Methodological Appendix

Contents

The Actors and Events of Brazilian Environmental Foreign Policy Database

The *Actors and Events of Brazilian Environmental Foreign Policy database* (Maitino 2025) compiles the individual participants in Brazilian delegations to multilateral environmental conferences related to the UN system from 1970 to 2018.

The process of building the database can be summarized in three stages. First, guided by the United Nations Information Portal on Multilateral Environmental Agreements (InformMEA) and supplementary literature (e.g. Johnson 2012; Chasek, Downie, and Brown 2017; Ivanova 2021), we compiled a list of the main multilateral environmental agreements as the events of interest for the research[1]. Multilateral events of all main issue areas in environmental governance were included in the database, although access to participant lists varied across issues, which may result in some bias in the analysis. Then, we proceeded to collect official documents containing participant lists, processing, and classifying the data obtained in these sources. In this process, 549 events were identified, and the list of participants successfully obtained for 303 events, in a total of 4806 persons and 7766 participations in delegations. For each event, information on date and place of the meeting were collected; for each name, the organization to Ih It was associated and Its position at the moment of participation, when such information was available. To enable proper network analysis, organization and individuals' names were treated to avoid errors due to spelling variation—individuals' names, in particular, were standardized through the use of clustering and supervised data cleaning algorithms provided by Google Refine.

This database was then used to generate a projected network of organizations that participate in the community. The network uses the organizations to which individual participants belong (e.g., governmental departments, subnational entities, NGOs, business groups) as nodes and their co-participation in the same international events as edges. From this network, we compute the betweenness centrality for the ministries of Foreign Affairs and Environment.

Ministries centrality and influence

As described in the main document, we use the *Actors and Events of Brazilian Environmental Foreign Poicy* database to compute centrality scores for the Ministry of Foreign Affairs and for the Ministry of Environment. As we are interested in the agencies' capacities for coordinating the policy community, we selected the ministries' betweenness centrality (in the network of organizations) as our measure of interest.

Betweenness is given by $B_k = \sum g_{i,k,j}/g_{i,j}$, where $g_{i,k,j}$ means the number of shortest paths linking *i* and *j* passing through *k* and $g_{i,j}$ the total number of shortest paths linking *i* and *j.* In our

1 Once relevant conventions and conferences were identified, we added negotiation meetings prior to treaty signing, plenipotentiary meetings, and meetings of the convention's main body (COP/MOPs). These were separated in the following issue-areas: biodiversity, endangered species, climate, desertification, financing, forests, environmental governance, UN sustainable development, chemicals and hazardous waste, ozone, oceans.

case, shortest paths also consider edge weight, which measures the strength of the connection between the organizations (the number of events in which they co-participate).

Betwenness centrality was calculated and normalized through R package *igraph* (Csardi and Nepusz 2006). To compute normalized betweenness B^n, *igraph* uses $B^n = \frac{2B}{(n-1)(n-2)}$, where *B* represents raw betweenness and *n* is the number of vertices in the graph. As *igraph* considers edge weights as costs and, in our case, weight represents strength of the connection, we used inverse weights for the calculation.

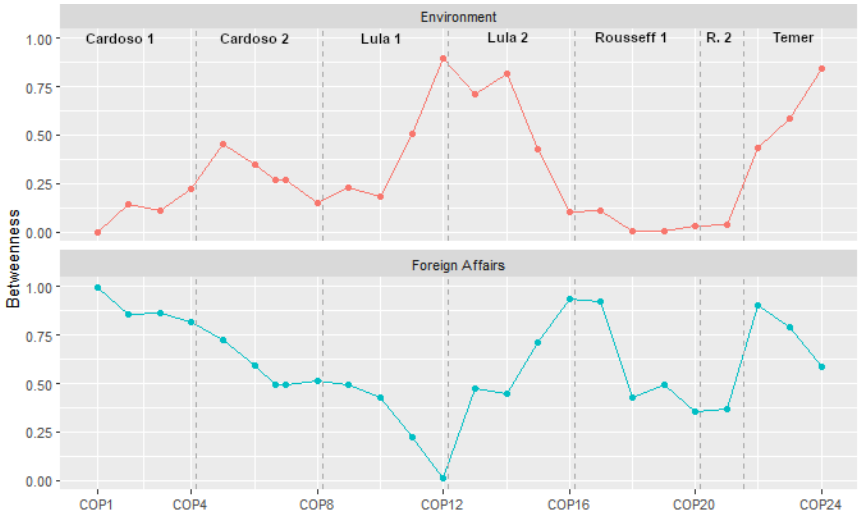
As we aim to uncover the relational capacities of the ministries, when generating the networks of organizations we assume interactions in events last over time. This is also important as multilateral environmental events have different periodicity (e.g., climate COPs occur every year; CBD MOPs every two years) and this can make centrality scores computed for annual networks too erratic, even if the underlying patterns in which we are interested remain stable. Exactly how long these interactions should last, however, is up for debate.

In the main document, we reported betweenness centrality scores based on a 4-year moving window, as this corresponds to the duration of a presidential term in Brazil. This allows us to compute annual betweenness centrality scores while maintaining some stability in our measure. As robustness checks, we present betweenness scores for both shorter and longer thresholds in the moving window, as well as the results for when we compute betweenness separately for each presidential term.

Alternative thresholds for the moving window

Figure 1 below, presented in the main document, shows actors' betweenness centrality in a network based on a 4-year moving window. This means that, for year T, the network encompasses all events between T-3 and T (both included). As discussed in the main document, in the last half of Lula's first administration, we see a sharp rise in MoE centrality and a decline in MFA centrality. In Lula's second administration, this trend is inverted, and the ministries change place.

Figure 1. Betweenness centrality in 4-year moving window



Figures 2 and 3 below show betweenness centrality for 5- and 3-year moving windows, respectively. As one can see, the timing and direction of changes coincide with those seen in the 4-year moving window.

Figure 2. Betweenness centrality in 5-year moving window

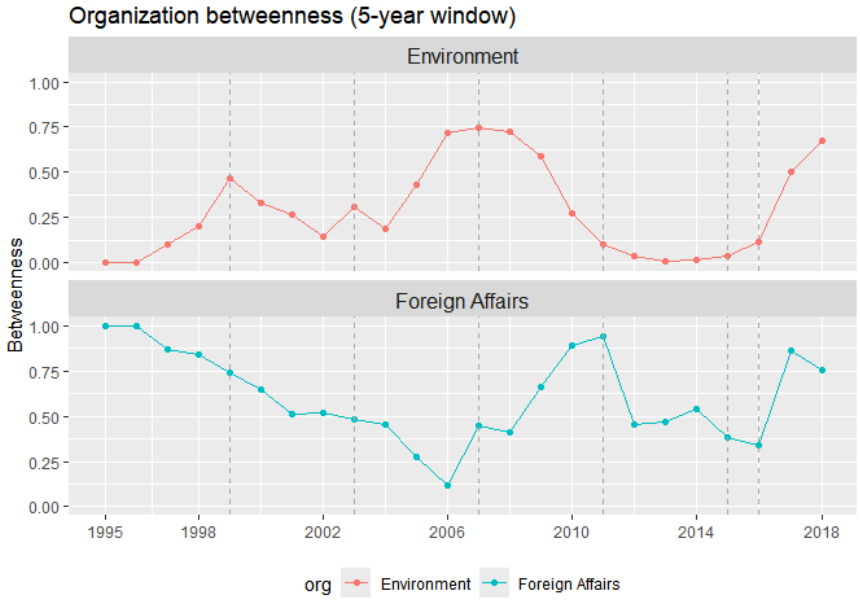
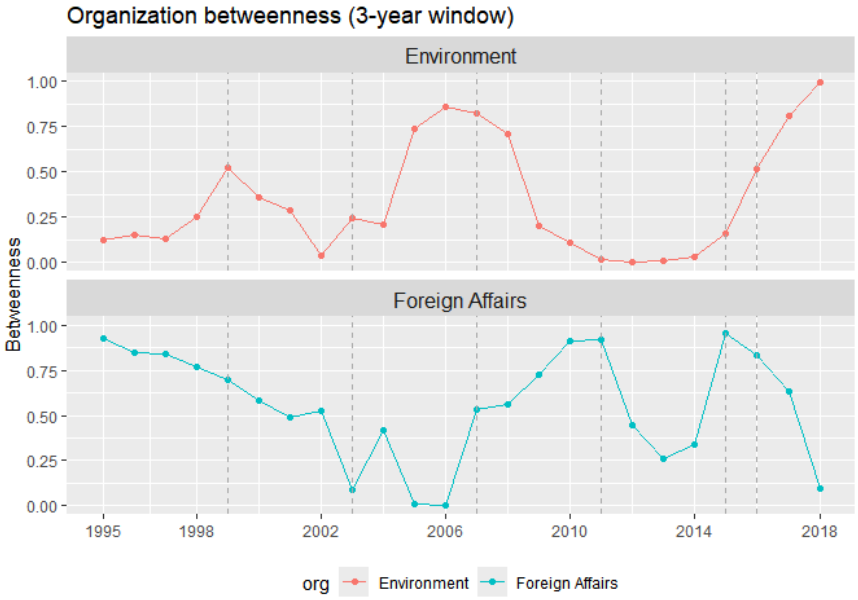


Figure 3. Betweenness centrality in 3-year moving window



Term-wise data on agency centrality

Table 1 presents actors' betweenness centrality for different periods, providing a measure for ministries influence in each presidential administration.

Table 1. Betweenness centrality for selected ministries, per presidential administration

	Cardoso 1	**Cardoso 2**	**Lula 1**	**Lula 2**	**Rousseff 1**	**Rousseff/Temer**
	1995-1998	1999-2002	2003-2006	2007-2010	2011-2014	2015-2018
Foreign Affairs	0.82	0.51	0.01	0.10	0.36	0.59
Environment	0.22	0.15	0.9	0.94	0.03	0.84
Average centrality	*0.05*	*0.02*	*0.01*	*0.01*	*0.00*	*0.01*

Results are in line with those obtained in the moving-windows calculations. As we can see, organization centrality varies significantly across presidential administrations. We can clearly see how, in the 1990s, during the Cardoso presidency, the Ministry of Environment had little leverage over international environmental policy. The Ministry of Foreign Affairs, on the other hand, was highly central, dominating the network—especially in the first term. Lula's

administrations saw a massive change in this regard: Environment became, by far, the most central organization, and we see a very concentrated network, as Foreign Affairs loses relevance. The Ministry of Foreign Affairs grows in influence during Rousseff's presidency and Environment becames largely irrelevant. This irrelevancy is short-lived, however, as the Environment ministry reclaims its space after the 2016 impeachment and Michel Temer assumes the presidency.

Positions at the UNFCCC

To measure the timing and direction of changes in actors' positions at the UNFCCC, we use Castro's (2017) *Relational Data Between Parties to the UNFCCC*, which covers negotiations from 1995 to 2013. This database compiled countries' negotiation interactions from detailed descriptions of negotiations published in the *Earth Negotiation Bulletin* reports, identifiying various types of interaction between country dyads and classifying them. We use the database's most straightforward classification scheme, a binary variable (*cooperation*) that assigns interactions as cooperative or conflictive.

From this data, we compute, for each year, an average score of cooperation between Brazil and the country groupings of interest—for the results presented in the main document, we selected the European Union, G-77+China, and AOSIS (here, we also report variations with different groupings as robustness checks). The cooperation index for year *t* and group *G* can be computed by:

$$Index_{G,t} = \frac{\sum_{i}^{G}(Coop_{i,t} - Conf_{i,t})}{Int_t},$$

where *i* is any country that pertains to group *G*, *Coop* is the sum of cooperative interactions between that country and Brazil in year *t*, *Conf* is the sum of conflictive interactions between that country and Brazil, and *Int* is the total number of interactions Brazil during year *t*.

After computing cooperation indices for the various groupings, we proceed to aggregate them via Principal Component Analysis (PCA). We favor the PCA over the separate indices to minimize the fact that, as we use data on dyadical interactions, variation might be more reflective of changes in the other countries' positions than in Brazil's. Still, we include the data on cooperation with the EU, AOSIS, and G-77 as robustness checks below. Following standard procedures for PCA, we standardize the data (using R's *scale()* function) before extracting principal components (using R *stats princomp()* function). We then analyze the most relevant dimensions, the proportion of explained variance, and the contribution of each variable to the dimension.

For the PCA index reported in the main document, we then proceeded to aggregate the main components by multiplying each for its proportion of explained variance and summing them, as described below.

PCA Diagnostics for the aggregation of Brazil's cooperation indices with EU, AOSIS, and G77+China

To assess the structure of the underlying dimensions captured by the PCA, we present here key diagnostic results. Table 3 reports the standard deviation and the proportion of explained variance for each principal component, allowing an evaluation of the relative contribution of each component to the total variance in the data.

Table 3. Summary information – PCA for EU, AOSIS, and G77+China

	Standard deviation	Proportion of variance	Cumulative proportion
Component 1	1.38	0.67	0.67

Component 2	0.78	0.21	0.88
Component 3	0.58	0.12	1.00

Figure 4 provides a biplot of the first two principal components, which together capture 88% of the variance. The arrows represent the variable loadings and the circles the distribution of observations. Analyzing the biplot, we can note how, in line with our theoretical framework, conflict is mostly explained by the first dimension, which opposes cooperation with the G77 in one direction and cooperation with the EU and AOSIS in the opposite direction.

Figure 4. Biplot – PCA for EU, AOSIS, and G77+China

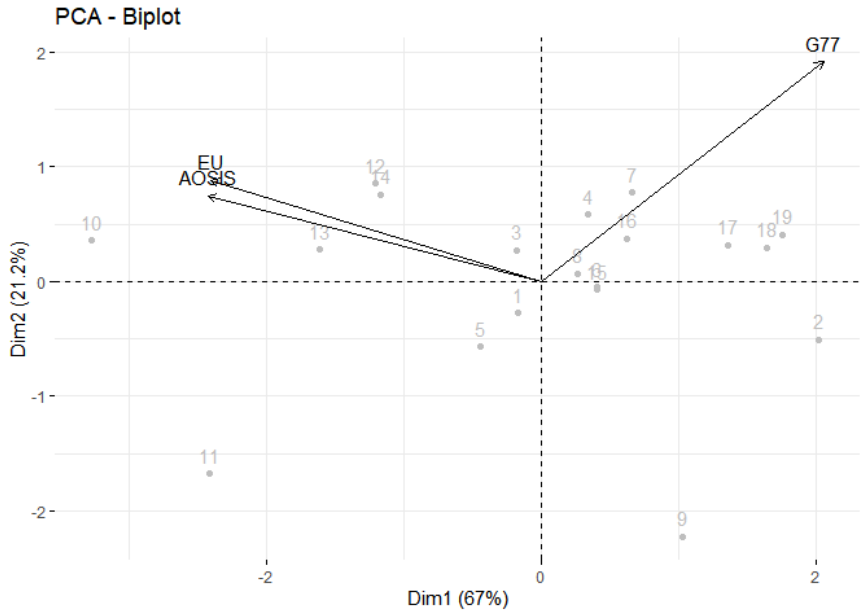
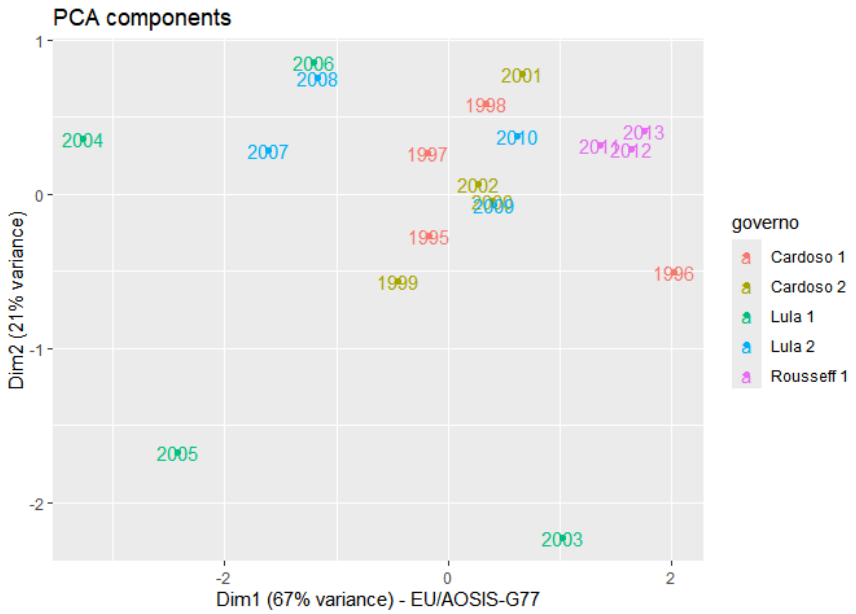


Figure 5 plots the observations along the two main dimensions, identifying the year and presidential term associated with each point.

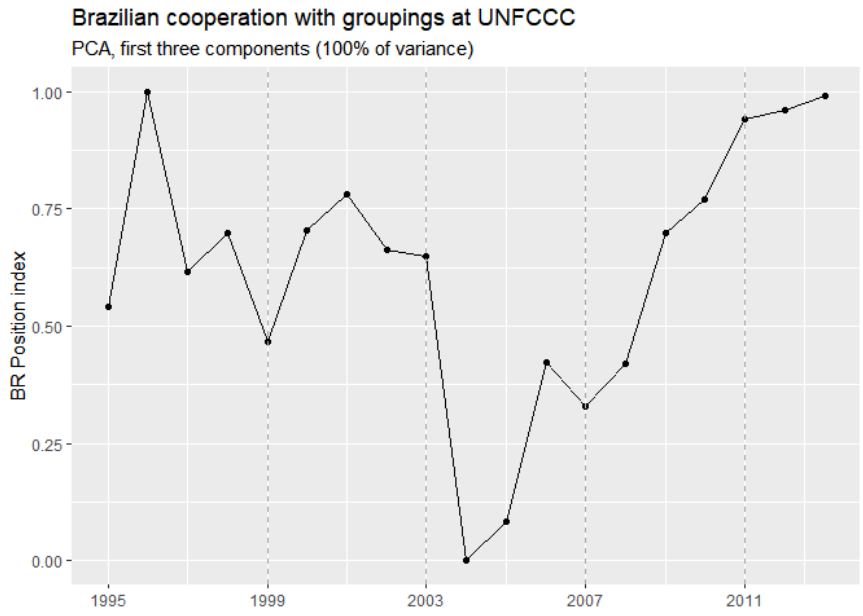
Figure 5. Observations in two-dimensional space – PCA for EU, AOSIS, and G77+China



We can see how, in line with our analysis in the main document, the first Lula administration is the period with most within-term variation, with Brazilian position initially approaching those of AOSIS and EU countries.

For the final index, presented in the main document, we aggregated the three relevant components using the following formula: $FinalIndex_{year} = 0.67 * Comp.1_{year} + 0.21 * Comp.2_{year} + 0.12 * Comp.3_{year}$. Figure 6 presents the index's evolution over time.

Figure 6. Final cooperation index – PCA for EU, AOSIS, and G77+China



Alternative specifications for the PCA

To assess the robustness of the main PCA-based index, which aggregates Brazil's cooperation levels with the EU, AOSIS, and the G77, we present a series of alternative specifications. These variations incorporate additional cooperation patterns—such as alignment with BASIC countries and other country groupings—to test whether the underlying structure of the index holds under different group selections. Exploring alternative specifications is important for two reasons. First, it allows us to evaluate whether our results are driven by broader shifts in other countries' positions rather than by Brazil's strategic orientation. Second, it helps determine whether the observed variation reflects the intended dimension of cooperation or is instead sensitive to specific group choices. By expanding the set of included variables, we try to show that the patterns captured by the PCA are not artifacts of an arbitrary selection of partners.

Including BASIC countries in the PCA

Our first alternative specification adds the cooperation scores for Brazil and other countries from the BASIC (Brazil, South Africa, India, and China) grouping, assessing whether this changes our results. BASIC was only created as a formal negotiation grouping in 2009, arguing for the continuity of the Kyoto Protocol and opposing clear differentiation of responsibilities within developing countries (Blaxekjær e Nielsen 2015)—positions that bring it closer to our notion of the *geopolitical gains* framing. While BASIC countries do coordinate positions, the actual degree to which they remain together in negotiations is highly variable. Still, Brazil shares important

structural characteristics with the other BASIC countries—such as high GDP, large populations, and intermediate levels of development—that are known to shape national preferences in climate negotiations. In this sense, including BASIC cooperation allows us to test whether the original index is sensitive to the exclusion of a group with which Brazil is more structurally aligned. It also helps ensure that our results are not driven solely by patterns of convergence or divergence with countries that differ markedly from Brazil in terms of capabilities and interests.

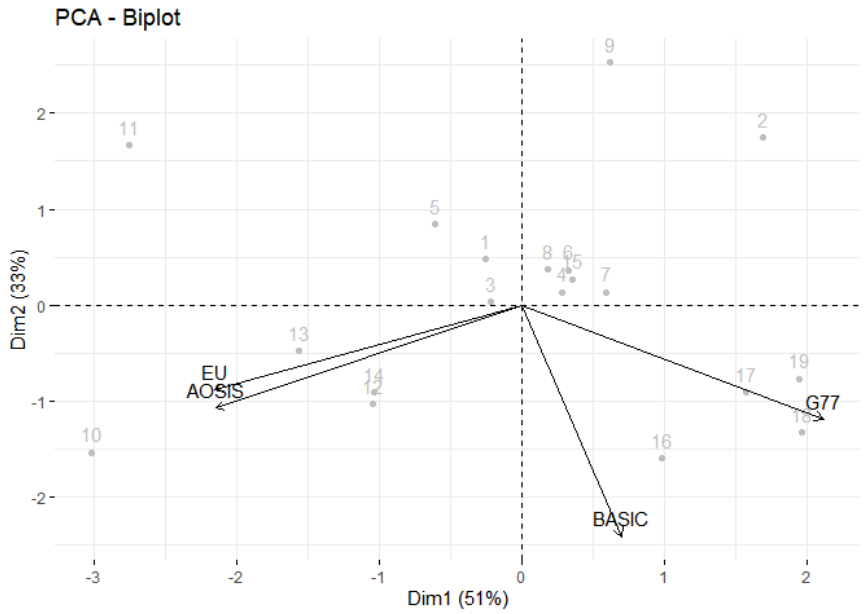
To assess the structure of the underlying dimensions captured by the PCA, we present here key diagnostic results. Table 4 reports the standard deviation and the proportion of explained variance for each principal component, allowing an evaluation of the relative contribution of each component to the total variance in the data. Results are rounded for presentation.

Table 4. Summary information – PCA for EU, AOSIS, G77+China, and BASIC

	Standard deviation	Proportion of variance	Cumulative proportion
Component 1	1.39	0.51	0.51
Component 2	1.12	0.33	0.84
Component 3	0.6	0.09	0.93
Component 4	0.5	0.06	1.00

Figure 7 shows the biplot for this PCA specification. In the biplot, we can see that the first dimension is mainly driven by convergence with AOSIS-EU/G77, while the second dimension is mostly related to convergence with BASIC.

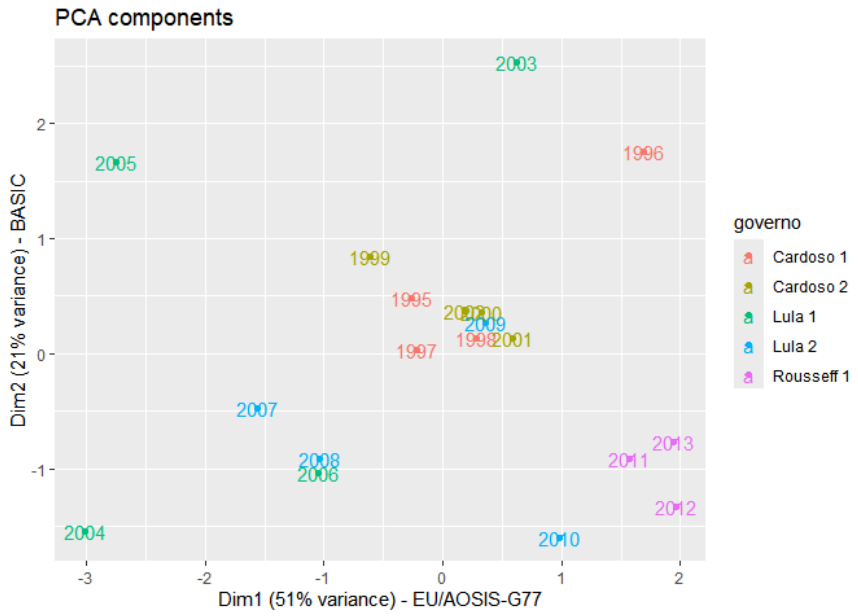
Figure 7. Biplot – PCA for EU, AOSIS, G77+China, and BASIC



In the paper, we advanced the notion that cooperation with AOSIS, EU and the G77 serves as a proxy for a specific line of conflict in the negotiations—the disputes around responsibility and the CBDR principle. While cooperation with BASIC countries is partly related to this dimension (going in the same direction as agreement with G77 countries), it seems to primarily answer to a different logic from cooperation with AOSIS-EU/G77.

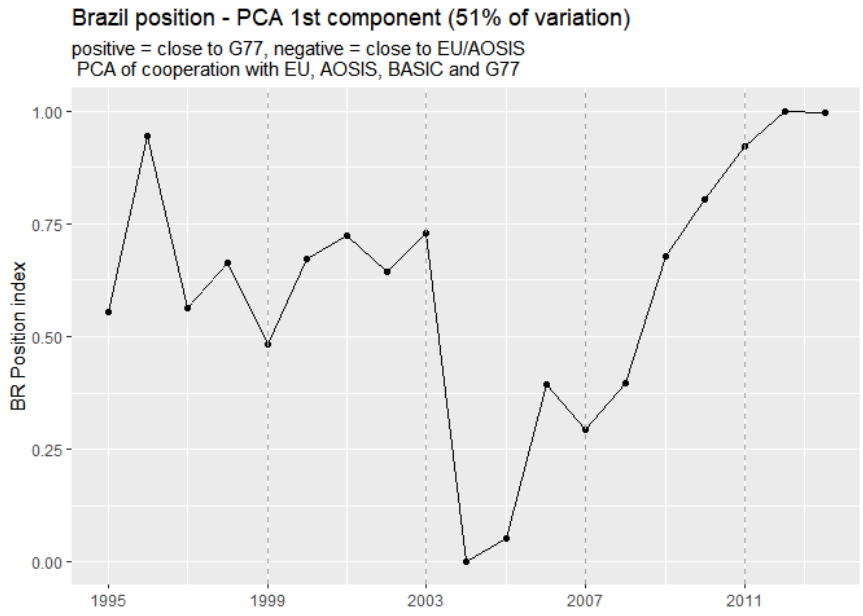
Figure 8 plots the observations along the two main dimensions, identifying the year and presidential term associated with each point. We note how the first Lula administration is still the period with most within-term variation, as we see a significant movement in the first dimension, initially approaching the EU/AOSIS pole and, afterwards, moving in the opposite direction.

Figure 8. Observations in two-dimensional space — PCA for EU, AOSIS, G77+China, and BASIC



If we plot the first dimension over time, we can see it closely resembles our results for the PCA index presented in the main document. This is presented in Figure 9 below. This shows that timing and direction of changes remains roughly the same as in the original specification.

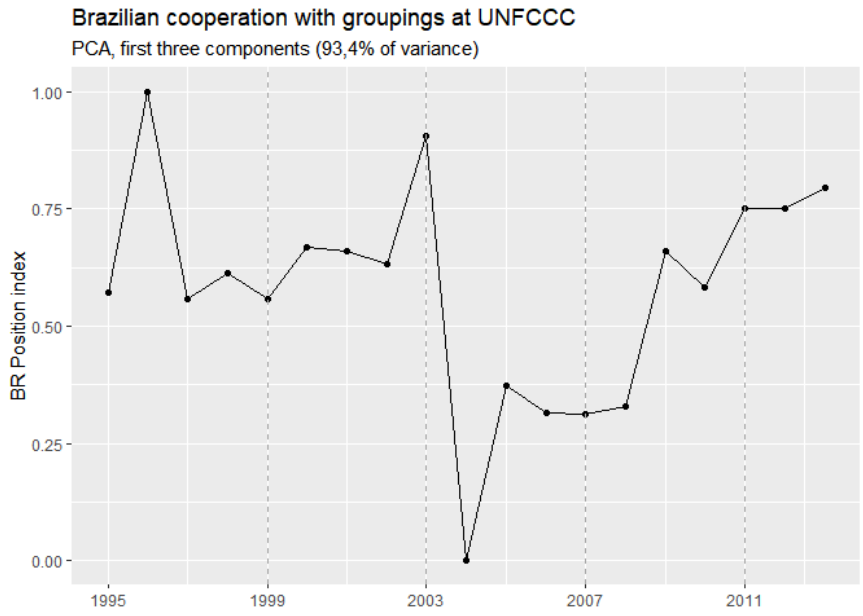
Figure 9. First component over time – PCA for EU, AOSIS, G77+China, and BASIC



If we aggregate the first three components, we also see roughly the same pattern of changes in the Brazilian position. For this, we aggregated the three relevant components using the following formula: $FinalIndex_{year} = \frac{(0.51 * Comp.1_{year} + 0.33 * Comp.2_{year} + 0.09 * Comp.3_{year})}{0.93}$.

Figure 10 presents the index's evolution over time.

Figure 10. Final index over time – PCA for EU, AOSIS, G77+China, and BASIC



Expanding the PCA to include all country groupings

As an additional robustness check, we construct a PCA-based index that incorporates Brazil's cooperation scores with a larger number of country groupings available in Castro's database rather than limiting the analysis to the EU, AOSIS, and G77. This comprehensive specification tests whether the results obtained using a more selective set of partners are robust to the inclusion of a wider range of cooperative relationships. By considering a broaderset of groupings, we reduce the risk that our findings are an artifact of group selection or that they reflect patterns specific to a few coalitions rather than broader trends in Brazil's diplomatic behavior.

Castro's database identifies 27 country groupings operating at the UNFCCC during the 1995-2013 period, but we cannot include them all, as we only have 19 observations, and the number of variables must not exceed this number. Calculations for cooperation scores with Brazil were performed for the 19 most active coalitions in the Castro database (i.e. those who appear most frequently as senders or targets). Thus, we compute a PCA index aggregating Brazilian cooperation with countries from 19 selected country groupings: G77, Umbrella Group, Asian Group, African Group, OPEC (Organization of Petroleum Exporting Countries), Arab Group, CfRN (Coalition for Rainforest Nations), LDCs (Least Developed Countries), AOSIS, LMDC (Like-Minded Developing Countries), EU, ALBA (Bolivarian Alliance of the Americas), BASIC, Southern African Development Community, Central America, SICA (Central American Integration System), Economies in Transition (EITs), EIG (Environmental Integrity Group), and the Caribbean Community (CARICOM).

Table 5 reports the standard deviation and the proportion of explained variance for each component, allowing an evaluation of the relative contribution of each component to the total variance in the data. Results are rounded for presentation.

Table 5. Summary information – PCA for all available groupings

	Standard deviation	Proportion of variance	Cumulative proportion
Component 1	2.96	0.514	0.514
Component 2	1.78	0.185	0.699
Component 3	1.42	0.119	0.818
Component 4	0.99	0.057	0.875
Component 5	0.82	0.039	0.914
Component 6	0.74	0.032	0.946
Component 7	0.54	0.017	0.964
Component 8	0.42	0.010	0.974
Component 9	0.39	0.009	0.983
Component 10	0.34	0.007	0.99
Component 11	0.26	0.004	0.994
Component 12	0.20	0.002	0.996
Component 13	0.16	0.001	0.998
Component 14	0.14	0.001	0.999
Component 15	0.11	0.001	0.999
Component 16	0.05	0.000	0.999
Component 17	0.03	0.000	0.999
Component 18	0.01	0.000	1

Figure 11 shows the biplot for this PCA specification. In the biplot, we can see that it is now the second dimension that is mainly driven by the conflict between those who emphasize developed countries' responsibilities and those who argue for an increase in developing countries commitment. While not as clear as in the other specifications, we can still see that the G77, AOSIS, and the EU correspond to the most 'extreme' values in this dimension. While variance is more explained by the first dimension, it's interpretation is unclear.

Figure 11. Biplot – PCA for most active country groupings

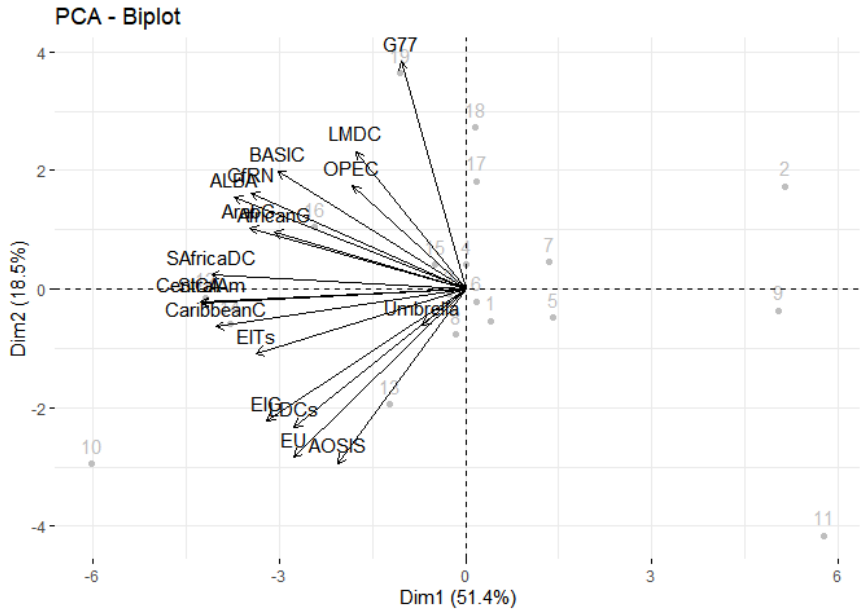
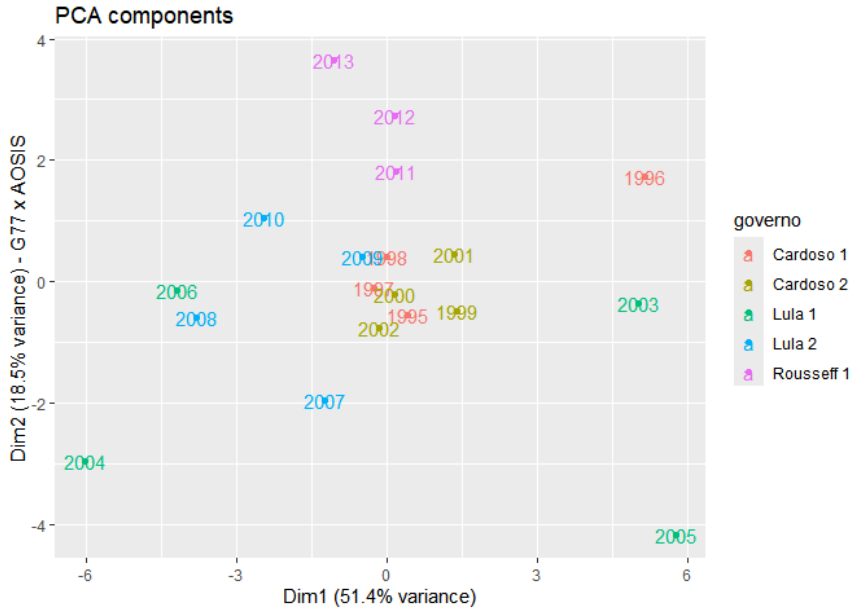


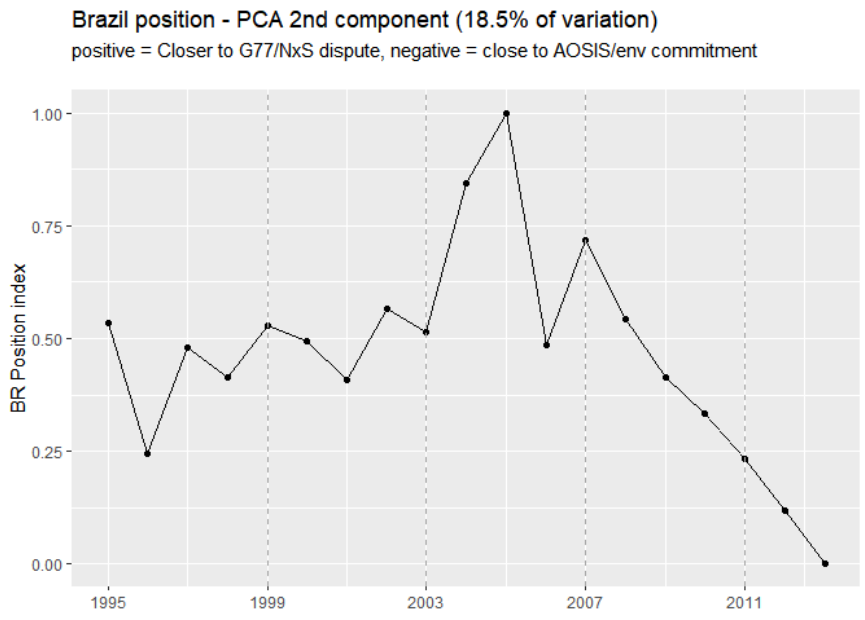
Figure 12 plots the observations along the two main dimensions, identifying the year and presidential term associated with each point. As in other specifications, the first Lula administration remains the period with most within-term variation, with significant movement now in the second, vertical, dimension, initially approaching the EU/AOSIS pole and, afterwards, moving in the opposite direction.

Figure 12. Observations in two-dimensional space – PCA for all country groupings



As we are interested in the variation along an axis that opposes *ecological problem* and *geopolitical gains* framings, we focus on the second dimension of the PCA. Figure 13 shows how this dimension develops over time.

Figure 13. Second component over time – PCA for most active country groupings



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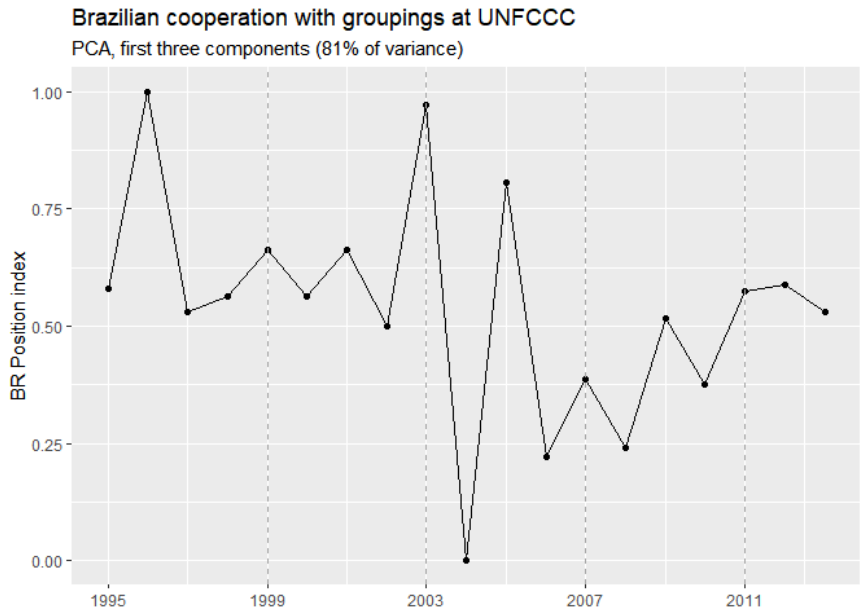
The timing and direction of changes is similar to that observed in the other PCA specifications. The first Lula administration is a moment of change in the Brazilian position, with the first half showing an increase in the *ecological problem* framing and the second half a return to positions associated with *geopolitical gains*. This trend towards this type of position continues in the second Lula administration, as in the other PCA indices. Data for the Rousseff administration, however, seems slightly different—in this specification, the rising trend continues, whereas in previous cases we saw relative stability.

Trends are also relatively similar, although more erratic when we take the first three components into account, as in Figure 14 below. For this, we aggregated the three relevant components using the following formula: $FinalIndex_{year} = \frac{(0.51 * Comp.1_{year} + 0.18 * Comp.2_{year} + 0.12 * Comp.3_{year})}{0.81}$.

Figure 14. First three components over time – PCA for most active country groupings



The persistence of the trends in different PCA specifications suggests that the observed changes are not results of changes in selected partners' positions but, indeed, related to the Brazilian positions at the UNFCCC.

Disaggregated cooperation data

To further assess the robustness of our PCA-based index, we examine the disaggregated cooperation scores with the EU, AOSIS, and G77 individually. This approach allows us to verify whether the patterns captured by the composite index are consistent when each component is considered separately. By analyzing the cooperation trajectories with each group in isolation, we can identify whether the overall trend is driven disproportionately by one particular coalition or reflects a broader and more balanced pattern of alignment. This disaggregated perspective also enhances interpretability, offering additional insight into the specific dimensions of Brazil's engagement with different negotiating blocs.

Figure 15, 16, and 17 below show how Brazilian cooperation with the European Union (red line), the G77 (blue line), and AOSIS (green line) varies over time. Positive scores mean, on average, Brazil tends to agree with statements by grouping members and/or grouping members tend to disagree with Brazilian statements. Values range from -1 (disagreement is manifested for every statement in the negotiation) to +1 (agreement is manifested for every statement).

Figure 15. Brazilian cooperation with G77 at UNFCCC

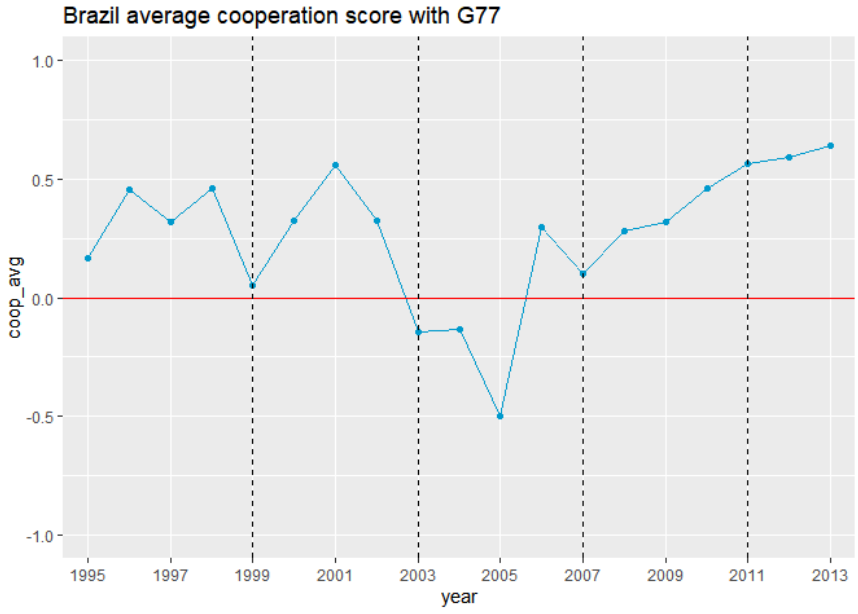


Figure 16. Brazilian cooperation with the EU at UNFCCC

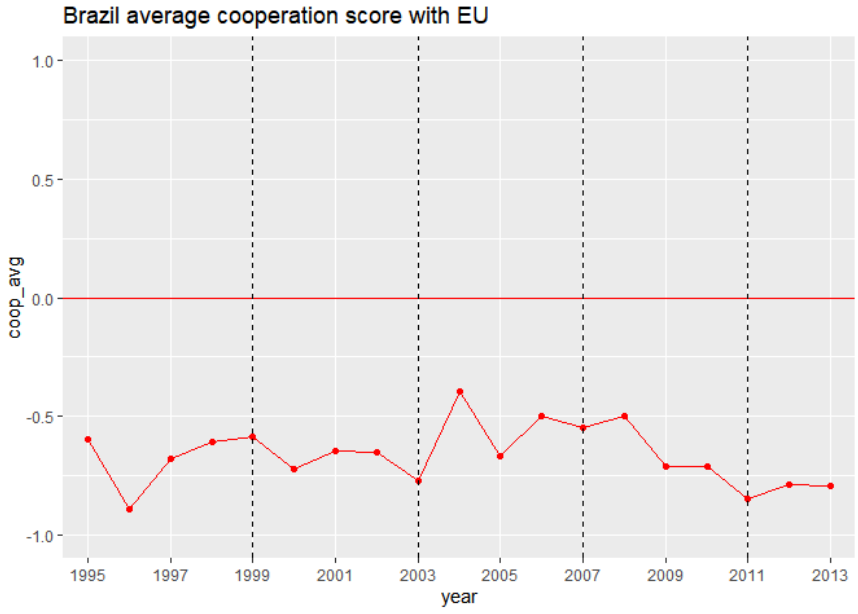
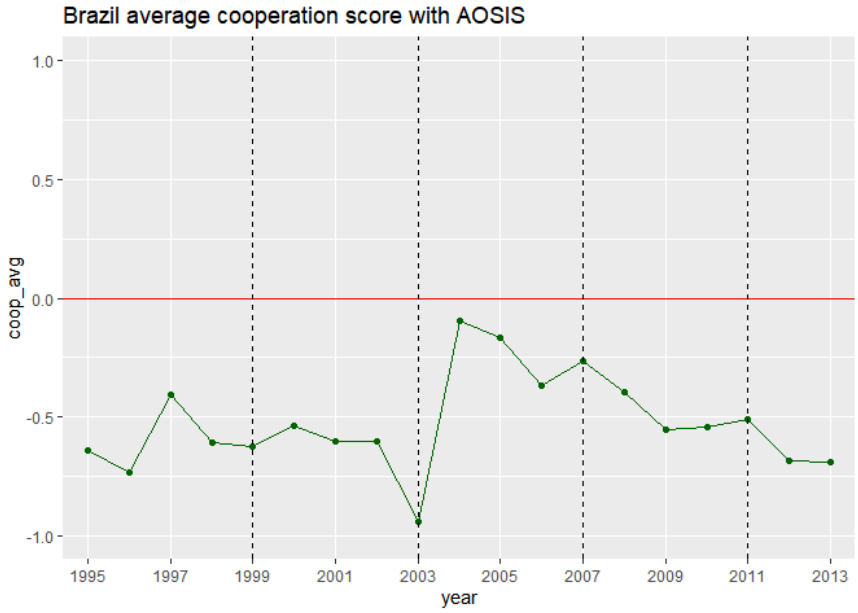


Figure 17. Brazilian cooperation with AOSIS at UNFCCC



The figures show how Brazilian positions are consistently closer to the G77's than to the EU's and the AOSIS's.

Cooperation with the EU shows little variation over time, being relatively stable but for a peak growth in cooperation in 2004. Cooperation with the G77 closely follows the trends seen in the PCA indices. As in the PCA, we see a period of relative disengagement with the G77, in particular during the first half of Lula's first administration, followed by a peak growth in 2006 and stable approximation from 2008 onwards. Cooperation with the AOSIS seems to follow an inverse trajectory: during the first years of Lula's first term, we see a significant rise in cooperation; afterwards, we see slow decline.

Credibility check – Placebo test using other countries' cooperation with EU, AOSIS, and the G77+China

Should discuss the idea of a placebo test here as credibility check: we do not have data or design to allow causal identification. Positions are confounded by overall negotiation dynamics (agenda, changes in other countries positions, etc). We should expect other countries' positions to be affected by this as well.

If the pattern we saw of association between the Brazilian position and agency centrality was primarily driven by these confounding variables, we should see similar patterns emerging in other countries' cooperation indices with the G77, AOSIS, and the EU.

Thus, we compute the cooperation indices for XXXXX. (Why these countries? Would we have different results with other countries? Check Argentina and India as well)

You **can't claim causality**, but you **can show patterns** that appear *systematic* rather than *random*.

A **placebo test** (e.g., testing whether Brazil's internal capacities "predict" the positions of other countries) helps you **rule out some alternative explanations**—namely, that your result reflects **general negotiation trends**, rather than something specific about Brazil's domestic structure.

In short, the placebo test **strengthens the plausibility** that there is a meaningful empirical relationship, even if you can't identify it causally.

"To assess whether the observed association between ministerial capacity and Brazilian positions might simply reflect broader negotiation dynamics, I conduct a placebo test using the positions of other countries as an outcome. Since Brazilian domestic institutions should not shape the negotiation stances of unrelated countries, a lack of association here provides modest support that the pattern observed in Brazil is not purely driven by global trends or agenda cycles."

(note how trend is not the same as we see in Brazil. Probably not driven by broader negotiation dynamics)