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The Nexus between the World Trade Organization and Codex Alimentarius

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Abstract

This paper investigates the nexus between institutional design and the structure, composition and evolution of regulatory networks. More specifically, the analysis focuses on the international legalization of Codex Alimentarius through the World Trade Organization in 1995 and the resulting politicization of standard-setting processes and global food governance in the subsequent years.

This version of the paper provides a preliminary descriptive analysis of a newly created dataset on the participation of 196 states, 327 non-governmental and 56 intergovernmental organizations in the standard-setting processes at Codex Alimentarius. The dataset presents a longitudinal, valued affiliation network which captures the participation of state and non-state actors in over 850 meetings of 43 technical committees between 1963 and 2015.

The preliminary descriptive analysis finds suggestive evidence for an increased politicization of Codex Alimentarius as indicated by the considerable increase in the number of participating state and non-state actors as well as the sizeable increase in the number of delegates these actors send to the standard-setting Codex committees post-1995. Preliminary insights from social network analysis suggest that the United States remain the most central actor in Codex Alimentarius. The analysis also finds that there is a number of non-state actors that participate in more Codex Alimentarius committees and/or send more delegates to certain committees than most of the state actors do.

These findings are relevant for at least two reasons. First, they contribute to a literature that points out the politicization of Codex Alimentarius but is based on a selection of case studies and interviews. Second, international standards play an important role in food trade and are directly linked to human health - it is therefore important to understand who actually develops these standards and in whose interest these standards are designed. The WTO dispute settlement case EC - Hormones between the United States and the European Communities further underpins the importance of Codex standards and the potential controversies related to them.

Keywords: Institutional design, regulatory networks, global food governance, social network analysis, Codex Alimentarius, World Trade Organization

Introduction

Technical regulations and standards are essential to international trade and global value chains (GVCs). They determine whether intermediary products are compatible with the next stage of the value chain and whether the final products are safe for consumption or usage. While they play an important role in most sectors and industries, technical regulations and standards do tend to receive particular public and political attention when they are related to products that can directly affect human health - such as, for instance, food. The repeatedly returning debates on chlorinated chicken and glyphosate-based pesticides are only two of the prominent examples.

Technical regulations and standards on food safety can vary considerably between countries as they reflect country-specific characteristics including economic development, production methods, regulatory philosophies and cultural heritage. In the absence of

(partial) harmonisation, mutual recognition or mutual equivalence, this regulatory heterogeneity can present a challenge to both exporters and importers.

In an attempt to address this regulatory heterogeneity and reduce these so-called non-tariff measures (NTMs) associated with it, the Codex Alimentarius (Codex) was established in 1963 by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO). Recognised for their expertise in the area of food issues, the FAO and the WHO set up Codex to develop a collection of internationally recognized standards, codes of practice, guidelines, and other recommendations relating to foods, food production, and food safety. Currently, Codex has 189 Members made up of 188 Member Countries and one Member Organization (the European Union (EU)). Furthermore, there are currently 226 Codex Observers - 56 inter-governmental organizations (IGOs), 154 non-governmental organizations (NGOs) and 16 United Nations (UN) organizations. The Codex Alimentarius Commission (CAC) is the decision-making body of Codex. The CAC oversees the work of its subsidiary bodies and, broadly speaking, adopts the standards developed by the subsidiary bodies through consensus. The subsidiary bodies include the Executive Committee and the Secretariat as well as a number of General Subject Committees, Commodity Committees, ad hoc Intergovernmental Task Forces and Regional Coordination Committees. In these committees, representatives from national governments as well as experts from IGOs, NGOs, industry and academia negotiate and develop international standards for food commodities, for labelling and hygienic handling of food, and for food-related safety risk assessment.

Since its establishment, Codex played an important role in the development of *voluntary* food standards. Despite the work of Codex and other organizations active in the field of food-related standards - notably the United Nations Economic Commission for Europe (UNECE), the International Organization for Standardization (ISO) and the Organization for Economic Cooperation and Development (OECD) - cross-national differences in food standards remained an impediment to international trade throughout the 1970s and 1980s. With the objective of addressing this and a long list of other trade-related issues, the General Agreement on Tariffs and Trade (GATT) created the World Trade Organization (WTO) during the Uruguay Round (1986-1994). In this Round, the WTO member states also negotiated the Agreement on the Application of Sanitary and Phyosanitary Measures (WTO SPS Agreement). The WTO SPS Agreement covers all measures whose purpose it is to protect human or animal health from food-borne risks, human health from animal- or plant-carried diseases and animals and plants from pests or diseases. The Agreement attempts to strike a balance between satisfying WTO members' demand for domestic regulatory autonomy and the global harmonization of product and process standards. In Article 3 of the WTO SPS Agreement, the WTO members agree that in order

"To harmonize sanitary and phytosanitary measures on as wide a basis as possible, Members shall base their sanitary or phytosanitary measures on international standards, guidelines or recommendations, where they exist [...]".

Annex A of the WTO SPS Agreement further defines

"International standards, guidelines and recommendations [...] for food safety, [as] the

standards, guidelines and recommendations established by the Codex Alimentarius Commission relating to food additives, veterinary drug and pesticide residues, contaminants, methods of analysis and sampling, and codes and guidelines of hygienic practice [...]".

The WTO SPS Agreement presents an interesting case of international legalization, defined by Abbott and Snidal (2000) and Abbott et al. (2000) as a form of institutionalization characterised by three dimensions: obligation, precision, and delegation. According to the authors, obligation means that states are legally bound by rules or commitments and therefore subject to the general rules and procedures of international law. Precision means that the rules are definite, unambiguously defining the conduct they require, authorize, or proscribe. Delegation grants authority to third parties for the implementation of rules, including their interpretation and application, dispute settlement, and (possibly) further rule making.

Arguably, the WTO SPS Agreement presents a case of fairly "hard legalization". Indeed, *"Members shall base their sanitary or phytosanitary measures on international standards, guidelines or recommendations"* suggests a high degree of obligation. The rules laid out in the WTO SPS Agreement are precise and elaborated and the authority to develop the international standards is explicitly delegated to Codex.

The principal objective of this paper is therefore to investigate whether and, if so, how the international legalization of Codex through the WTO - the upgrade of Codex standards from being *voluntary* measures to being *de facto* legally binding rules that determine market access - has resulted in a politicization of the standard-setting processes. As outlined below, there is a small body of research that has assessed the linkage between the WTO and Codex through a selection of case studies and interviews. This paper contributes to this literature by studying the WTO-Codex relationship more systematically. While the current version of this paper is limited to a preliminary descriptive analysis, the ultimate objective is to quantify the causal effect of international legalization through the WTO on Codex and to study the resulting power asymmetries between and among state and non-state actors in global food governance.

Related literature

There are three bodies of literature that are particularly relevant to this paper. The first body of research looks at the specific relationship between the WTO and Codex. The second body of research provides theoretical guidance on the concepts of institutional design and the governance of regulatory networks. The third body of literature offers methodological advancements in the empirical study of affiliation networks. While the current version of this paper is limited to only mentioning some of the key contributions relevant to this paper, the final version aims to discuss the literature in much further detail.

The Codex Alimentarius and the World Trade Organization

One of the most comprehensive studies on Codex is provided by Masson-Matthee (2007). Her book on the *The Codex Alimentarius Commission and Its Standards* offers a detailed

legal analysis of Codex' institutional framework and its history; the standard-setting procedures and their legitimacy; and the relationship between Codex, the EU and the WTO. Particularly relevant to this paper is her review of selected committee reports and early academic studies that suggest that the entry into force of the WTO SPS Agreement has led to a politicization of Codex and its standard-setting procedures (See for instance, Garrett et al. (1998), Braithwaite and Drahos (2000), Roberts et al. (2004), Poli (2004), Victor (2004), Veggeland and Borgen (2005)). Based on a selection of interviews and the study of selected committee reports, the authors argue that the agreement by consensus on the adoption of Codex measures became harder to achieve after the WTO SPS Agreement's entry into force in 1995. It is also argued that Codex members have become keener to ensure that adopted Codex standards fully respond to their concerns, in particular, if they already have a regulatory measure in place at the national or regional level. The authors' analysis of a selection of committee reports suggests that, as a consequence of the politicization, the number of state and non-state representatives participating in the committee meetings has increased after 1995.

The politicization of Codex and the organization's relationship to the WTO is also the focus of a number of publications by Tim Büthe and his co-authors. In Büthe (2008) and Büthe (2009), the author studies the Uruguay Round negotiations and assesses the reasons and consequences of Codex, rather than UNECE, ISO or the OECD, being explicitly delegated the authority to develop international standards for food safety. The participation of developing countries and non-state actors in the standard-setting processes of Codex Alimentarius post-1995 is the focus in Büthe and Harris (2011) and Büthe and Mattli (2011). In his latest contribution on the subject, Büthe (2015) concludes that the previously mentioned institutionalization has increased the cost of non-compliance with Codex standards, consequently raised the stakes in transnational rule-making and ultimately caused food safety rule-making to become substantially more contentious.

The explicit endorsement of Codex through the WTO SPS Agreement is also the subject of research in Jackson and Jansen (2010), Jansen (2012a) and Jansen (2012b). The authors argue that the Uruguay Round not only represented a clear shift towards the encouragement of using international standards but towards a regulatory system of delegation and explicitly connected international agencies.

How this delegation might be orchestrated and which principal-agent dynamics may play a role in this particular WTO-Codex context is discussed by Dupont and Elsig (2012) and Elsig (2015).

Based on a selection of case studies and interviews, the contributions briefly outlined above provide many interesting insights into the WTO-Codex relationship. Büthe (2008), Büthe (2009), Dupont and Elsig (2012) and Elsig (2015) expand on this and use the WTO-Codex case to develop conceptual frameworks that can be employed to explain the causes and consequences of international legalization more generally. Their contributions therefore also fall under the second body of literature relevant to this paper - on international legalization and the governance of regulatory networks.

Halabi (2015)

International legalization and the governance of regulatory networks

Conceptually, this paper relates closely to the literature on institutional design, international legalization, soft and hard law and the governance of regulatory networks.

While the concept of international legalization (Goldstein et al. (2000), Abbott et al. (2000)) is not undisputed (See, for instance, Finnemore and Toope (2001) and Goldstein et al. (2001).), its previously mentioned dimensions of obligation, precision and delegation have been influential in the international relations (IR) and international law (IL) literature. There is a number of studies, for instance, that employ this conceptual framework to investigate the work and influence of the WTO (See, for instance, Abbott (2000), Kahler (2000), Goldstein and Martin (2000), Newman and Zaring (2013).)

Closely related to the concept of international legalization is the literature on soft and hard law (For a comprehensive literature review, see Shaffer and Pollack (2013).) Here again, the WTO and its Agreements have been the focus of discussion in a number of contributions including Abbott and Snidal (2000), Steinberg (2002) and Newman and Zaring (2013).

Institutional design plays an important role in the governance of regulatory networks - a topic on which much of the more recent literature is focused. Particularly relevant to this paper are the contributions by Abbott and Snidal (2009) (governance triangle), Kahler (2009a) and Kahler (2009b) (trans-governmental networks, TGNs), Abbott and Snidal (2010) (transnational new governance, TNG), Carpenter (2011) (transnational advocacy networks, TANs), Abbott et al. (2016) (private transnational regulatory organizations, PTROs) and Kahler (2018) (complex governance). Together with the studies on the interplay between state and non-state actors in global governance by Drezner (2007), Moravcsik (2013) and Spiro (2013), these contributions provide an array of theoretical frameworks that are helpful in the conceptual study of Codex.

Social network analysis

The review of relevant methodological literature stands at its beginning. Over the last years, the academic interest in social network analysis has grown rapidly and many methodological advancements have been made since the seminal contributions by Wassermann and Faust (1994) and Jackson (2008). A *Special Issue on Political Networks* can be found in McClurg and Lazer (2014) and a recent survey of literature related to the study of political networks is provided by Victor et al. (2018).

The latest advancements in the analysis of networks that evolve over time are collected by Doreian and Snijders (2010) and Doreian and Snijders (2012). Agneessens and Everett (2013) present recent methodological contributions to the study of affiliation networks, also known as two-mode networks. In contrast to one-mode networks, actors in two-mode networks are not linked directly but through common affiliation, such as the common participation in events.

The Codex dataset presents a combination of these network types, which complicates the identification of a suitable methodology. First, the network is longitudinal as it captures the period of time between 1963 and 2017. Second, Codex presents an affiliation

network since states, IGOs and NGOs (mode 1) are associated with one another because they participate in the same committee meetings (mode 2). Third, participation is not measured in a binary manner (participate or not participate) but also captures the strength of participation through the number of participating delegates that each state, IGO and NGO sends to the committee meetings. Finally, social network analysis traditionally focuses on the exogenous attributes of actors and the endogenous tie formation between them. This paper, however, aims to quantify the causal effect that an external event has on the structure and evolution of the network. Only very recently, have authors including Shijaku et al. (2016), Brandenberger (2016) and Stadtfeld and Block (2017) focused on this topic.

As the review of different methodologies continues, the current version of this paper focuses on a descriptive analysis of Codex before and after the international legalization through the WTO in 1995. The analysis of the node (states, IGOs, NGOs and committees) characteristics relies on the contribution of Opsahl et al. (2010) and the related R package *tnet* (Opsahl, 2015) which allow the computation of node centrality measures in weighted two-mode networks. The analysis of network characteristics relies on Everett and Borgatti (2015) who extend both centrality and centralization measures to two-mode networks.

Lazega (2017)

Theory

As outlined in the brief literature review above, there is a number of scholars who argue that the international legalization (institutionalization) of Codex through the explicit endorsement by the WTO has led to a politicization of the standard-setting processes in Codex. In a nutshell, the argument behind this is the following: The WTO SPS Agreement has 'upgraded' Codex standards from being *voluntary* measures to being *de facto* legally binding rules for food safety that determine market access. This international legalization has therefore increased the cost of non-compliance with Codex standards. To minimise the cost of compliance, Codex members as well as non-members have an increased incentive to actively revise and amend existing standards and shape future standards to be designed in their interest. This leads to the following working-hypotheses:

Hypothesis 1: The number of actors participating in the Codex committee meetings increases post-1995. This increase is more significant for states and NGOs than for IGOs. The increase is most significant in the most powerful committee - the CAC.

The international legalization of Codex has not only increased the cost of non-compliance for Codex members but also for non-members since non-members have to comply with the standards if they want to export to Codex members. As a result, non-members have an increased incentive to join Codex and actively influence the standard-setting processes in their interest. This incentive is stronger for states and NGOs than for IGOs since states represent their national (industry and public) interests and NGOs represent the interest of their members (the large majority of NGOs active in Codex are *de facto* industry associations). In comparison, IGOs have little political and economic stakes in

Codex standards. The increased incentive to join Codex is expected to be reflected in the number of participating states, NGOs and IGOs. Since the CAC is the most powerful committee, the number of participating states, NGOs and IGOs is expected to be particularly significant here.

Hypothesis 2: The number of delegates of the participating actors in the Codex committee meetings increases post-1995.

The raised cost of non-compliance is argued to have increased the incentive for states, NGOs and IGOs to participate in Codex standard-setting processes and therefore in the committee meetings. However, to successfully shape standards in one's interest, mere participation might not be sufficient. To generate support for one's interests, actors are therefore expected to send larger numbers of delegates to participate at the Codex meetings. As in *Hypothesis 1*, the incentive to do so is expected to be larger for states and NGOs than for IGOs. Similarly, the increase in the number of delegates is expected to be particularly significant in the CAC.

Hypothesis 3: Post-1995, big and politically powerful exporters increasingly attempt to occupy central roles in the standard-setting processes of Codex. This results in a higher centralization of Codex.

Big and politically powerful exporters, such as the United States and the European Union, are known to actively diffuse their regulatory views and interests among their trading partners. In Codex, they are expected to do so by occupying central positions in the standard-setting processes of Codex. The incentive to do so has arguably increased with the international legalization of Codex. This is expected to result in a higher node centrality for these actors and, consequently, a higher network centralization. As explained in more detail below, in an affiliation network, node centrality measures the extent to which a node (an actor or an event) is central to the network. Network centralization captures the extent to which the network is more or less centralized around particular a node or sets of nodes.

Hypothesis 4: The rate at which Codex standards are developed, revised and amended increases post-1995.

The raised cost of non-compliance is argued to have increased the incentive for states, NGOs and IGOs to participate in the Codex committee meetings and to influence the standards in their respective interest. It is therefore expected that the rate at which existing standards are revised and amended increases post-1995. For the same reason, it is expected that the rate at which new standards are developed also increased post-1995.

In theory, the international legalization of Codex should only affect the behaviour of states, NGOs and IGOs after the entry into force of the WTO SPS Agreement in 1995. However, as is well documented in a number of the contributions outlined in the brief literature review above, the design of the WTO SPS Agreement is the result of a long and intense negotiation process - the Uruguay Round lasted from 1986 to 1993. It can

be therefore be expected that actors adjust their participation prior to the official entry into force of the WTO SPS Agreement.

Data

The dataset used in this paper is based on the committee reports published on the Codex Alimentarius website (Codex Alimentarius, 2018). In total, 871 reports (available in PDF format) from 43 committees have been downloaded for the time between 1963 and 2017. At the time of analysis, not all committee reports for 2016 and 2017 were uploaded which is why the analysis is based on the committee meetings between 1963 and 2015. For each report, the information contained in the annexed list of participants has been manually extracted. Manual extraction was necessary since the quality and formatting of the PDF files varied considerably, which made an automatised extraction difficult. For each report, the number of delegates for each state, IGO and NGO has been counted. In total, the dataset contains the number of delegates for 196 states, 327 NGOs and 56 IGOs. The datset also contains information on which standards have been adopted, revised or amended by each committee. In total, the dataset covers 358 standards, guidelines and codes of practice.

Methodology

This version of the paper aims to only provide first descriptive insights to the new dataset. The ultimate objective of this paper is to quantify the causal effect of the WTO's international legalization of Codex on the standard-setting processes. As mentioned in the literature review, it is not clear at this stage, if social network analysis is the appropriate methodology to do so. However, it does provide some first insights into the political power asymmetries in Codex.

One central question of this paper is related to *Hypothesis 3* and the position that actors (states, IGOs and NGOs) and events (committees) occupy in the network and how this may change over time - and, in particular, post-1995. In the terminology of social network analysis, an actor or event is referred to as a node or a vertex. These nodes are linked through edges. The Codex network presents an affiliation network, also referred to as a two-mode network. In this case, actors present mode 1 and events present mode 2. Nodes from either mode are only linked with one another through a node of the other mode. In other words, actors are only linked through the common participation in an event and events are only linked through common participating actors. Furthermore, the Codex network presents a weighted affiliation network since actors' participation in an event is captured through the number of participating delegates. This is an important feature of the Codex network for the following reason: As will be discussed below, there are a number of committees (in particular the CAC), in which almost every country participates. The mere participation reveals therefore little about the political power asymmetries in the committees. These power asymmetries are captured, however, in the number of delegates that actors send to participate in the committees. For the analysis of the position that actors and events occupy in Codex, it is therefore important to take the edge weights (number of participating delegates) into account.

To do so, the analysis of the node characteristics relies on the contribution of Opsahl et al. (2010) and the related R package *tnet*. An important indicator of a node's centrality in a network is its degree. In an one-mode network, a node's degree corresponds to the number of other nodes that it is connected to. In a two-mode network, there are two types of degree measures. Opsahl et al. (2010) point out that in a two-mode network, degree could either be the number of secondary nodes (mode 2) a primary node (mode 1) is connected to (and vice versa), or the number of primary nodes a primary node is connected to. To clarify the difference between these two measures, the authors refer to them as two-mode and one-mode degree, respectively. Put differently, the two-mode degree of an actor corresponds to the number of events the actor participates in. The two-mode degree of an event corresponds to the number of actors that participate in it. The one-mode degree of an actor corresponds to the number of actors that the actor is connected with through the common participation in events. The one-mode degree of an event corresponds to the number of events it is connected with through common participating actors. In the following analysis, the emphasis will be on the two-mode degree of actors and events.

A second indicator that can be computed in *tnet* (Opsahl, 2015), is the two-mode output, which essentially corresponds to the sum of an actor's edge weights - in other words, the sum of delegates that an actor sends to the events.

In addition to the node characteristics, *Hypothesis 3* poses that the international legalization of Codex through the WTO has led to a higher centralization of Codex. While the two-mode degree and two-mode output measures mentioned above relate to the properties of nodes, centralization relates to the overall structure of the network and captures the extent to which the network is more or less centralized around particular a node or sets of nodes. Everett and Borgatti (2015) extend this concept and calculate two-mode network centralization as follows:

$$\frac{\sum[c_* - c_i]}{max\sum[c_* - c_i]},$$

where

$$max\sum[c_* - c_i] = \frac{(n_*n_i - n_i - n_* + 1)(n_i + n_*)}{n_i n_*},$$

where c_i is the normalized two-mode degree centrality of node i and c_* is the normalized two-mode degree centrality of the most central node. n_* is the size of the node set that contains the node with the highest centrality and n_i is the size of the other node. In a two-mode network, the node with the highest centrality could be an actor or event. The normalization of the two-mode degree centrality is necessary to make the scores comparable between the two modes.

Descriptive analysis

This section provides a preliminary descriptive analysis of the new dataset and a brief discussion around the four hypotheses.

Participation of states, IGOs and NGOs at Codex committees

Hypothesis 1 states that the number of actors participating in the Codex committee meetings increases with the international legalization through the WTO SPS Agreement in 1995. This increase is expected to be more significant for states and NGOs than for IGOs and most significant in the most powerful committee - the CAC.

Figure 1 shows the number of states, IGOs and NGOs that participated in the Codex meetings since 1963. The vertical lines show the beginning of the Uruguay Round in 1986 and the entry into force of the WTO SPS Agreement in 1995. A first glance at the data does, indeed, suggest that there is an upward trend in the number of participating states, IGOs and NGOs. The average number of participating states is 74 pre-1995 and 144 post-1995. Prior to 1995, an average of 37 NGOs participated in the annual committee meetings of Codex - post-1995 this number was 76. The average number of IGOs participating in the Codex committees was six pre-1995 and eleven post-1995.

Figure 1: Number of participating states, IGOs and NGOs, 1963-2015

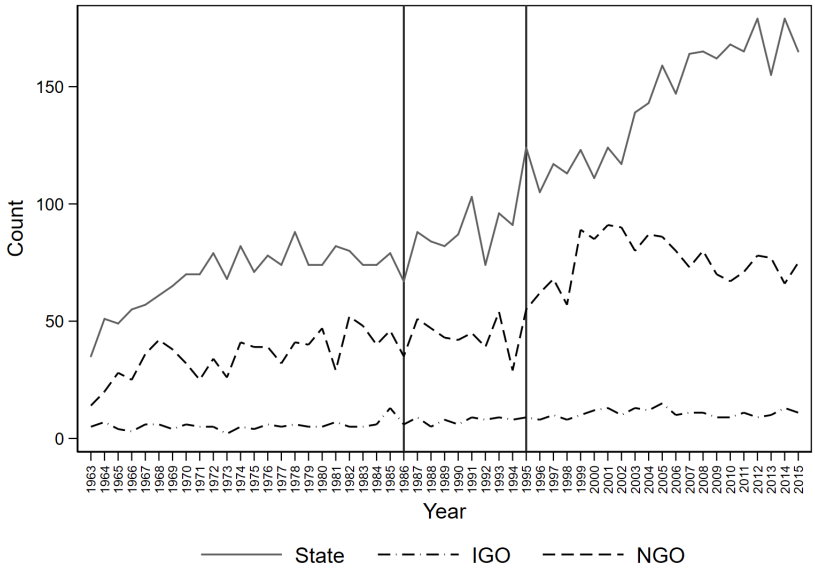
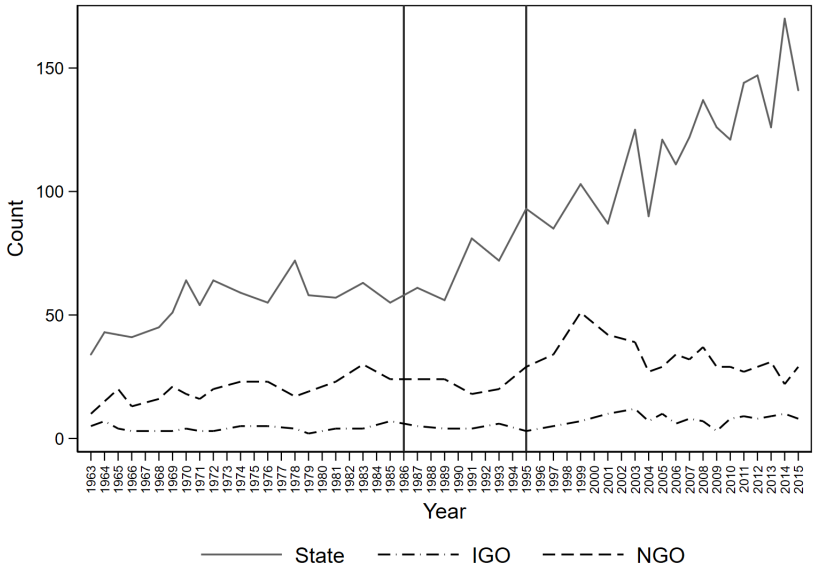


Figure 2 zooms into the number of participating states, IGOs and NGOs in the decision-making body - the CAC. Eyeballing the data also suggests an upward trend in the participation here. The average number of participating states has increased from 56 pre-1995 to 121 post-1995. Similarly, the average number of participating IGOs and NGOs has increased from four to seven and from 20 to 32, respectively.

Figure 2: Number of participating states, IGOs and NGOs in the Codex Alimentarius Commission, 1963-2015



In comparison, Figure 3 and Figure 4 show the participation in the different Commodity and Subject Committees. As becomes evident in the Figures, not all committees existed throughout the time period of consideration. Only five out of the 15 commodity committees existed before and throughout the Uruguay Round. Out of the 13 subject committees, nine existed before and after the Uruguay Round. Most of these committees experienced an increase in participation over time. In particular the Codex Committee on Food Hygiene (CCFH), the Codex Committee on Food Labelling (CCFL) and the Codex Committee on General Principles (CCGP) experienced a sizeable increase in participation that started during the Uruguay Round.

Figure 3: Number of participating states, IGOs and NGOs in the Commodity Committees, 1963-2015

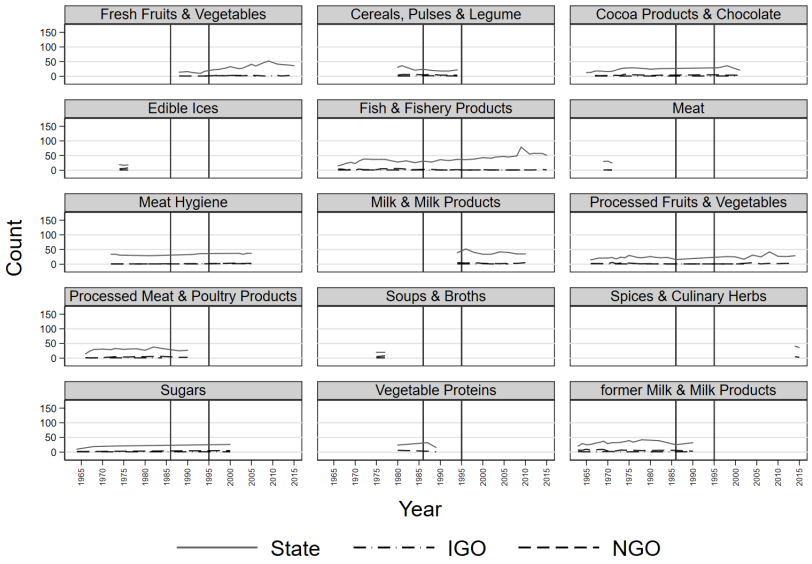
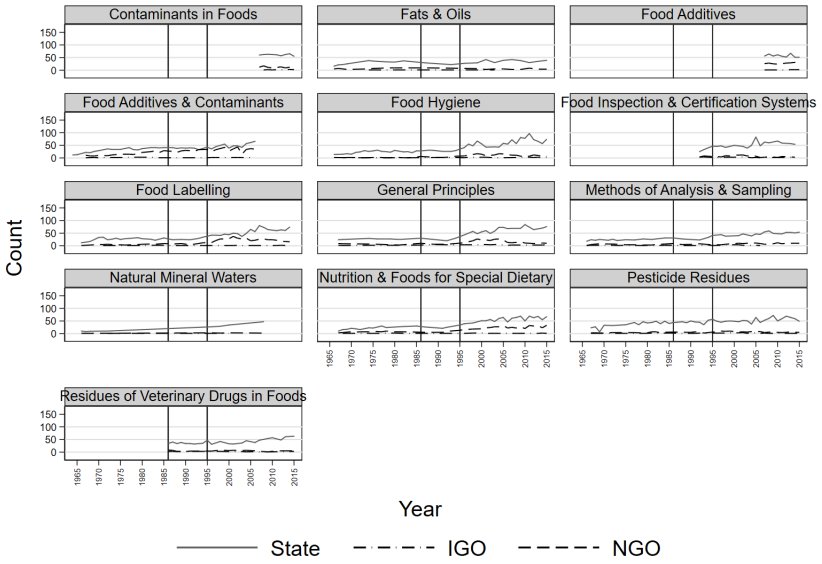


Figure 4: Number of participating states, IGOs and NGOs in the Subject Committees, 1963-2015

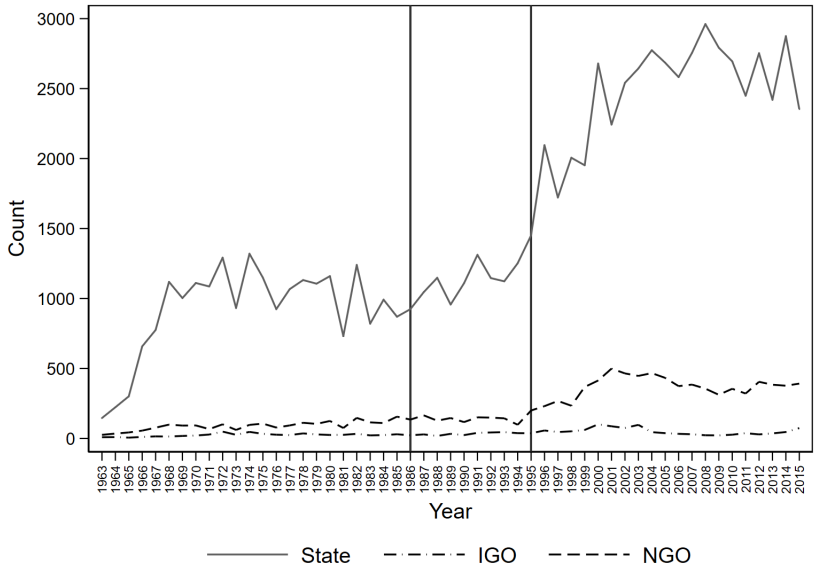


Of course, these are preliminary and descriptive observations. However, the average participation of states, IGOs and NGOs does double in the post-1995 period. The Figures also confirm that the CAC is the committee with the highest level of participating states, IGOs and NGOs. The increase in participation appears to be more significant in the CAC than in the Commodity and Subject Committees. There are, however, a few committees including the ones on food hygiene, food labelling and general principles that deserve a closer look at the increased participation.

Participation of delegates from states, IGOs and NGOs at Codex committees

Hypothesis 2 poses that the increase in the participation of states, IGOs and NGOs is accompanied by an increase in the number of delegates the actors send to the committee meetings post-1995. As expected, Figure 5 shows that the increase in participating states, IGOs and NGOs is accompanied by an increase in the number of delegates. The average count of state delegates increases from 974 pre-1995 to 2449 post-1995. The corresponding average count of IGOs and NGOs increases from 27 to 50 and from 103 to 366.

Figure 5: Number of participating delegates of states, IGOs and NGOs, 1963-2015



A quick peek at the distribution of the number of participating delegates in Figure 6 and Figure 7 suggests, however, that a closer look needs to be taken at the disaggregated level as the gap between actors with large numbers of delegates and actors with small numbers of delegates has grown considerably over time and, in particular, in the years following the entry into force of the WTO SPS Agreement.

Figure 6: Boxplot on the number of participating delegates of states, 1963-2015

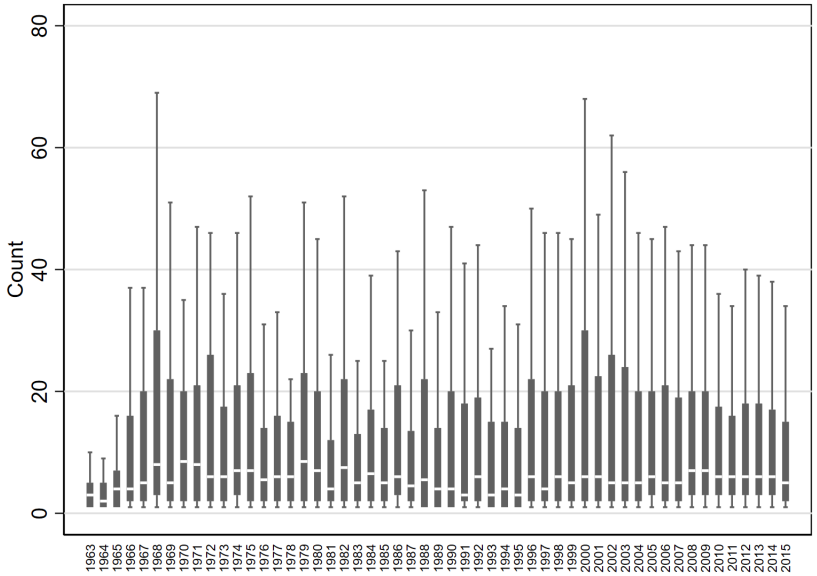


Figure 7: Boxplot on the number of participating delegates of NGOs, 1963-2015

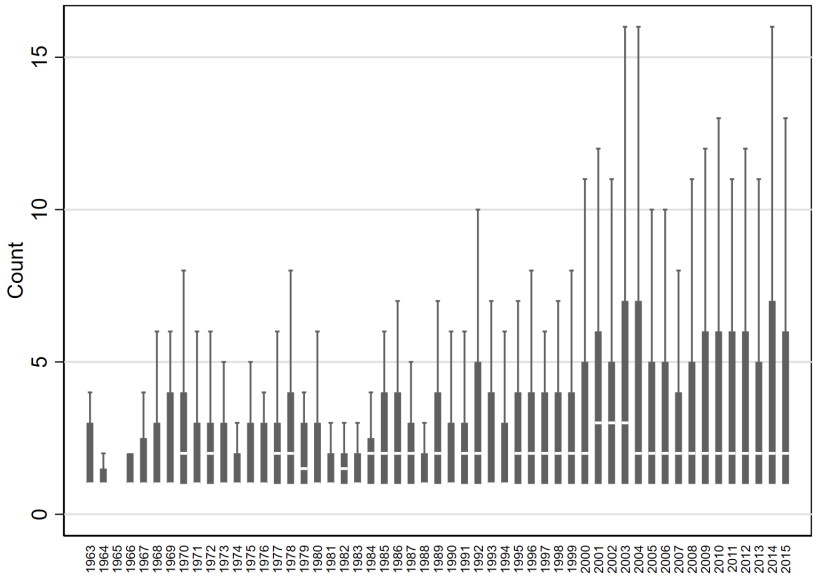


Figure 8 confirms that the CAC attracts the largest number of delegates. However, an upward trend in participation post-1995 can also be observed in Figure 9 and Figure 10 in the Codex Committee on Food Additives (CCFA), the Codex Committee on Food Hygiene (CCFH), the Codex Committee on Food Labelling (CCFL), the Codex Committee on General Principles (CCGP) and the Codex Committee on Nutrition and Foods for Special Dietary Uses (CCNFSDU).

Figure 8: Number of participating delegates of states, IGOs and NGOs in CAC, 1963-2015

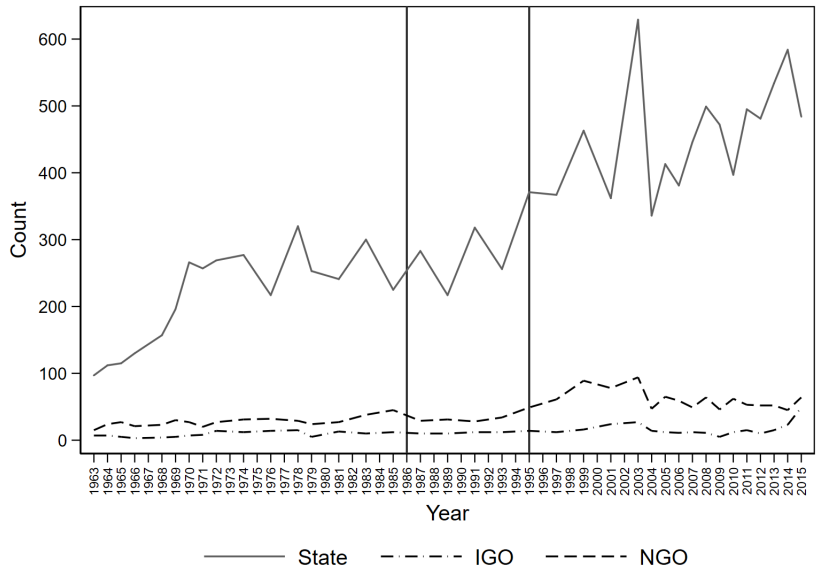


Figure 9: Number of participating delegates of states, IGOs and NGOs in the Commodity Committees, 1963-2015

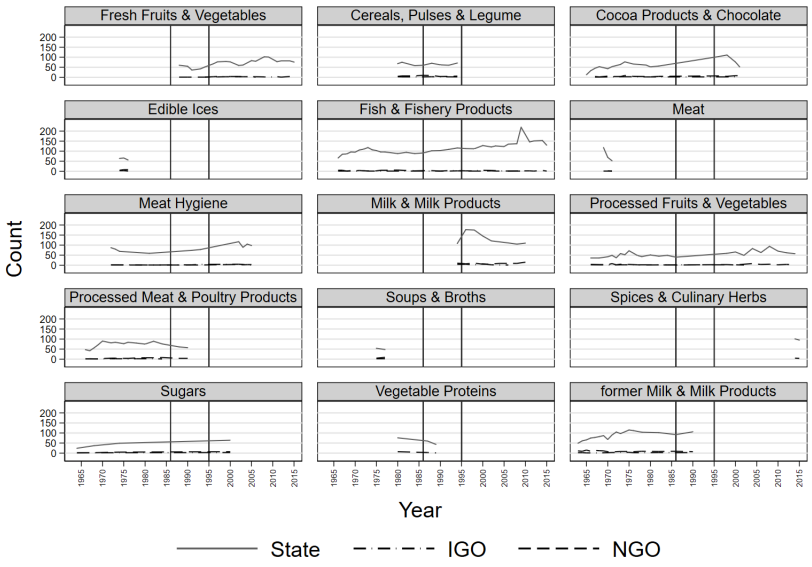
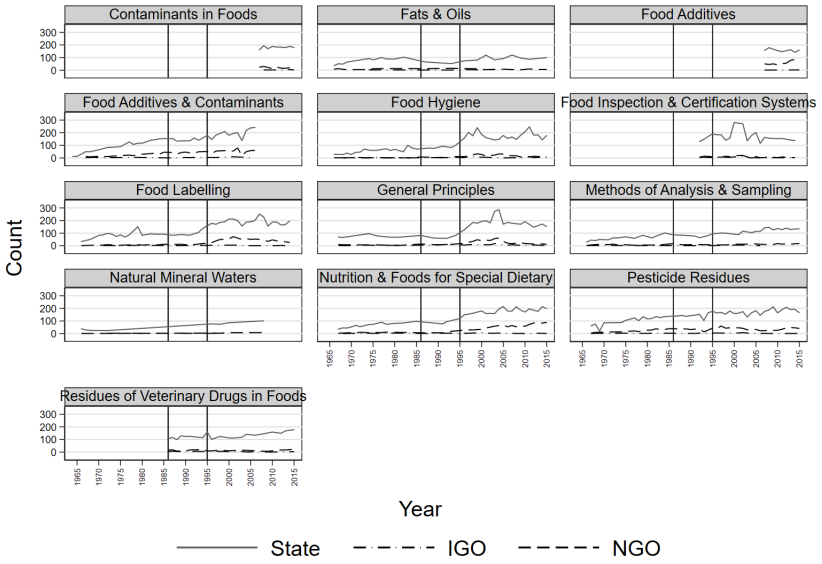


Figure 10: Number of participating delegates of states, IGOs and NGOs in the Subject Committees, 1963-2015



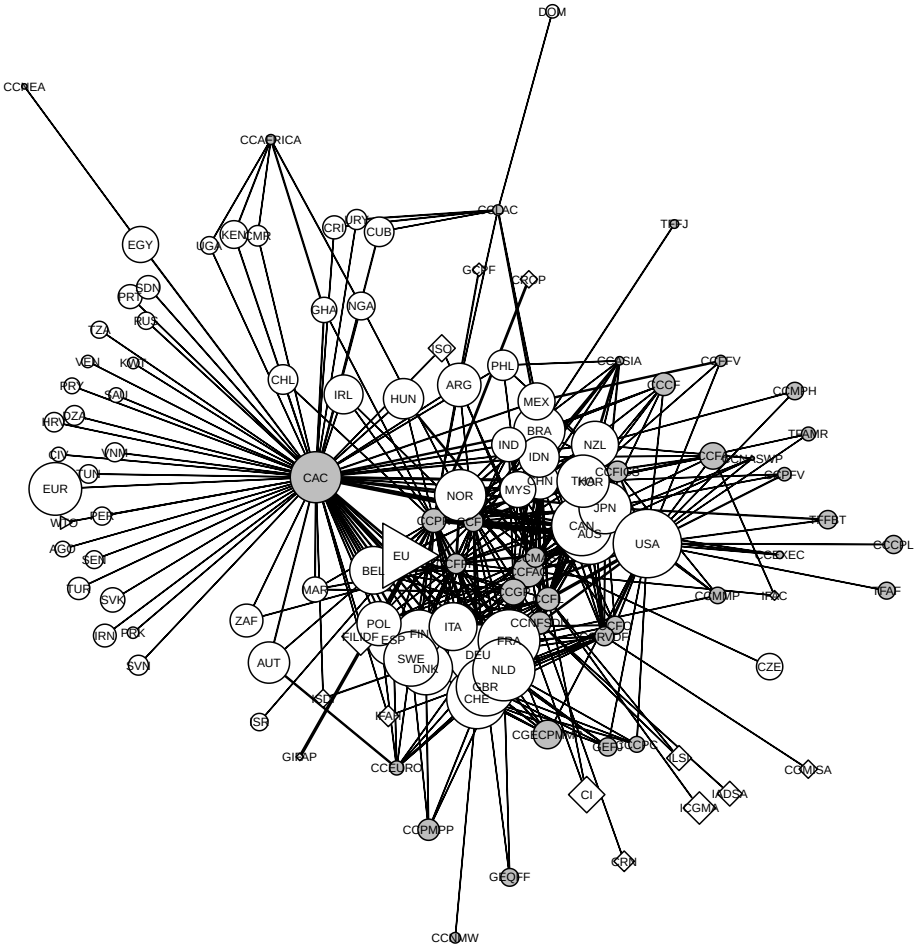
Codex as a weighted two-mode network

The number of actors and the number of their delegates participating in the standard-setting processes of Codex pre and post 1995 provides first descriptive insights into the consequences of the international legalization of Codex through the WTO. To understand the complexity of Codex, however, it is necessary to analyse the interactions between actors in the committees. To give an idea of the complexity of this network, Figure 11 shows the network aggregated over the period of time from 1963 to 2015. To illustrate this complex network, Figure 11 only shows the actors that have, on average over the period of time 1963-2015, sent at least one delegate to the respective event. The node size corresponds to the average normalized two-mode degree centrality and the edge width corresponds to the number of delegates.

Figure 11 confirms that the CAC occupies the most central position of the different committees, followed by the Codex Committee on Food Additives and Contaminants (CCFAC) and the Codex Committee on Milk and Milk Products (CGECPMMP). By far, the most central state in the Codex network is the US. The list of the ten most central states in Codex also includes the Netherlands, Australia, France, Switzerland, Canada, Germany, Great Britain, Sweden and Denmark. The European Union (as a state, abbreviated EUR) occupies the 11th rank on this list. The European Union (as an IGO, abbreviated EU) also presents the most central IGO. The reason for the double status of the European Union is that it participated in Codex meeting as an IGO until 2003. In that year the rules of procedure were amended and regional economic integration organizations allowed to become Codex members. Since then, the EU has been listed with the other member states in the list of participants. Other central IGOs include International Committee of Military Medicine and Pharmacy (ICMM), the European Council of the Codex Alimentarius (ECCA) and the International Committee of the Red Cross (ICRC).

The most central NGO is the Permanent International Bureau of Analytical Chemistry of Human and Animal Food (PIBAC), followed by the Dairy Society International (DSI), the European Committee for Milk and Butterfat Recording (ECMBR), the International Association of Veterinary Food Hygienists (IAVFH), the European Federation of Importers of Dried Fruits, Preserves, Spices and Honey (FRUCOM) and the International Dairy Foundation (FILIDF).

Figure 11: Network of states, IGOs and NGOs (reduced)

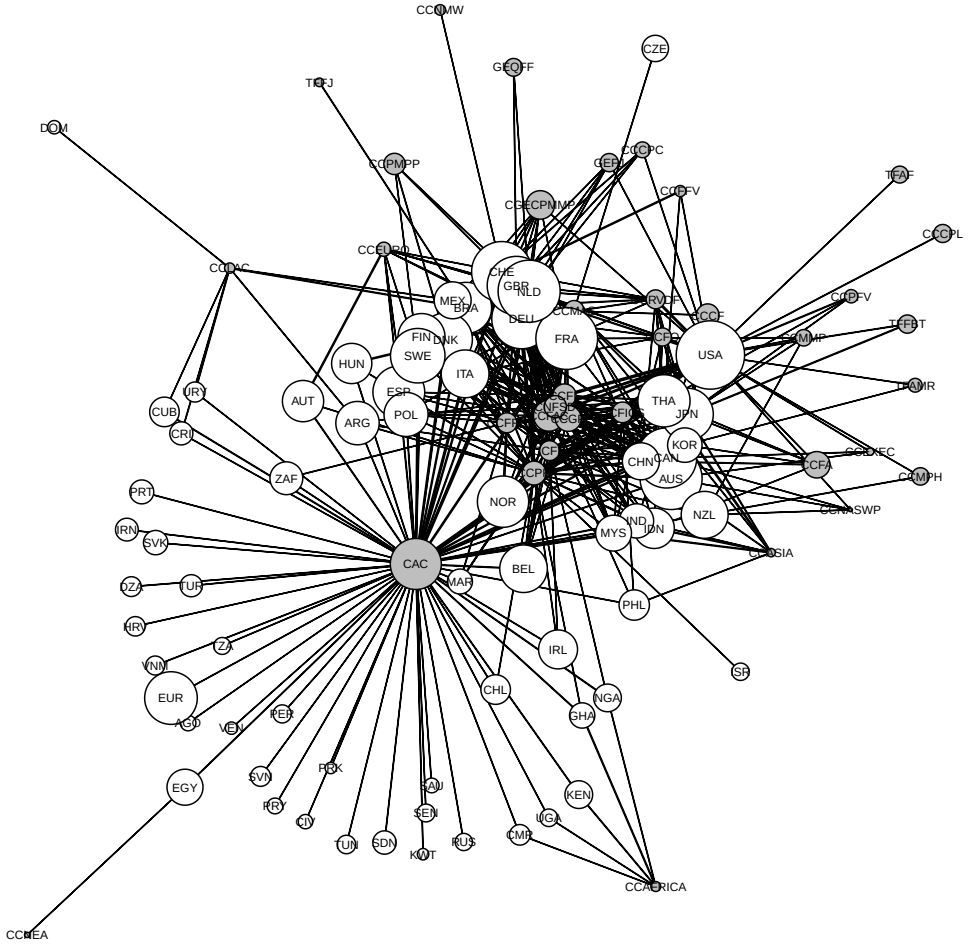


Note: Actors are white, events grey. States are circles, IGOs triangles and NGOs squares. Node size corresponds to the average normalized two-mode degree. Edge width corresponds to the number of delegates. The displayed network is reduced as it only shows actors that have, on average over the period of time 1963-2015, sent at least one delegate to the respective event.

Figure 12 shows the same network but only includes the states. The complexity of the network still makes it difficult to get an idea of the edge weights - the average number of delegates a state sends to a given committee. The US has the strongest connection to the CAC - it sends on average 14 delegates to each CAC meeting. Similarly, Canada sends an average of 14 delegates to the Codex Committee on Food Labelling (CCFL). The US also sends the largest average number of delegates to the Codex Committee on Food Hygiene (CCFH, 12 delegates) and only slightly less delegates than Canada to the CCFL (10 delegates). Germany is the third most important country when it comes to sending delegates to particular committees. With an average of nine delegates, Germany

appears to have the most influence on the Codex Committee on Nutrition and Foods for Special Dietary Uses (CCNFSDU).

Figure 12: Network of states (reduced)



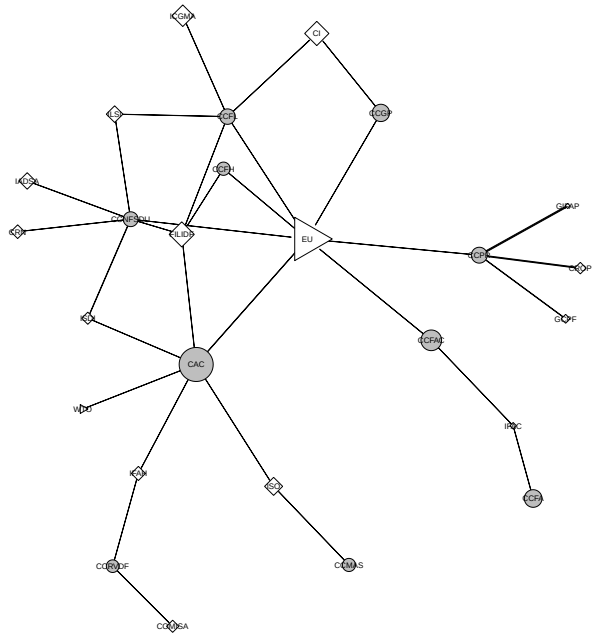
Note: Actors are white, events grey. Node size corresponds to the average normalized two-mode degree. Edge width corresponds to the number of delegates. The displayed network is reduced as it only shows actors that have, on average over the period of time 1963-2015, sent at least one delegate to the respective event.

Figure 13 focuses on the network of IGOs and NGOs in Codex. Besides the FILIDF, the NGOs mentioned above do not appear in this Figure. While they do take part in many meetings of many different committees and therefore have a high two-mode degree centrality within Codex, they tend to send small numbers of delegates to the meetings. In fact, they sent an average of less than one delegate to the committee meetings which is why they are not shown in Figure 13. Besides FILIDF, Consumers International (CI) and the International Council of Grocery Manufacturer Associations (ICGMA) present NGOs with central positions within Codex that also send a significant number of delegates to the meetings.

Figure 13 also illustrates that there are NGOs that might not have a central position within Codex in general but do occupy powerful positions within selected committees. The Codex Committee on Pesticide Residues (CCPR) presents an interesting case. The International Group of National Associations of Manufacturers of Agrochemical Products

(GIFAP), CropLife International (CROP) and the Global Crop Protection Federation (GCPF) do not occupy central positions within Codex. However, they do play important roles within CCPR. GCPF and CROP, on average, send three and seven delegates to CCPR, respectively. GIFAP even sends an average number of ten delegates to participate at CCPR - more than any other NGO, IGO or state. Besides the European Union, the WTO is the only other IGO that continuously participated at the CAC meetings.

Figure 13: Network of IGOs and NGOs (reduced)



Note: Actors are white, events grey. IGOs are triangles and NGOs squares. Node size corresponds to the average normalized two-mode degree. Edge width corresponds to the number of delegates. The displayed network is reduced as it only shows actors that have, on average over the period of time 1963-2015, sent at least one delegate to the respective event.

Node characteristics: States, IGOs and NGOs

Aggregating the Codex to a single static network provides first insights into the political powers of states, IGOs and NGOs. The aim of this paper, however, is to understand how these powers may have changed over time and, in particular, after the international legalization through the WTO in 1995. *Hypothesis 3* states that big and politically powerful exporters recognised the 'upgraded' regulatory status of Codex standards after 1995 and therefore increasingly attempted to occupy central roles in the standard-setting processes. A result of this would be the higher centralization of Codex.

Figure 14 shows the average two-mode output of states, IGOs and NGOs. The number of delegates that states send to Codex committee meetings fluctuates considerably pre-1995 but does appear to show an upward trend since then. The pattern of IGO and NGO two-mode output is les clear.

Figure 14: Node degree centrality: Average for states, IGOs and NGOs

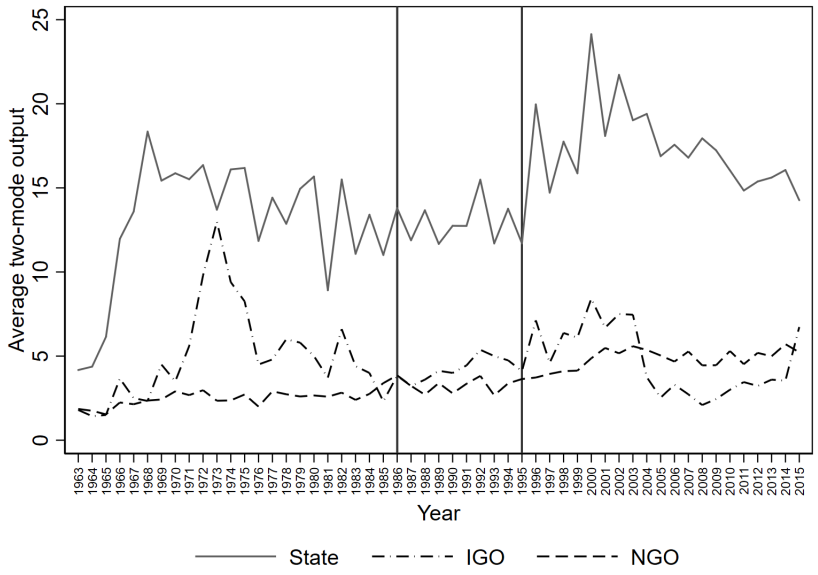
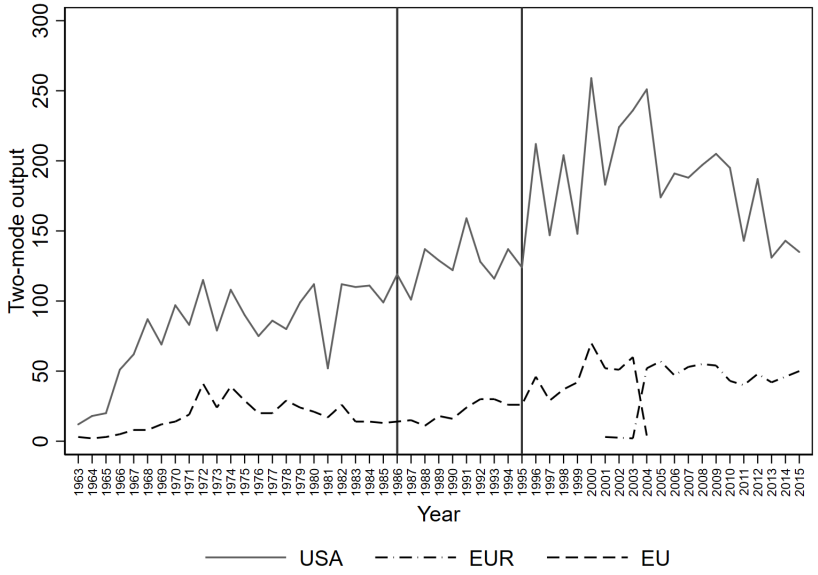


Figure 15 puts these average numbers into perspective. The Figure shows the two-mode output of two players that the literature considers as particularly powerful in Codex - the European Union and the Untied States. While the two-mode output of both actors increases with the start of the Uruguay Round, Figure 15 illustrates that the US is much more active in Codex.

Figure 15: Node degree centrality: US and the EU(R)



The full sample of states, IGOs and NGOs is illustrated in Figure 16, Figure 17/ Figure 18 and Figure 19, respectively. The Figures show the two-mode degree centralities and two-mode output centralities. While a detailed discussion is out of the scope of

the current version of this paper, the Figures provide first insights into the actors' participation in Codex committees and the number of delegates they send. A first look at Figure 16 suggests that the US increased its two-mode degree and two-mode output centrality post-1995. This appears also to be the case for the European Union as illustrated in Figure 17.

Figure 16: Node degree centrality: States

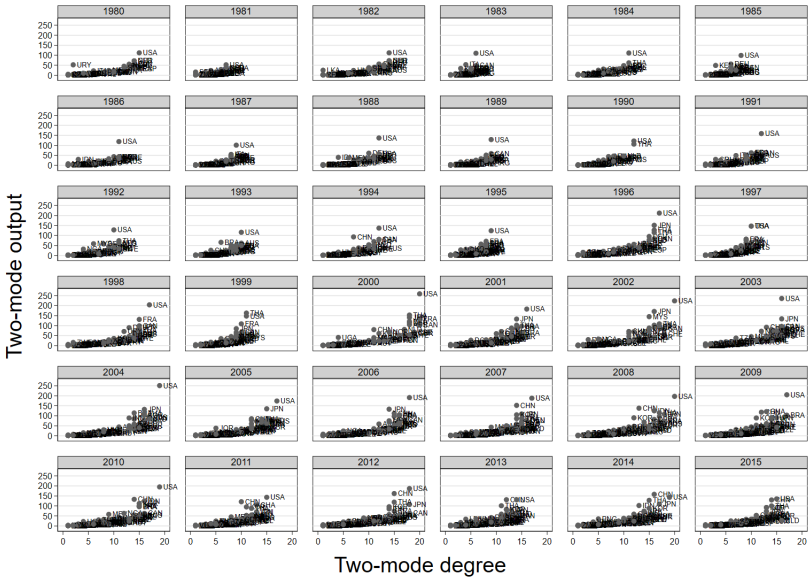


Figure 17: Node degree centrality: IGOs

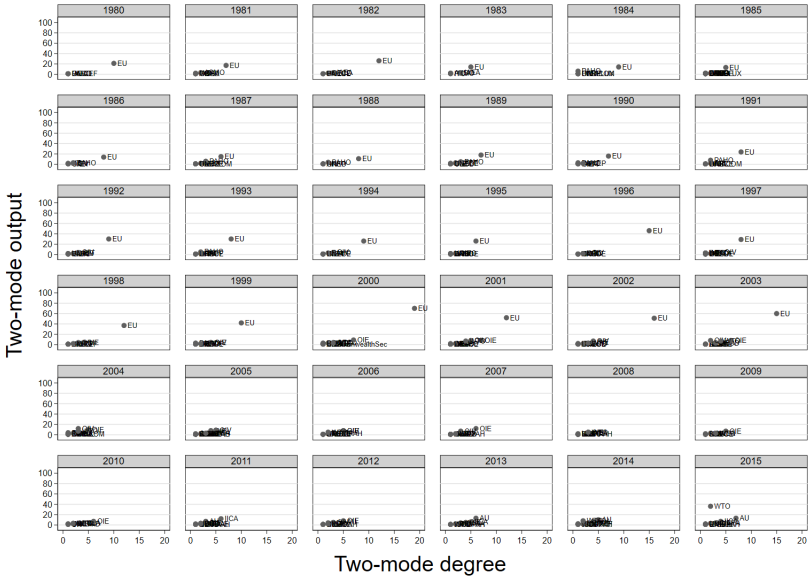


Figure 18: Node degree centrality: IGOs without EU

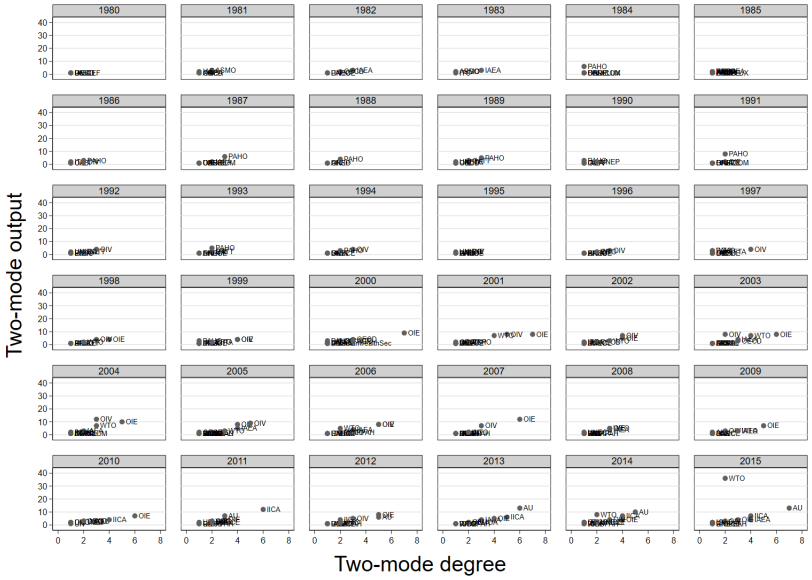
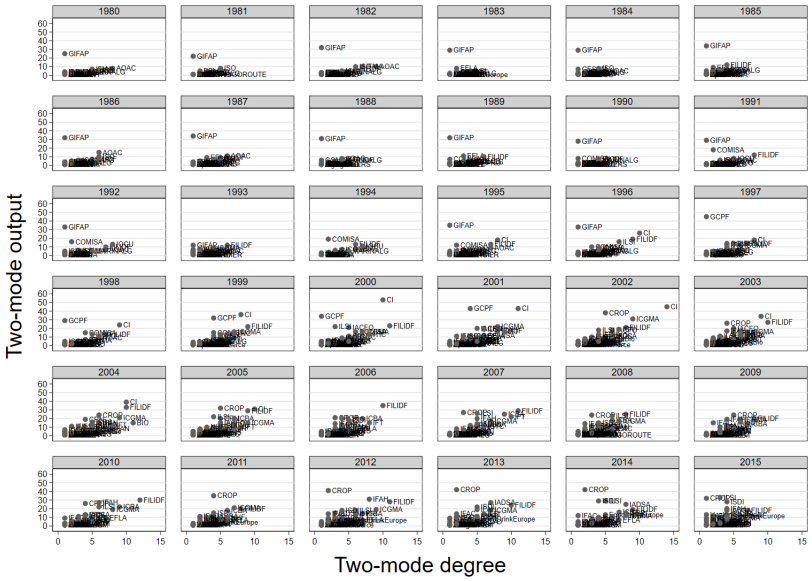


Figure 19: Node degree centrality: NGOs



Network characteristics

While these are some encouraging observations, a more detailed analysis will be required to assess *Hypothesis 3*. A more detailed analysis also needs to be conducted for the network centralization of Codex shown in Figure 20. Even though there do seem to be considerable changes in the participation of actors in Codex, the overall network centralization appears relatively stable over time. One potential reason could be that the centralization is computed on the basis of the normalized two-mode degree centralities

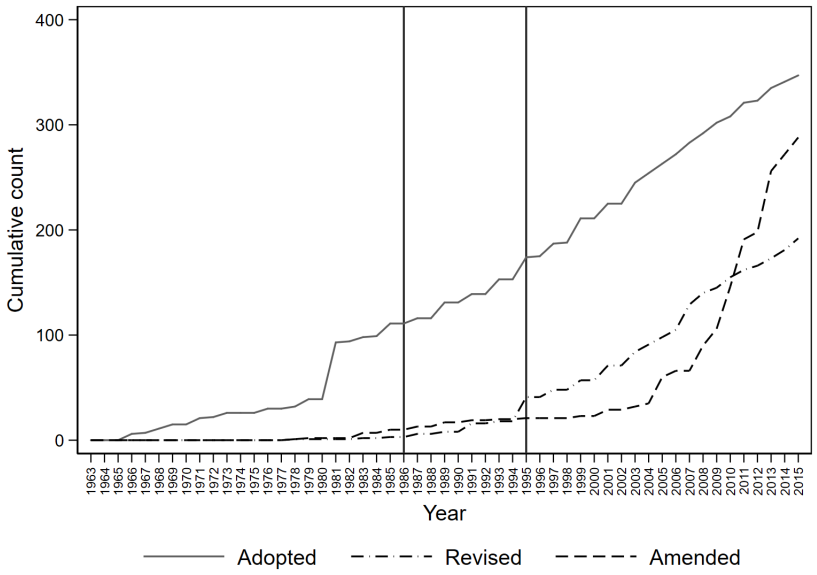
rather than two-mode output centralities. However, it is the later that appears to have changed more considerably over time.

Figure 20: Network centralization

Evolution of standard development

As previously discussed, the international legalization of Codex through the WTO is expected to have also increased the rate at which standards are developed, amended and revised at Codex. Figure 21 shows partly supporting evidence for *Hypothesis 4*. The rate at which standards are adopted seems to have jumped in 1981 but remained constant after this. The rate of revising standards does seem to increase gradually during the Uruguay Round, while the rate of amending standards starts growing rapidly during the early 2000s.

Figure 21: Evolution of standard development, 1963-2015



Conclusions and outlook

The current version of this paper provides a preliminary descriptive analysis of the newly created dataset on the participation of 196 states, 327 NGOs and 56 IGOs in the standard-setting procedures at Codex between 1963 and 2015. The analysis finds supportive evidence for the claim that the international legalization of Codex through the WTO has resulted in a politicization of the standard-setting processes. There is a lot of work to be done to quantify this effect. The next steps include a more detailed study of the related literature and a thorough review of potential empirical strategies.

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