as tariff negotiations are based on the Bound rates. Bound duties also give an indication of the potential revenue that the countries can raise from custom duties on electronic transmissions in the future, which

can be an important source of revenue given the rising trend in electronic transmissions and the ever-contracting tax revenue of the governments, especially in the small developing countries.

The paper undertakes the estimations of potential per annum tariff revenue loss for the countries following the Moratorium on ET by using three different kinds of duties. At the aggregated level the results show that for WTO developing member countries, as a group, the per annum tariff revenue loss of a Moratorium will be \$ 10 billion using average bound duties and \$ 5.1 billion using average MFN Applied rate. Potential tariff revenue loss from the Moratorium is found to be higher for Sub-Saharan African countries and WTO LDC countries as compared to WTO high-income countries. It should be noted that the estimated potential revenue losses do not include the revenue losses accruing from loss of additional custom duties and surcharges.

At the country-level, the results on potential tariff revenue loss are arrived at for 91 countries (58 developing and 33 developed countries).. It is found that 14 countries have average Bound duties higher than 20%. Average Bound duties are as high as 92% in Rwanda, followed by Nigeria (80%), Pakistan (62%), Jamaica (50%), Malawi (45%) and Tunisia and Guatemala (40%), while average Bound tariffs on Digitizable products is 0.09% in EU countries, followed by USA (0.02%) and Switzerland (0%).

The results show that the total potential tariff revenue loss of Moratorium for identified 58 developing countries is around \$8.0 billion using Bound duties. Of this, tariff revenue loss of \$3.5 billion is accounted by physical imports of digitizable products and \$4.4 billion from ET. The potential tariff revenue loss is found to be highest for Mexico followed by Thailand, Nigeria, India, China and Pakistan. Potential tariff revenue loss for 33 developed countries is estimated at \$212 million as their Bound custom duties are less than 1%.

The results, using MFN duties, show that if countries apply the same custom duties on the electronic transmissions of digitizable products as they apply on their physical imports then the potential tariff revenue loss to 58 identified developing countries would be \$3.4 billion. The top five countries which will face the maximum tariff revenue loss from the Moratorium using MFN applied duties are India followed by China, Thailand, Mexico and Paraguay.

Tariff revenue loss of moratorium on custom duties on physical imports of digitizable products for developing countries is found to be 30 times more than that for the developed countries. While developing countries can generate 40 times more revenue by imposing custom duties on ET as compared to the developed countries. It should be noted that this analysis presents conservative estimates of imports in ET. Further, the paper also provides evidence of technical feasibility of applying custom duties on intangible imports and present case studies of the countries which are levying taxes on intangible imports for example, Australia, New Zealand, EU, Indonesia and India.

9.2 Conclusions and Way Forward for Developing countries

This paper has highlighted the changing nature of international trade and the growing importance of electronic transmissions in the digital era. Trade in electronic transmissions is growing faster than physical trade and with the growth of digital technologies like 3D printing and Big Data analytics, it is expected to replace more and more of the physical

trade in the coming years. Most of the developing countries are net importers of electronic transmissions with growing imports. In such a scenario, any decision at the multilateral level with respect to moratorium on custom duties on electronic transmissions can have far reaching implications on developing countries' share in global trade and their industrialization efforts.

The paper discusses the existing debates around the trade in electronic transmissions and implications of a Moratorium on tariff revenues of different countries. It is found that the potential per annum tariff revenue loss following a Moratorium will be much more for developing countries as compared to the developed countries, which have very low bound custom duties on the digitizable products. Conversely, electronic transmissions can provide an important growing source of tariff revenue for the developing countries and LDCs.

Broader implications of the Moratorium on developing countries are in terms of losing policy space to develop their digital capabilities as well as their software sectors, which can have important implications for their manufacturing and industrialization processes. In order to remain competitive in the digital era, developing countries will need to build their digital infrastructure and digital capabilities. While developed countries are investing huge amounts in digital technologies like robotics, artificial intelligence, big data analytics and 3D printing, developing countries are still struggling to build their ICT infrastructure and improve their internet penetration. In many African countries, less than 10% population has internet access with less than 20% of households with internet access in LDCs. Even big developing countries like India are still struggling to improve their internet bandwidth per internet user (important for developing competitive cloud computing infrastructure) and the speed and cost of internet.³³ The manifestations of this growing digital divide can now be seen in manufacturing production. The digital content in manufacturing products in terms of value added by digital services and use of digital technologies is rising much faster in the developed countries as compared to the developing countries.³⁴

Developing countries need to be cognizant of the rapidly changing landscape of international trade in manufactured products. Digital technologies like robotics is increasing the speed of manufacturing, while 3D printing is changing the nature of manufacturing. Electronic transmissions as well as e-commerce is aiding marketing of manufactured products, supported by Big Data analytics. These are the areas where the developing world is yet to catch-up and develop competitiveness. In such a scenario, it becomes extremely important to regulate trade in electronic transmissions in a way that provides policy space to the developing countries to provide level playing field to their domestic producers as well as protect their infant digital services providers. Making the Moratorium on custom duties on electronic transmissions permanent will forever take away this policy space from the developing world and can make them forever dependent on the developed world for digital products and technologies.

An important way forward for developing countries will be to resolve the existing debates around the categorization of 'digital content' in the WTO. Since digital revolution is about rising digital content in products, this issue can no longer be ignored, and any decision

³³ Banga (2019)

³⁴ (UNCTAD 2017).

taken without resolving this issue can increase the complexities in its implementation. Many negotiated outcomes at the multilateral level have the danger of losing their significance if an agreement is not reached on digital content. For example, as more products become digitalized and their electronic transmissions become possible, custom duties negotiated under Uruguay Round will lose their relevance. Many electronic transmissions can also be categorized as e-services or services associated with manufacturing, which will make commitments undertaken in GATS irrelevant. Any further decisions on Moratorium on custom duties on ET therefore need to be taken with caution and clarity about the scope of the Moratorium and categorization of 'digital content'. While GATT gives developing countries the flexibility of imposing custom duties on digital content and maintaining with their negotiated tariffs, GATS can provide them the flexibility of regulating trade in ET according to their domestic laws and regulations. Irrespective of the categorization, it is imperative for developing countries to have policy instruments controlling the trade in ET.

REFERENCES:

- Aggarwal and Fox (2017), *International Tax and Public Finance*: Volume 24, Issue 5 (2017), Pages 903-926
- Banga, R.(2019), 'Is India Digitally Prepared for International Trade?' *Economic and Political Weekly*, Vol. 54, Issue No. 5, 02 Feb, 2019
- Cannistra and Cuadros (2010), 'Digital Convergence and Electronic Commerce: Customs and Trade Implications', *Global Trade and Customs Journal*. Vol 5, Issue 4: pp 137
- Cruz, M, Milet. E. and Olarreaga M (2017), "Mind the gap: Online exports and the wage gap", CEPR Discussion Paper 12092, (<https://voxeu.org/article/online-exports-and-wage-gap>).
- Ernst and Young (2016) – 'Digital supply chain: it's all about the data', EY.
- ING (2017), "3D printing: a threat to global trade" (https://www.ing.nl/media/ING_EBZ_3d-printing_tcml62-131996.pdf)
- JETRO (2015), "US & Multilateral Trade and Policy Developments", pp 23.
- Kommerskollegium, National Board of Trade (2016), 'Trade Regulation in a 3D Printed World' First Edition. ISBN: 978-91-88201-12-6.
- Mattoo, A., Schuknecht, L. (2000) "Trade Policies for Electronic Commerce", Washington DC, World Bank, Policy Research Working Papers No. 2380.
- Mattoo, A., R. Pérez-Esteve, and L. Schuknecht (2001) "Electronic Commerce, Trade and Tariff Revenue: A Quantitative Assessment", *The World Economy*, Volume 24, Issue 7, pp. 955–970.
- McKinsey (2016), "Digital Globalization: The New Era of Global Flows" Available at <http://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/digital-globalization-the-new-era-of-global-flows>.
- Pérez-Esteve, R. and L. Schuknecht (1999) " A Quantitative Assessment of Electronic Commerce", WTO Staff Working Paper ERAD-99-01.
- Platzer, Michaela D. & Sargent, John F., Jr. U.S. Semiconductor Manufacturing: Industry Trends, Global Competition, Federal Policy, report, June 27, 2016; Washington D.C..
- UNCTAD (2000) *Tariffs, Taxes and Electronic Commerce: Revenue Implications for Developing Countries* (Geneva: United Nations Conference on Trade and Development).
- UNCTAD (2000) *Tariffs, Taxes and Electronic Commerce: Revenue Implications for Developing Countries* (Geneva: United Nations Conference on Trade and Development).
- UNCTAD (2017). *Rising Product Digitalisation and Losing Trade Competitiveness*. UNCTAD/GDS/ ECIDC/2017/3. New York and Geneva.
- WTO (2016) *Fiscal implications of The Customs Moratorium on Electronic Transmissions: The Case of Digitisable Goods*, Job/GC/114.
- WTO (2017), *20 Years of Information Technology Agreement*, WTO
- Wunsch-Vincent, Sacha. 2006a. *The WTO, the internet and trade in digital products: EC-US perspectives*, Oxford: Hart
- World Trade Report (2018), "The future of world trade: How digital technologies are transforming global commerce", WTO
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APPENDIX

Table A.1: List of Digitizable Products

S. No	HS COMBINED- Description
<i>Photographic and Cinematographic Films</i>	
1	370510 -- (-2016) - For offset reproduction
2	370520 -- (-2006) - Microfilms
3	370590 -- (-2016) - Other
4	370610 -- - Of a width of 35 mm or more
5	370690 -- - Other
<i>Printed Matter</i>	
6	482110 -- - Printed
7	490110 -- - In single sheets, whether or not folded
8	490191 -- -- Dictionaries and encyclopaedias, and serial instalments thereof
9	490199 -- -- Other
10	490210 -- - Appearing at least four times a week
11	490290 -- - Other
12	490300 -- Children's picture, drawing or colouring books
13	490400 -- Music, printed or in manuscript, whether or not bound or illustrated
14	490510 -- - Globes
15	490591 -- -- In book form
16	490599 -- -- Other
17	490600 -- Plans and drawings for architectural, engineering, industrial, commercial, topographical or similar purposes, being originals drawn by hand; handwritten texts; photographic reproductions on sensitised paper and carbon copies of the foregoing
18	490700 -- Unused postage, revenue or similar stamps of current or new issue in the country in which they have, or will have, a recognised face value; stamp-impressed paper; banknotes; cheque forms; stock, share or bond certificates and similar documents of title
19	490810 -- - Transfers (decalcomanias), vitrifiable
20	490890 -- - Other
21	490900 -- Printed or illustrated postcards; printed cards bearing personal greetings, messages or announcements, whether or not illustrated, with or without envelopes or trimmings
22	491000 -- Calendars of any kind, printed, including calendar blocks
23	491110 -- - Trade advertising material, commercial catalogues and the like
24	491191 -- -- Pictures, designs and photographs
25	491199 -- -- Other
<i>Sound & Media</i>	
26	852349 -- (2012-) -- Other
27	852380 -- (2007-) - Discs, tapes, solid-state non-volatile storage devices, "smart cards" & other media for the recording of sound/of other phenomena, whether/not recorded, incl. matrices & masters for the production of discs, but excl. products of Ch.37., other n.e.s.

28	852410 -- (-2006) - Gramophone records
29	852421 -- (-1995) Records, tapes and other recorded media for sound or other similarly recorded phenomena, Of a width not exceeding 4 mm
30	852422 -- (-1995) Records, tapes and other recorded media for sound or other similarly recorded phenomena, Of a width exceeding 4 mm but not exceeding 6,5 mm
31	852432 -- (1996-2006) -- For reproducing sound only
32	852439 -- (1996-2006) -- Other
33	852451 -- (1996-2006) -- Of a width not exceeding 4 mm
34	852452 -- (1996-2006) -- Of a width exceeding 4 mm but not exceeding 6.5 mm
35	852453 -- (1996-2006) -- Of a width exceeding 6.5 mm
36	852460 -- (1996-2006) - Cards incorporating a magnetic stripe
37	852499 -- (1996-2006) -- Other
<i>Software</i>	
38	852431 -- (1996-2006) -- Data Processing Software on CD Roms for Reproducing Phenomena Other Than Sound Or Image
39	852440 -- (1996-2006) - Computer Software, Magnetic tapes for reproducing phenomena other than sound or image
40	852351 -- (2007-) -- flash memory cards or flash electronic storage cards, Semi-conductor media, solid-state non-volatile storage devices, for the recording of sound/of other phenomena, but excl. products of Ch. 37.
41	852352 -- (2007-) -- 'Smart cards'
42	852359 -- (2007-) -- Other semi-conductor media, for the recording of sound/of other phenomena, but excl. products of Ch. 37., other than "Smart Cards" & Solid-state non-volatile storage devices, proximity cards and tags
43	852491 -- (1996-2006) -- For reproducing phenomena other than sound or image
44	854212 -- (1996-2001) -- Cards incorporating an electronic integrated circuit ("smart" cards)
<i>Video Games</i>	
45	950450 -- (2012-) - Video game consoles and machines, other than those of subheading 950430
46	950430 -- Games; operated by coins, banknotes, bank cards, tokens or by other means of payment, other than billiard articles and accessories, and automatic bowling alley equipment
47	950440 -- Games; playing cards
48	950490 -- Games; articles for funfair, table or parlour games, including pintables, special tables for casino games, automatic bowling alley equipment, n.e.c. in heading 9504
49	950410 -- (-2011) - Video games of a kind used with a television receiver

Table A.2: Actual Physical Imports and Estimated Electronic Transmissions or ‘On-Line’ Imports of Digitizable Products in 2017 (\$Mn)

		Physical Imports of Digitizable Products (\$Mn)	Estimated Online Imports or ET using Growth Analysis (\$Mn)	Total Imports of Digitizable Products (\$Mn)
1	Albania	16	202	218
2	Algeria	129	209	338
3	Argentina	456	105	561
4	Armenia	11	13	24
5	Australia	2 044	2 167	4 211
6	Austria	2 139	2 574	4 713
7	Belarus	80	365	445
8	Belgium	1 913	1 087	3 000
9	Bolivia	63	52	115
10	Brazil	389	672	1 061
11	Bulgaria	170	99	269
12	Cambodia	119	36	155
13	Canada	4 594	4 849	9 443
14	Chile	500	360	860
15	China	6 623	15484	22 107
16	Colombia	281	142	423
17	Congo, Rep.	16	441	457
18	Cote d'Ivoire	72	30	102
19	Croatia	186	52	238
20	Cyprus	41	77	118
21	Czech Republic	2 696	947	3 643
22	Denmark	1 087	1 015	2 102
23	Dominican Republic	157	49	206
24	Ecuador	105	118	223
25	El Salvador	102	31	133
26	Estonia	62	18	80
27	Ethiopia(excludes	139	69	208
28	Fiji	21	37	58
29	Finland	415	723	1 138
30	France	5 337	3 702	9 039
31	French Polynesia	24	14	38
32	Germany	8 839	6 330	15 169
33	Greece	381	294	675
34	Guatemala	291	116	407
35	Honduras	70	72	142
36	Hungary	691	435	1 126
37	India	2 308	4 295	6 603
38	Indonesia	545	574	1 119
39	Ireland	1 011	305	1 316
40	Italy	2 115	2 613	4 728

41	Jamaica	103	56	159
42	Japan	4 866	5 116	9 982
43	Jordan	98	165	263
44	Kazakhstan	185	1 243	1 428
45	Korea, Rep.	1764	7438	9 202
46	Kyrgyz Republic	19	5	24
47	Latvia	91	4	95
48	Luxembourg	162	265	427
49	Macedonia, FYR	40	116	156
50	Madagascar	51	41	92
51	Malawi	129	89	218
52	Maldives	16	1	17
53	Malta	51	8	59
54	Mauritius	30	20	50
55	Mexico	2 614	2 842	5 456
56	Netherlands	4 055	5 500	9 555
57	New Zealand	469	571	1 040
58	Nicaragua	82	35	117
59	Niger	10	2	12
60	Nigeria	611	115	726
61	Norway	804	1054	1 858
62	Pakistan	443	142	585
63	Panama	228	574	802
64	Paraguay	335	2689	3 024
65	Peru	359	116	475
66	Portugal	428	535	963
67	Romania	407	983	1 390
68	Russian Federation	992	1797	2 789
69	Rwanda	33	43	76
70	Saudi Arabia	886	622	1 508
71	Senegal	70	23	93
72	Serbia,	109	246	355
73	Singapore	2 731	2 283	5 014
74	Slovak Republic	499	263	762
75	Slovenia	169	192	361
76	South Africa	880	484	1 364
77	Spain	2 851	965	3 816
78	Sri Lanka	97	29	126
79	Sweden	1 107	1 250	2 357
80	Switzerland	2 290	1 271	3 561
81	Tanzania	36	65	101
82	Thailand	2 272	5 685	7 957
83	Togo	15	25	40
84	Tunisia	122	248	370
85	Turkey	464	737	1 201
86	Uganda	58	96	154
87	United Kingdom	6 585	5 707	12 292
88	United States	23 049	11 991	35 040

89	Uruguay	57	12	69
90	Vietnam	491	72	563
91	Zimbabwe	59	55	114
		110 176	114 595	224 771

Source: Authors' estimates based on World Integrated Trade Solutions (WITS).

Note: figures of 2016 are used for countries which do not report 2017 data

Table A.3: Simple Average of Bound, MFN and Effectively Applied Duties on Digitizable Products

	Reporter Name	Simple Average of Bound Duties on Imports of Digitizable Products for the Latest Year (2017/2016) (1)	Simple Average of MFN Duties on Imports of Digitizable Products for the Latest Year (2017/2016) (2)	Simple Average of Effectively Applied Duties on Imports of Digitizable Products for the Latest Year (2017/2016) (3)
1	Albania	0.13	0.13	0
2	Algeria	23.47	23.47	14.18
3	Argentina	33.18	10.09	8.99
4	Armenia	4.06	4.06	3.88
5	Australia	1.85	1.85	1.67
6	Austria	0.09	0.09	0.04
7	Belarus	4.06	4.06	3.62
8	Belgium	0.09	0.09	0.04
9	Bolivia	10.08	10.08	9.47
10	Brazil	10.32	10.32	10.08
11	Bulgaria	0.09	0.09	0.04
12	Cambodia	18.32	9.62	7.14
13	Canada	0.4	0.4	0.1
14	Chile	5.75	5.75	1.05
15	China	2.23	2.23	2.05
16	Colombia	8.2	8.2	6.05
17	Congo, Rep.	11.82	11.82	11.58
18	Cote d'Ivoire	11.29	11.29	11.11
19	Croatia	0.09	0.09	0.04
20	Cyprus	0.09	0.09	0.04
21	Czech Republic	0.09	0.09	0.04
22	Denmark	0.09	0.09	0.04
23	Dominican Republic	9.02	9.02	7.09
24	EU	0.09	0.09	0.04
25	Ecuador	25.5	14.55	12.04
26	El Salvador	5.84	5.84	4.17

27	Estonia	0.09	0.09	0.04
28	Ethiopia(excludes Eritrea)	13.94	13.94	13.21
29	Fiji	9.94	9.94	9.31
30	Finland	0.09	0.09	0.04
31	France	0.09	0.09	0.04
32	French Polynesia	8.27	8.27	6.19
33	Georgia	0.97	0	0
34	Germany	0.09	0.09	0.04
35	Greece	0.09	0.09	0.04
36	Guatemala	39.47	6.07	3.89
37	Honduras	28.27	6.15	4.21
38	Hong Kong, China	0	0	0
39	Hungary	0.09	0.09	0.04
40	India	7.53	7.53	7.08
41	Indonesia	4.84	4.84	3.63
42	Ireland	0.09	0.09	0.04
43	Italy	0.09	0.09	0.04
44	Jamaica	50	8.19	11.2
45	Japan	0.1	0.1	0.07
46	Jordan	12.1	12.1	4
47	Kazakhstan	3.85	3.85	3.39
48	Korea, Rep.	1.59	1.59	0.54
49	Kyrgyz Republic	4.06	4.06	2.93
50	Latvia	0.09	0.09	0.04
51	Luxembourg	0.09	0.09	0.04
52	Macao	0	0	0
53	Macedonia, FYR	1.35	1.35	0.98
54	Madagascar	14.62	14.62	5.91
55	Malawi	45	9.36	5.91
56	Maldives	1.61	1.61	0
57	Malta	0.09	0.09	0.04
58	Mauritius	1.72	1.72	1.34
59	Mexico	34.2	5.71	2.26
60	Netherlands	0.09	0.09	0.04
61	New Zealand	0.73	0.73	0.45
62	Nicaragua	5.26	5.26	3.7
63	Niger	11.29	11.29	11.17
64	Nigeria	80	11.82	12.81
65	Norway	0.09	0.09	0.04
66	Pakistan	62.81	8.73	8.36
67	Panama	21.43	5.81	6.32
68	Paraguay	8.63	8.63	7.39
69	Peru	3.39	3.39	1.71
70	Portugal	0.09	0.09	0.04

71	Romania	0.09	0.09	0.04
72	Russian Federation	4.06	4.06	3.67
73	Rwanda	92.73	11.24	11.06
74	Saudi Arabia	2.58	2.58	2.24
75	Senegal	11.29	11.29	11.28
76	Serbia, FR(Serbia/Montenegro)	6.42	6.42	3.21
77	Singapore	0.61	0	0
78	Slovak Republic	0.09	0.09	0.04
79	Slovenia	0.09	0.09	0.04
80	South Africa	2.7	2.7	1.83
81	Spain	0.09	0.09	0.04
82	Sri Lanka	7.94	7.94	7.34
83	Sweden	0.09	0.09	0.04
84	Switzerland	0	0	0
85	Tanzania	11.31	11.31	11.05
86	Thailand	21.93	4.59	3.78
87	Togo	11.29	11.29	11.12
88	Tunisia	39.57	5.91	7.57
89	Turkey	0.43	0.43	0.21
90	Uganda	11.31	11.31	11.11
91	United Kingdom	0.09	0.09	0.04

Note: Wherever Bound Duties were not available MFN Duties are reported in Column 2

Table A.4: Inputs in 3D Printing: Construction and Plastics

Output	Number	Input	HS Code	HS Description
Construction	1	Cement	2523	Portland cement, aluminous cement, persulphate
Construction	1	Cement	6810	Articles of cement, of concrete/artificial stone
Construction	2	Concrete	3816	Refractory cements, mortars, concretes and simi
Construction	2	Concrete	382350	Non-refractory mortars and concretes
Construction	3	wax	3404	Artificial waxes and prepared waxes
Construction	4	Polymers	3901	Polymers of ethylene, in primary forms
Construction	4	Polymers	3902	Polymers of propylene or of other olefins, in p
Construction	4	Polymers	3903	Polymers of styrene, in primary forms
Construction	4	Polymers	3904	Polymers of vinyl chloride and halogenated olef
Construction	5	polymer bond	38220019	Other for medical diagnosis
Construction	6	reactive bond		

Construction	7	cellulose	3912	Cellulose and its chemical derivatives, nes, in
Construction	7	cellulose	6811	Articles of asbestos-cement, of cellulose fibre-
Construction	7	cellulose	392073	Plates..., of cellulose acetate, not reinforced
Construction	7	cellulose	392079	Plates..., of other cellulose derivatives, not
Construction	8	mixture of seeds and clay	2507	Kaolin and other kaolinic clays, whether or not
Construction	8	mixture of seeds and clay	250830	Fire-clay
Construction	8	mixture of seeds and clay	250840	Other clays, nes
Construction	9	Peat	2703	Peat (incl. peat litter)
Construction	9	Peat	270600	Tar distilled from coal, lignite or peat, and o
Plastic	1	ABS filament	39169090	Othr plymrns and coplymrns prdcts
Plastic	1	ABS filament	39162099	Other of other polmrns of vinyl chlride
Plastic	2	Polylactic acid, or PLA	390770	Poly (lactic acid)
Plastic	3	ASA	84439990	Prts of othr prntng mchnry and mchns fr uses ancillary to printing
Plastic	4	Polyethylene terephthalate	390760	Polyethylene terephthalate, in primary forms
Plastic	5	Polycarbonate	390740	Polycarbonates, in primary forms
Plastic	6	flexible filaments	84439990	Prts of othr prntng mchnry and mchns fr uses ancillary to printing
Plastic	7	Carbon fiber	68151090	Non-electrical artcls of othr carbon
Plastic	8	Hybrid Materials		
Plastic	9	soluble filament materials	390311	Expansible polystyrene, in primary forms
Plastic	9	soluble filament materials	390319	Polystyrene (excl. expansible), in primary form
Plastic	9	soluble filament materials	390430	Vinyl chloride-vinyl acetate copolymers, in pri
Plastic	10	BVOH filaments [Butenediol Vinyl Alcohol Co-polymer (BVOH)]	39053000	Pv alchl w/n cntng unhydrolyed actaTE GRPS
Plastic	11	photosensitive liquid resins	3907	Polyethers and epoxide resins; polyesters, in p
Plastic	11	photosensitive liquid resins	3909	Amino-resins, phenolic resins and polyurethanes
Plastic	12	isopropyl alcohol	290723	4,4-Isopropylidenediphenol (bisphenol A, diphen
Plastic	13	Polyamides	3908	Polyamides in primary forms
Plastic	14	Polypropylene	390950	Polyurethanes, in primary forms

Source: Various web sites including- <https://www.think3d.in/raw-materials-for-3d-printing/>;
<http://www.3dprinterhelp.co.uk/what-materials-do-3d-printers-use/>

Table A.5: List of Countries in Aggregate Groups

	WTO LDC members (31)	WTO Developing members (59) excl. LDCs & BC<35%	Sub-Saharan Africa SSA	WTO High-income Members (21)
1	Angola	Albania	Angola	Australia
2	Bangladesh	Antigua and Barbuda	Benin	Bahrain
3	Benin	Argentina	Botswana	Brunei
4	Burkina Faso	Armenia	Burkina Faso	Canada
5	Burundi	Barbados	Burundi	European Union
6	Cambodia	Belize	Cameroon	Hong Kong, China
7	Central African Republic	Bolivia	Cape Verde	Iceland
8	Chad	Botswana	Central African Republic	Israel
9	Congo, Dem. Rep.	Brazil	Chad	Japan
10	Djibouti	Bulgaria	Comoros	Korea, Rep.
11	Gambia, The	Chile	Congo, Dem. Rep.	Kuwait
12	Guinea	China	Congo, Rep.	Macao
13	Guinea-Bissau	Colombia	Cote d'Ivoire	New Zealand
14	Haiti	Costa Rica	Eritrea	Norway
15	Lesotho	Croatia	Ethiopia(excludes Eritrea)	Qatar
16	Madagascar	Dominica	Gabon	Saudi Arabia
17	Malawi	Dominican Republic	Gambia, The	Singapore
18	Mali	Ecuador	Ghana	Switzerland
19	Mauritania	Egypt, Arab Rep.	Guinea	Taiwan, China
20	Mozambique	El Salvador	Guinea-Bissau	United Arab Emirates
21	Myanmar	Fiji	Kenya	United States
22	Nepal	Gabon	Lesotho	
23	Niger	Georgia	Liberia	
24	Rwanda	Grenada	Madagascar	
25	Senegal	Guatemala	Malawi	
26	Sierra Leone	Guyana	Mali	
27	Solomon Islands	Honduras	Mauritania	
28	Tanzania	India	Mauritius	
29	Togo	Indonesia	Mayotte	
30	Uganda	Jamaica	Mozambique	
31	Zambia	Jordan	Namibia	
32		Kyrgyz Republic	Niger	
33		Macedonia, FYR	Nigeria	
34		Malaysia	Rwanda	
35		Mexico	Sao Tome and Principe	

36		Moldova	Senegal	
37		Mongolia	Seychelles	
38		Morocco	Sierra Leone	
39		Namibia	Somalia	
40		Nicaragua	South Africa	
41		Oman	Sudan	
42		Pakistan	Swaziland	
43		Panama	Tanzania	
44		Papua New Guinea	Togo	
45		Paraguay	Uganda	
46		Peru	Zambia	
47		Philippines	Zimbabwe	
48		Romania		
49		South Africa		
50		St. Kitts and Nevis		
51		St. Lucia		
52		St. Vincent and the Grenadines		
53		Swaziland		
54		Thailand		
55		Trinidad and Tobago		
56		Tunisia		
57		Turkey		
58		Uruguay		
59		Venezuela		