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Electronic transmissions and international trade - shedding new light on the moratorium debate

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ELECTRONIC TRANSMISSIONS AND INTERNATIONAL TRADE – SHEDDING NEW LIGHT ON THE MORATORIUM DEBATE

Andrea Andrenelli and Javier López-González (OECD)

The debate about whether or not to extend the WTO Moratorium on imposing customs duties on electronic transmissions has, to date, narrowly focused on its potential customs revenue implications. This paper sets out to broaden and deepen this debate. First, by putting current estimates of the customs revenue implications into perspective, showing that potential losses tend to be low relative to overall government revenue. Second, by deepening the debate on the cost of tariffs, arguing that these are unstable sources of revenue, that they are associated with lower output and productivity and that their burden falls mainly on domestic consumers, not foreign firms. Third, by broadening the debate to consider the benefits associated with electronic transmissions, including growing consumer welfare and export competitiveness. The paper argues that, overall, the revenue implications of the Moratorium are likely to be relatively small and that its lapse would come at the expense of wider gains in the economy.

Keywords: Electronic transmissions, digital trade, customs duties, e-commerce, digital economy, trade policy, digitisable goods

JEL Codes: F13, O33

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Table of Contents

Tables

Figures

Boxes

Key Messages

What is the issue?

- Since 1998, WTO Members have extended a Moratorium on imposing customs duties on electronic transmissions. However, with growing digital trade, discussions on whether or not to extend the Moratorium have intensified, with some WTO members questioning its implications for government revenue.
- As a result, new estimates of the revenue implications of the Moratorium have emerged. Owing to different methods and assumptions, these range between USD 280 million and USD 8.2 billion, underscoring wide disagreement on measurement.

Shedding new light on the Moratorium debate

- Notwithstanding methodological differences, current estimates suggest that the opportunity cost in terms of foregeone revenue due to the Moratorium is likely to be low.
  - At 0.08%-0.23% of overall government revenue, the estimates of potential foregone customs revenue for developing countries are, in relative terms, low. In addition, the highest potential impacts would occur in countries that rely least on customs revenue for their overall government budget.
  - At 1.2% of total trade, the highest estimated share of digitisable goods is also low. This will likely remain low even with the advent of technologies such as 3D printing, which are unlikely to have far-reaching implications on trade in the near term.
  - Moreover, revenue impacts are likely to have been overestimated by certain studies owing to the use of bound tariffs, the assumption that all goods that could be digitised would be digitised, and not taking into account complementarities between electronic transmissions and growing trade in other physical hardware.
- Tariffs also come with costs. They are associated with lower output and lower productivity and their burden falls mainly on domestic consumers, not foreign firms. They are also an unstable source of revenue. Alternatives exist in the form of non-discriminatory value added taxes or goods and services taxes.
- Beyond differences over costs of lost revenue, there are also considerable benefits to being able to conduct trade electronically which have often been overlooked in the Moratorium debate.
  - If all goods that could be digitised were to become digitally transmitted today, consumer welfare would increase by USD 940 million, outweighing costs associated with revenue loss by USD 73 million. Additional welfare gains would also arise from reductions in transport costs.
  - Analysis also shows that the use of foreign business services, which are increasingly digitally delivered, is associated with growing export competitiveness. Access to such business services is found to be most important for lower-middle income and lower income countries.
  - Firm-level evidence also shows that digital technologies such as webpages or digital delivery enable firms in developing countries, including SMEs, to become exporters, giving rise to new opportunities to grow.

What does this mean?

- When countries consider whether to extend the Moratorium, it is important to consider not only foregone revenue related to tariffs, but also to undertake a broader cost/benefit analysis of the impacts across the economy and alternative revenue sources.
- Overall, the revenue implications of lifting the Moratorium are likely to be relatively small and would come at the expense of more significant gains in consumer welfare and export competitiveness.

Executive Summary

The ability to engage in electronic transmissions, via digital networks, is a key feature of the evolving digital trade environment. However, as more trade becomes digitally deliverable, some WTO Members are voicing concerns about possible foregone government revenue due to the Moratorium on imposing customs duties on electronic transmissions. This paper provides an overview of the different issues at stake in this debate.

Although there is no official WTO agreement on what electronic transmissions are, in a trade context, they are generally understood to refer to digitally delivered trade. However, the scope of the Moratorium has been interpreted in different ways. Some argue that it applies to the content of the transmission while others say it applies to the transmission itself (the "medium"). Discussions have also focused on what tariffs could be charged on what products absent the Moratorium.

This has translated into disagreement on how to measure the impact of the Moratorium. Calculations require making assumptions about what trade flows might be digitisable, what trade flows might already have been digitised and what trade flows could be digitised in the future. There is also disagreement on methodological issues, including the use of bound versus applied tariffs in the analysis. This has led to different estimates of the potential customs revenue effect of the Moratorium ranging from USD 280 million to USD 8.2 billion, further polarising the debate.

With no easy answer to what the correct counterfactual to the Moratorium should be, it is worthwhile taking available estimates and putting them into perspective.

- At 0.08% – 0.23% of overall government revenue (on aggregate for developing countries), the highest estimated potential foregone revenue is low. These foregone revenue estimates are also found to be higher in countries with lower reliance on customs revenue for their overall government budget.
- At 1.2% of total trade, the highest estimated share of digitisable goods as identified in Banga (2019) is also low. Moreover, a careful assessment of 3D printing technology suggests that this share is likely to remain relatively low in the coming years.

Some of the existing studies are likely to overestimate the revenue implications of the Moratorium. This is because of the use of bound tariffs in the analysis, the assumption that all goods that could be digitised would be digitised, and not taking into account complementarities between electronic transmissions and growing trade in related goods. Still, current estimates, notwithstanding methodological differences, all point in a similar direction. The opportunity cost of the Moratorium in terms of foregone government revenue is likely to be low.

There are also a number of issues that have not been readily explored in the literature and which deserve further consideration:

- Tariffs are associated with lower output and lower productivity. The burden of tariffs also falls mainly on domestic consumers who face higher prices rather than on foreign firms.

- Tariffs can be an unstable source of revenue and alternatives exist in the form of non-discriminatory forms of taxation such as value-added taxes or goods and services taxes.

Beyond differences over costs of lost revenue, there are also considerable benefits to being able to conduct trade electronically which have often been overlooked in the Moratorium debate:

- Being able to digitise goods is tantamount to a reduction in transport costs which can be as high as 20-30% of overall trade costs. Since such costs tend to be highest for developing countries, electronic transmissions have the potential to help level the playing field in this area.
- Any tariff revenue reductions arising from the removal of tariffs on digitisable goods would be offset by increases in consumer welfare, overall giving rise to net welfare gains. Indeed, when tariff reductions on trade in digitisable goods are simulated, consumer welfare increases by USD 940 million, outweighing costs associated with revenue loss by USD 73 million. Additional welfare gains are also likely to arise from reductions in transport costs, although these are more difficult to model.
- The use of foreign business services, which can increasingly be digitally delivered, is found to increase export competitiveness. Access to such business services is found to be most important for lower middle income and lower income countries.
- Firm-level evidence confirms that digital technologies such as webpages or digital delivery allow firms in developing countries, including SMEs, to become exporters, giving rise to new opportunities to grow. Duties applied by other countries on electronic transmissions, including content, could affect the ability of domestic SMEs to export.

When countries consider whether to extend the Moratorium, they should take into consideration the wider benefits of the Moratorium and not focus solely on the revenue implications. The results in this analysis suggest that the revenue implications of the Moratorium are likely to be relatively small and its discontinuation would cause wider economic losses, including losses to consumer welfare and export competitiveness.

1. Introduction

The digital transformation has led to considerable changes in the way we engage in international trade. One important aspect of this evolving environment is the ability to transmit electronic content via digital networks – often referred to as electronic transmissions. Since 1998, WTO Members have regularly extended a Moratorium on imposing customs duties on electronic transmissions (hereafter "the Moratorium"),[1] most recently in 2017 at the eleventh WTO Ministerial Conference in Buenos Aires (MC11). However, as digital trade grows and as discussions "to commence WTO negotiations on trade-related aspects of electronic commerce" progress (WTO, 2019[1]) deliberations on electronic transmissions have been intensifying. Some WTO Members that are not participating in the Joint Statement Initiative (JSI) have expressed concerns about the revenue implications of the Moratorium (WTO, 2018[2]; WTO, 2019[3]).

Against this backdrop, this paper aims to provide an overview of the different issues at stake in this debate, with a view to supporting ongoing dialogue at the WTO. This work seeks to step back and think carefully through the numbers and the issues that countries may want to consider in deciding how to approach the Moratorium. It is hoped that this approach will provide a useful analytical tool for countries thinking through the issues, including at the national level.

To this end, this paper begins with an overview of what electronic transmissions refer to and the key issues raised by the Moratorium. It then reviews the empirical literature to assess the different approaches used to date to capture the economic impact of the Moratorium and their estimates. Section 3 then seeks to contextualise and shed new light on the debate by looking into issues that have often been left out of discussions: first, by putting current estimates of the revenue implications of the Moratorium into perspective; second, by looking more closely at who bears the costs of tariffs and at other possible sources of revenue; and third, by taking account of some of the benefits that arise from electronic transmissions. Finally, Section 4 summarises the main findings and makes some policy observations.

[1] With the exception of the Ministerial Conference of Seattle in 1999 and Cancun in 2003.

2. What issues do electronic transmissions raise?

Although there is no WTO definition of "electronic transmissions" referred to in the various ministerial decisions, in a trade context, they are generally understood to cover cross-border digital delivery, a key element of the evolving digital trade landscape (López González and Jouanjean, 2017[4]).[2]

Issues around duties on electronic transmissions have been the subject of debate since WTO discussions on e-commerce began in 1998. One of the most often raised questions relates to the economic and fiscal implications of the Moratorium on imposing duties on electronic transmissions. For a number of developing countries, tariffs can constitute an important source of fiscal revenue and, as such, some have voiced concerns about foregone revenue arising from the Moratorium (WTO, 2018[2]; WTO, 2019[3]).

The aim of this section is to provide a factual overview of the issues and debates around the Moratorium, including what the Moratorium is and what the evidence says about its economic implications.

2.1. What is the Moratorium and what does it apply to?

In parallel to the creation of the Work Programme on Electronic Commerce in 1998, WTO Members declared that they would continue their existing practice of not imposing customs duties on electronic transmissions. With the exception of the Ministerial Conferences in Seattle in 1999 and Cancún in 2003, the Moratorium has, thus far, regularly been extended.[3] Most recently, at MC11 in Buenos Aires in 2017, agreement was found on maintaining "the current practice of not imposing customs duties on electronic transmissions until our next session which we have decided to hold in 2019" (WTO, 2017[5]).

Even though the decision did not include a definition of electronic transmissions, WTO discussions point to the assumption that the Moratorium covers digital delivery. This means that it would not apply to other forms of digital trade or e-commerce such as physically delivered trade that has been digitally ordered (Wunsch-Vincent, 2006, p. 21[6]).[4] At the same time, the Moratorium states only that it covers customs duties and, therefore, not domestic and internal taxes.

However, there continue to be unresolved questions about the Moratorium and uncertainties about its coverage. For instance, absent the Moratorium, would duties apply to the transmission itself, through which content is 'transported' (the digital delivery service) or would they apply to the *content* of the transmission (Wunsch-Vincent, 2006,

[2] This contrasts with traditional definitions of e-commerce, which are based on the ordering process. Electronic transmissions refer to the digital element of the delivery, not the ordering.

[3] The Moratorium was not explicitly extended at the Ministerial Conference in Seattle (1999) and so its status was uncertain for two years until Ministers renewed it at the 2001 Ministerial Conference in Doha until the next Ministerial in Cancún (Wunsch-Vincent, 2006, p. 41[6]).

[4] Panagariya (2000, p. 960[67]) notes that "at the outset […] there is no ambiguity at present regarding the status of the goods ordered and paid for on Internet but delivered physically in the conventional manner. Except for the order and payment themselves, these transactions are treated as goods trade and the GATT discipline applies to them. The ambiguity arises only when the goods are delivered on the Internet".

p. 39[6])? This issue was recently raised by Indonesia, who argued that: "the extension of the moratorium applies only to the electronic transmissions and not to products or contents which are submitted electronically" (WTO, 2017[7]). Another question relates to whether electronic transmissions should be treated as goods or as services (see discussions in WTO (2003[8])). Additionally, there has also been some debate about whether electronic transmissions, including their content, can be considered "like" their physical counterparts.

In case electronic transmissions are considered as services these would be governed by GATS. Imposing duties on services would violate National Treatment obligations where commitments have been made, since duties are, by definition, discriminatory taxes (WTO, 1998, pp. 9-10[9]). It was also once suggested that electronic transmissions might be intellectual property (WTO, 1999[10]). If this were to be the case, Indonesia and Singapore suggest "the question of customs duties would not come into play. This is because it would be a question of royalties that have to be paid rather than tariffs" (WTO, 1999, p. 4[10]).

Against this backdrop, some WTO Members, including India and South Africa, have intensified their questioning of the revenue implications of the Moratorium (WTO, 2018[2]; WTO, 2019[3]) and Indonesia has signalled that they may begin to impose custom duties on the content of electronic transmissions. In March 2018, Indonesia introduced a specific tariff line for electronically transmitted content, laying the ground for enacting tariffs on electronically transmitted movies, e-books, and software (Cory, 2019[11]; Buditomo, 2019[12]; Buditomo, 2018[13]).

In parallel, certain WTO Members are advocating that the Moratorium be made permanent. For instance, under the Joint Statement Initiative on E-commerce, the EU has proposed that: "Members shall not impose customs duties on electronic transmissions, which include the transmitted content" (WTO, 2019[14]). The US and others also propose similar language (WTO, 2019[15]; WTO, 2019[16]; WTO, 2019[17]; WTO, 2019[18]).[5]

In addition, 56 WTO Members have signed at least one Regional Trade Agreement (RTA) including a provision prohibiting the application of customs duties on electronic transmissions. The majority (34) of these are RTAs between developed and developing countries; 19 RTAs are among developing countries, and three RTAs are among developed countries only. Many of these provisions bind signatories on a permanent basis (WTO, 2016[19]).

2.2. What is the current evidence on the economic impact of the Moratorium?

Many studies have sought to identify the economic impact of the Moratorium, however most focus exclusively on its potential revenue implications. This is to the detriment of a more holistic approach which would also take account of the benefits associated with trade cost reductions and potential productivity gains.

An early attempt by Schuknecht and Pérez-Esteve (1999[20]) used a list of goods derived from the Standard Industrial Trade Classification and the Harmonised System classification that included cinematographic film, newspapers and videogames to provide upper bound estimates of possible tariff revenue losses. Assuming that these goods would be fully digitised, and therefore that the extent of foregone revenue would be equal to the loss of tariff revenue from these physical goods in 1996, Schuknecht and Pérez-Esteve (1999[20])

[5] Some private sector organisations have also expressed their concerns and voiced their support to the renewal of the Moratorium, including on a permanent basis (International Chamber of Commerce, 2019[71]) (BSA, 2019[72]).

reported modest revenue effects, amounting to less than 1% of total tariff revenue across most countries. The paper also highlighted the strong potential of electronic transmissions to enhance services trade, underscoring that modest tariff revenue losses would need to be weighed against gains arising from growing trade in services (a point also made in Mattoo and Schuknecht (2000[21]) and Mattoo, Pérez-Esteve and Schuknecht (2001[22])).

Using weighted average applied MFN tariffs in 1997, and assuming that a range of goods would be fully digitised, Teltscher (2000[23]) argued that developing countries would incur 63% of the total tariff revenue losses arising from the Moratorium. This is because, even if developing countries have lower import volumes, they tend to apply higher tariffs on goods that are digitisable than developed countries. That said, losses for developing countries would range between 0% and 6% of customs revenue depending on the country, implying relatively modest overall losses in government revenue, ranging between 0% and 0.07% of total revenues.

More recently, and at the request of WTO Members, WTO (2016[19]) re-examined and updated analysis of tariff revenue losses arising from the Moratorium. Using a list of 30 HS 6 digit goods and their applied tariff rates, WTO (2016[19]) estimated that the revenue collected from "digitisable goods" had fallen from USD 1.2 billion in 2000 to USD 823 million in 2014 – a loss nearing USD 400 million.[6] This would amount to 0.26% of total estimated customs revenue in 2014, with only four developing countries collecting more than 1.5% of total customs revenues from such tariffs.

Using an updated list of 38 goods that could be digitised (identified from the HS goods classification) and the World Integrated Trade Solutions (WITS) partial equilibrium simulation model (SMART), Banga (2017[24]) re-calculated the revenue implications of the Moratorium. The overall loss of revenue, under the assumption that all digitisable goods would no longer be subject to tariffs, was estimated to be around USD 280 million in 2015.

Banga (2019[25]) used an updated list of 49 goods, also using the HS classification, to estimate the revenue impact of the Moratorium, focusing not only on the potential revenue loss arising from these trade flows being fully digitised, but also on the revenue not collected on trade flows that might have already been digitised such as e-books. To identify these, Banga (2019[25]) created a counterfactual projection of the value of trade that might have already been digitised by taking the growth rates of trade in these goods between 1998-2010 and extrapolating these for the period 2011-2017.[7] Using average *bound* tariffs, Banga (2019[25]) argues that potential aggregate tariff revenue losses could amount to USD 8 billion for developing countries and USD 212 million for developed economies in 2017. As expected, when using *effectively applied* duties, the foregone revenue is much reduced – USD 2.7 billion for developing countries and USD 123 million for developed countries.

In a different vein and using a computable general equilibrium (CGE) model, Lee-Makiyama and Narayanan (2019[26]) investigate the possible impact of applying tariffs on electronic transmissions, moving beyond customs revenue considerations.

[6] WTO (2016[19]) defines "digitisable goods" as "physical goods which have the potential to be digitised and subsequently sent across borders digitally".

[7] Foregone revenue on customs duties not currently imposed on electronic transmissions is calculated using the annual average rate of growth of trade in digitisable goods during the period 1998-2010 to proxy for trade in electronic transmissions for the period 2011-2017.

Lee-Makiyama and Narayanan (2019[26]) estimate that levying tariffs on digitally deliverable services could bring about GDP losses ranging between USD 6.5 billion and USD 10.5 billion for developing countries.[8] The paper argues that, for countries such as India, the GDP losses would outweigh the revenue gains by a factor of 49.

Overall, estimates of the revenue implications of the Moratorium vary widely (see Table 3.1 for a summary), ranging from USD 280 million to USD 8.2 billion, depending on the trade flows covered and tariffs applied (i.e., whether effectively applied, MFN or bound rates), as well as other underlying assumptions.[9] The variance in the results reflects the fact that providing precise estimates of the impact of the Moratorium is difficult, requiring consideration of issues such as 'likeness' (for instance, how similar an electronic transmission's content is to its physical counterpart) and how consumers might respond to changes in prices. It also entails making assumptions about how much trade has already been digitised and how much will be digitised in the future. This explains why it has been difficult to reach consensus figures on what might be at stake.

[8] However, these numbers are likely to be driven by the assumption in footnote 19 that "imports do not substitute domestic production". This means that countries would pay higher prices for their imports and would not be able to substitute these with domestic production giving rise to larger impacts on GDP.

[9] This includes the value of trade that might or might not be affected, the counterfactual scenario, or whether or not it is assumed to be possible to impose duties on trade in services.

3. Shedding new light on the Moratorium debate

Understanding the full economic implications of the Moratorium requires putting the existing empirical evidence into a wider context and broadening the debate. To this end, this section provides a checklist of some of the factors to be considered, drawing on new and up-to-date data where possible and, where not, using existing literature to identify likely impacts.

The first part of the section puts the current estimates of the revenue implications of the Moratorium into perspective, looking at the share of revenue represented by the lost tariff revenue and the share of trade likely to be affected. The section then discusses other issues that need to be considered when thinking about the impact of the Moratorium in terms of tariff revenue, including, who bears the burden of tariffs and whether tariffs are an appropriate and/or efficient tool for raising revenue or whether alternative taxation methods might be better suited for the digital economy.[10] Finally, the section attempts to address a critical gap in the literature by providing an overview of some of the broader economic benefits associated with electronic transmissions, including in terms of welfare and productivity gains.

3.1. Putting potential revenue implications into perspective

Differences in estimates of the revenue implications of the Moratorium arise from different choices in counterfactual scenarios or parameters. At one end of the spectrum, WTO (2016[19]) identifies revenue losses using applied tariffs for a set of 30 "digitisable goods". At the other end, Banga (2019[25]) uses an expanded list of 49 goods to construct a counterfactual scenario proxying for trade that might have already been digitised, using their bound tariff to calculate potential revenue loss.

As is often the case with assumptions and counterfactual scenarios, there is no right answer. Lists of digitisable goods can, and most likely will, be disputed. The same applies to estimates of the amount of trade that has already been digitised or the type of tariff that should be used to calculate revenue implications (although there appears to be a strong case, in the absence of precise revenue data from customs, to favour estimations that use applied rather than bound tariffs – see Box 3.1).

Given disagreements in current estimates, there is value in taking a step back and putting the different empirical estimates into perspective.

[10] The feasibility of imposing customs duties on electronic transmissions was raised in a recent India and South African Communication (WTO, 2019[3]). However, less researched areas such as the costs involved might also be important in this context.

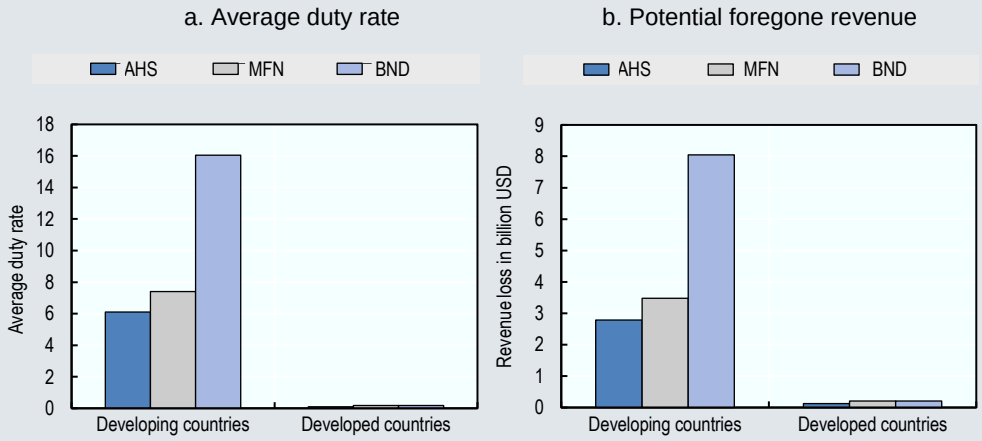
Box 3.1. Duty types and estimates of potential revenue losses

The use of bound tariffs to calculate potential foregone revenue from the Moratorium can pose conceptual challenges. This is because it implicitly presumes that:

- Countries would revert to bound tariffs where they have already agreed to preferential tariffs. It also disregards the fact that some countries have already agreed, in their bilateral agreements, not to charge customs duties on electronic transmissions (WTO, 2016[19]).
- Governments would change their current tariff policy stance favouring revenue collection over other objectives. Applied tariffs reflect a range of trade-offs which include, among others, consumer welfare, export competitiveness and tariff revenue. Using bound tariffs in the analysis assumes changes in current objectives in favour of higher tariffs than those currently applied. This change in objectives would require further justification.
- Changes in tariffs do not necessarily lead to changes in prices. That is, even if tariffs increase from 12% to 80%, as would be the case if Nigeria were to move to its bound rate for the goods covered in Banga (2019), the value of trade that Nigeria would import under current analyses would remain the same. A more realistic analysis would reflect that trade would likely go down as a result of the change in price which would yield a smaller revenue effect than when calculated by simply multiplying the tariff times the value of trade.

This matters because the choice of duty type has a considerable impact on the calculated foregone revenue. Indeed, the bound tariff rate estimates in Banga (2019[25]) are 2.8 times larger than the effectively applied estimates (Figure 3.1).

Figure 3.1. Potential revenue implications by tariff rate in Banga (2019)



Source: Adapted from Banga (2019).

Even calculations based on statutory[1] and not effectively applied rates can be problematic. According to Brenton et al. (2009[27]), "using statutory rather than actually applied duties to investigate the impact of tariff liberalization scenarios will [...] typically lead to a substantial overestimation of the impact of tariff liberalization on trade flows and revenues". Indeed, "in practice large amounts of imports are exempted from paying customs duties. A common feature of import regimes of developing countries is the widespread use of tariff exemptions for various reasons. For example, a range of institutions including the government, international agencies, embassies and NGOs often do not pay duties on products imported for official purposes" (Brenton et al., 2009, p. 3[27]). This suggests that it might be more accurate to consider applied tariff estimates when discussing the potential foregone revenue implications of the Moratorium.

1. Statutory tariffs refer to tariffs on paper rather than those that are effectively collected.

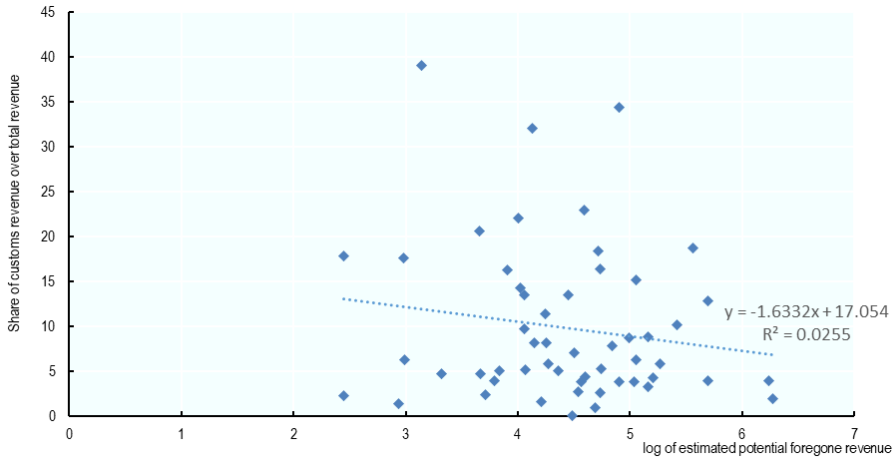
Estimated foregone revenue as a share of overall revenue is small and concentrated

Existing estimates of potential foregone customs revenue vary widely – from USD 280 million to USD 8.2 billion depending on the study (Table 3.1). However, even when taking the highest estimates, potential foregone revenue as a share of total revenue is relatively small, amounting to an average 0.08%-0.23% reduction in government revenue for developing countries (Table A.2 for calculations and disaggregated results). While potential revenue impacts tend to be higher for developing countries than for developed countries (not unexpected, given that developing countries tend to levy higher tariffs on such goods than developed countries), the potential for welfare gains from tariff liberalisation are higher for developing countries than for developed countries.

The data also shows a negative correlation between potential foregone revenue, as calculated in Banga (2019[25]) using bound tariffs, and the share of customs revenue over total government revenue (Figure 3.2). This implies that developing countries with higher potential foregone revenue rely least on customs revenue as a source of overall government revenue. However, there are ten developing countries where potential foregone revenue calculated using bound rates might represent more than 1.5% of overall government revenues, but this number decreases to four countries when effectively applied duties are considered (see Box 3.1 for a discussion of issues arising from the use of bound duties to calculate foregone revenue).

Most – 74% – of the potential foregone revenue, as calculated in the highest numbers in Banga (2019[25]), would accrue to developing countries that are part of the Joint Statement Initiative, and therefore already actively discussing issues around the Moratorium.

Figure 3.2. Higher potential revenue losses are in countries which rely least on customs revenue as a source of overall government revenue



Note: Estimates of potential revenue loss are those calculated in Banga (2019[25])for bound tariffs.
Source: Own calculations using Banga (2019[25]) and World Development indicators.

Table 3.1. Summary of empirical literature

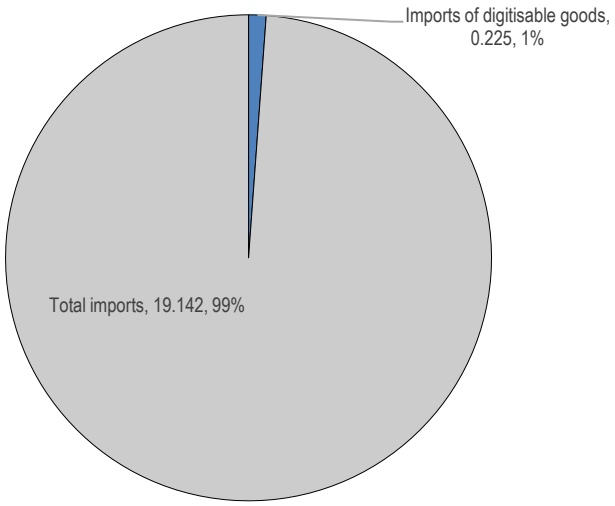
Study	Methodology		Average total revenue losses						Range
			Million USD		% of total customs revenues		% of total government revenues		% of total government revenues
			Developed countries	Developing countries	Developed countries	Developing countries	Developed countries	Developing countries	
Schuknecht and Pérez-Esteve (1999[20])	The physical delivery of digitisable goods is totally replaced by electronic delivery and no tariffs are imposed on the latter; weighted average applied rates		233.4	613.5	0.7	0.9	0.01	0.13	Max: People's Republic of China (0.95) Min: Japan, Norway, United States (0.0)
Teltscher (2000[23])	The physical delivery of digitisable goods is totally replaced by electronic delivery and no tariffs are imposed on the latter; weighted average applied rates		264	449.3	1.39	0.7	0.02	0.07	Max: Paraguay (6.39) Min: Estonia, European Union, Japan, Kyrgyzstan, Lithuania, Norway, Singapore, Switzerland, United States (0.0)
WTO (2016[19])	Taking the difference between revenues collected on "digitisable goods" in 2014 and 2000; applied rates		117.2	236.8	0.2	0.65	0.01	0.06	
Banga (2017[24])	SMART model - World Integrated Trade Solutions. The sample includes 37 countries and the European Union; bound rates		24.5	255.8	0.03*	0.15*	0.00*	0.01*	Max: United Arab Emirates (2.26) Min: Australia, Canada, European Union, Japan, New Zealand, United States (0.0)
Banga (2019[25])	Considering tariffs imposable on imports in the absence of the Moratorium, both on digitisable and digitised goods	Actual applied rates	123.8	2,788.50	0.16*	1.58*	0.00*	0.08*	Max: Fiji (8.04)* Min: Albania, Maldives, Singapore, Turkey, Canada, European Union, Japan, Norway, Switzerland, United States (0.0)*
		Average MFN duties	212.2	3,482.90	0.24*	2.00*	0.00*	0.10*	Max: Fiji (8.58)* Min: Singapore, Turkey, European Union, Japan, Norway, Switzerland, United States (0.0)*
		Bound rates	212.2	8,043.90	0.24*	4.35*	0.00*	0.23*	Max: Malawi (8.99)* Min: Japan, New Zealand, Norway, Turkey, United States (0.0)*

Note: *Estimates obtained using the World Bank's World Development Indicators (WDI).

The amount of trade that is involved is, to date, also relatively small…

A central element in the Moratorium debate is the value of trade which can potentially be digitised. Depending on the study, estimates of imports of digitised and digitisable goods range from USD 20 billion to USD 225 billion.[11] Even when taking the highest available estimates, which include a proxy for trade that has already been digitised (Banga, 2019[25]), these values remain modest, representing only 1.2% of total trade (Figure 3.3).[12]

Figure 3.3. Share of imports of digitisable goods over total imports, 2017 (USD trillion)



Note: Values in USD trillion. Includes countries covered in Banga (2019).
Source: Own calculations using Banga (2019[25]) and WDI.

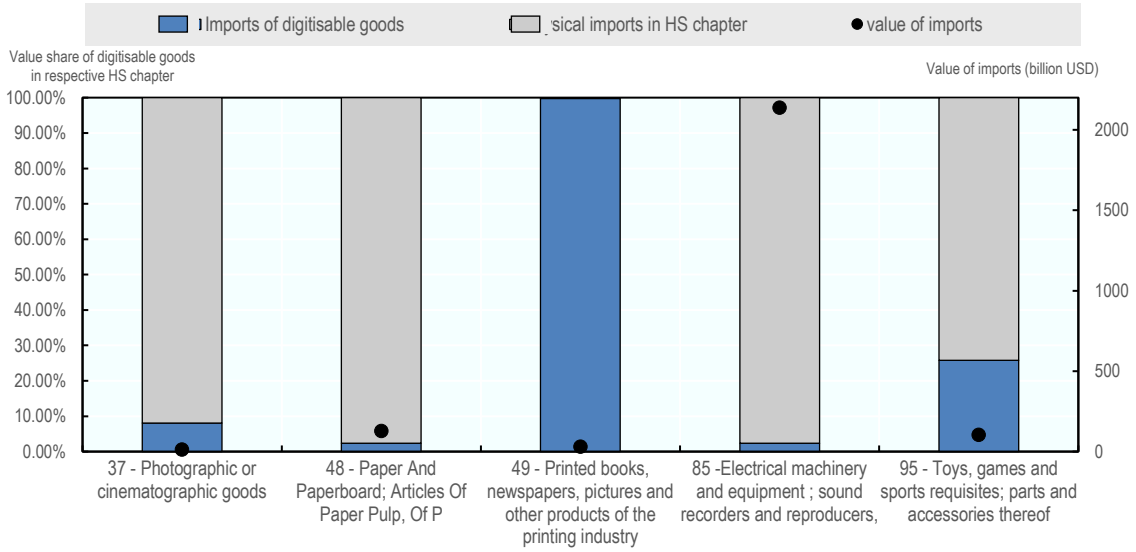
Digitisable goods also concentrated in few product categories. The most extensive list of such goods includes 49 HS 6-digit categories (Banga, 2019[25]), distributed in only five of the ninety-six Harmonised Commodity 2-digit Chapters: Photographic or Cinematographic goods, Paper and Paperboard, Printed matter, Sound Recorders and Reproducers, and Toys and Games. Within these Chapters, the potential share of goods that could potentially be digitised also varies widely. For instance, while most printed matter could be digitisable, fewer goods are potentially digitisable in sectors such as toys or electrical machinery (Figure 3.4). Within specific categories, there is also a question about whether all potentially digitisable goods would actually be digitised.

[11] There are two figures in Banga (2019[25]) for total imports of digitisable goods. The first is USD 255 billion based on their Figure 1, the second is USD 225 billion, based on their Table A A.2.

[12] Total imports include both goods and services. When taking into consideration only trade in digitisable goods as per Banga (2019[25]), without estimates of trade that has already been digitised, then the share is a more modest 0.75%.

Figure 3.4. Digitisable goods concentrate in few product categories

Share and value of digitisable trade by product category in 2017

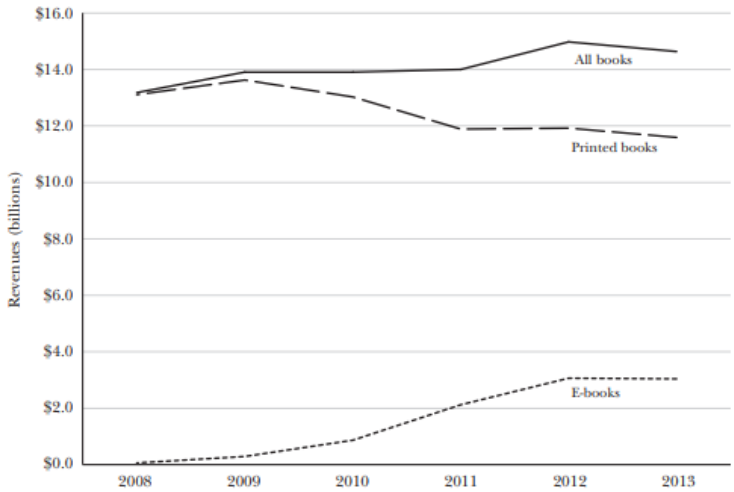


Source: Own calculations using COMTRADE based on list of digitisable goods in Banga (2019[25]).

Not all trade that can be digitised will be digitised and new customs revenues could be generated

The extent to which electronic transmissions will replace physical counterparts remains uncertain. Not all product categories that are digitisable will be fully digitised. For instance, Gilbert (2015[28]) shows that sales of e-books in the United States have plateaued, representing about a fifth of total sales of all books (Figure 3.5). This suggests that many of the current estimates of the potential revenue implications of the Moratorium might overestimate the actual impact since most assume that all trade that could be digitised will be digitised.

Figure 3.5. Sales of books in the United States

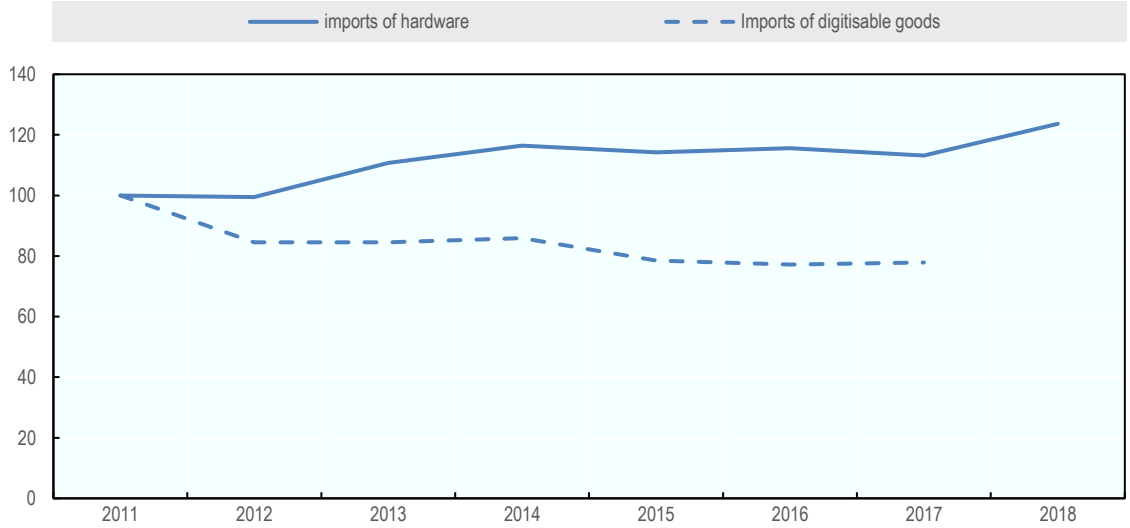


Source: Gilbert (2015[28]), originally from Book Industry Study Group (2011[29]; 2014[30]).

Another issue relates to growing complementarities between electronic transmissions and other goods. For example, lower prices for e-books can drive demand for e-readers. Similarly, demand for smart TVs or projectors can rise as the cost of online streaming falls. Hence, growing electronic transmissions can spur trade in other related goods (which may themselves be subject to tariffs).

This is the case for a set of smart or hardware goods which include mobile phones, projectors, headphones, speakers, smart TVs and computers (see Annex A for a discussion of how these goods were chosen). As seen from Figure 3.6, reductions in imports of goods that could be digitised were concurrent with increases in physical imports of hardware, which were nearly six times larger in volume.[13] This suggests that reductions in customs revenue in one sector could be compensated by increases in revenue in other sectors.

Figure 3.6. Changes in imports of hardware and digitisable goods (2011=100)



Note: See Table A.1 for list of hardware and Banga (2019[25]) for list of digitisable goods.
Source: Own calculations based on WITS.

The value of trade that is likely to become digitisable in the next few years may also be smaller than supposed

A recurring topic in the Moratorium debate relates to uncertainties arising from new technologies and their impact on what could become digitally deliverable in the future. In particular, some argue that 3D printing has the potential to exacerbate the revenue implications of the Moratorium by making more goods digitally deliverable (WTO, 2018[2]; WTO, 2019[3]).

3D printing refers to a manufacturing process that operates through the successive superposition of layers of materials (e.g. plastics, ceramics) to produce goods from

[13] Although it is difficult to establish the causal relationship between electronically transmitable trade and trade in related physical goods.

computer-aided design (CAD) files using a 3D printer.[14] Given uncertainties related to the capabilities and adoption of the technology, the implications of 3D printing for trade have been the subject of wide speculation, with some suggesting that 3D printing might replace as much as two-fifths of world trade in goods by 2040 (Leering, 2017[31]).

However, adoption of 3D printing technology, while growing, has been slow (OECD, n.d.[32]). There are also limitations to the use of 3D printing technologies. For instance, additive manufacturing does not provide significant opportunities for economies of scale, implying that its ability to fully replace more traditional manufacturing might be limited (Kommerskollegium, 2016[33]).[15] High specific costs are a central impediment to the widespread adoption of additive manufacturing systems (Baumers et al., 2016[34]), and print-time and material use remain important factors that condition 3D printing costs (OECD, 2017[35]). For these reasons, the technology is traditionally associated with the production of smaller batches of more specialised and geometrically complex products, most useful in manufacturing prototypes; materially simple or customised final consumer goods; and customised intermediate products (see the example of air-cooling ducts in the F-18 Super Hornet Fighter-Jets in Khajavi, Partanen and Holmström, (2014[36])).

The scope of products that can be printed depends on the size of the object and on the materials used to print – the 'ink' (OECD, 2017[35]). 3D printers can be limited by the size of their casing (Attaran, 2017[37]), although they are now being used to produce larger objects, as is the case in the architecture industry (OECD, 2017, p. 178[35]). Limitations can also arise from the strength of the materials used, which may condition the size of what can be printed (Huang et al., 2013, p. 1194[38]). The scope of 3D printing can also be limited when it comes to micro or nano-products (OECD, 2017, pp. 178-179[35]; Li et al., 2011[39]). Moreover, products requiring many different materials like, for instance, mobile phones, are less likely to be fully 3D printable, at least in the near future (OECD, 2017, p. 179[35]).[16] This suggests that, while 3D printing is a versatile technology, the scope of products that can be 3D printed remains low.

At the same time, the adoption of additive manufacturing technology does not necessarily imply a reduction in cross-border trade in goods. A variety of factors, including operating costs and personnel costs might make it more convenient to deploy 3D printers in one location and then ship products to service locations ('centralised rapid manufacturing') rather than adopting 3D printers in a variety of locations and transferring digital files between these ('distributed rapid manufacturing') (Holmström et al., 2009[40]). While the configuration of trade flows in selected product categories and countries might change as a result, this does not necessarily imply a decrease in the value of cross-border trade in goods. Indeed, in the case of hearing aids, the growing adoption of 3D printing technologies has resulted in an increase rather than a decrease in trade in hearing aids (Box 3.2).

[14] The latter vary in the exact printing process they employ, including extruding a solid filament of material through a heated nozzle (Thermoplastic injection) or using liquid photopolymer that hardens when UV light strikes it (Light-polymerised printing) (OECD, 2017[35]).

[15] A number of technical studies compare injection moulding techniques to additive manufacturing for the production of spare parts, to identify the breakeven volumes at which it is more convenient to deploy traditional injection moulding techniques than 3D printing. One result is that beyond 10 000 parts, traditional injection moulding techniques are more economical than additive manufacturing. (Ruffo, Tuck and Hague, 2006[73]) (Hopkinson and Dickens, 2003[74]).

[16] This does not mean that the technology cannot be used in manufacturing plants to print specific components of a mobile phone that can then be assembled.

Similarly, the wider adoption of 3D printing is likely to spur more trade in the raw materials, or natural resources, used as 'ink' (Kommerskollegium, 2016[33]; Lee-Makiyama and Narayanan, 2019[26]).

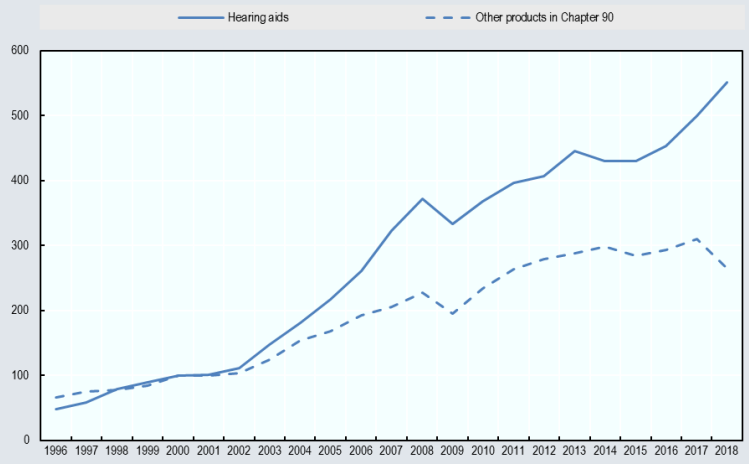
Hence, while it is difficult to estimate the impact of an evolving technology, a review of the existing literature suggests that dramatic changes in trade arising from the wider adoption of 3D printing technology are unlikely in the short-term. According to McKinsey Global Institute (2019[41]) 3D printing might replace between 1 and 2% of physical trade by 2030.

Box 3.2. Digitisation can increase goods trade: a case study of hearing aids

Hearing aid manufacturers rely on data for pre- and post-purchase customisation. They scan the customers' ear channels to produce a precise 3D-model of the inner ear which they then use to 3D-print a hearing aid in house and send to the customer. Once shipped to the customer, data flows support remote technical calibration for better performance of the hearing aid (Casalini and López González, 2019[42]).

Although trade in hearing aids remains modest, at around USD 4.7 billion, it has been growing at a faster rate than trade in other products of that same chapter (Figure 3.7) since the industry switched to additive manufacturing techniques in around 2007. This suggests that 3D printing technology can complement rather than substitute for physical trade.

Figure 3.7. Trade in hearing aids 1996-2018 (2000=100)



Note: Hearing aids identified using HS-code 902140 : 'Hearing aids, excluding parts and accessories'.
Source: Own calculations using WITS COMTRADE based on World Bank (2019[43]) quoting Freund, Mulabdic and Ruta (n.d.[44]).

3.2. Deepening the debate on tariffs

There are a number of issues that have received less attention in the Moratorium debate but which require further thought. These include discussions about who bears the burden of tariffs or whether or not there are alternative sources of government revenue better suited to the digital economy.

Tariffs tend to tax domestic consumers and can have wider negative impacts

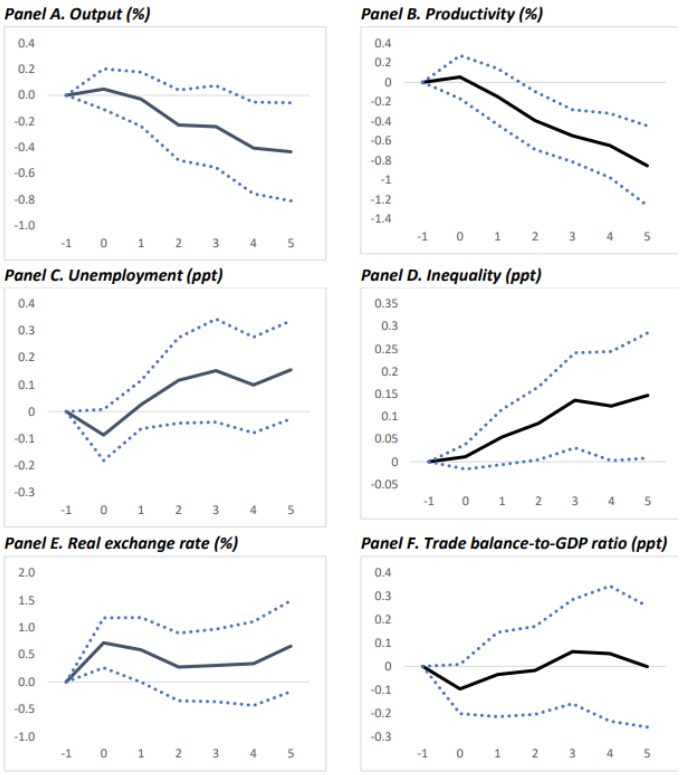
Customs duties are a form of discriminatory taxation applied to goods originating from abroad. They create a wedge between domestic and foreign prices with consequences for consumers, government revenue and domestic and foreign producers. Tariff increases often come at the expense of consumers who end up paying higher prices. Part of the impact is a transfer from consumers to producers and to the government, but there is also an associated deadweight loss to the economy (Annex B).

The extent to which consumers are affected depends, in part, on the tariff pass-through, which is the degree to which increases in tariffs are translated into higher domestic prices. At one extreme, there can be full pass-through when domestic prices increase in proportion to the tariff. At the other extreme, tariffs can be fully absorbed by companies reducing their profit margins to compensate for the tariff increase with a view to remaining competitive in the domestic market.

Recent evidence on the incidence of tariffs shows that a quasi-complete pass-through of tariffs to domestic prices tends to be most common (Amiti, Redding and Weinstein, 2019[45]; Fajgelbaum et al., 2019[46]; Cavallo et al., 2019[47]). This suggests that price increases arising from tariffs are most likely to be absorbed by consumers and not foreign companies. That is, foreign companies will pass-on the price increases to domestic consumers affecting their ability to afford electronically transmittable trade.

Moreover, tariffs can also have broader negative impacts over time. Recent work by Fajgelbaum et al. (2019[46]) shows that "tariff increases lead, in the medium term, to economically and statistically significant declines in domestic output and productivity. Tariff increases also result in more unemployment, higher inequality and real exchange rate appreciation" (Figure 3.8). Tariffs applied on electronic transmissions, including content, could also lead to reductions in GDP as identified in Lee-Makiyama and Narayanan (2019[26]).

Figure 3.8. The effect of tariffs



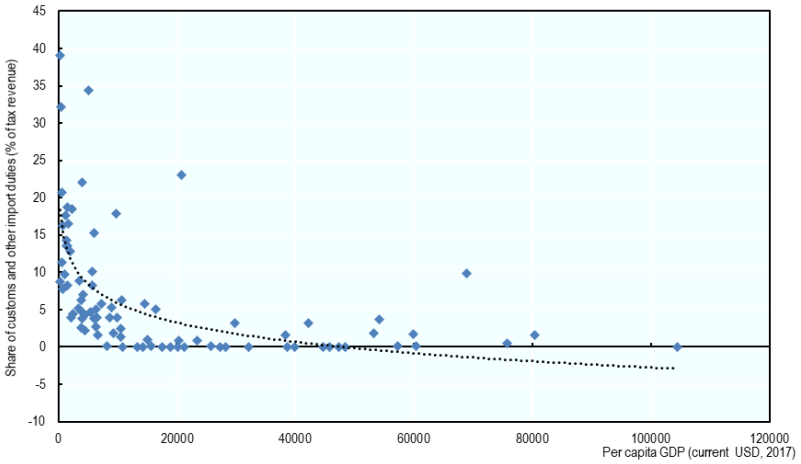
Note: The solid line indicates the response of the variable in question to a one standard deviation increase in tariff. The dotted lines corresponds to the 90% confidence interval.
Source: Fajgelbaum et al. (2019[46]).

Alternative, non-discriminatory and more stable mechanisms for collecting revenue exist

In the off-line world, relative to alternative taxes such as consumption or sales taxes, one advantage of customs duties is that they apply to physical products crossing borders and therefore tend to be "easy to collect" (Aizenman and Jinjarak, 2006[48]). They also have lower administrative costs (World Bank, 1988[49]).[17] This, coupled with more limited institutional capabilities, is why developing countries tend to rely more on tariff revenues than developed countries (Aizenman and Jinjarak, 2006[48]) – see Figure 3.9. However, it is not clear that these differences remain in the case of tariffs and taxes on electronic transmissions including content: there is little information about the likely fixed set-up and administrative and compliance costs of a system for collecting tariffs on digital deliveries, but it is likely to be similar to those for collecting consumption or sales taxes.

[17] The administrative costs of trade and excise taxes range from 1 to 3% of revenue collected, whereas the corresponding figure for VATs can be as high as 5% (World Bank, 1988[49]).

Figure 3.9. Share of overall revenue from customs and per capita GDP



Source: Own calculations from World Development Indicators.

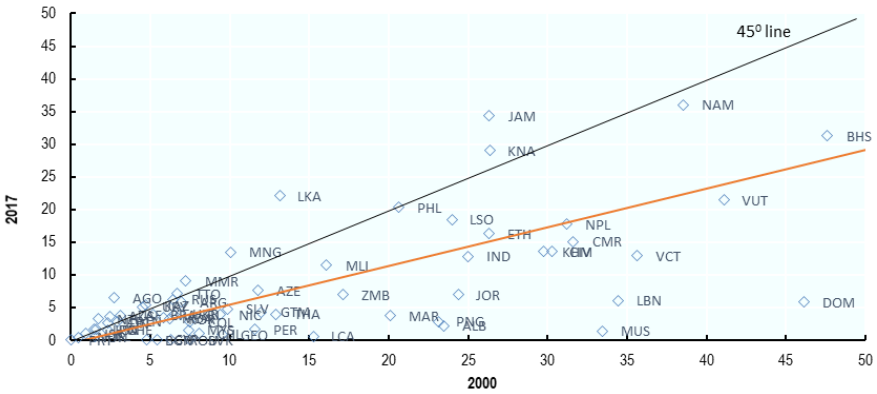
Evidence suggests that developing countries adopting indirect taxes like value added taxes (VAT) experience 40 to 50% less tax revenue instability than countries which do not have a VAT system (Ebeke and Ehrhart, 2011[50]). There is also evidence that shifting from trade taxes to consumption and income taxes might be desirable given that trade taxes can be an inefficient way of raising government revenues (Kowalski, 2005[51]). Indeed, trade taxes apply to a narrow base, taxes applied to either domestic production, consumption or both would have the advantage of being broader based compared to trade taxes (Whalley, 2002[52]).

This is partly why countries are moving away from tariffs as a source of government revenue (Figure 3.10), including towards the implementation of VAT/Goods and Services Tax (GST) systems. In the area of VAT/GST in the digital age, international cooperation has delivered concrete solutions to address the challenges arising from digitalisation. The OECD has developed international guidelines which are now implemented across many countries worldwide (Box 3.3).[18] This suggests that, for countries concerned about revenue

[18] This is not to be confused with OECD efforts related to income taxation in the digital economy. These discussions are currently structured in two pillars: the first addresses the allocation of taxing rights on income generated on cross-border activities, responding to technological change enabling companies to carry out economic activities abroad without significant physical presence. The second pillar addresses remaining BEPS issues, including strengthening the ability of jurisdictions to tax profits where other jurisdictions apply low effective rates of taxation on these profits. A detailed Programme of Work has been adopted by the OECD/G20 inclusive Framework on BEPS – and its 134 member countries and jurisdictions – In May 2019 (OECD, 2019[75]), subsequently endorsed by G20 Finance Ministers at their 8-9 June meeting in Fukuoka. To date, the Inclusive Framework members and the OECD Secretariat are working on a proposal that could unify the various positions and serve as a basis of a global long-term, consensus-based solution to the tax challenges of the digitalisation of the economy. G20 and G7 Leaders, at their respective summits in Osaka (June 2019) and Biarritz (August 2019), reaffirmed their commitment to find a multilateral solution to be presented in 2020.

losses in the context of tariffs on electronic transmissions, there is a feasible alternative for generating revenue without discriminating against foreign suppliers.[19]

Figure 3.10. Share of customs revenue over total government revenue is declining



Note: Based on data from 67 countries.
Source: Own calculations using World Development Indicators.

Box 3.3. Using VAT/GST in digital and ecommerce

The OECD has been leading global efforts in designing efficient, effective and internationally agreed responses to the VAT/GST challenges of digitalisation for several years. These responses build on the 1998 Ottawa taxation framework conditions that set the broad taxation principles for electronic commerce. These include the neutrality between electronic and conventional commerce, efficiency in minimising costs for governments, certainty and simplicity, effectiveness and fairness, and flexibility (OECD, 1988[53]).

The OECD delivered the International VAT/GST Guidelines ("the Guidelines") in 2016 as the first global standard for the consistent and effective design of VAT-systems. The Guidelines were adopted by G20 Leaders as part of the G20/OECD BEPS Project, and endorsed by over 100 jurisdictions and organisations at the OECD Global Forum on VAT in 2015. The Guidelines and the 2015 BEPS Action 1 Report included rules, mechanisms and recommended approaches for the effective collection of VAT/GST on sales of goods, services and intangibles from online trade in the consumers' jurisdiction, to ensure tax neutrality between domestic and foreign suppliers, regardless of their location.

Following the delivery of the Guidelines, the OECD has developed packages to ensure that the recommended solutions are implemented effectively and consistently, that they are adjusted to the rapidly changing economic context, and that the vulnerability of the international VAT framework to fraud and avoidance from online trade be minimised. The 2017 report on "Mechanisms for the Effective Collection of VAT/GST Where the Supplier is Not Located in the Jurisdiction of Taxation" (OECD, 2017[54]) provides further detailed practical guidance to support their consistent and effective implementation. Another recent key deliverable from this work is the report on "The Role of Digital Platforms in the Collection of VAT/GST on Online Sales" (OECD, 2019[55]) which provide guidance on a range of measures for enlisting e-commerce marketplaces and other digital platforms in the collection of VAT on the sales that they facilitate.

Work is being developed with the active involvement of a wide range of jurisdictions beyond the OECD membership, notably via the OECD Global Forum on VAT/GST – a unique global platform for dialogue on

[19] It is important to recall that the Moratorium debate is different. Issues around the Moratorium are limited to discriminatory customs duties and fall within the remit of the WTO. The conflation between VAT/GST regimes or income taxation and customs duties on electronic transmissions is for example present in Banga (2019[25]) or in WTO (2019[3]).

international VAT/GST standards which brings together over 100 jurisdictions, including regional and international organisations.

To date, over 50 jurisdictions have adopted rules for the application of VAT/GST to B2C supplies of services and intangibles from online sales by foreign vendors in accordance with rules and mechanisms recommended in the Guidelines and the 2015 BEPS Action 1 Report. The evidence on the impact of these measures suggests that their implementation has greatly enhanced compliance levels and yielded substantial tax revenues for market jurisdictions, and has levelled the playing field between domestic suppliers and foreign vendors. Estimates on the tax revenue generated from the adoption of the VAT/GST standards are available, including AUD 269 million and NZD 131 million for Australia and New Zealand respectively in the first year of implementation, ZAR 3 billion for South Africa over a five-year period, and EUR 10.2 billion for the European Union over the first three years of implementation (OECD, 2019, p. 6[56]).

Among those countries that have successfully implemented those solutions, Australia recently adopted legislation imposing GST on imported services and digital products. This provides an example of good practice on the use of taxes to address the tax challenges of the digital economy (Box 3.4).

Box 3.4. Australia's Goods and Services Tax on offshore intangible supplies

On 1 July 2017, Australia extended its Goods and Services Tax (GST) to the sale of "imported services and digital products to Australian consumers". From this date, GST applies to all intangible supplies such as the supply of digital content, games and software – as well as consultancy and professional services performed offshore for customers in Australia.

Under these new arrangements, entities supplying these services and digital products, and who meet the GST turnover threshold (of AUD 75 000 in sales that are connected with Australia over a 12-month period), must register for GST, charge GST on these sales, and lodge returns with the Australian Taxation Office.

The GST is levied on overseas suppliers for transactions involving Australian customers (B2C transactions). The Goods and Services Tax Ruling 2017/1 provides greater detail on how overseas suppliers can determine if the supply is connected with Australia – that is, if the recipient is an Australian consumer.

Electronic Distribution Platforms (EDPs), which are entities that make supplies of services and digital products available to end-consumers by means of electronic communication, are also subject to the GST on the sales for which they are liable. EDPs are also required to register for GST, charge GST on their sales and lodge returns if they meet the GST turnover threshold. However, only one entity is liable for the GST on a taxable sale. If an EDP is responsible for GST on a sale, no other entity has GST obligations.

This reform ensures that imported services and digital products purchased by Australian consumers face the same tax arrangements as those that are sourced from within Australia. This helps create a level playing field between overseas and domestic suppliers of services and digital products, and allows for the collection of GST on the increasing value of inbound intangible consumer supplies.

Source: (Australian Taxation Office, 2017[57]), https://www.ato.gov.au/Business/International-tax-for-business/GST-on-imported-services-and-digital-products/

3.3. Thinking about the benefits of electronic transmissions

Another element that has often been neglected in the Moratorium debate is a wider discussion of the benefits associated with being able to conduct trade electronically. Indeed, the empirical literature has, to date, narrowly focused on the revenue implications and not the associated benefits. Drawing on a combination of existing literature and new data, this section discusses how electronic transmissions can enable desirable economic outcomes, including welfare gains and increases in export competitiveness, outcomes which are put at risk by measures, such as tariffs, that increase their cost.

Electronic transmissions can reduce trade costs and removing tariffs is, overall, welfare enhancing

At its most basic, digitising goods is tantamount to a reduction in the cost of engaging in trade (WTO, 2018[58]; López González and Ferencz, 2018[59]).[20] Indeed, a good that was once delivered physically but which can now be transmitted electronically will no longer incur transportation costs. These, according to Duval, Utoktham and Kravchenko (2018[60]) can represent, on average, between 20-30% of total trade costs for goods (by contrast, tariff costs typically represent, on average, 2-3% of trade costs).[21] This suggests that, with greater connectivity, electronic transmissions can offer poorer countries new opportunities to overcome their trade cost disadvantages (Figure 3.11).

Trade cost reductions, including those that arise from digital delivery, are likely to have welfare enhancing impacts (Annex B). Moreover, when a good that was facing a tariff is digitised, foregone government revenue is generally redistributed to the consumer, with the overall impact remaining positive. If a government were able to introduce a tariff on the related electronic transmission, including its content, it would recover some government revenue (the size of which will depend on the elasticity of demand), but this would come at the expense of the consumer and would generate deadweight loss for the economy.

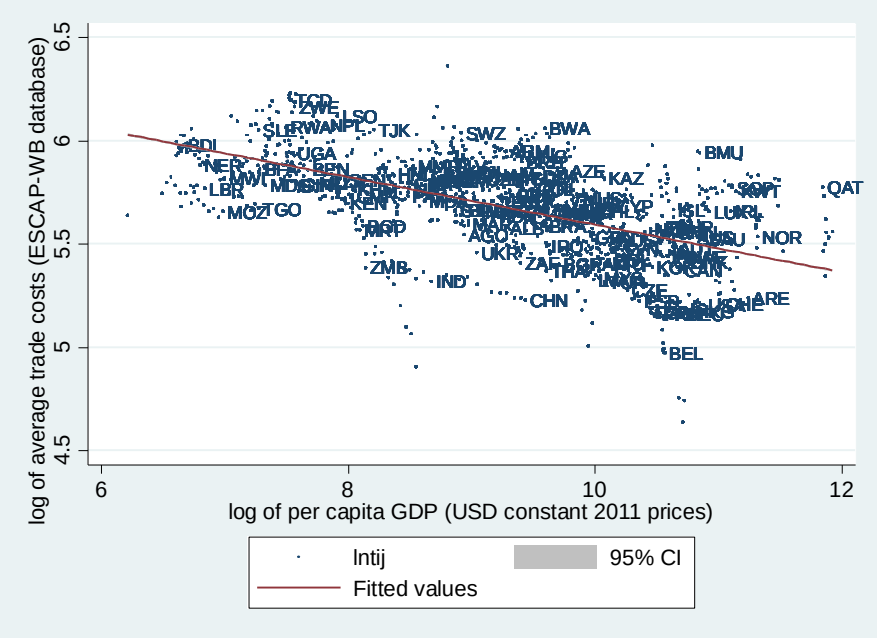
A simple exercise can help illustrate the welfare effects associated with tariff liberalisation on goods that could be delivered electronically. While this is not a calculation of the revenue implications, it provides insights into the welfare effects of trade liberalisation in the context of the Moratorium, looking not only at tariff revenue losses but also at consumer welfare gains.[22]

[20] Note that the process of digitalisation might also reduce overall costs of production. For instance, a record label might no longer have to incur the costs related to producing the physical carrier medium for records. This suggests that digitisation can also have important cost saving effects (see Annex B for a brief discussion of the welfare implications when we incorporate cost and transport reductions).

[21] Samuelson (1954[76]) introduced the concept of "iceberg costs", to refer to transport costs, suggesting that, when trading, exporters would need to send a higher value of a product given that a part of the value of the product 'melts' as it arrives at its destination. The ability to transmit electronically reduces the incidence of these costs dramatically.

[22] Consumer welfare refers to individual benefits derived from consumption. It is generally calculated as the difference between what a consumer is willing to pay to consume a product and what the consumer actually pays.

Figure 3.11. Trade costs and per capita GDP



Note: Average trade costs calculated as simple average across all partners.
Source: Own calculation using data from the Penn World Tables v 9.1. and ESCAP-WB trade cost database.

Taking the 49 digitisable goods defined in Banga (2019[25]) and using the WITS-SMART partial equilibrium simulation model, Table 3.2 summarises the welfare impacts of liberalising trade in these products – See Annex Table A.3 for a country breakdown.[23] The results show that reductions in government revenue associated with tariff liberalisation are completely offset by increases in consumer welfare across all countries. Indeed, overall, as a result of tariff liberalisation, consumer welfare increases by USD 940 million with government revenue falling by USD 865 million, giving rise to an overall net welfare increase of USD 73 million. Moreover, if, within this framework, one were also able to account for gains associated with reductions in trade costs, the net welfare gains would increase dramatically.

Table 3.2. Impact of reducing tariffs on digitisable goods (2018), 1000 USD

	Tariff revenue	Consumer surplus	Net impact
Developing	- 844 078.67	917 813.11	73 734.44
Developed	- 20 446.86	20 582.69	135.83
TOTAL	- 864 525.53	938 395.80	73 870.27

Note: Based on WITS-SMART model. Developing countries are defined on the basis of WTO classification.
Source: Own calculations using the WITS-SMART model.

[23] The WITS-SMART model is used because it is a readily available tool for running partial equilibrium simulations that is well understood and trusted by many countries, including developing countries.

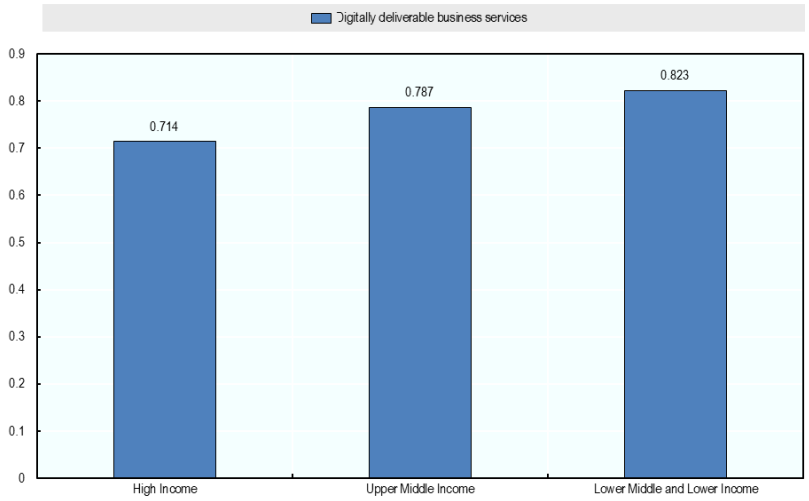
Digitally deliverable services increase domestic value added in exports

Another channel through which digital deliveries can benefit countries is through the input channel. As is shown in Kowalski et al. (2015[61]) and Lopez-Gonzalez (2016[62]), the use of foreign value added is associated with positive economic outcomes such as export diversification, productivity growth and rising domestic value added in exports. Indeed, access to more and cheaper varieties of intermediate goods and services enable firms, including SMEs (López González, 2017[63]), to reap input benefits and grow their export competitiveness.

Moreover, exports of ICT-enabled services like telecommunication services, financial services or other business services have grown at the average pace of 10-13% between 2005 and 2017 for developing countries (Roy, 2019[64]). Indeed, "other business services", which accounted for 23% of total services exports in 2017, grew at an average annual pace of 11% between 2005 and 2017. Developing country exports form an integral part of these trends (Roy, 2019, p. 10[64]).

Taking foreign sourcing of business services as a proxy measure for digitisable inputs that can be electronically transmitted such as software, Figure 3.12 highlights the positive impact of digitally deliverable business services on domestic value added embodied in exports (See also Table A.4 and Annex C). Looking at differences across income levels reveals that impacts are highest for lower middle income and lower income countries. These results reflect the increasing use of a range of digitally deliverable inputs for which it can be more difficult to find domestic substitutes. To the extent that these may be considered to attract tariffs, these types of services would become more expensive, undermining these gains.

Figure 3.12. Impact of digitally deliverable business services on domestic value added in exports across countries at different levels of development



Note: Figure shows standardised coefficients capturing impact of increasing foreign value added in business services by one standard deviation on domestic value added in exports.
Source: Own calculations, see Annex C and Table A.4.

Digitalisation enables more firms to become exporters

A last element that is worth highlighting is the role that digitalisation and adoption of digital technologies can play in helping firms become exporters, notably firms in developing countries. Using the World Bank Enterprise Survey, and following estimations in Lopez-Gonzalez (2017[63]; 2019[65]) and Lopez-Gonzalez and Sorescu (2019[66]), Table 3.3 shows that firms in developing countries that use a webpage, including SMEs, have a higher propensity to become exporters than those that do not. Moreover, albeit for a reduced sample, those that use the internet for digital delivery are also seen to have higher export propensities.

This suggests that digitalisation, including the ability to deliver and to source digitally, is associated with new export opportunities, including for SMEs. Duties applied by other countries on electronic transmissions, including content, could affect the ability of domestic SMEs to export.

Table 3.3. Role of digital technologies in determining export propensities

	All	SME	Large
Webpage	0.525***	0.416***	0.383***
	(0.0206)	(0.0216)	(0.0352)
Observations	58,440	44,670	13,727
Use of internet for digital delivery	0.185***	0.183***	0.198**
	(0.0525)	(0.0561)	(0.0928)
Observations	5,230	3,409	1,795

Note: Coefficients reflect estimates of the role of webpages and the use of the internet for digital delivery on export propensities across firms of different sizes in developing countries. See Annex Tables 0.5 and 0.6. for full estimates. Note that coefficients across estimations are not comparable, due, among other, to wide differences in sample sizes.
Source: Own calculations based on World Bank Enterprise Survey and Lopez-Gonzalez (2017[63]; 2019[65]).

4. Policy considerations

This paper set out to provide an overview of the issues which are important in the Moratorium debate. It put into perspective the empirical results in the literature, highlighting that the opportunity cost of the Moratorium, in terms of foregone tariff revenue, is, on aggregate, relatively small. It also reviewed the literature about 3D printing and established that, while difficult to estimate, dramatic changes in trade arising from the wider adoption of the technology are unlikely in shorter term.

The paper also raised a number of issues that have not been extensively explored in discussions, including that tariffs tend to be associated with lower output or productivity, and that they tend to fall on domestic consumers rather than on foreign firms. The paper also highlighted that other feasible options exist for generating government revenue, notably the use of non-discriminatory consumption or sales taxes.

Finally, the paper highlights the benefits that are associated with electronic transmissions, including for developing countries. For instance, since electronic transmissions imply considerable reductions in transport costs, they can level the playing field for developing countries which tend to face higher transportation costs. Tariff reductions are also associated with higher consumer welfare and can increase export competitiveness, notably across goods and services sectors. Digital technologies such as webpages and the ability to deliver content over the internet are also seen to provide benefits to firms in developing countries, including SMEs, by increasing their ability to engage in export markets. This suggests that the practice of not imposing tariffs on electronic transmissions is likely to have delivered important gains both in terms of access to cheaper goods, but also in terms of enabling firms to export without facing additional barriers.

Overall, this paper suggests that careful consideration to all these issues, and not just revenue implications, should be given when thinking about whether or not to extend the Moratorium. This requires a careful analysis of the costs and also the benefits associated with the Moratorium. Regarding costs, it is important that revenue implications be considered in the context of overall government revenue, and, even where recouping that revenue is the main concern, that consideration also be given to alternative, broader-based, non-discriminatory taxes. At the same time, in forming an overall view, countries may also wish to think about the broader economic benefits that arise from the Moratorium. This includes lower prices for consumers (on whom the costs of tariffs fall), and greater export competitiveness. This broader view of costs and benefits allows for a more holistic understanding of countries' interests in the Moratorium, than a focus on estimates of lost tariff revenue alone.

References

Aizenman, J. and Y. Jinjarak (2006), "Globalization and Developing Countries-a Shrinking Tax Base?", *NBER Working Paper Series*, No. 11933, National Bureau of Economic Research, Cambridge, http://www.nber.org/papers/w11933. [48]

Amiti, M., S. Redding and D. Weinstein (2019), "The Impact Of The 2018 Trade War on U.S. Prices and Welfare", *Discussion Paper Series - International Trade and Regional Economics*, No. DP13564, Centre for Economic Policy Research, London. [45]

Attaran, M. (2017), "The rise of 3-D printing: The advantages of additive manufacturing over traditional manufacturing", *Business Horizons*, Vol. 60/5, pp. 677-688, http://dx.doi.org/10.1016/j.bushor.2017.05.011. [37]

Australian Taxation Office (2017), *GST on imported services and digital products*, https://www.ato.gov.au/Business/International-tax-for-business/GST-on-imported-services-and-digital-products/ (accessed on 11 September 2019). [57]

Banga, R. (2019), "Growing Trade in Electronic Transmissions: Implications for the South", *UNCTAD Research Paper*, No. 29, UNCTAD, Geneva. [25]

Banga, R. (2017), "Rising Product Digitalisation and Losing Trade Competitiveness", *UNCTAD/GDS/ECIDC*, No. 3, UNCTAD, Geneva. [24]

Baumers, M. et al. (2016), "The cost of additive manufacturing: Machine productivity, economies of scale and technology-push", *Technological Forecasting and Social Change*, Vol. 102, pp. 193-201, http://dx.doi.org/10.1016/j.techfore.2015.02.015. [34]

Book Industry Study Group (2014), *Book -Stats: An Annual Comprehensive Study of the U.S. Publishing Industry. Vol. 4*, Association of American Publishers. [30]

Book Industry Study Group (2011), *BookStats: An Annual Comprehensive Study of the U.S. Publishing Industry. Vol. 1*, Association of American Publishers. [29]

Brenton, P. et al. (2009), "Assessing the Adjustment Implications of Trade Policy Changes using the Tariff Reform Impact Simulation Tool (TRIST)", *Policy Research Working Papers*, No. 5045, World Bank, Washington, http://dx.doi.org/10.1017/S1474745610000509. [27]

BSA (2019), *Why Should WTO Members Support Extension of the WTO Moratorium on Customs Duties on Electronic Transmissions?*, BSA | The Software Alliance. [72]

Buditomo, R. (2019), *What We Should Know About Duties on Intangible Goods*, Baker McKenzie, https://www.bakermckenzie.com/en/insight/publications/2019/02/what-should-we-know (accessed on 17 May 2019). [12]

Buditomo, R. (2018), *Intangible Goods are Now Subject to Import Duty*, Baker McKenzie, https://www.bakermckenzie.com/en/insight/publications/2018/03/intangible-goods-import-duty-indonesia (accessed on 17 May 2019). [13]

Casalini, F. and J. López González (2019), "Trade and Cross-Border Data Flows", *OECD Trade Policy Papers*, No. 220, OECD Publishing, Paris, https://dx.doi.org/10.1787/b2023a47-en. [42]

Cavallo, A. et al. (2019), *Tariff Passthrough at the Border and at the Store: Evidence from US Trade Policy (Preliminary)*, Mimeo. [47]

Cory, N. (2019), *The Ten Worst Digital Protectionism and Innovation Mercantilist Policies of 2018*, The Information Technology and Innovation Foundation (ITIF), Washington. [11]

Duval, Y., C. Utoktham and A. Kravchenko (2018), "Impact of implementation of digital trade facilitation on trade costs", *ARTNeT Working Paper Series*, No. 174, ESCAP, Bangkok. [60]

Ebeke, C. and H. Ehrhart (2011), "Does VAT reduce the instability of tax revenues?", *Etudes et Documents*, No. 24, Centre d'Etudes et de Recherche sure le Développement International, Clermont Ferrand, http://www.cerdi.org. [50]

Fajgelbaum, P. et al. (2019), "The Return to Protectionism", *NBER Working Paper Series*, No. 25638, National Bureau of Economic Research, Cambridge, http://www.nber.org/papers/w25638. [46]

Freund, C., A. Mulabdic and M. Ruta (n.d.), "Is 3D printing a threat to global trade? The trade effects you didn't hear about", No. forthcoming, The World Bank Group. [44]

Gilbert, R. (2015), "E-books: A Tale of Digital Disruption", *Journal of Economic Perspectives*, Vol. 29/3, pp. 165–184, http://dx.doi.org/10.1257/jep.29.3.165. [28]

Holmström, J. et al. (2009), "Rapid manufacturing in the spare parts supply chain: Alternative approaches to capacity deployment", *Journal of Manufacturing Technology Management*, Vol. 21/6, pp. 687-697, http://dx.doi.org/10.1108/17410381011063996. [40]

Hopkinson, N. and P. Dickens (2003), "Analysis of rapid manufacturing - Using layer manufacturing processes for production", *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science*, Vol. 217/1, pp. 31-40, http://dx.doi.org/10.1243/095440603762554596. [74]

Huang, S. et al. (2013), "Additive manufacturing and its societal impact: A literature review", *International Journal of Advanced Manufacturing Technology*, Vol. 67/5-8, pp. 1191-1203, http://dx.doi.org/10.1007/s00170-012-4558-5. [38]

International Chamber of Commerce (2019), "The business case for a permanent prohibition on customs duties on electronic transmissions", *ICC Issues Brief*, No. 2, International Chamber of Commerce, Paris. [71]

Khajavi, S., J. Partanen and J. Holmström (2014), "Additive manufacturing in the spare parts supply chain", *Computers in Industry*, Vol. 65/1, pp. 50-63, http://dx.doi.org/10.1016/j.compind.2013.07.008. [36]

Kommerskollegium (2016), *Trade Regulation in a 3D Printed World – a Primer*, Swedish National Board of Trade. [33]

Kowalski, P. (2005), "Impact of Changes in Tariffs on Developing Countries' Government Revenue", *OECD Trade Policy Papers*, No. 18, OECD Publishing, Paris, https://dx.doi.org/10.1787/210755276421. [51]

Kowalski, P. et al. (2015), "Participation of Developing Countries in Global Value Chains: Implications for Trade and Trade-Related Policies", *OECD Trade Policy Papers*, No. 179, OECD Publishing, Paris, https://dx.doi.org/10.1787/5js33lfw0xxn-en. [61]

Lee-Makiyama, H. and B. Narayanan (2019), "The Economic Losses from Ending the WTO Moratorium on Electronic Transmissions", *Policy Brief*, No. 3, European Centre for International Political Economy, Brussels. [26]

Leering, R. (2017), "3D printing: a threat to global trade", *Economic and Financial Analysis Global Economics | Technology*, ING. [31]

Li, L. et al. (2011), "Laser nano-manufacturing - State of the art and challenges", *CIRP Annals - Manufacturing Technology*, Vol. 60/2, pp. 735-755, http://dx.doi.org/10.1016/j.cirp.2011.05.005. [39]

Lopez Gonzalez, J. (2016), "Using Foreign Factors to Enhance Domestic Export Performance: A Focus on Southeast Asia", *OECD Trade Policy Papers*, No. 191, OECD Publishing, Paris, https://dx.doi.org/10.1787/5jlpq82v1jxw-en. [62]

López González, J. (2019), "Fostering participation in digital trade for ASEAN MSMEs", *OECD Trade Policy Papers*, No. 230, OECD Publishing, Paris, https://dx.doi.org/10.1787/63561b11-en. [65]

López González, J. (2017), "Mapping the participation of ASEAN small- and medium- sized enterprises in global value chains", *OECD Trade Policy Papers*, No. 203, OECD Publishing, Paris, https://dx.doi.org/10.1787/2dc1751e-en. [63]

López González, J. and J. Ferencz (2018), "Digital Trade and Market Openness", *OECD Trade Policy Papers*, No. 217, OECD Publishing, Paris, https://dx.doi.org/10.1787/1bd89c9a-en. [59]

López González, J. and M. Jouanjean (2017), "Digital Trade: Developing a Framework for Analysis", *OECD Trade Policy Papers*, No. 205, OECD Publishing, Paris, https://dx.doi.org/10.1787/524c8c83-en. [4]

López González, J. and S. Sorescu (2019), "Helping SMEs internationalise through trade facilitation", *OECD Trade Policy Papers*, No. 229, OECD Publishing, Paris, https://dx.doi.org/10.1787/2050e6b0-en. [66]

Mattoo, A., R. Perez-Esteve and L. Schuknecht (2001), "Electronic commerce, trade and tariff revenue: A quantitative assessment", *World Economy*, Vol. 24/7, pp. 955-970, http://dx.doi.org/10.1111/1467-9701.00391. [22]

Mattoo, A. and L. Schuknecht (2000), "Trade Polices for Electronic Commerce", *Policy Research Working Paper*, No. 2380, The World Bank, Washington. [21]

McKinsey Global Institute (2019), *Globalization in Transition: the Future of Trade and Value Chains*, McKinsey & Company. [41]

OECD (2019), *OECD/G20 Inclusive Framework on BEPS Progress report: July 2018 - May 2019*, OECD, Paris. [56]

OECD (2019), *Programme of Work to Develop a Consensus Solution to the Tax Challenges Arising from the Digitalisation of the Economy, OECD/G20 Inclusive Framework on BEPS*, OECD, Paris, http://www.oecd.org/tax/beps/programme-of-work-to-develop-a-consensus-solution-to-the-tax-challenges-arising-from-the-digitalisation-of-the-economy.htm. [75]

OECD (2019), *The Role of Digital Platforms in the Collection of VAT/GST on Online Sales*, OECD, Paris, http://www.oecd.org/tax/consumption/the-role-of-digital-platforms-in-the-collection-of-vat-gst-on-online-sales.pdf. [55]

OECD (2017), *Mechanisms for the Effective Collection of VAT/GST Where the Suppler is Not Located in the Jurisdiction of Taxation*, OECD , Paris. [54]

OECD (2017), *The Next Production Revolution: Implications for Governments and Business*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264271036-en. [35]

OECD (2001), *Taxation and electronic commerce : implementing the Ottawa taxation framework conditions.*, OECD, Paris. [70]

OECD (1988), *Electronic Commerce: Taxation Framework Conditions*, OECD, Paris. [53]

OECD (n.d.), "3D printing and international trade". [32]

Panagariya, A. (2000), "E-Commerce, WTO and Developing Countries", *The World Economy*, Vol. 23/8, pp. 959-978, https://doi.org/10.1111/1467-9701.00313. [67]

Roy, M. (2019), "Elevating Services Trade Policy, WTO Commitments, and their Role in Economic Development and Trade Integration", *Staff Working Paper*, No. ERSD-2019-01, WTO. [64]

Ruffo, M., C. Tuck and R. Hague (2006), "Cost estimation for rapid manufacturing - Laser sintering production for low to medium volumes", *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, Vol. 220/9, pp. 1417-1427, http://dx.doi.org/10.1243/09544054JEM517. [73]

Samuelson, P. (1954), "The Transfer Problem and Transport Costs: The Terms of Trade When Impediments are Absent", *The Economic Journal*, Vol. 64/254, pp. 264-289, http://dx.doi.org/10.2307/2226834. [76]

Schuknecht, L. and R. Pérez-Esteve (1999), "A Quantitative Assessment of Electronic Commerce", *Staff Working Paper ERAD*, No. 01, WTO, Geneva. [20]

Teltscher, S. (2000), "Tariffs, Taxes and Electronic Commerce : Revenue Implications for Developing Countries", *Policy Issues in International Trade and Commodities Study Series*, No. 5, UNCTAD. [23]

Whalley, J. (2002), *Taxes and Trade*. [52]

World Bank (2019), *World Development Report 2020 Trading for Development in the Age of Global Value Chains: Grey Cover Draft*, World Bank, Washington. [43]

World Bank (1988), *World Development Report 1988: Opportunities and Risks in Managing the World Economy*, World Bank, Washington. [49]

WTO (2019), *Joint Statement on Electronic Commerce. WT/L/1056*. [1]

WTO (2019), *Joint Statement on Electronic Commerce: Communication from Canada (INF/ECOM/34)*. [17]

WTO (2019), *Joint Statement on Electronic Commerce: Communication from New Zealand (INF/ECOM/33)*. [16]

WTO (2019), *Joint Statement on Electronic Commerce: Communication from Singapore (INF/ECOM/25)*. [18]

WTO (2019), *Joint Statement on Electronic Commerce: Communication from the United States (INF/ECOM/5)*. [15]

WTO (2019), *Joint Statement on Electronic Commerce: EU Proposal for WTO Disciplines and Commitments Relating To Electronic Commerce: Communication from the European Union (INF/ECOM/22)*. [14]

WTO (2019), *Work Programme on Electronic Commerce: The E-commerce Moratorium and Implications for Developing Countries Communication from India and South Africa (WT/GC/W/774)*, https://unctad.org/en/PublicationsLibrary/ser-rp-2019d1_en.pdf. [3]

WTO (2018), *Work Pogramme on Electronic Commerce: Moratorium on Customs Duties on Electronic Transmissions: Need for a Re-think. Communication from India and South Africa (WT/GC/W/747)*. [2]

WTO (2018), *World Trade Report*, WTO, Geneva. [58]

WTO (2017), *Statement by Indonesia: Facilitator's Consultation on Electronic Commerce, Mc11 declaration, and other relevant plenary sessions(WT/MIN(17)/68)*. [7]

WTO (2017), *Work Programme on Electronic Commerce: Ministerial Decision of 13 December 2017 (WT/MIN(17)/65)*. [5]

WTO (2016), "Fiscal Implications of the Customs Moratorium on Electronic Transmissions: the Case of Digitisable Goods", WTO. [19]

WTO (2016), "Fiscal Implications of the Customs Moratorium on Electronic Transmissions: the Case of Digitisable Goods", WTO. [69]

WTO (2003), *Fifth Dedicated Discussion on Electronic Commerce under the Auspices of the General Council on 16 May and 11 July 2003: Summary by the Secretariat of the Issues Raised (WT/GC/W/509)*. [8]

WTO (1999), *Work Programme on Electronic Commerce: Communication from Indonesia and Singapore. WT/GC/W/247*. [10]

WTO (1998), *The Work Programme on Electronic Commerce: Note by the Secretariat S/C/W/68*. [9]

WTO (1998), *The Work Programme on Electronic Commerce: Note by the Secretariat S/C/W/68*. [68]

Wunsch-Vincent, S. (2006), *The WTO, the Internet and Trade in Digital Products: EC-US Perspectives*, Hart Publishing, Portland. [6]

Annex A. Putting the estimates of the revenue implications into perspective

This paper relies on a variety of sources to put the results of the empirical literature on the revenue implications of the Moratorium into perspective. This includes ensuring that the analysis reflects, as much as possible the same countries so as to not underestimate values. In much of the analysis, data on average bound, MFN and applied rates on electronically transmittable trade is obtained from Banga (2019[25]).

The World Development Indicators are used to measure total imports of goods and services in Figure 3.3. The value of total imports of electronically transmittable trade included in the estimation is taken from Banga (2019[25]), and includes both physical imports and digitally delivered imports.

WITS COMTRADE data and HS correspondence tables are used to identify the share of electronically transmittable trade in their respective HS chapters (Figure 3.4). The most extensive list of such trade used in the literature is used (Banga, 2019[25]). However, the value of imports is obtained from COMTRADE, and hence includes physical trade only.

WITS COMTRADE data is also used to measure imports in HS code 902140 and in HS chapter 90 for Figure 3.7.

At the country level, data on total revenue from customs duties and total government revenues for developed and developing countries are obtained using the World Development Indicators (Table 3.1). These are derived by calculating total government revenues by multiplying Tax revenues as a % of GDP by GDP in USD at current prices for the year 2017. Second, the estimate for revenues generated from customs duties is obtained by multiplying Customs and other import duties (% of tax revenue) and total government revenues as obtained from the calculation above.

Other estimates of revenues raised from customs duties at the country level are calculated using WITS TRAINS data with a view to providing a measure of total revenues from customs (Table A.2). This is obtained by retrieving imports and tariffs data on all HS commodities at the 6 digits level for all countries. The measure of revenues generated from imports is obtained by multiplying the simple average of the duty rate for one HS 6-digits goods code by the value of imports for each country on each bilateral trade flows. The sum of revenues obtained from all HS codes and for each country is used as an estimate of total revenue from customs. Where the year 2017 is not available, the latest available year is used. The methodology is adopted for both Applied and MFN duties. EU countries are aggregated into the category "European Union" in order to obtain tariff data, and the tariff revenue losses estimated by Banga (2019[25]) are considered as the sum of the losses at the country level for this category.

Estimates for the value of trade in smart and hardware goods are obtained using COMTRADE data and HS correspondence tables for cross-temporal comparison. Data on the value of physical trade that is digitisable is obtained from Banga (2019[25]). The list of hardware and smart goods includes items like mobile phones, speakers and headphones for illustrative purposes, and is by no means an exhaustive list of hardware or smart goods. For the category

of smart goods, Apple's HS 6-digits classification of selected Apple products was used (Table A.1).[24]

Table A.1. Illustrative list of hardware and smart goods

Product	HS-17 code	Description
Mobile phones	8517.12	Telephones for cellular networks or for other wireless networks
	8517.18	Other - Other apparatus for transmission or reception of voice, images or other data, including apparatus for communication in a wired or wireless network (such as a local or wide area network)
	8517.62	Machines for the reception, conversion and transmission or regeneration of voice, images or other data, including switching and routing apparatus
	8517.69	Other
Speakers	8518.10	-Microphones and stands therefor -Loudspeakers, whether or not mounted in their enclosures :
	8518.21	Single loudspeakers, mounted in their enclosures
	8518.22	Multiple loudspeakers, mounted in the same enclosure
	8518.29	Other
Headphones	8518.30	Headphones and earphones, whether or not combined with a microphone, and sets consisting of a microphone and one or more loudspeakers
Computers	8471.41	Comprising in the same housing at least a central processing unit and an input and output unit, whether or not combined
	8471.49	Other, presented in the form of systems
	8471.50	Processing units other than those of subheading 8471.41 or 8471.49, whether or not containing in the same housing one or two of the following types of unit: storage units, input units, output units
	8471.60	Input or output units, whether or not containing storage units in the same housing
	8471.70	Storage units
	8471.80	Other units of automatic data processing machines
	8471.90	Other

[24] Apple Inc. makes no representation or warranty as to the accuracy or reliability of the classifications listed in this Classification Chart. Any use of such classifications by the user, is without recourse to Apple Inc. and is at the users' own risk. Apple Inc. is in no way responsible for any damages whether direct, consequential, incidental, or otherwise, suffered by the user as a result of using or relying upon such classifications, for any purpose whatsoever. https://www.apple.com/fr/legal/more-resources/gtc.html

Product	HS-17 code	Description
Smart TV	8525.50	Transmission apparatus
-Cathode-ray tube monitor	8528.42	Capable of directly connecting to and designed for use with an automatic data processing machine of heading 84.71
- Other monitors	8528.52	Capable of directly connecting to and designed for use with an automatic data processing machine of heading 84.71
- Projectors	8528.62	Capable of directly connecting to and designed for use with an automatic data processing machine of heading 84.71

Source: https://www.apple.com/fr/legal/more-resources/gtc.html.

Table A.2. Banga (2019) results and relative revenue implications, 2017 or latest available year

Country	Total tariff revenue loss from moratorium using bound duties (USD 1000)	Total tariff revenue loss from moratorium using effectively applied duties (USD 1000)	Total tariff revenue loss from moratorium using mfn duties (USD 1000)	Losses relative to customs revenues - applied duties	Losses relative to customs revenues - MFN duties	Losses relative to tax revenues - applied duties	Losses relative to tax revenues - MFN duties
Developing countries							
Albania	283	0	283	0.00%	0.30%	0.00%	0.01%
Algeria	79 324	47 926	79 324	1.16%	1.42%	0.08%	0.13%
Argentina	186 241	50 461	56 636	0.96%	0.58%	0.07%	0.08%
Armenia	986	942	986	1.32%	0.84%	0.04%	0.04%
Belarus	18 073	16 114	18 073	3.37%	1.63%	0.23%	0.25%
Bolivia	11 567	10 867	11 567	2.15%	1.45%	0.17%	0.18%
Brazil	109 489	106 943	109 489	0.90%	0.73%	0.04%	0.04%
Cambodia	28 384	11 062	14 905	0.92%	1.23%	0.32%	0.43%
Chile	49 419	9 024	49 419	3.06%	1.36%	0.02%	0.10%
China (People's Republic of)	492 999	453 205	492 999	0.71%	0.61%	0.04%	0.04%
Colombia	34 705	25 605	34 705	1.41%	0.85%	0.05%	0.07%
Congo.	54 111	53 012	54 111	13.77%	13.74%	6.47%	6.61%
Côte d'Ivoire	11 491	11 307	11 491	3.17%	3.22%	0.18%	0.19%
Dominican Republic	18 609	14 627	18 609	1.95%	1.26%	0.14%	0.18%
Ecuador	33 764	15 942	19 266	1.28%	1.06%		
El Salvador	4669	3 334	4 669	1.70%	0.64%	0.08%	0.11%
Ethiopia (excludes Eritrea)	8010	7 590	8 010	0.25%	0.26%	0.12%	0.13%
Fiji	113 108	105 939	113 108	47.86%	50.59%	8.04%	8.58%
Former Yugoslav Republic of Macedonia	2 105	1 528	2 105	1.29%	0.60%	0.08%	0.11%
French Polynesia	3121	2 336	3 121	3.03%	2.82%		
Guatemala	160 480	15 816	24 680	6.24%	2.84%	0.20%	0.31%
Honduras	40 103	5 972	8 724	2.35%	1.59%	0.15%	0.22%
India	497 189	467 476	497 189	1.87%	1.68%	0.16%	0.17%
Indonesia	54 143	40 607	54 143	0.46%	0.68%	0.04%	0.05%
Jamaica	79 403	17 786	13 006	3.49%	2.55%	0.46%	0.34%

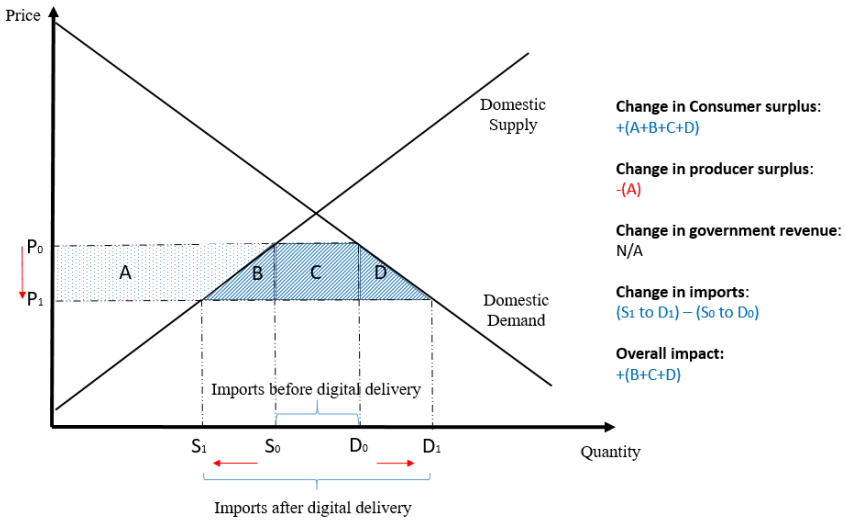
Country	Total tariff revenue loss from moratorium using bound duties (USD 1000)	Total tariff revenue loss from moratorium using effectively applied duties (USD 1000)	Total tariff revenue loss from moratorium using mfn duties (USD 1000)	Losses relative to customs revenues - applied duties	Losses relative to customs revenues - MFN duties	Losses relative to tax revenues - applied duties	Losses relative to tax revenues - MFN duties
Jordan	31 815	10 517	31 815	1.30%	1.80%	0.17%	0.52%
Kazakhstan	54 968	48 401	54 968	7.40%	4.03%	0.28%	0.32%
Korea	146 307	49 689	146 307	0.25%	0.38%	0.02%	0.06%
Kyrgyzstan	953	688	953	0.67%	0.49%	0.05%	0.07%
Madagascar	13 405	5 419	13 405	2.50%	4.44%	0.62%	1.52%
Malawi	98 000	12 871	20 384	11.93%	10.95%	1.18%	1.87%
Maldives	280	0	280	0.00%	0.12%	0.00%	0.03%
Mauritius	858	668	858	1.70%	1.81%	0.03%	0.03%
Mexico	1 865 737	123 291	311 503	2.46%	1.78%	0.08%	0.21%
Nicaragua	6 172	4 341	6 172	2.50%	1.21%	0.19%	0.27%
Niger	1 385	1 370	1 385	2.92%	2.95%	0.14%	0.14%
Nigeria	580 917	85 758	85 831	2.88%	2.84%		
Pakistan	367 240	48 880	51 043	1.00%	0.94%	0.17%	0.17%
Panama	171 830	50 675	46 586	9.03%	8.30%		
Paraguay	260 900	223 413	260 900	45.31%	29.81%	5.75%	6.72%
Peru	16 084	8 113	16 084	2.83%	2.27%	0.03%	0.06%
Russia	113 221	102 345	113 221	1.41%	1.32%	0.06%	0.07%
Rwanda	70 009	8 350	8 486	15.30%	7.36%	0.67%	0.68%
Saudi Arabia	38 906	33 779	38 906	1.37%	1.49%	0.14%	0.17%
Senegal	10 475	10 466	10 475	2.50%	2.50%	0.33%	0.33%
Serbia (Serbia/Montenegro)	22 813	11 406	22 813	4.39%	1.90%	0.14%	0.28%
Singapore	30 584	0	0	0.00%	0.00%	0.00%	0.00%
South Africa	36 829	24 961	36 829	0.83%	0.84%	0.03%	0.04%
Sri Lanka	10 017	9 260	10 017	1.01%	1.00%	0.08%	0.09%
Tanzania	11 352	11 091	11 352	2.08%	1.75%	0.18%	0.18%
Thailand	1 744 942	300 770	365 220	4.31%	2.76%	0.45%	0.54%
Togo	4 565	4 497	5 465	2.10%	2.55%	0.54%	0.66%
Tunisia	146 414	28 010	21 868	1.54%	1.20%	0.33%	0.26%
Turkey	5 161	2 520	5 161	0.04%	0.05%	0.00%	0.00%
Uganda	17 408	17 100	17 408	4.00%	2.82%	0.48%	0.49%
Uruguay	6 827	6 364	6 827	1.34%	0.80%	0.06%	0.06%
Viet Nam	51 588	39 874	46 463	0.85%	0.45%	0.11%	0.13%
Zimbabwe	14 173	8 166	14 173	3.17%	2.64%	0.23%	0.39%
Total				1.37%	1.17%	0.08%	0.10%
Developed countries							
Australia	77 907	70 327	77 907	3.94%	1.35%	0.02%	0.03%
Canada	37 772	9 443	37 772	0.28%	0.38%	0.00%	0.02%
European Union	71 120	31 610	71 120	0.11%	0.13%	0.00%	0.00%
Japan	9 982	6 987	9 982	0.08%	0.09%	0.00%	0.00%
New Zealand	7 596	4 683	7 596	0.92%	0.72%	0.01%	0.01%
Norway	1 673	744	1 673	0.10%	0.15%	0.00%	0.00%
Switzerland	0	0	0	0.00%	0.00%	0.00%	0.00%
United States	6 193	0	6 193	0.00%	0.01%	0.00%	0.00%
Total				0.16%	0.16%	0.00%	0.00%
Source	Banga (2019)	Banga (2019)	Banga (2019)	TRAINS	TRAINS	WDI	WDI

Source: Own compilation from Banga (2019[25]), TRAINS and WDI.

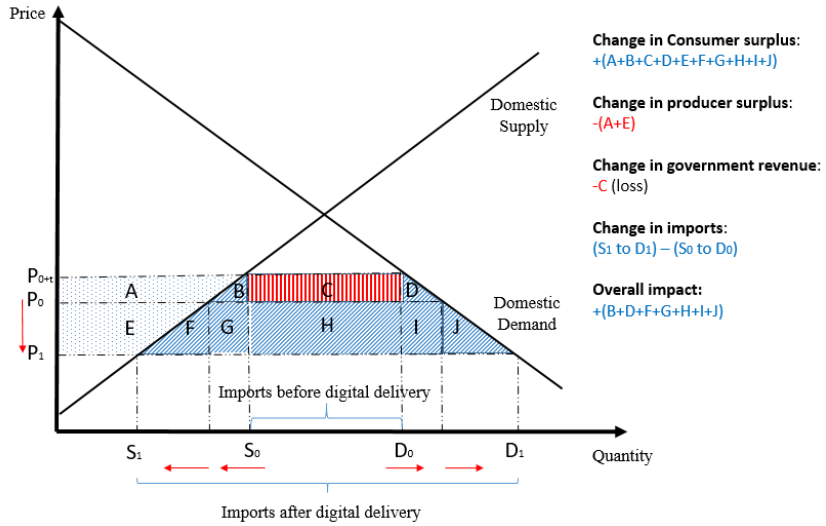
Annex B. Welfare analysis of electronic transmissions

The costs and benefits of electronic transmissions can be illustrated using traditional welfare analysis, often used to identify the gains from trade. Indeed, Amiti, Redding and Weinstein (2019[45]) argue that such models "are a powerful framework for understanding what has happened to prices, quantities and welfare" arguing that "The deleterious impacts of [...] tariffs have been largely in line with what one might have predicted based on a simple supply and demand framework".

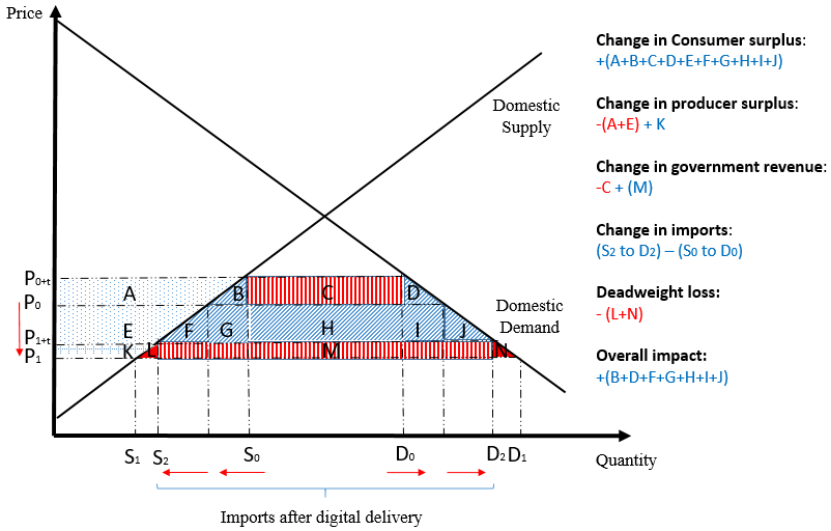
With firms no longer having to incur the cost of transportation, the ability to deliver content digitally can translate into a price reduction, the size of which would be proportional to the transport cost saving (P_0 to P_1 in the diagram below). The corresponding increase in demand leads to a rise in imports and an associated increase in consumer surplus. This is the difference between what a consumer is willing to pay and what she actually pays – the area below the demand curve (in the example below the change is captured by the areas A+B+C+D). But there is also a reduction in producer surplus. This is the difference between what a supplier is willing to supply and what the supplier gets from selling in the market—the area above the supply curve (in the example the change for producers is captured by a loss equivalent to area A). The overall gain to the economy is the difference between the consumer and the producer surplus. Since part of what the consumer gains is what the producer loses, these elements cancel out. Overall, a net positive impact to the economy emerges (captured by the area B+C+D).



However, if the good in question was already facing a tariff, then things get a little more complicated, with implications for government revenue. As was the case earlier, the digitisation of the item in question leads to a reduction in price, equivalent not only to the transport cost reduction but also to the tariff which is no longer applied to the good. The initial effect is a large increase in consumer surplus (equal to all the shaded areas), but part of this welfare gain is a redistribution from the domestic producer (areas A and E) and government revenue (areas C) to the consumer. The overall impact is positive and large, marked by the diagonal striped areas (B+D+F+G+H+I+J).



If governments were able to re-introduce a tariff on the electronic transmission, the positive welfare impact would fall (see below). The tariff would increase the price of the electronically transmitted item shifting some of the consumer welfare towards producers and the government. Relative to the no tariff on electronic transmission scenario (above), producers would gain area K from consumers and governments would collect and additional M in revenue, again from consumers. But there is also a deadweight loss to the economy equalling to areas L and N.



Overall, what this simple welfare analysis reveals is that digitisation can have an important trade cost reducing impact, with its associated positive welfare effects. When an item that was facing a tariff is digitised, foregone government revenue and lost producer surplus is redistributed to the consumer, with the overall impact remaining positive. If a government were to be able to introduce a tariff on the digitised item it would recover some government revenue (the size of which will depend on the elasticity of demand), but this will be at the expense of consumer surplus and would generate deadweight loss for the economy.

Ultimately, what this means is that customs duties on electronic transmissions will reduce the benefits associated to digitisation (lowering trade costs), prioritising government revenue over consumer welfare.

Table A.3. SMART Simulations – tariff reductions on digitisable goods, USD 1 000

Country	Year	Tariff revenue	Consumer surplus	net Impact
Albania	2018	-	-	-
Algeria	2018	-18 279.00	20 510.84	2 231.84
Angola	2018	-7 302.25	8 100.07	797.82
Argentina	2018	-36 453.80	39 235.83	2 782.03
Armenia	2018	-312.16	322.32	10.16
Australia	2018	-8 102.89	8 149.47	46.58
Bangladesh	2016	-47 963.40	62 241.50	14 278.10
Belarus	2018	-3 785.49	3 942.62	157.13
Bolivia	2018	-5 354.98	5 571.00	216.02
Brazil	2018	-42 770.90	52 816.90	10 046.00
Cambodia	2016	-7 754.54	8 029.85	275.31
Canada	2018	-7 432.67	7 477.89	45.22
Chile	2018	-2 342.10	2 361.93	19.83
China (People's Republic of)	2018	-97 029.60	98 804.85	1 775.25
Colombia	2018	-9 622.59	9 978.91	356.32
Costa Rica	2018	-658.53	665.49	6.96
Cote d'Ivoire	2018	-1 906.49	2 169.98	263.49
Democratic Republic of the Congo.	2014	-4 410.58	4 987.14	576.56
Dominican Republic	2018	-6 726.88	6 957.21	230.33
Ecuador	2018	-7 248.76	7 854.88	606.12
Egyp	2018	-14 145.70	15 817.83	1 672.13
El Salvador	2018	-2 169.93	2 246.97	77.04
Ethiopia (excludes Eritrea)	2018	-29 642.80	35 810.43	6 167.63
European Union	2018	-3 684.00	3 720.47	36.47
Fiji	2018	-1 639.64	1 773.53	133.89
Former Yugoslav Republic of Macedonia	2018	-133.95	135.68	1.72
French Polynesia	2018	-792.33	828.49	36.16
Guatemala	2015	-2 907.59	2 941.79	34.20
Honduras	2018	-1 151.80	1 181.83	30.03
India	2018	-172 188.00	179 575.50	7 387.50
Indonesia	2018	-7 601.75	7 701.60	99.85
Jamaica	2016	-3 030.65	3 242.36	211.71
Japan	2018	-350.60	352.59	1.99
Jordan	2017	-8 726.60	9 343.78	617.18
Kazakhstan	2018	-2 300.34	2 368.88	68.54
Kenya	2018	-5 440.90	5 906.76	465.86
Korea	2018	-21 720.20	22 062.46	342.26
Kyrgyzstan	2018	-517.96	535.73	17.77
Madagascar	2018	-5 448.19	5 826.71	378.52
Malawi	2016	-5 922.36	6 197.95	275.59
Malaysia	2016	-20 442.60	21 933.24	1 490.64
Maldives	2018	-	-	-
Mauritius	2018	-213.06	219.45	6.39
Mexico	2018	-60 597.60	61 956.26	1 358.66

Country	Year	Tariff revenue	Consumer surplus	net Impact
Mongolia	2018	-1 700.73	1 826.63	125.90
Morocco	2017	-1 868.42	1 908.71	40.29
Mozambique	2018	-692.67	728.22	35.55
Myanmar	2015	-55.62	56.08	0.47
New Zealand	2017	-871.88	877.44	5.56
Nicaragua	2018	-1 187.34	1 209.33	21.99
Niger	2018	-399.83	441.31	41.48
Nigeria	2016	-13 616.80	23 693.30	10 076.50
Norway	2018	-	-	-
Pakistan	2018	-14 054.60	14 666.58	611.98
Panama	2015	-3 695.37	3 862.28	166.91
Paraguay	2018	-12 241.80	12 571.17	329.37
Peru	2018	-1 028.32	1 036.93	8.61
Philippines	2018	-4 703.49	4 747.40	43.91
Russia	2018	-33 913.10	35 748.29	1 835.19
Rwanda	2018	-349.20	363.32	14.13
Saudi Arabia	2017	-4 606.47	4 775.76	169.29
Senegal	2018	-2 060.57	2 272.19	211.62
Serbia (Serbia/Montenegro)	2018	-1 465.42	1 486.44	21.02
Singapore	2018	-	-	-
South Africa	2018	-9 013.28	9 086.85	73.57
Sri Lanka	2018	-8 922.43	9 780.44	858.01
Switzerland	2018	-	-	-
Tanzania	2018	-2 364.46	2 767.21	402.75
Thailand	2015	-12 136.80	12 333.02	196.22
Togo	2018	-536.06	589.49	53.43
Tunisia	2016	-8 145.91	8 845.29	699.38
Turkey	2018	-2 826.78	2 845.74	18.96
Uganda	2018	-2 023.80	2 320.31	296.51
United States	2018	-4.82	4.83	0.01
Uruguay	2018	-3 817.93	4 076.56	258.63
Viet Nam	2018	-28 833.00	30 345.67	1 512.67
Zimbabwe	2016	-1 162.48	1 270.06	107.58
Total		**-864 525.53**	**938 395.80**	**73 870.27**

Note: Simulations assume full liberalisation from applied tariffs.
Source: Own calculations using SMART-WITS.

Annex C. Empirical specification and data for analysis of business service inputs

The empirical strategy follows López-González (2016[62]) which categorises the determinants of specialisation patterns into two broad categories: i) structural factors – such as factor endowments; and ii) policy variables – including institutional setting and trade and investment variables to which a third element is added – international linkages.

To control for structural determinants three measures are used: i) the ratio of capital to labour (from the Penn World Tables); ii) skills (measured as the share of government revenue spent on education; and iii) relative size of the market (measured as the country's GDP at constant 2011 prices).

The policy variables capture; i) the institutional setting (using the political stability index from the World Governance Indicators); and ii) investment openness (using the share of foreign FDI stocks in GDP from the WDI database).

To identify digitally deliverable business services, the foreign value added used to produce exports at a sector level is introduced. A temporal lag is taken to avoid mechanical associations or reverse causality with the dependent variable. The dependent variable is the domestic value added, from a particular sector, used to produce aggregate exports. These variables are calculated from first principles using the harmonised 25-sector EORA database for the years 2006-2015. This database is used so as to include a wider variety of least developed countries which do not currently figure in the OECD Trade in Value Added database (see Appendix in Kowalski et al. (2015[61]) for a comparison between different databases for calculating indicators of GVC participation).

The estimations rely on a fixed effect model with country, sector and year fixed effects.

Table A.4. Estimations of the impact of foreign business service inputs on domestic value added in exports

	(1)	(2)	(3)	(4)
	All	High Income	Upper Middle Income	Lower Middle and Lower Income
Real GDP (constant prices)	0.180***	0.201**	0.568**	-0.245
	(0.0593)	(0.0747)	(0.228)	(0.177)
Expenditure on education (% of GDP)	0.00273	-0.00105	0.0143	0.00106
	(0.00730)	(0.0107)	(0.0106)	(0.0228)
Political stability	0.00127	-0.00110	-0.00648	0.0207
	(0.00401)	(0.00470)	(0.00642)	(0.0131)
Capital labour ratio	0.157*	0.0417	0.111	0.418**
	(0.0790)	(0.0938)	(0.0964)	(0.151)
Internet Use	-0.0102	0.107*	-0.0301	-0.0870
	(0.0215)	(0.0607)	(0.0258)	(0.0606)
human capital index	0.0733*	0.106	0.0540	-0.332*
	(0.0432)	(0.0724)	(0.0520)	(0.179)
Inflows of FDI (% of GDP)	-0.00270	-0.00292	-0.0122	0.0313***
	(0.00256)	(0.00269)	(0.0183)	(0.00845)
Lag of foreign business service value added	0.737***	0.714***	0.787***	0.823***
	(0.0247)	(0.0374)	(0.0507)	(0.0304)
Constant	0.132**	-0.0189	0.406***	0.349
	(0.0535)	(0.131)	(0.0801)	(0.248)
Observations	10,466	7,060	2,106	1,300
R-squared	0.910	0.912	0.925	0.933
Number of cou	74	38	18	18
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1				

Source: Own calculations.

Table A.5. Determinants of exporting propensities, role of webpages

	All	SME	Large
Age of firm	0.00324***	0.000982**	0.00375***
	(0.000488)	(0.000421)	(0.000754)
Number of employees	6.80e-05*	0.0252***	6.60e-05**
	(3.63e-05)	(0.00129)	(3.16e-05)
Number of employees squared	-4.58e-10**	-0.000148***	-4.28e-10**
	(2.18e-10)	(1.34e-05)	(1.90e-10)
SME dummy	-0.762***		
	(0.0244)		
ISO certification	0.0271***	0.0226***	0.0276***
	(0.00579)	(0.00682)	(0.00998)
Use of foreign intermediates	0.00447***	0.00369***	0.00517***
	(0.000328)	(0.000328)	(0.000602)
Line of credit	0.0277***	0.0179**	0.0347***
	(0.00680)	(0.00710)	(0.00916)
Foreign ownership	0.00720***	0.00593***	0.00727***
	(0.000335)	(0.000390)	(0.000484)
Experience of Manager	0.00181***	0.00216***	0.00154
	(0.000645)	(0.000771)	(0.00107)
Purchase of fixed assets	0.0377***	0.0314***	0.0123
	(0.00868)	(0.00937)	(0.0122)
Webpage	0.525***	0.416***	0.383***
	(0.0206)	(0.0216)	(0.0352)
Constant	-0.752	-2.407***	-2.553***
	(1.129)	(0.614)	(0.424)
Observations	58,440	44,670	13,727
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1			

Source: Own calculations based on World Bank Enterprise Survey and López-González (2017[63]; 2019[65]).

Table A.6. Determinants of exporting propensities, role of digital delivery

VARIABLES	All	SME	Large
Age of firm	0.00282**	0.000536	0.00176
	(0.00111)	(0.00157)	(0.00145)
Number of employees	0.000430***	0.0310***	0.000424***
	(0.000142)	(0.00350)	(0.000132)
Number of employees squared	-1.73e-08***	-0.000201***	-1.62e-08***
	(6.55e-09)	(3.69e-05)	(6.01e-09)
SME dummy	-0.755***		
	(0.0692)		
ISO certification	0.0229	0.00643	0.0454**
	(0.0144)	(0.0181)	(0.0231)
Use of foreign intermediates	0.00234***	0.00184**	0.00367***
	(0.000712)	(0.000856)	(0.00117)
Line of credit	0.173***	0.101**	0.238***
	(0.0503)	(0.0498)	(0.0745)
Foreign ownership	0.00841***	0.0108***	0.00604***
	(0.000808)	(0.00118)	(0.000971)
Experience of Manager	-0.000796	0.000275	-0.00178
	(0.00189)	(0.00236)	(0.00266)
Purchase of fixed assets	0.169***	0.0825	0.0883
	(0.0394)	(0.0524)	(0.0626)
Use of internet for digital delivery	0.185***	0.183***	0.198**
	(0.0525)	(0.0561)	(0.0928)
Constant	-1.415***	-3.020***	-1.000***
	(0.302)	(0.469)	(0.149)
Observations	5,230	3,409	1,795
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1			

Source: Own calculations based on World Bank Enterprise Survey and López-González (2017[63]; 2019[65]).