

The Design of Enforcement: Collective Action and the Enforcement of International Law

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Supplemental Appendix — March 29, 2017

1 Theory Robustness

1.1 Diffuseness without Reducing the Individual Benefit

Suppose that all players have an identical value of τ , which is not a function of the number of players.

Claim 1: Each individual player is less likely to file as diffuseness (the number of players) increases.

Proof of Claim 1:

Define $\rho_i(n)$ as the probability that player i does not file when the game has n players. Then:

$$\rho_{-i}(n) = \prod_{j \neq i} \rho_j(n)$$

As shown in the main Appendix, each player's best response in an n -player game, $\bar{\alpha}_n$ is implicitly defined by the function:

$$\Psi^n(x = \bar{\alpha}_n) = x - \frac{k}{\tau} + \frac{\delta}{1 - \delta}b + \delta\rho_{-i}(n) \left[\frac{k}{\tau} - \frac{\delta}{1 - \delta}b + r + \int_0^x (\alpha - x) f(\alpha) d\alpha \right] = 0$$

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Define the difference function:

$$\begin{aligned}
\Delta(x) &\equiv \Psi^n(x) - \Psi^{n+1}(x) \\
&= \left\{ x - \frac{k}{\tau} + \frac{\delta}{1-\delta}b + \delta\rho_{-i}(n) \left[\frac{k}{\tau} - \frac{\delta}{1-\delta}b + r + \int_0^x (\alpha - x) f(\alpha) d\alpha \right] \right\} \\
&\quad - \left\{ x - \frac{k}{\tau} + \frac{\delta}{1-\delta}b + \delta\rho_{-i}(n+1) \left[\frac{k}{\tau} - \frac{\delta}{1-\delta}b + r + \int_0^x (\alpha - x) f(\alpha) d\alpha \right] \right\} \\
&= \delta[\rho_{-i}(n) - \rho_{-i}(n+1)] \left[\frac{k}{\tau} - \frac{\delta}{1-\delta}b + r + \int_0^x (\alpha - x) f(\alpha) d\alpha \right]
\end{aligned}$$

If $\rho_{-i}(n) < \rho_{-i}(n+1)$, then $\Delta(x) < 0$ and $\bar{\alpha}_{n+1} < \bar{\alpha}_n$. This would imply that:

$$\rho_{-i}(n+1) = F(\bar{\alpha}_{n+1})^n < F(\bar{\alpha}_n)^n < F(\bar{\alpha}_n)^{n-1} = \rho_{-i}(n)$$

So this leads to a contradiction. ($\Rightarrow \Leftarrow$)

If $\rho_{-i}(n) = \rho_{-i}(n+1)$, then $\Delta(x) = 0$ and $\bar{\alpha}_{n+1} = \bar{\alpha}_n$. This would imply that:

$$\rho_{-i}(n+1) = F(\bar{\alpha}_{n+1})^n = F(\bar{\alpha}_n)^n < F(\bar{\alpha}_n)^{n-1} = \rho_{-i}(n)$$

Once again, we have a contradiction. ($\Rightarrow \Leftarrow$)

So in equilibrium, $\rho_{-i}(n+1) < \rho_{-i}(n)$ and $\Delta(x) > 0$. This means that $\bar{\alpha}_n < \bar{\alpha}_{n+1}$. So each individual player is less likely to file as the number of players increases.

Claim 2: The overall likelihood of enforcement is increasing in diffuseness (the number of players).

Proof of Claim 2:

Define the probability that someone enforces in the n -player game as:

$$\beta(n) = 1 - \rho(n) = 1 - F(\bar{\alpha}_n)^n$$

Define the difference function:

$$\Gamma \equiv \beta(n+1) - \beta(n) = F(\bar{\alpha}_n)^n - F(\bar{\alpha}_{n+1})^{n+1}$$

Note that:

$$\lim_{\delta \rightarrow 0} \Psi^n(x) = x - \frac{k}{\tau} = 0 \quad \text{for all } n \quad \Leftrightarrow \quad \lim_{\delta \rightarrow 0} \bar{\alpha}_n = \lim_{\delta \rightarrow 0} \bar{\alpha}_{n+1} = \frac{k}{\tau}$$

So:

$$\lim_{\delta \rightarrow 0} \Gamma = F\left(\frac{k}{\tau}\right)^n - F\left(\frac{k}{\tau}\right)^{n+1} = F\left(\frac{k}{\tau}\right)^n \left[1 - F\left(\frac{k}{\tau}\right)\right] > 0$$

So for small δ , increasing the number of players increases the overall likelihood of enforcement.

1.2 Institutional Design: Parameters k and b

Let ρ_{-i} denote i 's belief about the probability that no other country will file. Let V_i denote i 's continuation value. Then conditional on reaching t , the expected utility functions for player i are:

$$\begin{aligned} EU_{it}(\text{file}|\alpha_{it}, \tau_i) &= \frac{\delta}{1-\delta} (r+b) \tau_i - k \\ EU_{it}(\text{don't file}|\alpha_{it}, \tau_i) &= -\alpha_{it} \tau_i + (1-\rho_{-i}) \frac{\delta}{1-\delta} r \tau_i + \rho_{-i} \delta V_i \end{aligned}$$

If we assume that each player's trade stake is identical (namely, that $\tau_i = \frac{T}{n}$ for every i), then there exists a symmetric Bayesian Nash equilibrium for an n -player game for small $\delta > 0$ in which every player's cutpoint, $\bar{\alpha}_n$, is implicitly defined by one equation with one endogenous variable:

$$\Psi^n(\bar{\alpha}_n) = \bar{\alpha}_n \left[1 - \delta F(\bar{\alpha}_n)^n\right] - \frac{kn}{T} + \frac{\delta}{1-\delta} b + \delta F(\bar{\alpha}_n)^{n-1} \left(\frac{kn}{T} - \frac{\delta}{1-\delta} b + r + \int_0^{\bar{\alpha}_i} \alpha f(\alpha) d\alpha \right) = 0$$

Claim: The likelihood of both individual and collective enforcement are decreasing in the cost of litigation (k), and increasing in the private benefit (b).

Proof of Claim:

(*Individual behavior*) We want:

$$\frac{\partial \bar{\alpha}_n}{\partial k} = -\frac{\Psi_k^n(\bar{\alpha}_n)}{\Psi_{\bar{\alpha}_n}^n(\bar{\alpha}_n)} \quad \text{and} \quad \frac{\partial \bar{\alpha}_n}{\partial b} = -\frac{\Psi_b^n(\bar{\alpha}_n)}{\Psi_{\bar{\alpha}_n}^n(\bar{\alpha}_n)}$$

As already shown in the proof of Proposition 1:

$$\Psi_{\bar{\alpha}_n}^n = 1 - \delta \rho > 0$$

Also:

$$\begin{aligned} \Psi_k^n(\bar{\alpha}_n) &= -\left[1 - \delta F(\bar{\alpha}_n)^{n-1}\right] \frac{n}{T} < 0 \quad \Rightarrow \quad \frac{\partial \bar{\alpha}_n}{\partial k} > 0 \\ \Psi_b^n(\bar{\alpha}_n) &= \frac{\delta}{1-\delta} \left[1 - \delta F(\bar{\alpha}_n)^{n-1}\right] > 0 \quad \Rightarrow \quad \frac{\partial \bar{\alpha}_n}{\partial b} < 0 \end{aligned}$$

So as the cost of litigation increases, each player is less likely to file. And as the private benefit increases, each player is more likely to file.

(Collective behavior) Define the probability that someone enforces in the n -player game as:

$$\beta(n) = 1 - \rho(n) = 1 - F(\bar{\alpha}_n)^n$$

Then:

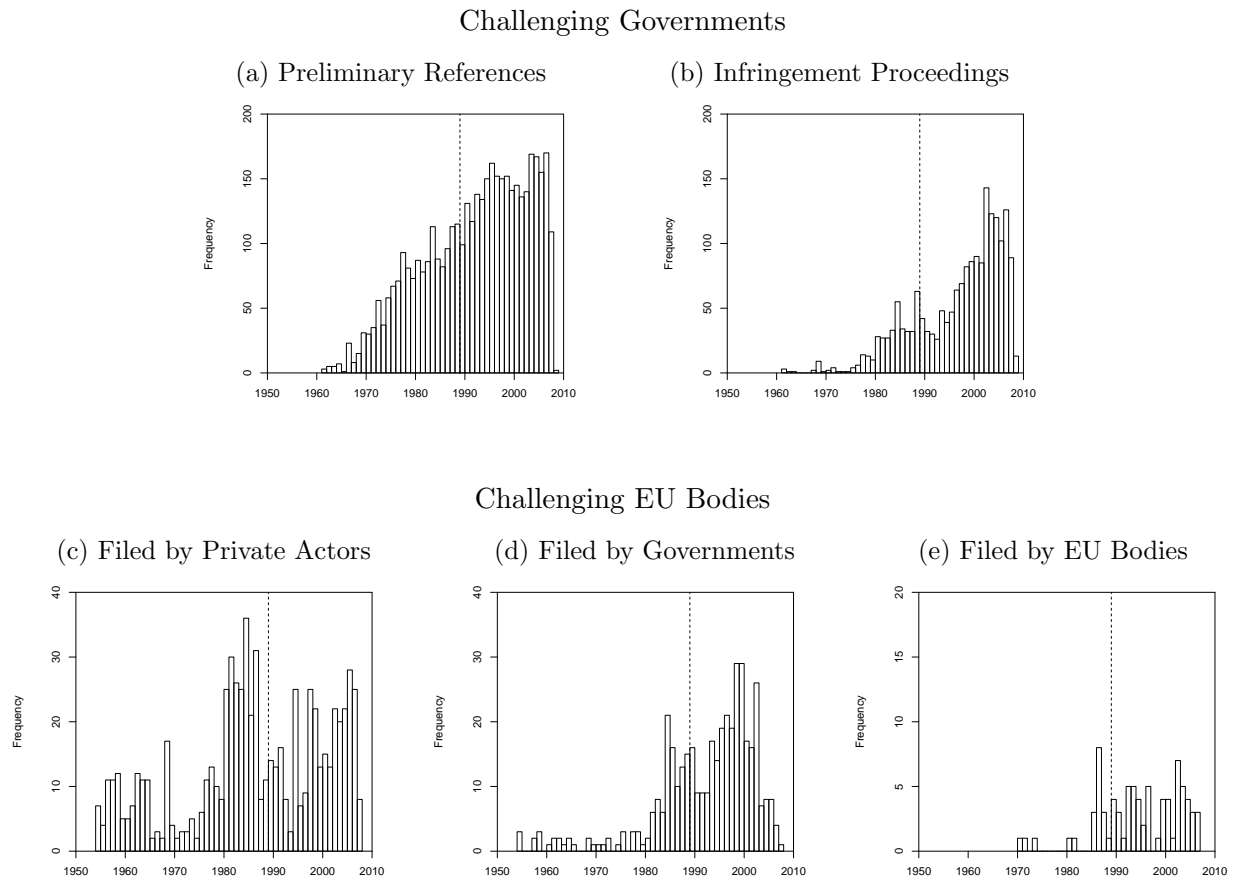
$$\begin{aligned}\frac{\partial \beta(n)}{\partial k} &= -nF(\bar{\alpha}_n)^{n-1} f(\bar{\alpha}_n) \frac{\partial \bar{\alpha}_n}{\partial k} < 0 \\ \frac{\partial \beta(n)}{\partial b} &= -nF(\bar{\alpha}_n)^{n-1} f(\bar{\alpha}_n) \frac{\partial \bar{\alpha}_n}{\partial b} > 0\end{aligned}$$

So as the cost of litigation increases, the overall probability of enforcement decreases. And as the private benefit increases, the overall probability of enforcement increases.

2 Data

Distribution of Cases Over Time

Figure 1: Histograms of Filing Dates



The dotted line denotes the Court reorganization in 1989.

Case Attributes

This table include counts of cases filed in each issue-area at either the Court of First Instances or the European Court of Justice. The table indicates which issue-areas were coded and appear in my dataset under the corresponding variable name. The table also provides reasons why some issue-areas were not coded, and hence do not appear in my dataset.

Table 1: Full List of Two-Digit Case Issue-Areas

Code	Description	n*	Coded?	Variable Name
B-01	Principles and citizenship of the Union	328	No; B	.
B-02	Free movement of goods	980	Yes	movegood
B-03	Agriculture	1,283	Yes	agricult
B-04	Free movement of persons and services	1,285	Yes	moveind
B-05	Free movement of capital and freedom of payments	91	Yes	movecap
B-06	Transport	161	Yes	transport
B-07	Competition	709	Yes	compete
B-08	Dumping	0	No; A	.
B-09	State aid	387	Yes	aid
B-10	Tax provisions	628	Yes	tax
B-11	Approximation of laws and uniform laws	517	Yes	approx
B-12	Conjunctural policy and balance of payments	18	Yes	conjbo
B-13	Economic and monetary policy	4	No; A	.
B-14	Commercial policy	193	Yes	commerce
B-15	Social policy	386	Yes	social
B-16	European Investment Bank	4	No; A	.
B-17	Association of Overseas Countries and Territories	33	Yes	overseas
B-18	Institutions and bodies of the Community	213	No; B	.
B-19	Legal proceedings	4,618	No; B	.
B-20	Acts of the institutions	974	No; B	.
B-21	Environment	248	Yes	environ
B-22	Financial provisions	270	Yes	finance
B-23	Accession of new Member States	96	Yes	access
B-24	Protective measures	8	No; A	.
B-25	International agreements	250	Yes	treaty
B-26	Implied powers	0	No; A	.
B-27	Amendment of the Treaty	1	No; A	.
B-28	General and final provisions	88	No; B	.
B-29	Trans-European networks	2	No; A	.
B-30	Development cooperation	4	No; A	.
B-31	Culture	4	No; A	.
B-32	Industry	2	No; A	.
B-33	Community trade mark	614	Yes	trademark
B-34	Employment	0	No; A	.
B-35	Public health	6	No; A	.
B-36	Consumer protection	0	No; A	.
B-37	Research and technological development	0	No; A	.
B-38	Community designs	1	No; A	.

* Includes judgments from both the European Court of Justice and the Court of First Instance

A = Fewer than 10 cases

B = No clear meaning or relevance

- B-01: no clear meaning

- B-18: coding of institutions (not substantive law)

- B-19 and B-20: coding of procedures (not substantive law)

- B-28: Most cases are about the privileges and immunities of the EEC (not substantive law)

Robustness: Challenging Governments

I re-ran the analysis in Table 3, using only those cases that had the government as a litigant in domestic proceedings. I exclude all cases that began as disputes solely between private actors. I get the following results:

Table 2: Challenging Governments–Restricted Preliminary References

Issue Area	Type of Plaintiff		Difference in Means p-value	Primary Enforcer
	Private actor*	Commission		
access	0.97	0.54	0.07	Private actor
agricult	21.46	4.19	0	Private actor
aid	1.80	1.83	0.94	.
approx	6.13	5.38	0.26	.
commerce	1.36	0	0	Private actor
compete	2.18	0.54	0	Private actor
conjbo	0.27	0.11	0.18	.
environ	2.15	7.53	0	Commission
finance	2.06	1.72	0.38	.
judgconv	0.35	0	0	Private actor
movecap	1.77	0.91	0.01	Private actor
movegood	19.51	8.71	0	Private actor
moveind	24.29	12.80	0	Private actor
overseas	0.32	0	0	Private actor
social	4.13	2.11	0	Private actor
tax	13.59	6.99	0	Private actor
trademark	0	0	.	.
transport	2.12	1.72	0.30	.
treaty	3.30	1.56	0	Private actor

Note: The table shows the percentage of judgments for cases filed by the given plaintiff-type that fall within each issue-area.

* Only includes preliminary references in which the government was a litigant at the domestic level.

Table 3: Challenging Governments—Percentage of Cases by Issue-Area: Variation Across Time

(a) Early Period (1954–1988)

Issue Area	Type of Plaintiff		Difference in Means p-value	Type of Benefit
	Private actor	EU body		
access	1.25	2.35	0.21	.
agricult	29.33	11.73	0	private
aid	1.39	4.11	0.02	public
approx	2.43	2.64	0.83	.
commerce	1.66	0	0	private
compete	4.92	0.59	0	private
conjbop	0.69	0.59	0.82	.
environ	0	2.64	0	public
finance	1.46	1.76	0.70	.
judgconv	4.02	0	0	private
movecap	0.35	0	0.03	private
movegood	27.32	21.70	0.03	private
moveind	22.82	8.21	0	private
overseas	0.14	0	0.16	.
social	3.40	3.52	0.91	.
tax	7.14	13.20	0	public
trademark	0	0	.	.
transport	1.73	1.47	0.72	.
treaty	2.29	0.88	0.03	private

(b) Late Period (1989–2009)

Issue Area	Type of Plaintiff		Difference in Means p-value	Type of Benefit
	Private actor	EU body		
access	0.88	0.13	0	private
agricult	13.16	2.50	0	private
aid	1.87	1.32	0.15	.
approx	11.04	5.99	0	private
commerce	0.99	0	0	private
compete	3.67	0.53	0	private
conjbop	0	0	.	.
environ	2.72	8.62	0	public
finance	1.76	1.71	0.9	.
judgconv	2.82	0	0	private
movecap	2.12	1.12	0.01	private
movegood	13.37	5.79	0	private
moveind	23.11	13.82	0	private
overseas	0.32	0	0	private
social	8.65	1.78	0	private
tax	13.09	5.60	0	private
trademark	0.14	0	0.05	private
transport	2.08	1.78	0.48	.
treaty	3.21	1.71	0	private

Note: The table shows the percentage of cases filed by the given plaintiff-type that fall within each issue-area.

Robustness: Challenging EU Bodies

If I examine only those annulment actions that were filed against the Council, I get the following results:

Table 4: Challenging the Council–Percentage of Cases by Issue-Area

Issue Area	Type of Plaintiff		Difference in Means p-value	Type of Benefit
	Government	EU body		
access	18.18	4.23	0.01	private
agricult	32.47	7.04	0	private
aid	0	4.23	0.08	.
approx	9.09	8.45	0.89	.
commerce	15.58	8.45	0.18	.
compete	1.30	0	0.32	.
conjbop	0	0	.	.
environ	1.30	9.86	0.03	public
finance	2.60	7.04	0.21	.
judgconv	0	0	.	.
movecap	0	0	.	.
movegood	1.30	5.63	0.16	.
moveind	5.19	5.63	0.91	.
overseas	3.90	0	0.08	.
social	3.90	1.41	0.35	.
tax	0	4.23	0.08	.
trademark	0	0	.	.
transport	2.60	8.45	0.13	.
treaty	7.79	12.68	0.33	.

Note: The tables show the percentage of cases filed by the given plaintiff-type that fall within each issue-area.

Table 5: Challenging EU Bodies—Percentage of Cases by Issue-Area: Variation Across Time

(a) Early Period (1954–1988)

Issue Area	Type of Plaintiff		Difference in Means p-value	Type of Benefit
	Government	EU body		
access	5.13	0	0.01	private
agricult	52.14	10.53	0	private
aid	11.11	0	0	private
approx	0	0	.	.
commerce	1.71	21.05	0.06	.
compete	3.42	0	0.05	private
conjbop	1.71	0	0.16	.
environ	0	0	.	.
finance	2.56	21.05	0.07	.
judgconv	0	0	.	.
movecap	0	0	.	.
movegood	3.42	21.05	0.09	.
moveind	0	0	.	.
overseas	0	0	.	.
social	3.42	5.26	0.74	.
tax	0	0	.	.
trademark	0	0	.	.
transport	0.85	10.53	0.20	.
treaty	1.71	5.26	0.52	.

(b) Late Period (1989–2009)

Issue Area	Type of Plaintiff		Difference in Means p-value	Type of Benefit
	Government	EU body		
access	4.44	4.84	0.89	.
agricult	42.66	6.45	0	private
aid	20.82	4.84	0	private
approx	5.46	11.29	0.18	.
commerce	4.10	3.23	0.73	.
compete	1.71	0	0.03	private
conjbop	0	0	.	.
environ	1.02	11.29	0.01	public
finance	2.39	9.68	0.07	.
judgconv	0	0	.	.
movecap	0.34	0	0.32	.
movegood	1.37	0	0.05	private
moveind	2.39	6.45	0.22	.
overseas	2.39	0	0.01	private
social	0.68	0	0.16	.
tax	0.34	4.84	0.11	.
trademark	0	0	.	.
transport	1.71	6.45	0.15	.
treaty	2.39	12.90	0.02	public

Note: The table shows the percentage of cases filed by the given plaintiff-type that fall within each issue-area.