# How Novel are Post-Crisis International Financial Reforms? A Text-Based Approach

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#### Abstract

While analysts agree that the period following the 2007-2008 Global Financial Crisis has been marked by extensive international financial regulatory reforms, they disagree about how to assess these reforms and their significance in the context of the international financial architecture. How can we determine whether or not international financial regulatory standards significantly deviate from the past? Using an original dataset based on the texts of 138 international bank standards from 1983-2017 and 152 international securities rules from 1994-2017. We find that post-crisis bank regulatory initiatives are quite novel, while a similar pattern is less clear within post-crisis securities rules. Further, we find that G20-sanctioned initiatives in the post-crisis period are, on average, more novel than other regulations, implying that external actors – such as the G20 – may help international regulators pass novel reforms. Together, this paper provides a unique assessment of the collective character of international financial regulatory reforms.

## **1** Introduction

The scale of the Global Financial Crisis (GFC) that began in 2007 had no equivalent in the post-Bretton Woods era, and triggered a wave of international financial regulatory reforms aimed to prevent future financial crises. It is not surprising that established technocratic, international standard-setting bodies – including the Basel Committee on Banking Supervision (BCBS) and International Organization of Securities Commissions (IOSCO) – were involved in this process. Unique to the post-GFC period, however, was overt involvement of politicians through the G20 Leaders' process. In particular, since the early stages of the crisis, leaders of the G20 countries called upon international bodies, such as BCBS and IOSCO, to devise standards to fix specific regulatory deficiencies that became clear from the crisis. G20 leaders committed to implement these regulations, and agreed to allow centralized implementation monitoring of these commitments. The newly created Financial Stability Board (FSB) would both write international rules and act as a central monitoring body for G20 implementation of these commitments is still in progress, the process of rule-making in response to the crisis is largely complete. Indeed, in 2014, the Financial Stability Board updated the G20 Leaders, stating "the job of agreeing measures to fix the fault lines that caused the crisis is now substantially complete" (FSB, 2014).

This paper offers a data-driven analysis that clearly defines the full population of international financial regulatory reforms written by the two most established international financial standard setting bodies, the BCBS (the international bank regulatory body) and IOSCO (the international securities regulatory body) since their establishment in 1974 and 1989, respectively. And, for the post-GFC period, we identify the subset of BCBS and IOSCO rules that are part of the G20-FSB agenda. In particular, we use content analysis of international standards to identify the degree of text similarity between a given international rule and each of the previously published BCBS and IOSCO rules. In this way, we arrive at a measure of how novel – in scope and/or approach – any new international regulation is compared to existing regulations. Together, we are able to characterize the set of international reforms, and analyze across-time and within-period trends of regulatory novelty.

We find strong support that the post-global financial crisis period is one with especially novel inter-

national rules in banking, while international securities reforms were no more novel than expected based on pre-crisis novelty. This finding – robust to alternative specifications – implies that post-crisis rules in banking do, indeed, deviate significantly from pre-crisis reform. Then, focusing on the post-crisis period, we provide initial evidence that novel international regulations are associated with G20 leaders initiatives; the set of initiatives that are part of G20-sanctioned implementation monitoring are associated with greater novelty than other rules. Results are robust to alternative specifications, and we extend the analysis of rule novelty to make inferences about novelty in the post-Asian Financial Crisis period.

The paper continues as follows. Section 2 reviews the existing debate about the degree of novelty of post-GFC financial reforms, and explains how scholarly insights have been limited by the lack of indicators that can be compared across-reforms. The section explains that this paper contributes by providing such a measure, which allows for a big-picture view of international financial regulations across time and within post-crisis periods of change. Section 3 operationalizes the key concepts and provides descriptive statistics and statistical analysis. The section first outlines the construction of our dataset and introduces the Max Similarity measure of international rule novelty, and justifies its validity. The section then provides an analysis of post-crisis period novelty of international bank regulations. We conclude with discussion and further implications.

## 2 Post-crisis international financial reforms: Radical change? Or, continuity?

While most scholars acknowledge that the 2007-2008 Global Financial Crisis (GFC) was followed by many international regulatory initiatives and change, how significant are these reforms? This question has been the object of an important debate that has emerged among international political economy (IPE) scholars since the beginning of the crisis.

One set of scholars emphasize instances of rapid and meaningful change in the scope of issues being tackled by regulators, in regulatory approach, and in regulatory stringency. For instance, one of the cornerstones of the international financial architecture, the Basel Agreement setting minimum capital requirements for international banks, was revised in the aftermath of crisis. Drezner (2014, 141) argues that despite fierce resistance from the global banking industry, BCBS bank regulators were able to revise the Basel Agreement (Basel III) in only two years, against the more than six years that it took to negotiate a faulty Basel II. Wilf (2016) provides evidence that stockholders perceived Basel III reforms as a credible constraint on banks that might decrease future profits. Others scholars detail how the international regulatory response to the crisis has expanded the scope of the international regulatory agenda to a slew of new areas that had previously been left outside of the scope of direct regulatory intervention. New regulatory areas include, among others, hedge funds (Helleiner and Pagliari, 2009a), derivatives (Knaack, 2015), resolution regimes for too-big-to-fail financial institutions (Quaglia, 2017), and shadow banking (Rixen, 2013; Ban, Seabrooke and Freitas, 2013). Finally, others highlight how many of these regulatory policies have been characterized by a shift in the approach informing the action of regulators, such a departure from the reliance on self-regulation that characterized many of the pre-crisis policies (Pagliari, 2012) or a shift from a micro-prudential to a macro-prudential approach (Baker, 2013).

A second set of scholars are skeptical that regulatory reforms represent a clear turning point in the way financial markets are regulated. Reforms negotiated at the international level have often been described as "incremental" tweaks to the international financial architecture that did not display a "paradigmatic" (Hall, 1993) shift in the international financial regulation (Moschella and Tsingou, 2013<u>b</u>; Helleiner, 2012, 2014).<sup>1</sup> Moschella and Tsingou (2013<u>a</u>, 2) provide a clear statement of an incrementalist argument: "the process of international financial reform has fallen short of initial (and proclaimed) expectations of rapid and revolutionary transformation and has instead been characterized by small and incremental changes." These authors cite as evidence of this trend the fact that many of the announced pieces of post-crisis reforms were at the time of writing still missing or in their infancy and had yet to be incorporated into formal and binding rules. Along the same lines, Helleiner (2012, 1) has argued that "the reforms to international financial standards were much less significant than many anticipated... [as they] merely tweaked in incremental ways, rather than significantly challenged, the 'market-friendly' content of international standards." Moreover, Helleiner as well as others have justified their assessment of the incremental nature of the post-crisis reforms not only on the basis of what has been agreed but also on the basis of those issues that have remained outside of the agenda of the international regulatory community.

<sup>&</sup>lt;sup>1</sup>Moschella and Tsingou (2013<u>a</u>, 7) define incrementalism in the context of post-crisis international regulatory reform "as a process that adjusts policy without challenging the overall terms of a given policy paradigm at least in the short run".

Given that both sets of scholars make reasonable arguments, how might one adjudicate between these two perspectives?

#### 2.1 How can one resolve this debate?

Two problems, in particular, limit the way in which existing literature has assessed the nature of post-crisis reforms.

First, existing literature has struggled to establish clear benchmarks against which to assess the regulatory changes brought about by the financial crisis. For instance, scholars have assessed agreed-upon reforms against the expectations that different commentators (e.g. prominent economists) or interested parties (e.g. representatives of countries calling for a broader recognition of their priorities; or, financial industry representatives denouncing excessive regulatory burdens) have put forward at different times. Is a reform a failure if it doesn't fully meet an ideal (or most preferred) policy proposal?

Such assessments are also based on competing interpretations of the root cause of crisis and identifying the set of regulatory reforms that would adequately address pre-crisis regulatory deficiencies. Said differently, in many cases, it is difficult to disentangle the assessment of the type of regulatory change that has occurred from an author's view about what should be the priorities of policymakers. For instance Helleiner (2012, 5) notes, "Many analysts also lament the fact that the G20 leaders did not go much further to endorse initiatives such as the forced breaking up of large, interconnected firms, or restrictions on large banks from engaging in high-risk, casino-like activities" or imposing "internationally coordinated levies/taxes on the financial sector". Financial crises remain multifaceted phenomena. Different policymakers and scholars may vastly disagree on the root cause of a crisis, as well as policy priorities in the aftermath of crisis. As a result, existing literature has often struggled to define an objective benchmark against which to assess the type of regulatory changes negotiated internationally.<sup>2</sup>

A second limitation is that most analyses of post-crisis international financial regulatory reforms and their determinants have often derived conclusions from analysis of one reform, or through comparison of a few select reforms. However, individual reforms are part of a negotiated package in the post-GFC period. As a result, for every instance where an author emphasizes the limitations of a post-crisis reform

<sup>&</sup>lt;sup>2</sup>It is important to notice how different have evaluated the impact of the international regulatory response to the crisis by focusing on the domestic implementation of the international standards within different countries (Walter, 2008).

(for example, in the areas of financial derivatives (Knaack, 2015) or bank capital requirements (Admati and Hellwig, 2013)), opposing conclusions may be reached in other issue areas (for example, successful reform progress within commodity derivatives (Clapp and Helleiner, 2012), macroprudential regulation (Baker, 2013), and consumer protection rules (Kastner, 2014)). How should one characterize the accumulation of these perceived regulatory successes and failures? Given such a large number of agreed-upon financial regulations, issue-specific studies are increasingly constrained in their capacity to produce findings that can be generalized to the international regulatory regime as a whole. At a minimum, to better understand how a specific regulatory issue fits within the broader population of international financial regulations – whether it is an outlier or relatively representative of broader regulatory trends – would allow for better interpretation of reform-specific insights.

#### 2.2 Our approach: A text-based measure of international regulatory novelty

In this paper, we contribute to the debate concerning the significance of post-crisis regulations through an original, data-driven approach. We assess novelty of an international regulation based on how similar or different is its text in comparison to previous international rules. In particular, we view the level of similarity between a new rule's text and the text content of each previously published international rule as an observation of the extent to which a given international rule breaks new regulatory ground or incrementally builds upon existing regulations. A new regulation that updates or marginally revises an existing international initiative will share a high percentage of meaningful words in common with the past initiative and will have a relatively high degree of textual similarity. In contrast, a new international standard that more significantly departs from all previous initiatives (in addressing a new topic or taking a new regulatory approach) will share a fewer words with all existing regulations and have a relatively low level of similarity with previous initiatives.

We believe this approach provides a high-quality measure of novelty in regulatory scope and regulatory approach (which we care about), while it is unlikely to capture novelty in regulatory stringency. International standards that address different regulatory issues (e.g. bank capital requirements vs. corporate governance vs. failures of rating agencies) are likely to significantly differ in their text vocabulary, or when an international standard addresses an existing regulatory area from a new perspective and endorses a new

solution (e.g. disclosure standards vs. command and control for mandatory requirements). Both concepts of regulatory change – regulatory scope and regulatory approach – have been examined for individual regulatory reforms within existing literature.<sup>3</sup> We note the limitation that a high level of similarity between two documents is not able to capture differences in regulatory stringency.<sup>4</sup> For instance, a regulatory initiative setting capital requirements for international banks at 10% and a revision of the same standard doubling the same requirements to 20% would share most of the same relevant terms but would have a very different impact over the regulated entities. Nonetheless, our proposed measure captures important aspects of regulatory novelty, and moves us much closer to an ideal measure.

Our proposed measure of regulatory scope and approach novelty allows us to overcome the two limitations of existing literature discussed above. First, it establishes, in a data-driven way, a clear baseline against which the novelty of each international regulation can be assessed. It is able to arrive at a measure of novelty for any specific standard. Second, by considering novelty across the entire population of international standards, we are able to make insights into general international regulatory trends across time (again, against a clear baseline).

After defining, illustrating, and validating such a measure of novelty, we apply this approach to assess the novelty of the international regulatory reforms introduced in the aftermath of the Global Financial Crisis. In particular, we will first assess the novelty of international regulatory reforms introduced after the GFC, by comparing the level of novelty of the regulatory initiatives coordinated at the international level after the crisis with those introduced before the crisis. Second, we analyze whether post-GFC reforms that are part of the agenda sanctioned by G20 leaders are especially novel regulations as compared to the other international rules written by international standard-setting bodies over the same period. A key benefit of this approach is to answer these questions in a data-driven way and against clearly defined baselines.

### **3** Empirical analysis

We make systematic inferences about the collective character of international reforms by uniquely collecting the entire population of international financial regulatory standards written by the two most established

<sup>&</sup>lt;sup>3</sup>For example, Helleiner and Pagliari (2009<u>a</u>) note expanded regulatory scope in hedge funds and derivatives, and Baker (2013) notes new macroprudential regulatory approaches.

<sup>&</sup>lt;sup>4</sup>For example, Wilf (2016) examines increased regulatory stringency of bank capital regulations.

standard-setting bodies, the BCBS (the main international group of bank regulators) and IOSCO (the main international group of securities regulators). Each group has written standards for more than twenty-five years, and we identify 144 bank rules for the period 1975-2017 and 165 securities rules for the period 1989-2017. This section describes our original corpus of international financial regulatory standards from each group and how we measure topic novelty using content analysis. With this data at hand, we can show each group's across-time trends in international rule novelty. We then provide statistical analysis of across-time trends (e.g. pre- and post-GFC) and we analyze variation of rule novelty within the post-GFC period (e.g. among documents that are and are not part of the G20-sanctioned financial regulatory agenda).<sup>5</sup>

#### **3.1** The population of international standards

We focus on the full set of standards written by the BCBS and IOSCO which are the two, longest-standing international financial regulatory groups. Often called standard setting bodies, these groups – composed of national regulators – write and publish financial regulatory rules.<sup>6</sup> National regulators – both those that do and do not participate in the writing of the standards – can use international standards as best practices or to harmonize regulation with other countries. As defined by the Financial Stability Board (FSB) standards include statements of principles, best practices and/or guidelines.<sup>7</sup>

We first collect all available BCBS and IOSCO regulatory documents by web scraping each organization's "publications" page.<sup>8</sup> Each website catalogs historical documents that range from white papers (that define regulatory problems and discuss possible solutions), to statements of regulatory principles, to consultative reports on specific standards, to final rules, and beyond. Both original and revised versions of documents are available. Importantly, the BCBS and IOSCO have incentives to make agreed-upon interna-

<sup>&</sup>lt;sup>5</sup>Please note that this paper uses the terms international "standard", "rule", and "regulation" interchangeably, as these all reflect international regulatory bodies' outputs meant for use by national regulators.

<sup>&</sup>lt;sup>6</sup>As noted above, this paper uses, interchangeably, the terms international "standard", "rule", and "regulation".

<sup>&</sup>lt;sup>7</sup>"Principles are fundamental tenets pertaining to a broad policy area[...] usually set out in a general way[.] Practices[...] are more specific and spell out the practical application of the principles (drawing on country experiences) within a more narrowly defined context. Guidelines[...] provide detailed guidance on steps to be taken or requirements to be met in a particular area." FSB website, accessed 2017 Sep 28. URL: http://www.fsb.org/what-we-do/about-the-compendium-of-standards/.

<sup>&</sup>lt;sup>8</sup>This is the BCBS Publications page (resulting in 580 BCBS documents published between 1975 and 2017) and IOSCO's Public Reports page (resulting in 521 IOSCO documents between 1989 and 2017). Appendix Figure A.1 displays the full distribution of publications available each year.



Figure 1: Annual count of new banking (left) and securities (right) international standards, 1975-2017. Many international standards are written in the aftermath of crisis (grey panels). Grey panels indicate the Global Financial Crisis (GFC) and its aftermath (2007+) as well as the previous Asian Financial Crisis (1997-1999).

tional standards publicly accessible.

Second, we identify the subset of publications that constitute international standards consistent with the FSB definition of standards as principles, best practices, and/or guidelines.<sup>9</sup> This process resulted in a set of 144 BCBS international standards that span the years 1975–2017 and 165 IOSCO international standards that span the years 1970–2017.<sup>10</sup>

Figure 1 graphs the annual count of new BCBS (banking) international standards and IOSCO (securities) international standards. Both the BCBS and IOSCO display spikes in new international rules in the aftermath of crises. Grey areas display the outbreak and height of the Asian Financial Crisis (1997-1999) and the full Global Financial Crisis and post-crisis period (2007-present). This is consistent with both general theoretical expectations that post-crisis periods have increased likelihood of being a period of new regulatory cooperation (Singer, 2004, 2007), and conventional wisdom about the post-GFC period, in par-

<sup>&</sup>lt;sup>9</sup>We did this through hand-coding. See footnote 7.

<sup>&</sup>lt;sup>10</sup>Discussed later, data limitations allow for statistical analysis of a maximum of 139 BCBS rules between 1983 and 2017 and 153 IOSCO rules between 1990 to 2017. The earliest document from each group will have no measure of "similarity to previous rules" and thus statistical analysis includes a maximum of 138 BCBS observations and 152 IOSCO observations.

ticular, as one with many new rules. To understand the significance of a new international rules, however, we must consider their contents. Do international rules reflect updates of existing initiatives? Alternatively, do they mark a shift to meaningfully expand regulatory scope and approach?

#### 3.2 Maximum Similarity as international rule novelty: mechanics and intuition

Appropriate use of text as data is dictated by the research question at hand (Grimmer and Stewart, 2013), and we use a basic metric from content analysis – cosine similarity – to arrive at a theoretically-informed, datadriven measure of regulatory novelty for any specific international standard. Max Similarity – the highest cosine similarity between a new rule's text and the text content of each previously published international rule – is our measure of a given international standard's (scope and approach) novelty.

We start by identifying a population of international standards. Formally, let *i* be an international standard from the full population of an international regulator's standards,  $N = \{1, 2, ..., i, ..., n\}$ . Let  $D = \{d_1, d_2, ..., d_n\}$  be associated with the set of *N*, where  $d_i$  is the publication date of international standard *i*. Let  $S = \{s_1, s_2, ..., s_n\}$  also be associated with the set of *N*, where  $s_i$  is the text of international standard *i*.

Cosine similarity is a "bag of words" approach to text similarity, which collapses the word content of a document into a vector of wordcounts over m-dimensions, where each dimension represents a specific word (Mihalcea, Corley and Strapparava, 2006; Huang, 2008). Thus, the text of a given international standard,  $s_i$ , may be represented by an m-dimensional vector  $\vec{s_i} = \{s_{i1}, s_{i2}, ..., s_{im}\}$ , for all possible words  $M = \{1, 2, ..., m\}$ . Cosine similarity for any two international standards, i and j, is calculated as a function of their text vectors  $\vec{s_i}$  and  $\vec{s_j}$  as in Equation 1.

$$CosSim(s_i, s_j) = \frac{\overrightarrow{s_i s_j}}{\sqrt{\overrightarrow{s_i}}\sqrt{\overrightarrow{s_j}}}$$
(1)

Between any two document texts,  $s_i$  and  $s_j$ , the value of cosine similarity is bounded between 0 (completely distinct document words) and 1 (completely similar document words). Low cosine similarity between two documents indicates documents that likely address different issues, while high cosine similarity indicates documents that likely address.

To measure novelty of a given international standard, i, we want to know how distinct the new rule is compared to all existing rules. An international standard with relatively low cosine similarity with all previous standards likely indicates it addresses a new topic or takes a new approach to regulation. International standards that partially or significantly build upon previous standards are likely to have at least one previously written international rule with relatively high similarity, indicating that the international rule is less novel with regards to scope and approach.

Thus, *maximum* cosine similarity – between the new international rule's text and all previously published rules by the same regulator – offers a measure of novelty for an international standard. Formally, for a given international standard, i, we create a set  $A_i$  that contains the cosine similarity values between the new international standard text ( $s_i$ ) and each international standard text previously published by the same regulatory body, as in Equation 2.

$$A_i = \{ CosSim(s_i, s_j) \mid \forall j \in N \ s.t. \ i \neq j \ \& \ d_j < d_i \}$$

$$\tag{2}$$

The measure of an international standard's novelty is  $MaxSim_i$ , which is the maximum value of the set of cosine similarity values between the new rule's text and all previously published texts, as in Equation 3.

$$MaxSim_i = max(A_i) \tag{3}$$

To answer our research question about the degree to which post-crisis reforms are novel in comparison to pre-crisis international rules, where appropriate, we impose an additional constraint on the set of  $A_i$  to consider only documents with dates prior to d', where d' indicates some crisis date. In these cases the quantities of interest are calculated as follows:

$$A_{id'} = \{ CosSim(s_i, s_j) \mid \forall j \in N \ s.t. \ i \neq j \ \& \ d_j < d_i, d' \}$$

$$\tag{4}$$

$$MaxSim_{id'} = max(A_{id'}) \tag{5}$$

This additional constraint is appropriate to capture novelty of an international standard written after the onset of crisis. For instance, the novelty of a rule written in 2012 may be more similar to an international standard written in 2011, which is captured in the full set of previous rules (MaxSim<sub>id'=0</sub>), but very different from all pre-crisis documents (MaxSim<sub>id'=2007</sub>).<sup>11</sup> To capture novelty of post-GFC rules compared to pre-GFC rules, MaxSim<sub>id'=2007</sub> better captures this quantity than MaxSim<sub>id'=0</sub>.

<sup>&</sup>lt;sup>11</sup>MaxSim<sub>id'=2007</sub> is necessarily subset of MaxSim<sub>id'= $\emptyset$ </sub>, and therefore will always be less than or equal to MaxSim<sub>id'= $\emptyset$ </sub>.

In sum, for a given international standard, i, Max Similarity (MaxSim<sub>i</sub>) offers a measure of regulatory novelty.

#### Maximum similarity as international rule novelty: Validating the measure

We use the r package quanteda (Benoit et al., 2017)<sup>12</sup> to compute cosine similarity, and validate the measures using substantive understanding of the international standards.

Table 1 illustrates the cosine similarity and Max Similarity calculations for a number of actual final international standards in the BCBS dataset.<sup>13</sup> The first five listed rules are in chronological order; the 1979 rule is the first international rule for which we have text and it therefore has an undefined Max Similarity score. The 1983 March document is similar to the one previous document (1979 rule) at 0.72, which is its Max Similarity. The third international rule has higher similarity to the 1979 rule (0.84) than the 1983 Mar rule (0.73), and thus its Max Similarity is equal to 0.84. Substantively, too, the 1983 May Concordat is a known revision of the original 1979 March "Concordat". Thus, a cosine similarity value of these two texts that is close to 1.00 is expected and reasonable. The 1986 March rule addresses off balance sheet exposures, which is an accounting rule, and relatively different than the previous three documents (1979, 1983 March, 1983 May) that each address general principles of international bank supervision. Thus, the 1986 rule is most similar to the 1979 document, but only at 0.50, much lower than the cosine similarity values of the 1983 May and March documents with the respective documents which which they displayed maximum cosine similarity.

Table 1, example document 6 – the 2017 June rule about anti-money laundering – illustrates how an additional constraint (d' = 2007) can affect the dependent variable value. The June 2017 BCBS rule is a known revision of a February 2016 rule, and thus similarity between those two documents is very high, at 0.99. Thus, max similarity between the June 2017 BCBS rule and all previous rules (MaxSim<sub>id'=0</sub>) is 0.99. However, to understand the degree to which the 2017 January rule addresses pre-crisis issues, we look for Max Similarity among pre-2007 BCBS international rules (MaxSim<sub>id'=2007</sub>); considering cosine values between the 2017 June rule and this smaller set of documents, we find that the 2017 June document is

<sup>&</sup>lt;sup>12</sup>We pre-process each text using standard techniques of stemming and removing punctuation and stop words.

<sup>&</sup>lt;sup>13</sup>Appendix Figure A.2 displays the full set of cosine similarity scores between a given rule and all previous documents (small, grey x's) and the measure of Max Similarity (large, white circles).

most similar to a 2001 October document (at measure of 0.85) about bank due diligence regarding customer account identities. In main specifications, we use the pre-2007 constrained dependent variable. We show that main results are not sensitive to the choice of (d' = 2007), and also that substantive results are not sensitive to dropping the set of observations in the post-GFC period (2007+) for which there are large gaps between values of MaxSim<sub>id'=0</sub> and MaxSim<sub>id'=2007</sub>.<sup>14</sup>

Visually, Figure 2 shows identification of Max Similarity for two international rules written by IOSCO in the post-crisis period. For a 2008 IOSCO standard for Credit Rating Agencies (left) and a 2013 IOSCO standard for Financial Benchmarks (right), each graph plots cosine similarity between the text of that standard and the text of every other IOSCO final rule. The 2008 Credit Rating Agency rule updates a 2004 IOSCO rule, while Financial Benchmarks are a new initiative introduced in response to the 2012 Libor scandal. As such, MaxSimilarity<sub>d'=2007</sub> is relatively high for Credit Rating Agencies (0.98 blue dot at 2004) and is relatively low for Financial Benchmarks (0.45 blue dot at 2004). In this way, consistent with substantive knowledge of these rules, the data itself tells us that the 2008 Credit Rating Agency standard is not especially novel compared to pre-crisis IOSCO rules (MaxSim<sub>id'=2007</sub>=0.98 (relatively high)), while the 2013 Financial Benchmarks standard addresses an issue using a regulatory approach that was not significantly addressed in the pre-crisis period (MaxSim<sub>id'=2007</sub>=0.45 (relatively low)).

Finally, we additionally validate the similarity score by looking at the similarity of documents that are hand coded to be revisions of previous documents. Appendix Figure A.3 shows the distribution of Max Similarity for documents that are known revisions of previous documents (white areas) as compared to non-revision documents (the leftmost, grey density distribution).<sup>15</sup> Mean max similarity of known revision documents for which max similarity matches is nearly 1 (indicating lower levels of novelty), while other documents have lower max similarity (indicating higher levels of novelty).

With high confidence that Max Similarity is a high-quality measure of international regulatory scope and approach novelty, we use this as the basis for analysis in the subsequent sections.

<sup>&</sup>lt;sup>14</sup>The latter often represent documents that build on workflows that began in the post-crisis period. We would like to keep the first observation (how similar the workflow is to the pre-crisis period) but ensure that results are not driven by having a number of new observations that all build on novel, *post-crisis* initiatives.

<sup>&</sup>lt;sup>15</sup>We are assessing general novelty (without crisis constraint) such that we use  $MaxSim_{d'=\emptyset}$ .

			Max Similarity			
Int'l standard	Previous international standards		All prev, pre-2007 stds	All prev standards		
(i)	$(j \in N, s.t.d_j < d_i)$		$(MaxSim_{id'=2007})$	$(MaxSim_{id'=\emptyset})$		
1979 Mar, Cons	olidated supervision of banks' international activiti	es	NA	NA		
,	no previous document texts	NA				
1983 Mar, Auth	orisation procedures for banks' foreign establishme	ents	0.72	0.72		
	1979 Mar, "Consolidated supervision"	0.72				
1983 May, Princ	iples for the supervision of banks' foreign					
establishments (	the Concordat)		0.84	0.84		
	1979 Mar, "Consolidated supervision"	0.84				
	1983 Mar, "Authorisation procedures"	0.73				
1986 Mar, The r	nanagement of banks' off-balance-sheet exposures		0.50	0.50		
	1979 Mar, "Consolidated supervision"	0.50				
	1983 Mar, "Authorisation procedures"	0.33				
	1983 May, "Principles for the supervision"	0.38				
1988 Jul Interna	tional convergence of capital measurement					
and capital stand	lards (Basel Capital Accord)		0.64	0.64		
	1979 Mar, "Consolidated supervision"	0.50				
	1983 Mar, "Authorisation procedures"	0.41				
	1983 May, "Principles for the supervision "	0.35				
	1986 Mar, "The management of banks'"	0.64				
2017 Jun, Sound	I management of risks related to money laundering					
revisions to con	respondent banking annex - final document		0.85	0.99		
	2016 Feb, "Sound management""	0.99				
	2001 Oct, "Customer due diligence"	0.85				
2010 Dec, Soun	d practices for backtesting counterparty credit risk	models	0.62	0.62		
	1996 Jan, "Framework for 'backtesting'""	0.62				
	1988 Jul, "Int'l convergence"	0.50				
	1983 May, "Principles for the supervision"	0.36				

Table 1: **Identifying Max Similarity from cosine similarities; examples from BCBS rules.**: For seven BCBS international standards (column 1), this table displays the cosine similarity score between this regulation and each previous BCBS regulation (column 2), and resulting Max Similarity scores (columns 3 and 4).



Figure 2: **Identifying Max Similarity from cosine similarities; examples from two IOSCO rules.** For a 2008 IOSCO standard for Credit Rating Agencies (left) and a 2013 IOSCO standard for Financial Benchmarks (right), each graph plots cosine similarity between the text of that standard and the text of every other IOSCO final rule. The Credit Rating Agency rule updates a 2004 IOSCO rule, while Financial Benchmarks are a new initiative. As such, MaxSimilarity<sub>d'2007</sub> is relatively high for Credit Rating Agencies (0.98 blue dot at 2004) and is relatively low for Financial Benchmarks (0.45 blue dot at 2004). In this way, consistent with substantive knowledge of these rules, the data, itself, tells us that the 2008 Credit Rating Agency standard is not especially novel compared to pre-crisis IOSCO rules, while the 2013 Financial Benchmarks standard addresses an issue using a regulatory approach that was not significantly addressed in the pre-crisis period.

#### 3.3 Analysis: How novel are post-crisis reforms?

We use our validated measure of international standard novelty to analyze across-time trends in international financial regulatory reform novelty. We know that there were many international standards that compose reform, and are interested to assess whether those instances of reform include truly novel contents.

If crisis leads to especially novel and sustained reform, we expect to see especially novel post-crisis standards (that is, lower levels of  $MaxSim_{d'=2007}$  for reforms in the post-crisis period). We use the precrisis patterns of a regulator's reform novelty as a benchmark against which to determine whether novelty of post-crisis international standards are especially high or low. We analyze banking rules and securities rules separately, as the measure of similarity is in comparison to past rules written by a given regulator.

Figure 3 plots international rules by date (x-axis) and Maximum Similarity (MaxSim<sub>d'=2007</sub>, y-axis) for international bank regulators (BCBS, left graph) and international securities regulators (IOSCO, right graph). The GFC period (2007+) is indicated by the grey panel, and mean levels of Maximum Similarity for pre- and post-crisis periods are indicated by solid lines. International bank standards show a drop in mean



Figure 3: **Dependent variable distribution - Max Similarity**<sub>d'=2007</sub> **for BCBS rules (left) and IOSCO rules (right).** Lines show the mean value of rules in a given period. In the pre-BCBS period, mean Max Similarity is 0.73, and this decreased to 0.66 in the post-GFC period. For pre- and post-crisis IOSCO standards have approximately equal means (0.59).

Max Similarity from the pre-crisis period (0.73) to the crisis and post-crisis period (0.66), while international securities' rules have nearly equal means across periods (0.59 and 0.59). While each regulator writes a number of novel initiatives in the post-crisis period (white dots with low levels of MaxSimilarity $_{d'=2007}$ ), this descriptive statistic captures average trends within each period. Thus, Figure 3 provides initial evidence that post-crisis international banking rules may have addressed substantively new rules at a more sustained rate, on average, than in the pre-crisis period. In contrast, simple mean novelty is approximately equal in pre- and post-crisis international securities rules.<sup>16</sup>

This provides initial evidence that post-crisis banking rules may have addressed substantively nIt's worthwhile to emphasize that the statistical analysis places equal weight on each international standard. It does not distinguish highly publicized standards (e.g. Basel III) from less publicized standards (e.g. Backtesting Counterparty Credit Risk). In this way, this approach complements existing literature that ana-

<sup>&</sup>lt;sup>16</sup>To better visualize within-period trends, Appendix Figure A.4 show the same data but fit with distinct Loess Curve for the pre-crisis (pre-2007) and crisis/post-crisis (2007+) period (top graphs), and shows similar trends when we exclude observations that are likely revising international initiatives introduced after the onset of crisis (bottom graphs).

lyzes specific regulations to see how typical a given regulation is within the full population of international standards. The analysis determines expected level of novelty based on the pre-crisis period and analyzes whether or not, on average, the post-crisis period international standards are more or less novel.

#### Statistical model, pre- versus post-GFC periods

We move from descriptive statistics to a statistical analysis of post-crisis (versus pre-crisis) international rule novelty. The unit of observation is an international standard. After missing data, a set of 138 BCBS rules from 1983-2017 (banking) and 152 IOSCO rules from 1994–2017 (securities) compose the dataset.

The dependent variable is regulatory novelty, measured by  $MaxSim_{d'=2007}$  as described at length above. Again, this captures maximum cosine similarity between the international standard and all previously published, pre-2007 international rules by a given regulator (BCBS or IOSCO). Given that our dependent variable is a continuous value bounded between values of 0 and 1, we use a beta regression model (Cribari-Neto and Zeileis, 2009; Ferrari and Cribari-Neto, 2004).

The explanatory variable of interest is the post-2007 crisis period, which is in indicator variable that takes the value of 1 for international rules published in 2007 and beyond ( $d_i \ge 2007$ ). The coefficient estimate will measure mean novelty in the post-2007 period compared to pre-2007.

We add control variables that might affect an international standard's level of Max Similarity. We first add indicators for documents that are direct revisions of previous documents. The revision indicator takes the value of 1 for the set of documents that are explicitly revisions of previous documents; by definition, these are likely to be similar to the document that it is revising, and therefore to have a relatively high Max Similarity score. To provide concrete examples, the May 1983 Basel Concordat updated the 1979 Basel Concordat, and the two texts have cosine similarity 0.84 (out of possible cosine similarity of 1.00). Basel II is a direct extension of Basel I, and Basel III directly updates Basel II; these sets of documents have cosine similarity 0.82 and 0.82 respectively. The 2017 June update of Money Laundering standards is extremely similar to the original 2016 February document, with cosine similarity 0.99. We add a control indicator for coauthored documents, which span multiple international regulatory bodies' jurisdictions.<sup>17</sup>

<sup>&</sup>lt;sup>17</sup>Alternative treatment to drop coauthored documents (rather than add a control indicator) does not change substantive results. 12% of BCBS and 19% of IOSCO rules are coauthored with international bodies that include each other (through the Joint Forum), the CPMI, the CGFS, the IADI, among others.

	(1)	(2)	(3)	(4)	(5)	(6)
	BCBS	BCBS	BCBS	IOSCO	IOSCO	IOSCO
Global Financial Crisis (2007+ ind.)	$-0.492^{***}$	$-0.996^{***}$	$-0.727^{**}$	-0.074	-0.255	1.048***
	(0.130)	(0.206)	(0.322)	(0.137)	(0.210)	(0.333)
Revision doc. ind.		0.622***	0.660***		1.374***	1.308***
		(0.139)	(0.141)		(0.259)	(0.253)
Coauthored doc. ind.		0.317*	0.313*		0.352**	0.401**
		(0.190)	(0.190)		(0.162)	(0.157)
Previous doc. ct.		0.016***	0.010		0.001	$-0.037^{*}$
		(0.005)	(0.023)		(0.005)	(0.020)
Time			-0.003			-0.066
			(0.082)			(0.086)
Time <sup>2</sup>			-0.003			-0.015***
			(0.004)			(0.005)
Time <sup>3</sup>			-0.0001			0.001***
			(0.0002)			(0.0004)
Constant	1.131***	0.393**	0.698	0.521***	0.381*	2.251*
	(0.099)	(0.178)	(1.446)	(0.105)	(0.198)	(1.188)
Ν	138	138	138	152	152	152
Years	1983-2017	1983-2017	1983-2017	1994-2017	1994-2017	1994-2017
$\mathbb{R}^2$	0.069	0.214	0.225	0.001	0.149	0.264
Log Likelihood	65.121	80.640	81.976	36.277	54.198	71.519
Notes:				***Signi	ficant at the 1	percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

Table 2: **Beta Regression, dependent variable is Max Sim**<sub>*id'*=2007</sub>. International banking rules display a negative, statistically significant association between post-2007 period and lower levels of Max Similarity (Models (1) through (3)), while IOSCO post-crisis rules do not display clear deviation in the post-crisis period from the pre-crisis novelty (Models (4) through (6)).

Previous document count captures that the more previous final documents that are tested for similarity, the more likely there might be one document that a new rule expands upon. Finally, a series of time indicators controls for across-time trends. We include years, years<sup>2</sup>, and years<sup>3</sup>.<sup>18</sup>

#### Results

Table 2 displays statistical estimates for international banking rules (written by the BCBS, Models (1) through (3)) and then for international securities rules (written by IOSCO, Models (4) through (6)). The dependent variable is  $MaxSim_{d'=2007}$ , which captures the degree to which a new international standard is

<sup>&</sup>lt;sup>18</sup>Years from 2007, given that we operationalize the dependent variable using d' = 2007.

similar to all previous, pre-crisis rules. We interpret higher Max Similarity as lower regulatory novelty, and lower Max Similarity as greater novelty. Model (1) shows that in the post-crisis period, BCBS international standards had lower MaxSim<sub>d'=2007</sub> – and therefore greater novelty – on average, than in the pre-crisis period. This negative association maintains in Model (2) when adding controls for characteristics of international rules. Revisions, coauthored documents and greater numbers of previous documents all are associated with higher levels of Max Similarity (indicating lower novelty). Model (3) adds additional controls for time trends, and the negative and statistically significant variable on Global Financial crisis period maintains. Together, international banking rules in the years after the Global Financial Crisis are more novel, on average, than prior to crisis.

Table 2 Models (4) through (6) show that post-GFC international securities rules do not share the trend from international bank rules. Model (4) shows that IOSCO rules in the post-GFC period display novelty that is neither higher nor lower than IOSCO's pre-crisis rules. This persists in Model (5) when controlling for additional international rule characteristics including revisions, coauthored documents and number of previous documents. In Model (6), once adding additional controls for time, post-GFC rules written by IOSCO are on average display *higher* levels of similarity – lower levels of novelty – than the average pre-crisis levels. Together, there is little evidence that IOSCO rules displayed novelty at a rate greater than in the pre-crisis period.

Thus, though we expect that regulatory change follows major crisis, while international bank standards displayed initiatives that, on average, showed high levels of novelty, in contrast, international securities rules in the post-crisis period were not especially novel. We now turn to variation within the set of post-crisis initiatives.

#### 3.4 Within the post-crisis period, are G20-supported standards especially novel?

A second step to assess novelty of the international regulatory response to the crisis is based on comparing post-crisis initiatives. In particular we are interested to see whether the international regulatory initiatives associated with agenda that was endorsed by G20 leaders in response to the financial crisis is associated with greater rule novelty than other international rules negotiated over the same period. To inform this question, we consider variation in the rule novelty for the set of rules written within the post-crisis period.

We identify international standards that are and are not part of the G20-sanctioned agenda.

We operationalize connection to the international agenda endorsed by G20 leaders in two ways. First, we identify "G20-sanctioned Monitoring Docs", which are the subset of post-crisis rules written by BCBS and IOSCO (among other international standard setters) are part of centralized monitoring of G20 national implementation. As mentioned above, G20 leaders committed their countries to implement financial regulatory reforms in a number of issue areas; the FSB centrally disseminates each G20 country's implementation progress within this set of areas. Those rules that enter into FSB information are coded as a "G20-sanctioned Monitoring Docs", because the G20 acknowledges their role in centralized monitoring.<sup>19</sup> We are agnostic about whether the international regulatory bodies are asking the G20 to endorse or whether G20 endorsement is the sincere preference of the G20. The top graphs of Figure 4 display the post-crisis rules, indicating G20-sanctioned Monitoring Docs with black circles (and non-monitoring documents with white circles). In the 2007+ period, 35% of BCBS international standards (25 of 71) and 13% of IOSCO international rules (20 of 88) were G20-Sanctioned Monitoring Docs.

A second measure of G20 connection is "Document Mentions 'G20", which is an indicator for international rules that mention the "G20" within its international rule text. International standards often begin with a background statement and/or objective, where the text may note that it supports the G20 leaders' commitments. Importantly, this measure reflects actions of the BCBS or IOSCO. One can imagine that a controversial international rule might refer to the G20 process for political cover. The bottom graphs of Figure 4 again display the post-crisis rules, but indicate which documents that mention the 'G20' with black circles (and all others in white circles). In the 2007+ period, 23% of BCBS international standards' texts (16 of 71) and 23% of IOSCO international rules' texts (20 of 88), included overt mentions of the G20.

#### Statistical model

Table 3 displays statistical associations between G20 connections and the degree of novelty of a given international regulation. Please note the statistical analysis here seeks to establish an association rather than a causal path. Very specifically, we do not imply that "G20-sanctioned Monitoring Docs" nor "Document Mentions 'G20" are characteristics of an international standard that *cause* its contents to be more novel

<sup>&</sup>lt;sup>19</sup>Specifically, we code the set of international rules that are part of the six *priority* areas. The other ten (non-priority) areas are self-reported to the FSB and we do not include them in this coding.



Figure 4: **Post-crisis (2007**+) **rules and G20 connections.** Each plot displays MaxSimd' = 2007 for the set of 71 international standards finalized by BCBS and 88 finalized by IOSCO between 2007 and 2017. In the top two graphs, documents that are part of G20-sanctioned monitoring are indicated by black dots, while others (white dots) are not part of the centralized monitoring process. In the bottom two graphs, international standards that that mention the "G20" within their text are indicated by black dots, while others (white dots) do not mention the "G20" within the rules text.

	BCBS	BCBS	BCBS	IOSCO	IOSCO	IOSCO	BCBS	BCBS	BCBS	IOSCO	IOSCO	IOSCO
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
G20-Sanctioned Monitoring Doc	-0.332** (0.148)	-0.368*** (0.124)	-0.367** (0.167)	-0.596*** (0.211)	-0.236 (0.190)	-0.523 (0.326)						
Document Mentions G20							-0.151 (0.173)	-0.130 (0.149)	0.032 (0.205)	-0.265 (0.190)	-0.173 (0.154)	0.056 (0.204)
Revision doc. ind.		0.542*** (0.134)	0.841*** (0.195)		1.496*** (0.232)	1.853*** (0.276)		0.516*** (0.140)	0.760*** (0.201)		1.476*** (0.234)	1.871*** (0.280)
Coauthored doc. ind.		-0.974*** (0.222)	-0.734** (0.336)		-0.457*** (0.175)	-0.003 (0.265)		-0.963*** (0.235)	-0.834** (0.355)		$-0.610^{***}$ (0.161)	-0.234 (0.227)
Constant	0.796*** (0.091)	0.729*** (0.084)	0.777*** (0.099)	0.567*** (0.087)	0.422*** (0.074)	0.451*** (0.083)	0.710*** (0.084)	0.632*** (0.081)	0.678*** (0.102)	0.529*** (0.093)	0.458*** (0.088)	0.424*** (0.095)
Exclude new workflow N Years R <sup>2</sup> Log Likelihood	No 71 2007-2017 0.063 42.817	No 71 2007-2017 0.373 58.134	Yes 42 2007-2017 0.422 37.348	No 88 2007-2017 0.049 31.360	No 88 2007-2017 0.360 56.419	Yes 56 2007-2017 0.408 43.649	No 71 2007-2017 0.010 40.795	No 71 2007-2017 0.308 54.384	Yes 42 2007-2017 0.361 35.132	No 88 2007-2017 0.013 28.586	No 88 2007-2017 0.361 56.324	Yes 56 2007-2017 0.405 42.474
Notes										***Sign	ificant at the 1	nercent level

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

Table 3: Beta Regression, dependent variable is Max  $Sim_{id'=2007}$ . This is analysis of the subset of international rules passed in 2007 and after. G20-sanctioned agenda documents are more novel, on average, than other, non-G20 sanctioned documents (Models (1) through (6)), though documents that mention the G20 are not statistically more or less novel than other documents (Models (7) through (12)).

than others. Instead, we are interested in whether these are statistically associated; if so, we would want to unpack the direction of causation and analyze selection into a given characteristic (that is, the decision that leads a document to be part of the G20-sanctioned monitoring process, and/or a document text mentioning the G20).

As in the previous statistical test, the unit of observation is an international rule and dependent variable is  $MaxSim_{d'=2007}$ . We restrict the set of observations to post-crisis rules (i.e.g  $d_i \ge 2007$ ). The explanatory variable is an indicator for G20-sanctioned Monitoring Docs, and an indicator for Document Mentions G20. Results are not sensitive to alternative starting years 2008 or 2009.

#### Statistical results

Table 3, Models (1) through (6) display statistical associations between G20 monitoring documents and novelty, while Table 3, Models (7) through (12) display statistical associations between rules that mention the G20 in their text and novelty. Model (1) shows that BCBS documents that are part of G20-sanctioned monitoring have lower average levels of similarity (greater novelty) than non-monitoring documents. Model (2) adds additional control variables for standard characteristics, and G20 monitoring documents still have statistically lower levels of similarity. Model (3) drops observations that are very different and results per-

sist.<sup>20</sup> Together, Models (1) through (3) indicate that BCBS rules that are part of G20-sanctioned monitoring are more novel, on average, than other international rules in the post-crisis period. Model (4) through Model (6) display IOSCO results. Model (4) shows that IOSCO documents that are part of monitoring seem to have lower on average novelty. This statistical finding does not persist, though, once controlling for other document characteristics in Model (5) and (6).

Repeating these analyses using the alternative explanatory variable of "Document Mentions G20" reveals no statistically significant association with novelty. Models (7) through (12) show that documents that mention the G20 are generally associated with more novelty (four of six coefficients are negative) though this is never statistically significant.

Together, this is initial evidence that the intervention of the G20 in the regulatory domain may be associated with the introduction of new issues in the international regulatory agenda.

#### 4 Robustness and discussion

Two key findings emerge from the above sections. First, rules emerging from the BCBS (re: international banking) in the post-GFC period displayed especially novel content. While IOSCO passed specific rules that displayed high levels of novelty, there is little evidence that initiatives were especially novel in the post-crisis period compared to the pre-crisis period. Second, G20-sanctioned monitoring documents seem to be associated with more novel rules.

These two key findings are robust to a number of alternative specifications. In particular, we can change the crisis date (d') and results are consistent using  $d' = \{2007, 2008, 2009, 2010\}$ . The BCBS results of novelty are robust to dropping post-crisis observations that likely build on post-crisis initiatives. Additionally, we can drop coauthored documents from the dataset, and results do not change. For G20 results, alternative measures of "Document Mentions G20" – to include *count* of G20 mentions, an indicator for, and count of, FSB mentions; and an indicator for, and count of, either FSB and/or G20 mentions – does not change results (that is, there is no statistically significant result).

A logical extension might apply the same design to analyze the post-Asian Financial Crisis period. While there exist some data limitations to such an analysis, we do conduct that analysis and present results

<sup>&</sup>lt;sup>20</sup>Specifically, we drop observations where the difference between  $MaxSim_{d'=2007}$  and  $MaxSim_{d'=\emptyset}$  is greater than the mean.

in the Appendix, using data through the end of 2006. Appendix Figure A.5 shows the distribution of the data, with Loess Curves for the pre- (through 1997) and post-crisis (1998-2006) periods. Appendix Table A.1 displays statistical estimates that indicate tat both the BCBS and IOSCO rules in the post-AFC period were *less novel* than prior to the crisis. Together, pre- and post-AFC analysis (Table A.1) and pre- and post-GFC analysis (Table 2) indicate that sustained novelty in the BCBS post-GFC period seems to be unique rather than the rule. While the post-GFC period BCBS rules seem to be characterized by especially high levels of innovation and expansion of scope and regulatory approach, on average, this is not the case for IOSCO, nor for the BCBS nor IOSCO rules that followed the Asian Financial Crisis.

### 5 Conclusion

While existing literature provides many insights about specific international financial regulatory reforms – often highlighting failures and successes – the collective character of international financial regulation has remained elusive. This paper provides a unique perspective of the population of international bank rules and international securities rules, with specific focus on across-time regulatory novelty.

Together, we find evidence that banking rules in the period after 2007 are especially novel; at the same time, this sustained level of novelty during a post-crisis period seems to be unique rather than the rule. In post-2007 securities rules, and in bank rules and securities rules following the Asian Financial Crisis, financial regulatory reforms, if anything, seemed to address topics and take regulatory approaches that were less novel than pre-crisis periods. At a high level, the inquiry provides some empirical evidence that post-crisis reforms often build on existing initiatives, which supports the narrative of incrementalists who say that post-crisis reform contents often do not go far enough. Average levels of low novelty, does not preclude, however, that one or a few outlier reforms are especially novel and may foster subsequent change in a meaningful way. Additionally, too, what led post-2007 banking rules to be especially novel. Why is this and are there lessons that policy-makers may use to foster future regulatory change? Such inquiries highlight the need for analysis of issue-specific reforms alongside broader analysis of the population of reforms.

The finding that G20-sanctioned monitoring documents support more novel initiatives is especially interesting. The role of the G20, and whose interests the G20-FSB agenda reflects, needs to be further unpacked. Does the G20's power come from its role as a delegatory institution (Kaya, 2015), its ability to channel endorsement power (Eccleston, Kellow and Carroll, 2015), its ability to facilitate issue linkage (Knaack and Katada, 2013), or something else? The delegatory role of the G20 hints at the need to theorize about the international financial regulatory regime complex. There are ever more international standard setting bodies that are linked and coordinated in ever more ways.

Scholars have long documented how the soft law of international financial regulations have many characteristics of hard law (Zaring, 1998) and affect the likelihood of domestic rule adoption (Bach and Newman, 2014) and international cooperation (Newman and Posner, 2016). Further, there are ever more international bodies writing international rules and that are ever more coordinated through bodies such as the G20 and the FSB. While scholars have analyzed individual institutional reforms, a regime complex narrative is long overdue. While international financial regulatory cooperation began in 1974 with the BCBS and grew to have parallel standard-setting bodies (e.g. BCBS, IOSCO and IAIS), what happens when these organizations no longer act in parallel, but within a hierarchical structure, as bodies such as the G20 and FSB coordinate work among these groups? This is a ripe area for future research. Again, w highlight the need for systemic analysis – such as establishing and theorizing about the population of international reforms and the financial regulatory regime complex as a whole – to complement the existing, high-quality work on individual regulatory reforms.

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## Appendix A Additional Figures and Tables

Figure A.1: Annual count of international standards (black bars) and all international regulatory documents (black line). Across time, there are ever more regulatory documents available on regulatory websites. At the same time, there is an incentive for international regulators (i.e. BCBS, IOSCO) to publicize their standards.



Figure A.2: All cosine similarity values. Statistical specifications use pre-crisis  $MaxSim_{id'=2007}$  (white circles). In the post-crisis period, we plot  $MaxSim_{id'=0}$  (black circles) and connect differences using solid lines. In robustness checks, we drop those observations where there is a large gap between  $MaxSim_{id'=2007}$  and  $MaxSim_{id'=0}$ ; results are not sensitive to dropping those observations.



Figure A.3: Validation of MaxSim using known revisions. For both BCBS and IOSCO final documents, known revisions (white area) have higher on average max similarity than other (non-revision) documents (grey area).



Figure A.4: **Data fit with Loess lines - all (top graphs) and subset (bottom graphs).** All observations (top graphs) and drop post-GFC observations that likely build on post-crisis initiatives (bottom graphs).



Figure A.5: Data fit with Loess lines - Asian Financial Crisis (AFC) period. To maximize pre-AFC observations, we use d' = 1998 (i.e. measure is  $MaxSim_{d'=1998}$ .

	(1) BCBS	(2) BCBS	(3) BCBS	(4) IOSCO	(5) IOSCO	(6) IOSCO
Asian Financial Crisis (1998+ ind.)	0.394*** (0.151)	0.393* (0.223)	0.299 (0.274)	0.400** (0.198)	-0.069 (0.324)	0.744** (0.346)
Revision doc. ind.		0.782*** (0.155)	0.861*** (0.155)		0.940* (0.480)	0.464 (0.432)
Coauthored doc. ind.		-0.169 (0.156)	-0.166 (0.151)		0.400** (0.203)	0.354* (0.183)
Previous doc. ct.		-0.002 (0.016)	-0.039 (0.053)		0.069* (0.041)	0.131* (0.072)
Time			0.100 (0.085)			$-0.260^{*}$ (0.155)
Time <sup>2</sup>			-0.007 (0.005)			0.0005 (0.034)
Time <sup>3</sup>			-0.001* (0.0004)			0.002 (0.003)
Constant	0.530*** (0.122)	0.423* (0.216)	1.265 (1.038)	-0.249 (0.177)	$-0.848^{**}$ (0.355)	$-1.551^{**}$ (0.768)
Ν	67	67	67	64	64	64
Years	1983-2006	1983-2006	1983-2006	1994-2006	1994-2006	1994-2006
κ- Log Likelihood	0.078 44.413	0.356 57.786	0.410 60.954	0.060 27.850	0.237 33.910	0.440 43.545
Notes: ***Significant at the 1 percent level. **Significant at the 5 percent level						

\*Significant at the 10 percent level.

Table A.1: Beta Regression, dependent variable is Max  $Sim_{id'=1998}$ . This is analysis of the subset of international rules passed prior to the Global Financial Crisis (-2006). In comparison to the pre-Asian Financial Crisis period, both international bank rules (Models (1) through (3)) and international securities rules (Models (4) through (6)) display higher levels of similarity (i.e. lower levels of novelty) to pre-1998 international rules.