Compliance in Time:

Lessons from the Inter-American Court of Human Rights

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This paper advances a novel framework to study compliance with international human right courts. First, we introduce a conceptual distinction between reparation measures that allow for *immediate* or *protracted* implementation. Second, we develop an innovative approach to measure delays in compliance. Most studies have analyzed compliance by modeling the status of pending legal cases, ignoring that implementation of some types of remedies takes longer than others, and that conditions affecting compliance change over time. To address this issue we introduce two metrics: the yearly probability of compliance (YPC) and expected time to compliance (ETC), showing how to estimate those metrics using discrete-time models. Combined with machine-learning tools, this approach allows analysts to reconstruct the life cycle of reparation measures. We finally illustrate the benefits of this time-centered conceptual and methodological approach in an analysis of an original database of all cases decided by the Inter-American Court of Human Rights between 1989 and 2019. The analysis shows that current perceptions of a compliance "crisis" partly reflect the failure to analyze the temporal dimension.

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This paper advances a framework to analyze the temporal dimension of state compliance with international court rulings and illustrates the importance of this approach with a novel dataset of all cases decided by the Inter-American Court of Human Rights (IACtHR) from 1989 to 2019. Our work integrates two, conceptual and methodological contributions that emphasize the importance of time in any assessment of compliance.

First, we note that practitioners and scholars have classified international court orders mostly according to their legal function, rather than according to their feasibility. For example, reparation measures are typically distinguished by the type of remedies they provide. At a conceptual level, we argue that thinking of reparations from the perspective of the responsible state, focusing on the feasibility of the implementation process, generates a more accurate understanding of delays. Based on the level of intra-state coordination required to implement particular remedies, we classify reparations as prone to immediate or protracted implementation.

Second, we note that most analyses have so far focused on *whether* states comply with international court orders rather than on *how long* they take to do so. We formalize this insight by developing two related concepts: the yearly probability of compliance (YPC) and expected time to compliance (ETC). At the methodological level, our proposal relies on discrete-time duration modeling—a well-known technique in the social sciences—to obtain estimates of these metrics. Combined with machine-learning tools, this framework allows us to reconstruct the “life cycle” of court orders, an ignored pattern in analyses of compliance.

Our proposed approach helps identify not only the types of reparations that experience faster implementation but also, most importantly, the specific periods during the “life cycle” when compliance with different types of measures is most likely. This information can help calibrate expectations and inform the way in which judges and legal advocates ensure timely reparations for victims.

International courts interact with domestic legal systems to shape state behavior in a broad range of areas, including human rights (Mitchell and Powell 2011). Understanding why (and when) states abide by the decisions of international tribunals is therefore crucial to mobilize the transformative potential at the intersection of international and domestic law (von Bogdandy et al. 2016). We focus our analysis on what Roger Fisher (1981) called "second-order" compliance, that is, state acquiescence with authoritative decisions of third parties. By contrast to "first-order" compliance—i.e., state behavior in agreement with international norms and treaties—second-order compliance has an unambiguous temporal structure (Fisher 1981: 25; see also Simmons 1988). By the time a tribunal issues an order, the status-quo is noncompliance. Observers must then determine if the state conforms to this order—and how long it takes to do so. The structure of the problem is equivalent for domestic and international courts (e.g., Fix et al. 2017; Gauri et al. 2015; Hall 2013; Kapiszewski and Taylor 2013; Songer and Sheehan 1990).

A spectacular increase in the number of international courts has offered scholars many opportunities to study second-order compliance in recent decades (Alter et al. 2018; Carrubba and Gabel 2017; Hillebrecht 2014a; Von Staden 2018). Despite this growth, however, the academic literature has generally overlooked questions of temporality. Assessing the timing of compliance is crucial to understand the outcome of international court rulings as well as the causes of state behavior. States often honor international court rulings only after long delays. Deferrals in compliance postpone reparations and subject victims of human rights violations to additional outrage.

This paper advances compliance studies in three ways. In the next section, we present a novel typology of reparative orders based on their potential for *immediate* or *protracted* implementation. We then introduce the expected-time approach as an analytic alternative to static understandings of state compliance in international law. This approach provides an intuitive framework to interpret results of discrete-time duration models. In addition, we employ cross-validation techniques to improve the representation of compliance life cycles.

In the third part of the paper, these ideas are applied to the analysis of a novel database including all 1872 reparation measures ordered by the IACtHR from 1989 to 2019. This contribution is especially relevant in the current context of the IACtHR, marked by a growing implementation backlog and by an ongoing debate about how to balance the desire for better rates of compliance (crucial for the Court's effectiveness), with a high-minded agenda of integral reparations (crucial for the Court's legitimacy). We show that this apparent "crisis" reflects in part the Court's reliance on protracted, rather than immediate remedies, a fact that has remained partially concealed in the absence of an adequate approach to measure delays. We hope that this paper will help human rights advocates identify concrete opportunities for pending cases and provide insights for future strategizing.

Immediate and Protracted Measures

To the extent that compliance requires a change in state behavior in order to conform to a norm (Von Stein 2013: 494; Young 1979: 104), the process necessarily takes time. All three major theories of state compliance acknowledge this temporal dimension. The "managerial school" anticipates an inevitable time lag between the rise of an obligation and its fulfillment due to factors such as normative ambiguities, bad planning, and capacity limitations (Chayes and Chayes 1995; Raustiala and Victor 1998). The "enforcement school" underscores mechanisms of retaliation, reciprocity, and reputation, invoking the "shadow of the future," "cascades," and "spirals," all metaphors that reflect the centrality of time (Carrubba 2005, Downes et al. 1996, Keck and Sikkink 1998, Keohane 1984, Risse et al 1999, Simmons 2009). Finally, the "constructivist school" draws heavily on slow-moving mechanisms such as internalization and acculturation (Checkel 2005: 802; Goodman and Jinks 2004; Koh 1997). At the theoretical level every scholar agrees that "the time dimension is crucial for compliance, and yet it is hardly addressed or incorporated in empirical studies" (Lutmar et al 2016: 560).[1]

This body of research indicates that time matters for second-order compliance in three related but analytically distinct ways. First, certain court orders might be intrinsically more difficult to comply with than others, so the *nature* of the remedy maters. Second, it always takes time for states to comply with court rulings, which creates the need to model and account for *delays* (von Staden 2018: 24). Third, domestic and international conditions vary over time, so that changes in *context* also matters for compliance. We address the first conceptual issue in this section, and explore the remaining two issues—with broader methodological implications, in the next section.

Some features determining the temporal structure of compliance are embedded in the court's decision, making certain delays expectable even before the clock starts to tick for the state. This means that an analysis of compliance in time not only requires an accurate

[1] A prominent exception to this omission is the exchange between Simmons (2000), von Stein (2005), and Simmons and Hopkins (2005) regarding first-order compliance with Article VIII of the International Monetary Fund's (IMF's) Articles of Agreement. A core issue in the debate is how the authors deal with time when addressing the "very real problem of selection bias" (Simmons and Hopkins 2005: 623). Otherwise, despite the central role time plays in theories of compliance, the fast-growing empirical research on international courts has struggled to accommodate questions about timing. Across research on humanitarian law (Valentino et al 2006, Prorok and Appel 2014), international criminal law (Kelley 2007), territorial settlement (Huth et al 2011), and human rights agreements (Hafner-Burton and Tsutsui 2007; Lupu 2015) scholars either disregard or simply control for time.

methodological approach to measuring delays, but also an accurate conceptual approach to identify remedy types.

The nature of reparations varies greatly from court to court. The European Court of Human Rights (ECtHR), for example, limits its actions to measures of satisfaction, monetary compensation and, only more recently, restitution (Antkowiak 2008). The IACtHR, on the other hand, has adopted the entire menu of possible remedies identified by the United Nations General Assembly (Neuwman 2014), commanding states to prosecute perpetrators, change legislation, and adopt broad-range transformative measures. As a result, the IACtHR not only has "the most comprehensive legal regime on reparations developed in the human rights field" (Grossman et al 2007: 1376), but also issues orders that require greater political will and a considerable amount of time to be implemented.

Most courts and legal scholars classify reparations according to standard United Nations categories (Neuwman 2014). For example, the IACtHR traditionally uses the categories of *restitution, satisfaction, indemnification, non-repetition, rehabilitation,* and *prosecution*, a practice that we follow in our own database. Some scholars expand this classification to better represent the original text of the rulings (Stiansen et al 2020), which reproduces idiosyncratic practices. Others use more abstract categories, grouping remedies, for example, according to their costs (Hillebrecht 2014a: 50). Typification of course has to adapt to the research purpose, but for any analysis of compliance in time it is key that categories capture the propensity to delays embedded in different kinds of remedies.

Our time-oriented classification of reparations reflects the established conventional wisdom that compliance is a domestic process driven by the executive branch, which often coordinates the tasks of other branches and multiple state agencies. Irrespective of the fact that domestic conditions, such as political will and electoral incentives, may affect the executive's motivation to perform (Hillebrecht 2012; Parente 2019), reparations contain from their inception at least two elements that affect the risk of delays. First, some reparations demand a single act, while others entail a process. Second, while some reparations involve just one state actor others require the coordination of several actors (Huneeus 2011). In this regard, we can identify two clear types of reparations.

The first type, which we call *immediate remedies*, are single acts which can be directly undertaken by the executive with no need to involve other branches or levels of government. These types of compensation include the payment of indemnifications, legal costs, and measures of satisfaction like public acknowledgements, as well as most measures of restitution intended to reverse the victim's situation to the *status quo ante*.

The second type, *protracted remedies*, corresponds to more complex processes involving different branches and levels of government. These include guarantees of non-repetition which often require administrative or legislative reform, measures of rehabilitation that entail long processes involving diverse agencies, and requests to investigate and prosecute crimes, which need the active collaboration of the judiciary.

Of course, we are not the first to note that certain reparations are easier to implement than others. Most studies of the IACtHR have examined the relationship between different types of reparations and the likelihood that governments will comply, noting that monetary indemnifications for victims of human rights violations and symbolic measures are more likely to result in compliance than orders that demand investigation of perpetrators or changes to legislation (Basch et al. 2010, Baluarte 2012, González-Salzberg 2010, 2013, Hawkins and Jacoby 2010, Hillebrecht 2014a, Parente 2019). However, most of these studies fail to theorize the distinction, and analyze whether states comply with those measures rather than analyzing delays in implementation. Our conceptual approach more explicitly captures the fact that certain types of reparations simply need more time than others to take effect.

Compliance in Time

Empirical analyses of compliance have mostly relied on what we call a "snapshot" approach, comparing rates of compliance across states or across types or reparation measures at a given point in time. In this section we review four aggregate measures of compliance, and introduce the *yearly probability* and the *expected time* as our preferred metrics. The section concludes with a simple example that illustrates the limitations of prevalent "snapshot" approaches and explains the advantages of a discrete-time approach to understand two central problems: delays in compliance and changes in the implementation context.

Delays. Because states need time to comply with court orders, a comparison of rates of compliance at a given point in time may under-estimate states' commitment to international norms (if states need additional time to comply) or over-estimate this commitment (if states complied only after long delays). This introduces two analytical challenges. On the one hand, it is possible that some states will appear in violation of recent court orders simply because they did not have enough time to adjust their behavior (Chayes and Chayes 1995: 17; von Staden 2018: 22). For instance, in a study of the International Court of Justice (ICJ), Tiffiny (2013: 77) concludes that compliance has declined with cases adjudicated in recent decades. Yet, it is unclear whether compliance has declined or states had less time to comply with recent decisions. Empirical studies often acknowledge this problem in crude ways. In his analysis of the IACtHR, González-Salzberg (2013) only considers rulings issued at least two years before his study. Hillebrecht (2014a: 55), as well as Naurin and Stiansen (2020: 974), estimate the probability of compliance controlling for the number of years elapsed between the ruling and the year of data collection. On the other hand, and maybe most important, it is possible that states will comply with court orders only after long delays. Staton and Romero (2019) note that “if compliance followed a protracted period of delay, such a coding will miss what we believe is substantively meaningful defiance.” Measuring *if* states comply can be as important as measuring *when* they do so (Kapiszewski and Taylor 2013: 829).

Changing Context. A second issue is that the conditions that drive compliance change over time. “The more time passes between a judicial ruling and public authorities’ response, the more intervening events may affect public authorities’ decision to carry out the behavior called for in the ruling,” note Kapiszewski and Taylor (2013: 816). Unfortunately, it is difficult to assess the role of time-varying explanations when we observe a snapshot of court cases at a particular moment. Hillebrecht (2014a), as well as Staton and Romero (2019), estimate the probability of compliance using initial conditions at the time of the ruling as predictors for the outcome. Other studies, including research on compliance with WTO rulings (Spilker 2012 and Peritz 2015) and decisions of the European Court of Human Rights (Grewal and Voeten 2015; Helfer and Voeten 2014), account for variation in the time to compliance as well as censoring of cases. Still, this research generally lacks a robust discussion of the time-varying factors that might affect a state’s propensity to comply. More in line with our proposal, Parente (2019) employs a discrete-time duration model to accommodate changes in domestic public opinion about court orders.

Figure 1. Four Metrics of Second-Order Compliance

Accounts for	Duration (delays)	
Changing conditions	No	Yes
No (snapshot)	*Rates of compliance* (across cases)	*Time to compliance* (given compliance)
Yes (discrete-time)	*Yearly probability of compliance* (YPC)	*Expected time to compliance* (ETC)

The problem of delays suggests that we should measure compliance in time units (not simply as a dichotomous outcome), while the problem of evolving conditions suggests that we should track changes in compliance over time. Taken together, the two criteria allow us to identify four aggregate metrics or indicators of second-order compliance, summarized in Figure 1. In the top row, the first two metrics depict a "snapshot" of pending legal cases at a particular point in time. Assessments ignoring time (in the first column) report rates of compliance for a particular set of cases (e.g., González-Salzberg 2010), while those accounting for delays (in the second column) report the average number of years elapsed until states fulfill their obligations. The latter indicator is uncommon because of right-censoring. A naïve average only reflects time to compliance among cases that achieved implementation, ignoring cases that remain open.

The bottom row of Figure 1 identifies two alternative metrics of compliance. Both metrics rely on a discrete-time approach, described in the next section. The first measure reflects the probability of compliance for specific cases (or reparation measures) in particular years.[2] For example, because public opinion toward security forces changes over time, Parente (2019) employs a complementary log-log model to estimate the probability of

[2] The probability of compliance could be, in principle, estimated for any time unit. We focus on the *yearly* probability of compliance because this is the relevant metric for most applications.

compliance in the years following an IACtHR decision. This metric implicitly accounts for delays, in the sense that the probability of compliance estimated for year t is conditional on non-compliance at t–1 (if the state had complied at t–1, the reparation measure would drop from the sample). However, estimates of the yearly probability of compliance do not explicitly account for time elapsed unless properly interpreted.

To offer an explicit metric for delays, we propose a fourth indicator, the Expected Time to Compliance (ETC). Estimates of ETC reflect the number of years predicted until compliance takes place.[3] This measure accommodates the fact that some states have not complied (yet?) by penalizing non-compliers with a longer expected time. An important point to keep in mind is that the yearly probability of compliance and the ETC are mathematically equivalent, allowing for flexible interpretation. For any yearly probability p_t, there is an equivalent ETC, $1/p_t$. We address the reason for this equivalence in the next section.

Snapshot vs. Discrete-Time Approaches

To illustrate the limitations of "snapshot" measures introduced in the top row of Figure 1, Figure 2 presents a hypothetical example in which three states (A, B, and C) are required to comply with two reparation measures each (labeled A1, A2, etc.). State A receives the ruling in 2002, complying with the first measure in 2008 and the second measure in 2009. State B receives the ruling in 2003, complying with the first measure in 2009 and the second measure in 2015. State C receives the ruling in 2009, complying with the first measure in 2010 and with the second in 2012. Thus, State C responds to the court's requests promptly, State A complies after several years, and State B complies after a very long time.

[3] More precisely, the ETC indicates the number of years needed to produce the average YPC observed.

Figure 2. Snapshot v. Discrete-Time

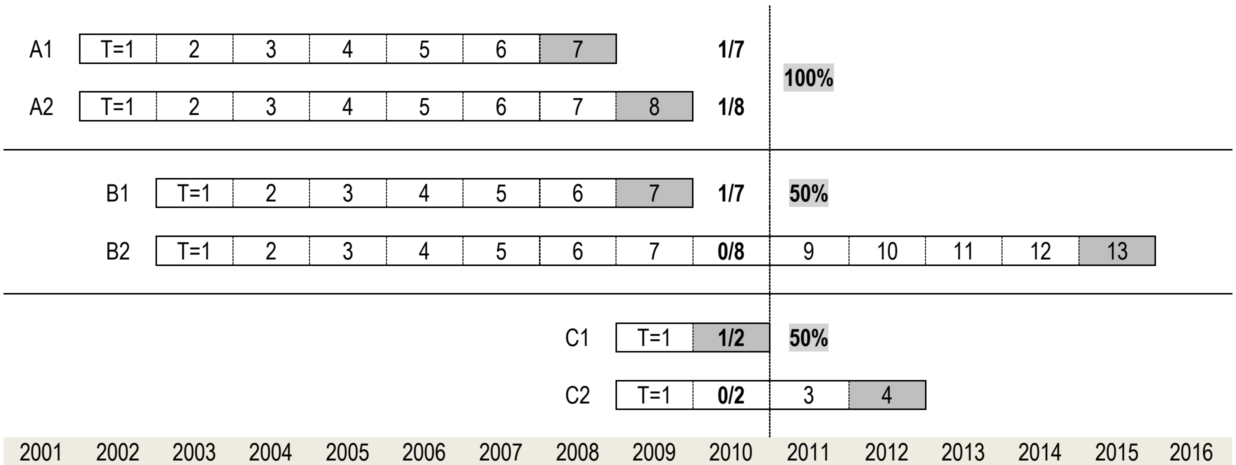


Figure 2 illustrates why the snapshot approach may generate misleading conclusions. Consider a student observing the status of all cases in 2011. At this point, State A has complied with 100% of its reparation measures, State B has complied with 50%, and State C has complied with 50%. Thus, State A appears to be most committed to international norms, even though C outperforms the other two states. Alternatively, a study comparing time-to-compliance in the three cases would identify State C as the fastest complier (2 years) vis-à-vis B (7 years) and A (7.5 years on average). But this metric would underestimate time-to-compliance for B and C, by ignoring information for right-censored reparation measures B2 and C2, that have not experienced compliance by 2011.

The alternative approach presented in Figure 1 allows us to calculate the probability of compliance in any given year, and to retrieve the expected time to compliance based on this information. This procedure, illustrated in Figure 2, involves three steps. First, we split the life of a reparation measure into discrete time units (e.g., years). Second, we estimate the yearly probability of compliance for each of those units. In the absence of time-varying covariates, the yearly probability of compliance implicitly follows a uniform distribution.

For instance, the average probability of compliance for A1 is 1/7 (0.143) per year, while the average probability of compliance for State A is 2/15 (0.133) per year. In the presence of time-varying covariates, we must employ discrete-time estimators, discussed below, to assess the yearly probability of compliance. Third, we retrieve the expected time to compliance (ETC), as the inverse of probability estimates. For example, ETC for State A is 7.5 years (1/0.133).

The discrete-time approach allows researchers to report results in two equivalent metrics: as a probability or as expected time. This flexibility results from the fact that the two quantities are the inverse of each other. Using this method, and assuming that we observe the situation of all cases in 2011, the probability of compliance is 0.133 (an ETC of 7.5 years) for State A, 0.067 (or 15 years) for State B, and 0.250 (4 years) for State C. In contrast to the snapshot approach, the discrete-time approach properly identifies State C as most inclined to honor its commitments, and State B as the least inclined to do so.

Proper interpretation of the ETC demands a few considerations. Because estimates of expected time incorporate information for right-censored orders, unrealistic ETCs reflect situations in which highly adverse conditions generate a dismal probability of compliance. For example, a yearly probability of compliance of just 0.01 will yield an ETC estimate of 100 years.[4] This in no way implies that the state will comply after a century. In addition, similar ETCs may reflect distinct life cycles of compliance. Different yearly probability distributions, when averaged over time, may produce the same expected time to compliance, even if the life cycle is quite different in each case.

[4] In the absence of *any* compliance events, $p_t = 0$ and the ETC is non-retrievable (i.e., expected time to compliance is infinite).

The Case of the IACtHR

We illustrate this framework with data for the Inter-American Court of Human Rights. The IACtHR has jurisdiction over most members of the Organization of American States (OAS) that signed the American Convention of Human Rights. The other organ of the System, the Inter-American Commission on Human Rights, receives individual petitions and elevates contentious cases to the Court only after a settlement with the state proves unviable. The limited caseload has allowed the Court to develop an ambitious doctrine about integral reparations, and to retain jurisdiction after its rulings, supervising compliance at regular intervals (Saavedra Alessandri 2020).

Between its first decision in 1989 and 2019, the IACtHR ruled in 262 cases, ordering 1872 reparation measures.[5] Cases vary significantly in the number of reparations ordered by the Court. For example, *Genie Lacayo vs. Nicaragua* involves a single reparation, while *López Soto y otros vs. Venezuela* includes 21 orders. About 80% of the rulings involve 10 measures or less, and the average case orders 7.3 reparations.[6]

A major transformation took place in the 21st century. After the Inter-American Commission of Human Rights (gatekeeper to the Court) adopted new procedures in 2001, the IACtHR began to process a larger number of cases. Moreover, the number of reparations ordered by the Court in each case also expanded. Yet, state compliance never caught up with the surge in caseload. The combination of more cases, more reparation measures, and an inadequate rate of compliance produced an accumulation of pending orders, creating

[5] The Court ruled for the state in five cases, issuing reparation orders in 257 cases (http://www.corteidh.or.cr/cf/jurisprudencia).

[6] Older cases often listed several measures under a single resolution point. Following the Court's monitoring procedures, we treated each measure as an individual measure in our database.

concerns about a compliance crisis. The number of reparation measures under supervision increased tenfold in less than two decades, from 120 measures in 2001 to 1,236 in 2019.

Following the convention in the field, we focus our analysis on compliance with individual reparation measures, rather than with the overall court ruling. States exercise compliance "à la carte", addressing some reparation measures while ignoring others (Hillebrecht 2014a). The Court reports episodes of "partial" and "full" compliance in its regular supervision resolutions, and it exercises supervision of each case until states satisfy all reparation measures in full. Only about 37% of all reparation measures have met full compliance to this day.

There is an extensive body of work on the Inter-American Court, but a vast majority of studies adopt "snapshot" approaches to assess compliance.[7] Scholars often claim that "Suriname and Chile present a compliance rate of 50%" (Gonzalez-Salzberg 2013: 10), that "Mexico complied with 67% of orders" (Baillet 2013: 480), or that "Guatemala has (…) an implementation rate of approximately 89 per cent" (Baluarte 2012: 291). They also estimate the likelihood of compliance using multivariate models in which reparation measures constitute the level of analysis (Hillebrecht 2014a; Naurin and Stiansen 2020; Staton and Romero 2019; for an exception, Parente 2019).

Our goal in this paper is not to develop a comprehensive theory of compliance with the IACtHR, but to illustrate how the approach proposed in the previous section can offer

[7] Research on the IACtHR emphasizes three types of explanations for compliance: internal characteristics of the state (Alvarez et al. 2007; Bailliet 2013; Coimbra 2013; Garavito and Kauffman 2016; Hawkins and Jacoby 2010; Huneeus 2011; Nuño 2016; Parente 2018; Parra Vera 2016; Sánchez 2013), external incentives (Alvarez et al. 2007; Bailliet 2013; Hawkins and Jacoby 2010), and the features of each case (Baluarte 2012, Basch et al. 2010, Calderón Gamboa 2014, Garavito and Kauffman 2016, González-Salzberg 2010, Hawkins and Jacoby 2010, Naurin and Stiansen 2019, Salazar and Cerqueira 2016). Part of the third set, the type of reparation measures requested is the most consistent explanatory factor in the literature.

fresh insights. For this purpose, we will focus on two variables of interest. The first one is the type of reparation ordered by the Court. We build on the initial discussion to illustrate the usefulness of our distinction between immediate and protracted remedies. The second variable is the age of the case, that is, the time elapsed between the Court's ruling and the date of the observation. Grewal and Voeten (2015), for instance, show that new democracies are more likely to comply with rulings of the ECtHR, but this inclination declines as legal cases age. This factor—often overlooked—deserves a substantive interpretation in discrete-time models, because the age of the ruling defines the life cycle of reparation measures.

Data and Estimation

We developed a database covering all cases decided by the Court by the end of 2019, and dated the time of compliance for each reparation measure based on information reported by the Court's supervision resolutions. While a snapshot analysis only requires tabulating the information observed by 2019, the discrete-time approach requires restructuring the data to create yearly records for each reparation measure. We created annual records for each of the 1,872 reparation measures ordered by the IACtHR, starting on the year of the ruling through the year of full compliance (or 2019, for pending measures). This process generated 12,093 observations at the reparation-year level.

The database measures compliance using three dichotomous indicators that take a value of 1 when an event takes place, and 0 in all previous years. The first indicator captures the timing of any state action leading to a declaration of *partial* compliance by the Court. The second one captures the timing of any state action leading to a declaration of *full* compliance (after this terminal event, the reparation measure drops from the sample). The third indicator captures the *first* manifestation of state compliance (partial or full) reported by the IACtHR. We stop coding the indicator for any given reparation measure after the event takes place.

The dataset also includes the two variables of interest discussed above. The first one is the age of the reparation measure, measured with a time counter t that records the number of years elapsed since the Court's decision. The second variable is the *type* of reparation measure. Following our initial discussion, we restructured the IACtHR's seven-fold classification of measures into two broader categories: *immediate remedies* (restitution, satisfaction, indemnification, legal costs) and *protracted remedies* (rehabilitation, guarantees of no repetition, obligation to investigate and sanction perpetrators). We treated orders to reimburse the Court's Victims Assistance Fund—technically not a form of reparation—as part of the legal costs category.

We estimate the probability of compliance for each reparation-year using a hierarchical discrete-time duration model, which includes frailties by country and by legal case. Given the purpose of this paper, we preserve a minimalist specification. Besides the type of reparation measure (the most common predictor in the literature), the model includes a polynomial for the time elapsed since the ruling. This polynomial accounts for duration dependence and, from a substantive point of view, maps into the life cycle of compliance. The structure of this baseline model is:

[1] $$Y_{it} = b_{0c} + \Sigma\, b_k * Type_k + \Sigma\, b_z * t^z + \varepsilon_{it}$$

where Y_{it} is a linear transformation of the yearly probability of compliance for reparation measure i in year t, b_k is a set of coefficients for k reparation types, and b_z is a set of coefficients for a polynomial of order z. Because every reparation i is nested in a legal case c, which in turn is part of a set of cases referring to state j, b_{0c} represents a latent probability of compliance, shaped by the unobserved facts of the case and by state characteristics. We model this as a frailty

[2] $$b_{0c} = b_{00} + b_{01c} + b_{02j}$$

where b_{00} is an intercept for the whole sample, b_{01c} is a random effect adjusting the constant for each legal case, and b_{02j} is a random effect by country.

Following Parente (2019), we employ a complementary log-log link to transform the probability of compliance into a linear function, but alternative links (e.g., a logistic function) produced equivalent results. Due to the link employed, the yearly probability of compliance (YPC) for any reparation measure *i* in year *t* is equivalent to: $1 - exp(-exp(Y_{it}))$, while the expected time to compliance (ETC) is equivalent to $(1 - exp(-exp(Y_{it})))^{-1}$.

YPC: Modeling the Life Cycle of Reparation Measures

In this section, we employ a machine-learning procedure to identify the optimal specification for the hazard function. Coefficient(s) b_z in Equation 1 estimate changes in the hazard function according to the number of years elapsed since the time of the ruling. Even though most analyses employing discrete-time models treat b_z merely as a nuisance parameter, we have a substantive interest in the shape of this function. The evolution of the yearly probability of compliance shapes the life cycle of reparation measures. Identifying periods during which states are more likely to comply is crucial for the victims' advocates and for human rights activists.

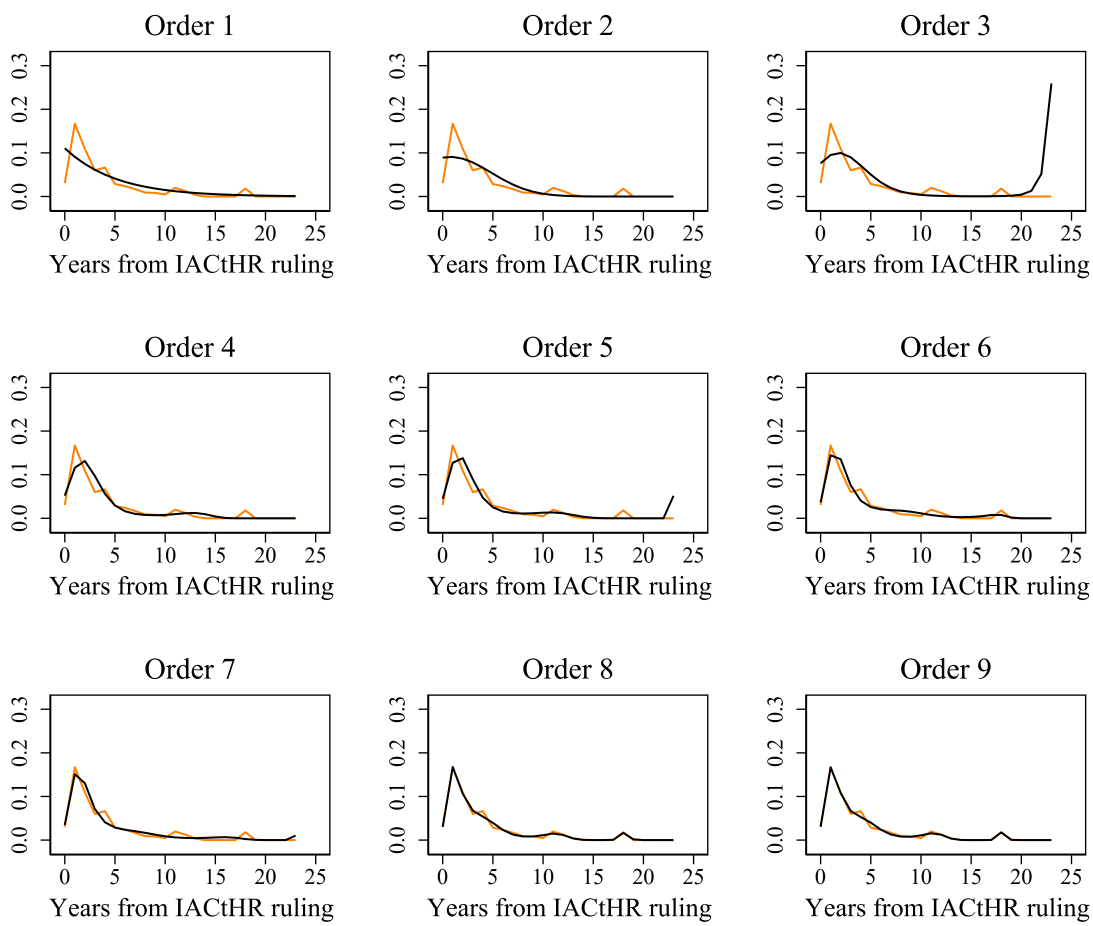
Although it is common to employ a cubic polynomial (z = 3) in duration models (Carter and Signorino 2010), there is no reason to believe that the life cycle of reparation measures necessarily follows a cubic specification. Unfortunately, there is little guidance on this problem. Many studies employ cubic splines, a strategy that produces greater flexibility but makes it very hard to retrieve the hazard function (Beck, Katz, and Tucker 1998; Friedman and Roosen 1995). More conventional duration models either assume a standard hazard function (e.g., a Weibull distribution) or sidestep this issue altogether by using a Cox estimator (e.g., Grewal and Voeten 2015).

Figure 4 documents the life cycle leading to full compliance. The colored line in each panel represents the rate of compliance per year following a decision of the IACtHR. The YPC is low in the immediate aftermath of the ruling, but escalates the following year. However, compliance drops within five years. Each panel in the figure compares the observed pattern against the prediction of a model using a different transformation of t, with polynomials of order 1 through 9.

The figure illustrates a fundamental tradeoff. On the one hand, elegant specifications are insufficient to capture the life cycle of compliance. For example, a linear representation of time (i.e., a polynomial of order 1) assumes a monotonic decline in compliance, overestimating state efforts on the year of the ruling, and underestimating them during the next five years. A cubic polynomial (order 3) anticipates a dramatic surge in compliance after two decades, a pattern with no empirical support. The quadratic specification conventionally used in discrete-time models thus appears to be a poor choice in this context. On the other hand, higher-order polynomials fit the data much better, but risk over-parametrization. Polynomials of orders 8 or 9 match the observed life cycle closely, but they possibly over-fit the data. It is unlikely that such nuanced representation of the life cycle observed in the sample will yield reliable out-of-sample predictions.[8]

[8] For instance, in Figure 3 compliance appears to improve about 18 years after a ruling, but this estimate reflects the experience of very few cases (*Castillo Petruzzi vs. Perú*; *Garrido y Baigorria vs. Argentina*; and *Suárez Rosero vs. Ecuador*) and thus it is highly uncertain.

Figure 3. Life Cycle (Full Compliance) and Predicted YPC for Alternative Polynomials



Note: The series reflect the predicted probability of full compliance after a given number of years. Colored line reflects the observed life cycle in the sample. Each panel presents the prediction of a complementary log-log model, using an alternative transformation of time. For instance, Order 2 is a quadratic specification where $y = b_0 + b_1t + b_2t^2$. For the purpose of the simulation, all models assume $b_k = b_{01c} = b_{02j} = 0$.

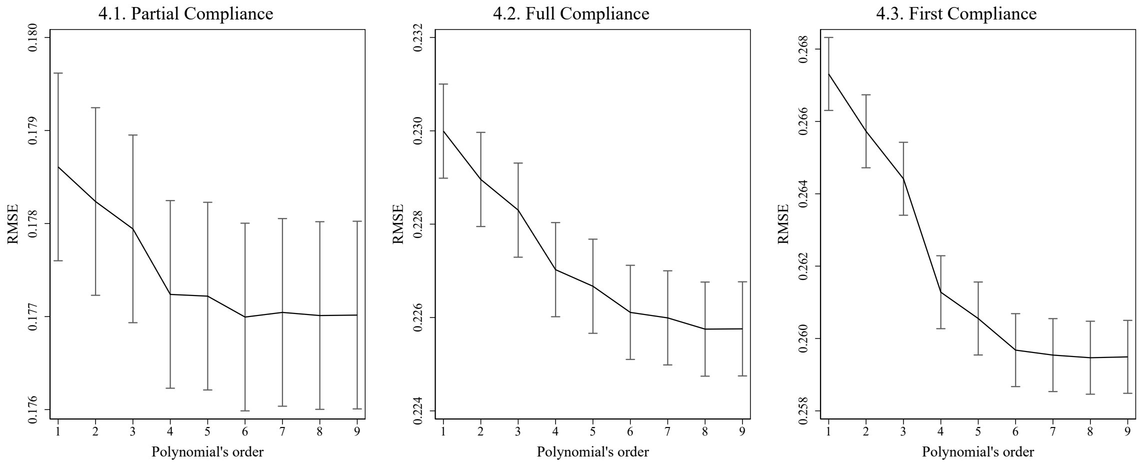
This tension between sample fit and out-of-sample validity reflects the tradeoff between bias and variance that is central to machine learning applications. We therefore build on this approach to address the issue, employing a five-fold cross-validation procedure with 50 repeats to identify the optimal specification for the hazard function.

To implement this procedure, we divide our sample randomly into five subsamples (folds), and perform cross-validation for each fold. First, a complementary log-log model for a polynomial of order *t* (for *t* = 1, …, 9) is fit on 80 percent of the sample (four folds). Second, we evaluate the prediction of this model using the fifth fold (the remaining 20 percent of the sample) as test data. For this purpose, we take the difference between y_{it}, the compliance outcome (0 or 1), and p_{it}, the predicted probability of compliance in any given year. We compute the root mean squared error (RMSE) for the test subsample of size N, where RMSE = $[\Sigma(y_{it} - p_{it})^2 / N]^{1/2}$. (Note that RMSE is the square root of the Brier score, common for dichotomous outcomes.) We repeat the procedure five times, using each fold as the test data, and generate five estimates of fit for every polynomial specification. This yields 45 RMSE estimates (9 polynomials, times 5 folds) for each repeat of the cross-validation exercise.

Krstajic et al. (2014) showed the importance of repeating cross-validation, reshuffling the folds when selecting an optimal model. Following their advice, we repeated the cross-validation procedure 50 times for each polynomial, and estimated the resulting distribution of performance statistics. In addition, we performed this procedure for our three compliance outcomes: partial compliance, full compliance, and the first instance of compliance (whether partial or full). Therefore, our cross-validation exercise computed 6,750 RMSE estimates of fit (45*50*3) for polynomials of order 1 through 9.

Figure 4 summarizes the results of this exercise, comparing the average performance statistic for each outcome and for each order of the polynomial. For instance, Figure 4.1 shows that the average RMSE for the model that predicts partial compliance using a quadratic transformation of time (t and t^2, or a polynomial of order 2) is 0.1782. This value represents an average across 250 performance estimates (5 test subsamples, repeated 50 times). The figure also depicts a 95% confidence interval for each point estimate.

Figure 4. Root Mean Squared Error for Alternative Transformations of Time



This exercise in cross-validation indicates that prediction bias declines monotonically as we approximate a polynomial of order 6. Estimates of bias are virtually indistinguishable for higher-order specifications. Therefore, we employ a sextic polynomial to model the hazard function.[9]

The implications of this hazard function are visible in Figure 3 (in the panel for the second row, third column): the probability of full compliance escalates from barely 3.6% on the year of the ruling to 14.4% one year later, as willing states promptly implement feasible orders. However, the yearly probability of compliance drops precipitously after the second year. Thus, Inter-American rulings create a window of opportunity to redress human rights abuses for a few years, but the likelihood of state compliance drops afterwards.

[9] To verify this result, we performed likelihood ratio tests for polynomials of order 2 through 7 using the full sample with frailties, and similarly concluded that a sextic polynomial offers the most accurate representation of the life cycle of compliance.

ETC: Expected Delays for Different Types of Reparations

This section builds on our initial distinction between immediate and protracted remedies to illustrate the advantages of the expected time to compliance (ETC) as an intuitive metric. In Equation 1, b_x represents the coefficients for different types of reparation measures. We initially coded measures following the classification scheme used by the IACtHR (restitution, rehabilitation, satisfaction, guarantees of no repetition, obligation to investigate, indemnification, and refund of legal costs), and mapped these categories into our two types.

Table 1 reports the estimates for two hierarchical discrete-time models predicting the first event of compliance (partial or full), and the occurrence of full compliance. (To avoid repetition, we do not report models for partial compliance, available on request.) The models incorporate coefficients for each reparation type, with restitution treated as the reference category. The specification also incorporates the sextic transformation of time.

The results confirm that "immediate" remedies experience higher probabilities of compliance (and thus shorter delays) while "protracted" measures experience lower levels of compliance (thus longer delays). To convey a substantive interpretation of these results, Figure 5 compares the ETC across reparation types. The top panel displays the ETC until the first indication of compliance (from Model 1.1), while the bottom panel reflects the ETC until full compliance (Model 1.2). Shorter ETCs in the top panel reflect that the probability of any form of compliance is by definition greater than the probability of full compliance. The vertical dotted line, included for reference, reflects the time elapsed since the Court's first ruling (1989), which sets a historical boundary for interpretation of duration estimates.

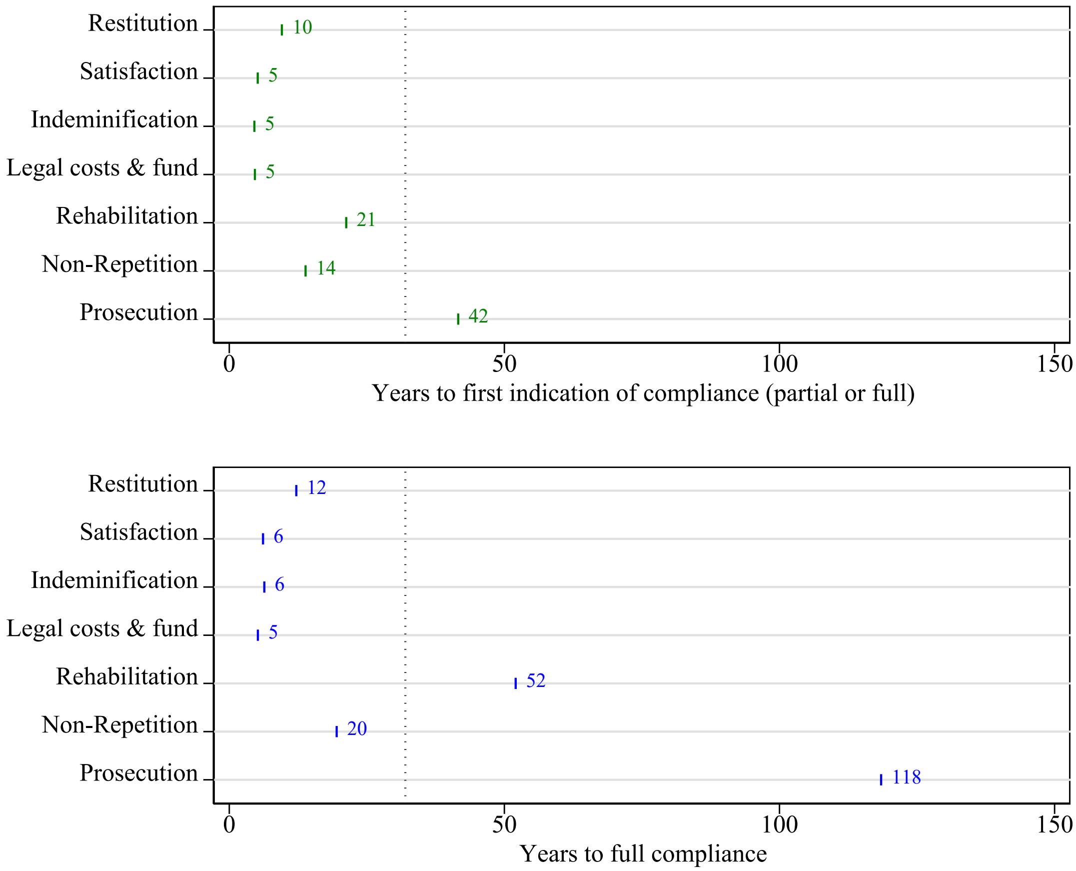
Table 1. Discrete-Time Models of Compliance with the IACtHR

	(1.1) First indication		(1.2) Full compliance	
Type of Reparation				
Immediate				
Satisfaction	0.96*	(0.17)	0.99*	(0.19)
Indemnification	1.17*	(0.18)	0.94*	(0.20)
Legal costs & fund	1.14*	(0.18)	1.26*	(0.20)
Protracted				
Rehabilitation	-1.06*	(0.29)	-1.76*	(0.40)
Non-Repetition	-0.51*	(0.20)	-0.61*	(0.22)
Prosecution	-1.87*	(0.28)	-2.66*	(0.40)
Life Cycle				
Years from ruling	3.37*	(0.21)	3.12*	(0.24)
Years from ruling^2	-1.73*	(0.15)	-1.50*	(0.16)
Years from ruling^3	0.35*	(0.04)	0.29*	(0.04)
Years from ruling^4	-0.03*	(0.01)	-0.03*	(0.01)
Years from ruling^5	0.00*	(0.00)	0.00*	(0.00)
Years from ruling^6	-0.00*	(0.00)	-0.00*	(0.00)
Intercept b_{00}	-4.25*	(0.35)	-4.70*	(0.36)
Var(Countries)	1.78	(0.71)	1.53	(0.63)
Var(Cases)	1.02	(0.17)	1.22	(0.20)
Countries	22		22	
Legal cases	257		257	
Reparation-years	10,510		12,093	

* $p < 0.01$. Estimates are coefficients for complementary log-log multilevel model (z statistics). Restitution is the baseline category.

Figure 5 indicates that the expected time to initial compliance is, on average, five years for measures of satisfaction, indemnifications, and legal costs; and ten years for measures of restitution. Upon the first indication of compliance, each of these reparations typically secure full compliance within two years.

Figure 5. Expected Time to Compliance, by Sub-Type of Reparation Measure



As expected, measures of non-repetition, rehabilitation, and the prosecution of perpetrators present lower probabilities of compliance, and thus longer ETCs. The figure anticipates some form of compliance for measures of non-repetition within 14 years, and full compliance within two decades. Estimates are less auspicious for measures of rehabilitation, with an expectation of 21 years and 52 years, respectively. At the extreme, orders to prosecute perpetrators display unrealistic ETCs, with 42 years to the first indication, and 118 years to full compliance. The extremely long horizons reflect dismal probabilities: .024 and .008 per year, respectively.

Figure 6. Yearly Probability of Full Compliance, by Type of Measure

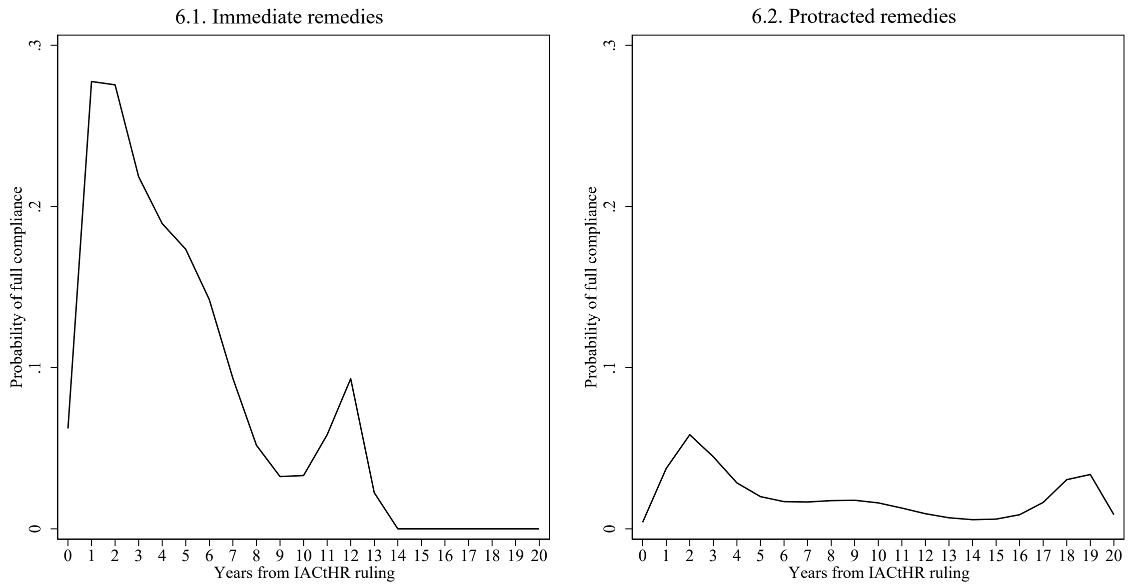


Figure 6 underscores this difference by comparing the life cycle of full compliance for immediate and protracted remedies. We estimated the polynomial hazard function separately for the two subsamples (models are not displayed to save space), and retrieved the yearly probability of full compliance for the two decades following a ruling.

States are most likely to comply with immediate remedies within two years of the decision, reaching a YPC of about 27% by year two. As noted in Figure 3, the probability of compliance declines in the following years. Within a decade of the ruling, the expected rate of compliance returns to the initial levels observed in the aftermath of the decision, and it recovers briefly before dropping to zero by year 14. In contrast, states are much less likely to comply with protracted measures, but they do so over a longer span. The YPC for protracted remedies also increases within two years of the decision, but it barely reaches 6% by year two. The rate of compliance declines slightly for several years, then recovers to about 3% before dropping after two decades.

Although the differences between immediate and protracted remedies are striking, Figures 5 and 6 temper any sense of "crisis" in the Inter-American System. It is not surprising that protracted measures, which encounter political resistance and demand significant state resources, experience low YPCs. The fundamental question is how much protracted measures weight in the overall portfolio of reparations ordered by the Inter-American Court.

Immediate remedies represent two thirds of all reparations ordered by the Court. Measures of satisfaction constitute 27% of all orders in our dataset; indemnifications, 17%; legal costs and repayments to the victims' fund, 16%; and restitution, 7%. In contrast, only about a third of all orders involve protracted guarantees of non-repetition (16%), requests to investigate or prosecute perpetrators (11%), and measures of rehabilitation (6%). As a result of this distribution, Model 1.1 estimates an average YPC of 0.131 for the whole sample, suggesting that the expected time to the first form of compliance is 7.6 years across all reparation measures. Model 1.2 in turn yields an average YPC of 0.104 for the whole sample, suggesting that the expected time to full compliance is about 9.6 years. These results qualify any concerns about *widespread* noncompliance in the Inter-American System.

Discussion and Conclusions

We illustrated the advantages of an expected-time framework to analyze compliance with international court rulings, emphasizing the conceptual distinction between immediate and protracted remedies. Most quantitative evaluations of second-order compliance continue to analyze whether states adapt their behavior to court rulings, but overlook the time elapsed until compliance. This conventional approach has led to potential misrepresentations of what constitutes (or not) a reasonable delay, which actors comply more willingly, and the general conditions that favor compliance.[10] Studies have relied on “snapshot” approaches to assess compliance with the International Court of Justice (Paulson 2004; Tiffiny 2013), the European Court of Justice (Beach 2005, Martinsen 2015), the ECtHR (Hillebrecht 2014b, von Staden 2018), the Law of the Sea Tribunal (Phan 2019), and the World Trade Organization’s dispute settlement mechanisms (Reinhardt 2001; Wilson 2007).

Our study is not the first to employ duration models to understand second-order compliance, but while most studies focus exclusively on the analysis of covariates, we advance a substantive interpretation of these models. This interpretive framework emphasizes two quantities of interest: the yearly probability of compliance (YPC), which allows analysts to map the compliance life cycle as determined by the hazard function, and the expected time to compliance (ETC), an intuitive metric that translates the YPC into years.

We documented the advantages of this approach with a study of all rulings of the Inter-American Court of Human Rights between 1989 and 2019. Because the goal of this study was to highlight our analytical strategy, we purposefully avoided the inclusion of a large number of covariates. To validate the strategy, we focused instead on the use of machine-learning tools to determine the shape of the latent hazard function.

Although observers of the Inter-American System have expressed concerns about an impending crisis of compliance, our findings suggest a more nuanced situation. The typical reparation measure ordered by the IACtHR experiences a rate of compliance close to 20% two years after the ruling. Two thirds of the reparation measures are immediate remedies with an expected time to compliance of a decade or less. However, as the previous literature

[10] For example, in his study of the European Court of Justice (ECJ), Beach concludes Greece is a serial non-complier (Beach 2005: 136). Yet, while the study bases its conclusion on a snapshot of non-compliance rates by 2001, a look at the whole time series would put Germany more squarely in the black list (Beach 2005: 117, 121)

has shown, ETCs vary widely across reparation types. Protracted measures of non-repetition, rehabilitation, and especially orders to investigate and sanction perpetrators confront enormous delays.

The analysis of compliance in time therefore offers important opportunities for future studies. Scholars are interested in the effect of shifting conditions that alter states' willingness and capacity to comply, including changes in government, public opinion, or economic performance (Dai 2005; Parente 2019; von Stein 2015). Moreover, courts may take action to address non-compliance at critical moments, scheduling on-site visits, releasing reports, and holding public hearings (Garavito and Kauffman 2016: 253; Saavedra Alessandri 2020). An evaluation of those strategies requires research designs sensitive to timely policy interventions and able to model changes in compliance over time.

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