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WTI Working Paper No. 03/2018

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December 14, 2018

Preliminary draft, 2018.

*World Trade Institute (WTI), University of Bern. We acknowledge support from the SNF's National Research Programme 75 (Big Data). We wish to thank in particular Mira Burri, Rodrigo Polanco and Rahel Schär for the data collection. An earlier version of this paper was presented at the Big Data and Global Trade Law conference, University of Lucerne, 16-17 November 2018.

Introduction

Innovation in information and communication technology (ICT) has been one of the key drivers of economic globalization. As a result, the numbers of goods and services and, therefore, cross-border data flows have been increasing at an exceptional speed. The World Trade Organization (WTO) and its Members have early on realized the importance of establishing global rules by launching a work programme on electronic commerce in 1998. The WTO and, in particular, the Secretariat has been instrumental in keeping the issue on the agenda, providing shared knowledge on the evolution of ICT-induced advances and by defining concepts which also act as focal points for trade regulation. Yet, we have witnessed that regulation has been late to address the dynamic market realities and if regulation has occurred, it was driven rather by unilateral approaches with limited international cooperation. Given the absence of progress in rule-making in the WTO for some time now, the negotiators of preferential trade agreements (PTAs) have been tasked to fill the gap of writing the rule book for 21st century trade - rules that would address needs resulting from an ever more integrated and data-driven economy. The first PTA that had an electronic commerce provision was the Jordan-US PTA in 2000 and the first data flow provisions go back to the Korea-US PTA from 2007. So, these types of provisions are a rather recent phenomenon in trade agreements.

This paper focuses on data-related provisions in PTAs to explore trends and patterns over time. We ask whether we observe particular clusters and models that emerge and related to this who are the "rule-makers" in this area as well as who are the "laggards". If PTAs are to be understood as "laboratories" for global rule-making, then which governments are pushing their regulatory ideas and templates?

The paper is organized as follows: First, we provide a short discussion on the literature that provides the backbone and rationale for the data collection. We then present particular indicators aggregated from the data that attempt to capture various salient dimensions of data-flow related provisions. This is followed by discussing trends over time using these indicators, exploring the rule-makers through both textual analyses and attention paid to different data-related design features. Finally, we graphically explore bi-variate relationships that relate to potential explanations why we expect to see variation in PTA design in this domain. The paper ends by outlining possible next steps research could pursue in this domain.

Literature

Various strands of literature in international relations and political-economy provide the impetus for collecting and analyzing PTA design features - some of which address general debates regarding the move towards more law, the relationship between multilateralism and regionalism or on rule-making vs rule-taking, the role of diffusion and debates specific to data flows and regulatory responses. Below, we map some of these debates.

The call for more fine-grained information on the content of international agreements has been around for a while. Both, the legalization as well as the rational design (RD) literatures (Goldstein et al. (2000), Koremenos et al. (2001)) provide useful guidance for choosing the types of design features to focus on. Both literatures develop indicators and propose measures to account for treaties' scope, degree of obligation as well as flexibility

features. In particular in the trade literature on PTAs, various indicators have been further developed such as the concept of depth of an agreement which captures the degree to which measures may lead to increased market integration (Dür et al., 2014) or various types flexibility tools which allow for legally imposing barriers normally for a limited period of time (e.g. Baccini et al. (2015)). How can we transfer these conceptualizations when we analyze data-flow provisions as part of PTA provisions?

Another literature to which this paper speaks is the work on regime complexity (Drezner (2007), Alter and Raustiala (2018)) usually defined as a set of non-hierarchical overlapping institutions. The universe of PTAs with over 1000 agreements, where all WTO Members are participating actors, serves as an interesting laboratory of how regime complexity affects the behavior of states both in collaborate or conflictive fashions. Linked to the concept of regime complexity is the emerging attention to diffusion drivers and effects (Simmons et al. (2006), Gilardi (2012)). Why is it that states sign PTAs? What is the role of competition with other trading nations and how does learning and mimicking from neighboring countries impact this decision to engage in PTAs? Or is PTA signature and the commitments a result of coercion by powerful states that aim to have their templates and models reflected in as many treaties as possible? Both, the regime complexity theory and diffusion theory provide strong testimony to how international treaties are interdependent and serve as a cautionary note on analyzing single agreements in isolation of other treaties. Within the study of international institutions and international trade, additional debates have emerged focusing on the actors theorizing about what group of countries promote their own rules (rule-makers) and which ones are on the receiving end of global regulation (rule-takers). This work focuses on the conditions under which rules diffuse using a mix of methods, including textual analyses (e.g. Alschner and Skougarevskiy (2016)).

Finally, research on trade and data flows has in particular focused on the relationship between the promotion of liberalization and a government's objective to protect public interests. While the early trade literature focused on various linkages such as trade and human rights and trade and environment (e.g. Hafner-Burton (2005), Bernauer and Nguyen (2015)), more recently with the ever growing market interdependence the optimal protection of individual rights related to data protection have become more central. Following the old idea of "embedded liberalism" (Ruggie, 1982), we are interested in how liberalization in data flows related to trade and services goes hand in hand with providing states with flexibility or escape instruments to protect citizen's interest in terms of privacy, and therefore pursuing social goals.

Design dimensions and related concepts

In recent years, research on trade agreements has made substantial progress by unpacking the various design features in PTAs to explore variation across treaties (Dür et al., 2014). We follow this work by zooming in on data-relevant provisions. The data presented below is based on 74 single variables focusing, on the one hand, on the electronic commerce chapters and, on the other hand, on data-relevant provisions in other PTA chapters, including services, intellectual property rights and specific rules on ICT, big data, data localization and similar content. The data is then aggregated to produce a number of

indicators measuring various key dimensions derived from the literature discussion above. Below, we briefly describe different concepts and the types of variables that we draw upon to constructing these.

1. *Scope*: This concept measures the attention paid to data-related provisions. Scope is different from depth as it does not capture the degree of obligation and commitment, but rather provides information about the extent to which the topic is covered within the agreement (see also Koremenos et al. (2001)). Therefore, we construct two different measures for scope or coverage: Scope1 is the word count for the electronic commerce chapter; Scope2 is the number of total provisions found in the electronic commerce chapter. Scope1 has a maximum of 3206 words and the average value is 793. Scope2 is an additive index which ranges from 0-74.

2. *Depth (of Data Flow Facilitation)*: This measure comes closest to what in the literature is described as the depth of the agreement (Downs et al. (1996), Dür et al. (2014)). In this case, depth is thought of in relation to commitments which tend to making trading easier when data transfer is involved. Here we create an additive index of 17 variables that include rules for easing trade and providing a regulatory environment to foster trade in data; these range from free movement of data commitments, promoting paper-less trading and electronic signatures, advocating self-regulation of the private sector to abstaining from data localization requirements. This additive indicator ranges from 0 to 17.

3. *Flexibility*: As the literature on international institutions suggests that deeper commitments are also more flexible (Baccini et al., 2015), we constructed one indicator that focuses on eight escape and flexibility measures that we detected in the agreements texts. These include both general and specific exceptions to commitments as well as reservations. The flexibility indicator ranges from 0 to 8.

4. *Consumer protection*: An important and more specific flexibility instrument consists of explicitly foreseeing way to protect consumer interests. This indicator ranges from 0 to 4 and includes elements of individual rights in relation to data protection, internet principles, data localization measures, or addressing spam.

5. *Non-discrimination*: This indicator measures how much attention treaty drafters have directed to general principles related to non-discrimination, such as to treating domestic and foreign actors equally as well as following the most-favorite nation (MFN) clause. On top, we add references to the WTO commitments and the need for technology neutrality. The higher the indicator, the more negotiators embed trade agreements within the multilateral trading system aiming for more consistency across treaties (e.g. see Allee and Elsig (2019)). The indicator ranges from 0 to 7.

6. *Regulatory cooperation*: The final indicator measures the degree to which treaty drafters advocate various forms of regulatory cooperation. We compile commitment that calls for cooperation on transparency, international alignment in regulatory fora, or working together on cyber security. In addition, we explore whether the treaty foresees working groups or committees to implement electronic commerce commitments. This indicator is

a proxy for how much regulatory cooperation is foreseen in the treaty text. The indicator ranges from 0 to 13.

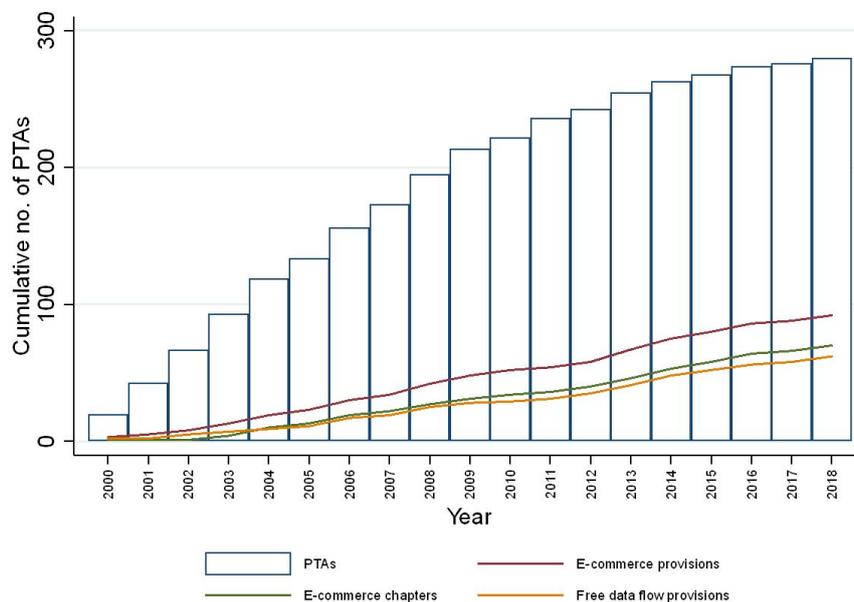
Describing trends and patterns

In this section we discuss briefly the evolution of PTAs over time. We provide some descriptive statistics based on the indicators developed above, derive a better idea about who the rule-makers are and explore a number of bivariate relations which are suggestive about potential interdependence between design features, but also between treaty content and domestic practice.

The first agreement referring to electronic commerce was signed in 2000. Therefore, we deal with a rather novel issue area for trade regulation. There are no observations prior to 2000 while discussions within the WTO had been going on for a while. This is suggestive to the possibility that governments have prioritized the multilateral arena, while then slowly turning to PTAs either because of lack of progress in the WTO or because of learning effects and development of various government strategies and potentially implicit models.

Figure 1 below shows the steady increase of e-commerce provisions, e-commerce chapters and provisions on free data flow both in absolute numbers as well as relative to the number of PTAs signed per year.

Figure 1: The evolution of e-commerce and data flow regulation in PTAs, 2000-2018



Source: Authors illustration based on the TAPED database.

In total, we have identified 99 PTAs that have at least one data-related provision. Table 1 provides the summary statistics for the different indicators outlined above and confirms the notion of considerable heterogeneity among PTAs.

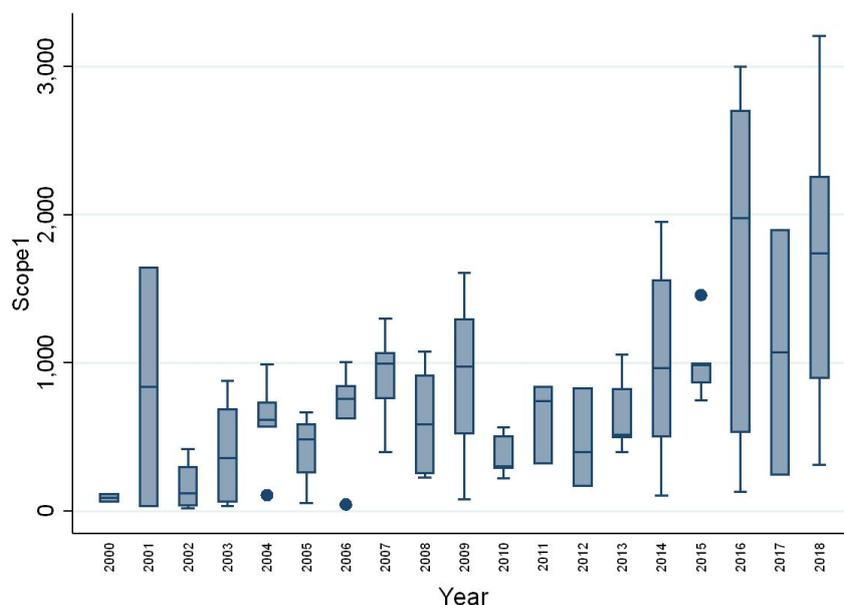
Table 1: Summary statistics on the indicators

Variable	Obs	Mean	Std.Dev	Min	Max
Scope1	99	793.2041	669.2556	17	3206
Scope2	99	22.9697	10.52059	2	46
Depth	99	6.565657	3.52299	0	15
Flexibility	99	3.313131	2.160151	0	8
Consumer protection	99	1.606061	0.8785213	0	3
Non-discrimination	99	3.080808	1.724238	0	6
Regulatory cooperation	99	4.343434	2.7224	0	12

Source: Authors illustration based on the TAPED database.

In the following Figures, we zoom into a selection of indicators and illustrate their evolution over time. Figure 2 shows the Scope1 indicator, which captures the number of words related to the regulation of e-commerce and data flows. The median and range of the count of words varies considerably over time. We also observe a number of outliers, including Jordan-Singapore 2004, the Central European Free Trade Agreement (CEFTA) in 2006 and Australia-Japan 2015. The latter one is an outlier for that year but is following an upward trend. We also observe large variation in the years 2016-2018.

Figure 2: The Scope1 indicator, 2000-2018

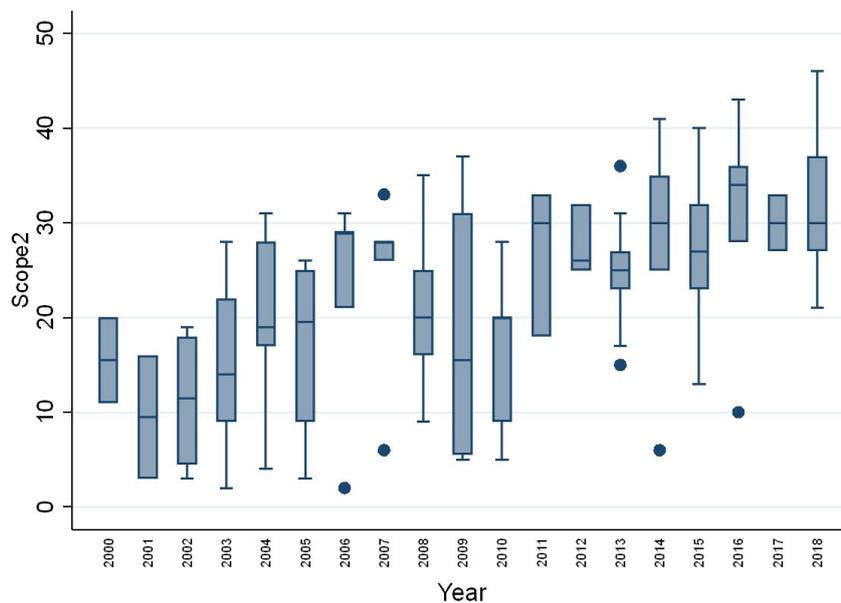


Source: Authors illustration based on the TAPED database.

In Figure 3 we show the second scope indicator, based on the number of provisions related to the regulation of e-commerce and data flows. Again, we observe that scope increases, however not gradually. In most years, we observe a considerable range of provisions as well as a number of outliers. Compared to other PTAs signed in 2006, CEFTA has only few provisions related to the regulations of e-commerce and data flows. In 2007, the same is true for the PTA between Japan and Thailand. In contrast, the Panama-US PTA in 2007 includes a rather large number of provisions on this topic.

The PTA between Colombia and Costa Rica presents the top outlier in 2013, the PTA between Central America and the European Free Trade Association (EFTA) the bottom outlier. Malaysia-Turkey and Canada-Ukraine present the two outliers in 2014 and 2016, respectively.

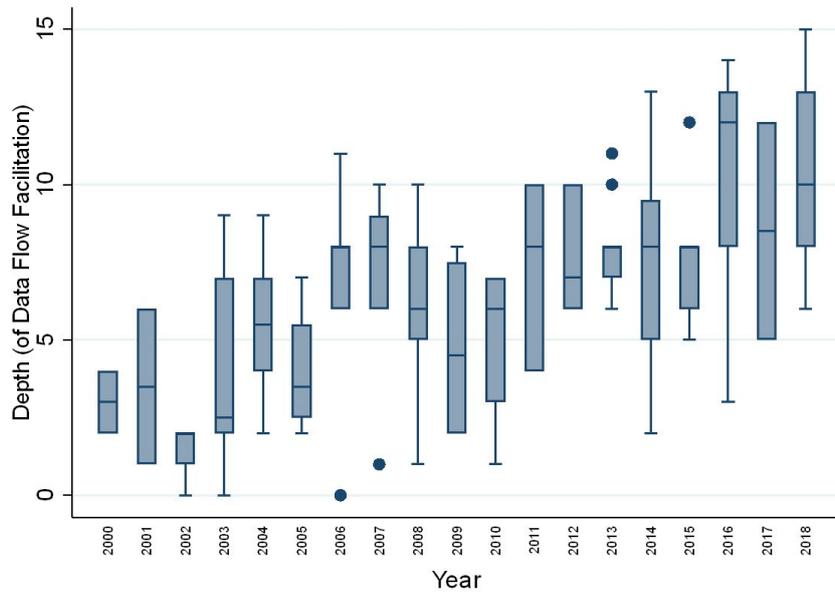
Figure 3: The Scope2 indicator, 2000-2018



Source: Authors illustration based on the TAPED database.

Over time, we also observe an increase in the Depth (Data Flow Facilitation) indicator (Figure 4). Following the above trend, the 2006 CEFTA agreement and the 2007 Japan-Thailand PTA indicate substantially shallower commitments than other agreements in these respective years. The outliers having substantially deeper commitments in 2013 than other agreements signed in that year are Colombia-Costa Rica as well as Colombia-Panama, most likely inspired by their commitments in one of their recent trade agreements with a rule-maker. In 2015, we observe in Mongolia's first ever PTA with Japan also deeper commitments in terms of data flow facilitation.

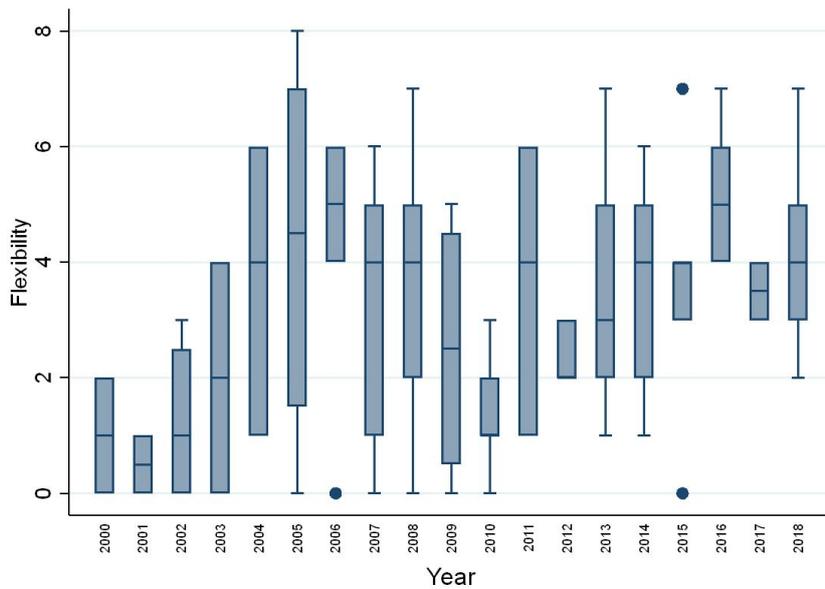
Figure 4: The Depth indicator, 2000-2018



Source: Authors illustration based on the TAPED database.

Turning to our flexibility indicator (Figure 5), we observe that already between 2004 and 2008, PTAs included higher levels of flexibility. Again, CEFTA presents the outlier in 2006 which is not surprising as it also scored low on scope and depth. The bottom outlier in 2015 is the PTA between Canada and Ukraine which might be explained by the low trade flows in goods and services with substantial data content between the two countries. The top outlier in the same year is the PTA between Australia and Singapore, which could be a result of two countries which usually deep agreements.

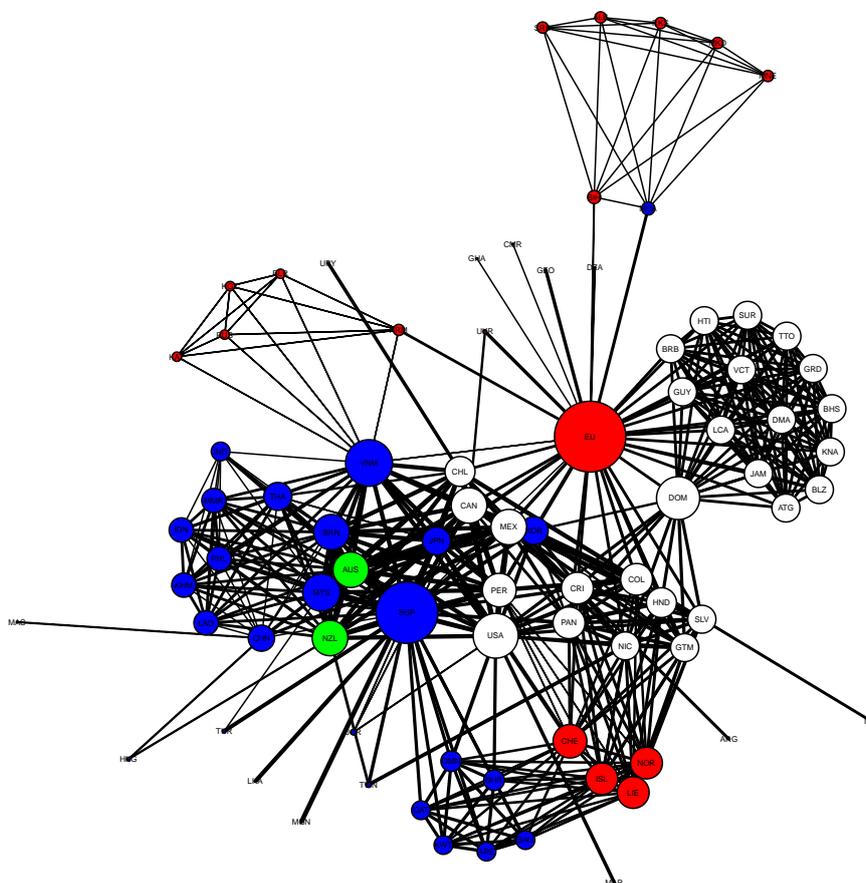
Figure 5: The Flexibility indicator, 2000-2018



Source: Authors illustration based on the TAPED database.

and data flows. What stand out are the European Union, the US and Singapore, but also other countries, such as Australia, Canada or Mexico.

Figure 7: The network of PTAs regulating e-commerce and data flows



Source: Authors illustration based on the TAPED database.
 Note: Blue-Asia, White-Americas, Red-Europe, Green-Oceania.

To investigate the patterns that can be graphically observed in above network, we zoom into the subset of PTAs that do not only have at least one provision on e-commerce and data flows but a full chapter. Out of the 99 PTAs signed since 2000, 72 have a chapter related to e-commerce and data flows. Seven of these PTAs are signed between Latin American countries and only available in Spanish, leaving us with 63 PTAs that are available in English language. Since Singapore and Australia renewed their PTA from 2003 in 2016, we only include the latter PTA in this analysis - leaving us with a subset of 62 PTAs.

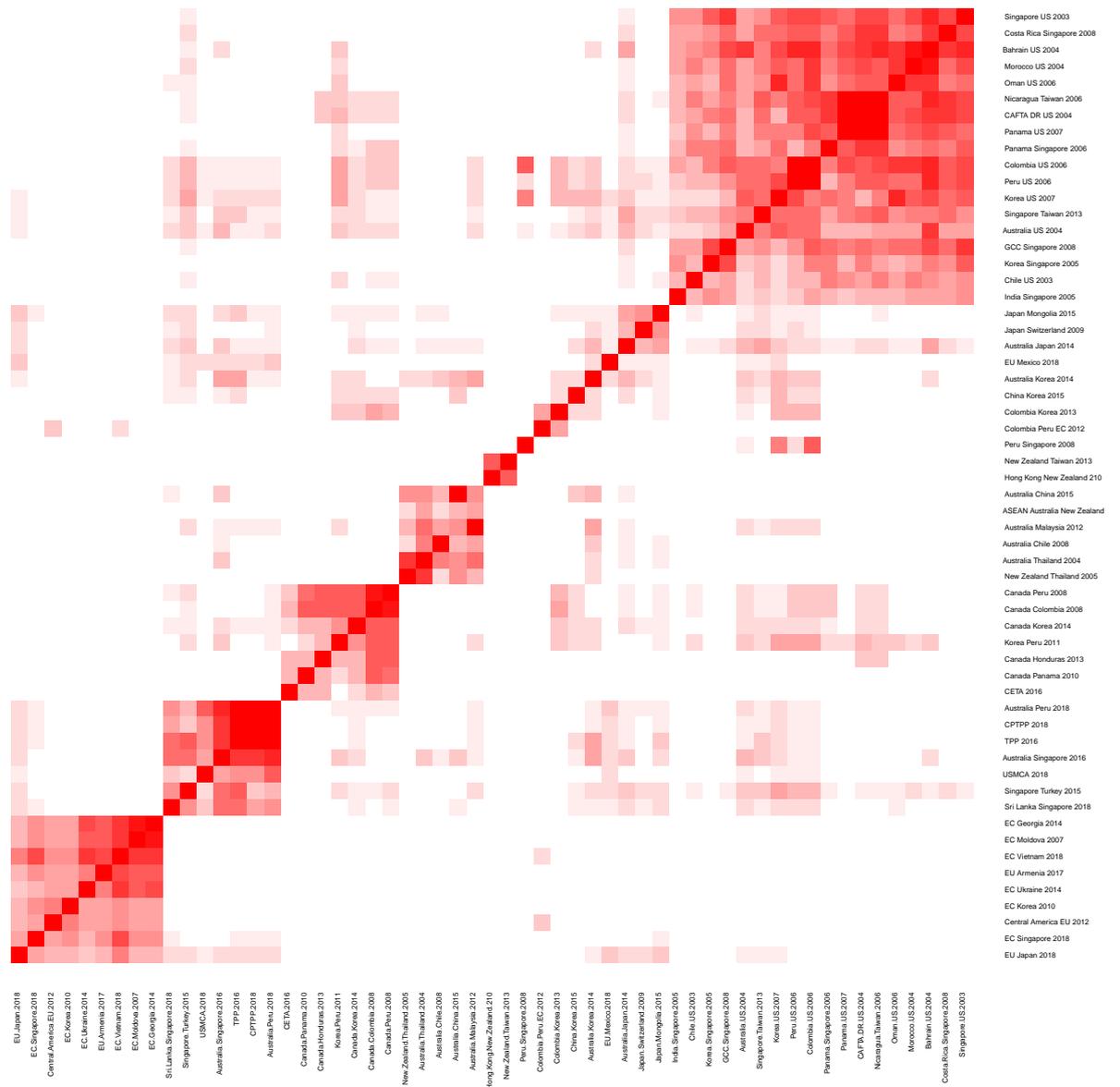
Relying on text-as-data analysis, we compare these 62 PTA chapters to detect potential patterns. More precisely, we use the plagiarism software WCopyfind to measure the textual overlap between the PTA chapters. The program allows for a number of refinements. We follow the convention to use a minimum of six consecutive identical words for a match (e.g. Allee and Lugg (2016), Allee et al. (2017a), Allee et al. (2017b)).

All punctuation, outer punctuation, numbers, letter case and non-words are ignored. It should be pointed out that WCopyfind only reports the PTAs that have a minimum of matches between PTAs. In our case, the PTAs between Jordan and Singapore (2004), Canada and Jordan (2009), the Eurasian Economic Union (EAEU) and Viet Nam (2015) and between Canada and the Ukraine (2016) appear to have to little overlap with the other PTAs and were consequently dropped by the program.

The heat map (Figure 8) below provides a number of interesting insights. The darker the red squares, the higher the textual overlap between the e-commerce and data flow chapters of two respective PTAs. In Figure 8, the PTA chapters are hierarchically clustered, meaning PTAs are grouped together into clusters. The clusters and their PTAs are fairly distinct from each other and the PTAs within a cluster are broadly similar to each other. Figure 8 suggests that there are five main clusters. The top right cluster includes 18 PTAs out of which the US is 11 times a signatory. Singapore is a signatory in 7 of these 18 PTAs. The second cluster in the center of Figure 8 includes six PTAs. Australia is a signatory of five of these PTAs, the sixth the PTA between New Zealand and Thailand in 2004. Down and to the left is another cluster that includes seven PTAs. Canada is a signatory in 6 of these PTAs. The second last cluster includes the Trans-Pacific Partnership (TPP, 2016) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP, 2018) as well as the United StatesMexicoCanada Agreement (USMCA, 2018). The other four PTAs in this cluster present PTAs in which at least one of the signatories is a (CP)TPP member. The cluster in the left bottom corner includes the nine PTAs of the EU which have a chapter dedicated to e-commerce and data flows.

Figure 8 confirms what the previous discussion has already hinted at: the US, Singapore, Australia, Canada and the EU play central roles in this network. Furthermore, the heat map suggests that their models are fairly distinct.

Figure 8: A heat map on text-as-data analysis of e-commerce and data flow chapters in PTAs



Source: Authors illustration based on PTA texts collected for the TAPED database.

Zooming in on the rule-makers

In this section we compare these rule-makers by focusing on the number of provisions (Scope2) and differentiate provisions that have legal language that suggests little bindingness and language that suggests a higher level of bindingness. The legal language provides clues as to whether we expect more or less obligation based on words such as

”should” or ”may”. We differentiate between high and low obligation. Figure 9 provides an overview on the five rule-makers identified before. The Figure shows the average and maximum count of total provisions as well as the average and maximum count of provisions suggesting a higher level of bindingness. The maximum scores might be more intuitive to interpret as countries potentially do not negotiate in their future agreements commitments below the ones already agreed upon.

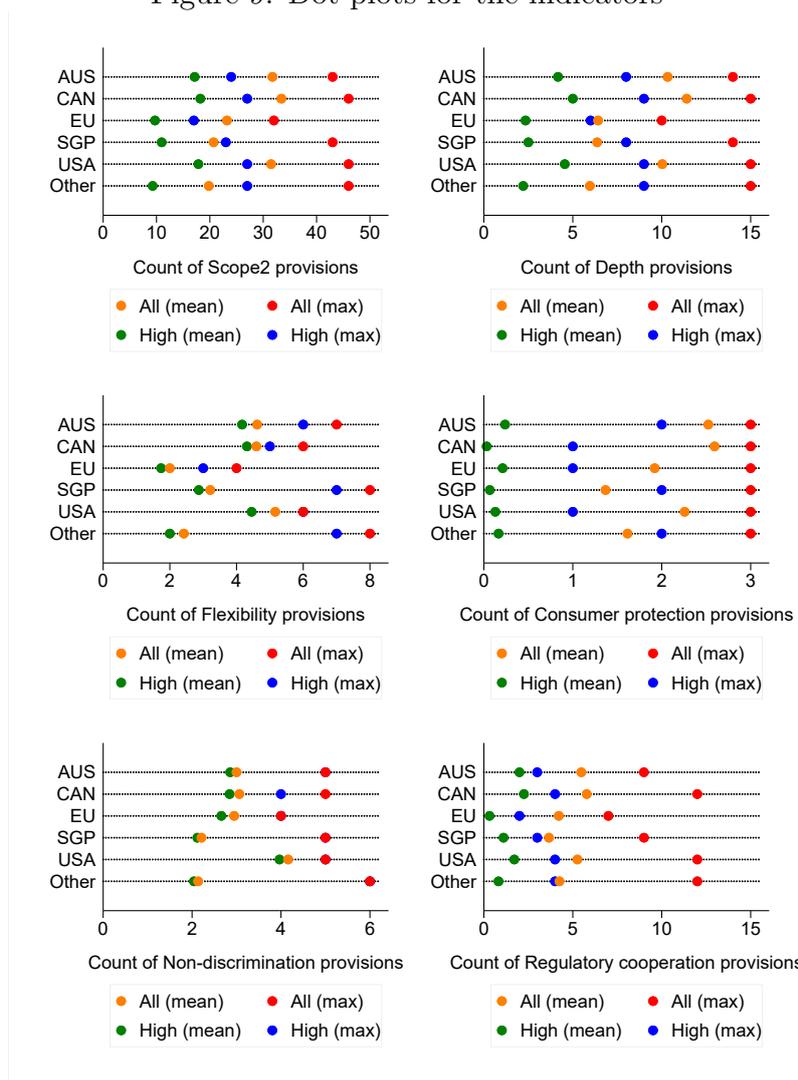
For scope and depth, we observe that for the so-called rule-maker group roughly half of all commitments are phrased in legal terms that suggest high obligation. In terms of the average and maximum values for scope and depth, the EU scores lower than the other rule-makers as well as other countries.

We observe a similar pattern for the flexibility indicator. Of the rule-takers, it is in particular Singapore which includes a considerable number of flexibility related provisions.

For the indicator related to consumer protection, we in particular observe that Singapore and Australia agree on legal language that signals higher obligation and therefore allowing for stronger rights to protect individuals.

The non-discrimination provisions are overwhelmingly commitments which come with high obligation based on the legal language. However, when we turn to regulatory cooperation, we observe in particular that the legal wording suggest rather low level of obligations, therefore are less easily enforceable in case of disagreement among PTA members.

Figure 9: Dot plots for the indicators



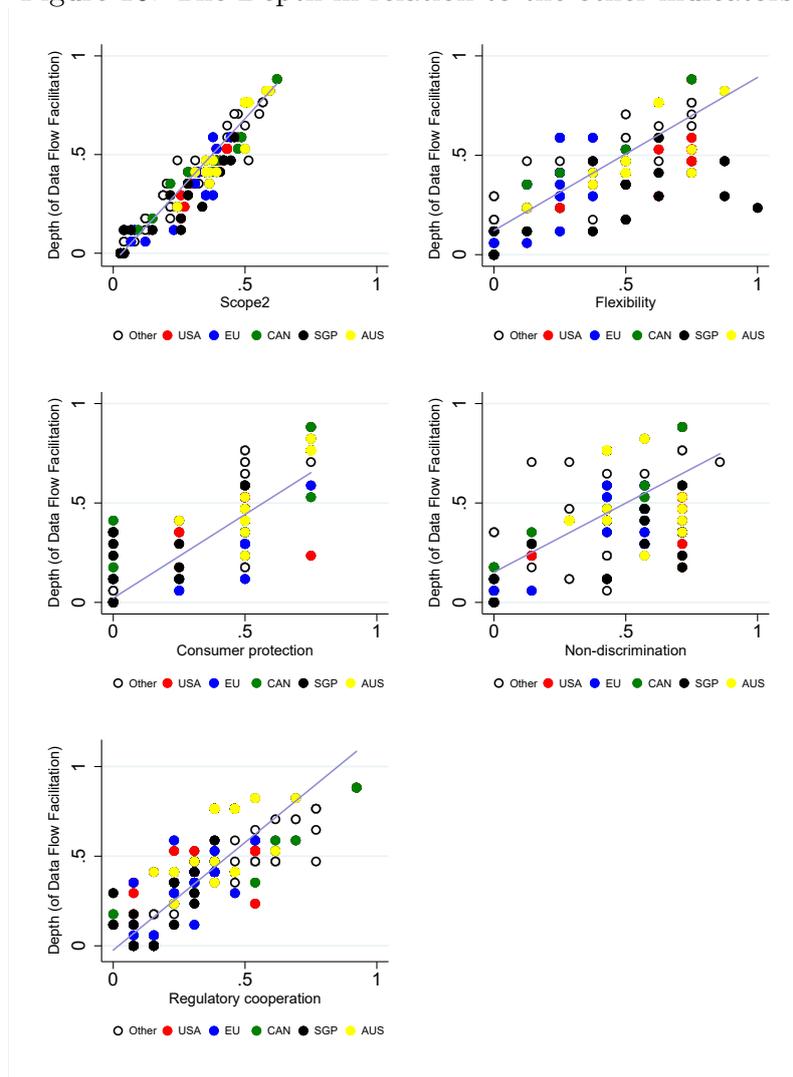
Source: Authors illustration based on the TAPED database.
 Note: In the figure on non-discrimination provisions, High(max) is equal to All(max) for Australia, the EU, Singapore, the US and Others which is why only the All(max) indicator is shown.

Exploring explanations for design

In this section we provide graphical descriptions of a number of bi-variate relations to address potential explanations for variation in PTA design. The first group of graphs (Figure 10) addresses the question as to whether PTA design is largely endogenous, in other words, many of the design features are related to each other as suggested by some the literature. We focus on the depth variable and explore how this is correlated with other indicators. First, we see that scope and depth are highly correlated which is not surprising. PTAs that are paying more attention to data-related issues are also deeper. Second, deeper agreements are also going hand in hand with PTAs that advocate regulatory cooperation. This could also be interpreted as negotiators are forward-looking promising to engage in regulatory discussion to accompany the fast changing regulatory environment. Deeper agreements are also more flexible, provide for more consumer

protection rights and non-discrimination clauses.

Figure 10: The Depth in relation to the other indicators



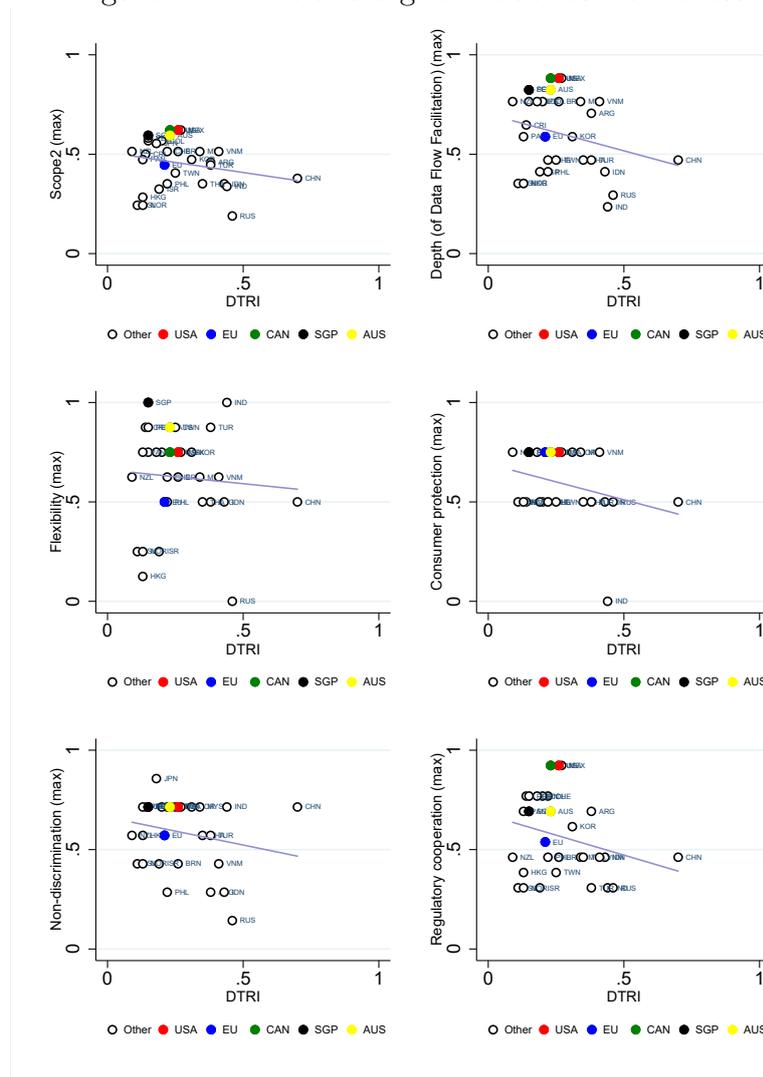
Source: Authors illustration based on the TAPED database.

Another set of explanations can be situated at the domestic level. To what degree are domestic policies mirrored in international law commitments? Are countries using international law as a commitment device to bring about domestic regulatory change or are we rather witnessing a screening effect in which commitments largely reflect domestic practice suggesting some cheap talk in relation to signing agreements (von Stein, 2005)?

Therefore below, we discuss how PTA design relates to domestic digital policies. We rely on the recently published Digital Trade Restrictiveness Index (DTRI) by the European Centre For International Political Economy (ECIPE). The DTRI covers a range of fiscal, establishment, data and trading restrictions related to digital trade for 64 economies worldwide. The Index ranges between zero and one, where zero indicates a fully open digital economy and one indicates a virtually closed digital economy. Between the TAPED

database and the DTRI, we have an overlap of 31 countries². Figure 11 illustrates how our six indicators relate to the DTRI. All indicators are negatively correlated with the DTRI³. As for those indicators that are about scope, depth and various obligations a negative correlation cast doubts about *prima facie* evidence that a commitment story is at play here. More interesting are downward trends for flexibility and consumer protection, countries with lower restrictions aim for more flexibility, this would rather suggest that these countries aim to keep policy space in this area, whereas countries with higher restrictions paradoxically demand less flexibility providing some support for the idea of a commitment device. Overall, we also observe that the rule-makers, with the exception of the EU, are substantially above the trend lines.

Figure 11: PTAs and digital trade restrictiveness



Source: Authors illustration based on the TAPED database.

²The relatively little overlap is due to the fact that the DTRI includes individual member states which in TAPED are grouped as EU.

³Scope2: -0.2208, Depth: -0.2483, Flexibility: -0.0746, Consumer protection: -0.2892, Non-discrimination: -0.2132, Regulatory cooperation: -0.2639.

Conclusion and next steps

Data-flow provisions have entered the universe of PTAs in the past 15 years. Although, only a third of all PTAs have commitments related to this area. This paper developed a number of indicators related to PTA design and has mapped the design evolution over time. Letting the data speak, we discovered a number of leading actors (rule-makers) and sets of overlapping models of treaties based on textual analysis. However, we seem to be at the beginning of a period where data-relevant provisions will only increase in importance as many classical trade and trade-related provisions become relatively less important (e.g. tariffs). What are the next steps in understanding design and design variation in this domain? First, research may explore explanations to account for variation in design based on political-economy models and arguments rooted in the IR literature. What role play commitment concerns or power asymmetry in agreeing new rules? Which interest groups are pivotal for pushing new rules? How does the competition between exporter interests and consumer protection interests define government positions entering into PTA negotiations? Second, research should pay more attention to the evolving competition among models that are being developed, in particular starting with the TPP and how this will affect the creation and promotion of other models (e.g. the EU). Are these models complementary or are they creating regulatory barriers? Related to this how do leading promoters of models use PTAs to diffuse their preferred models and what are the impacts on non-PTA members when they negotiate PTAs. Also to what degree to new domestic initiatives (e.g. EU General Data Protection Regulation) impact on PTA design and the push for updating existing PTAs. Finally, what is the impact of these commitments on state behavior, how do they assist in creating new domestic policies and laws on the role of data in trade, how do they inhibit government action to restrict trade more in light of consumer protection concerns? Also, more generally, how do these commitments directly or indirectly impact on trade flows in goods and services and investment location decisions for firms with large data components in their business models.

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