

Supplementary Materials

S1. Corpus Retrieval and Screening Protocol

The policy corpus was retrieved from PKULaw and official government websites, with retrieval completed in June 2024. For PKULaw, central-level retrieval covered departmental rules and industry regulations, while local-level retrieval covered local normative documents, local working documents, and industry regulations. The retrieval strategy used 114 search expressions covering urban public safety governance and specific safety domains. The 2004–2023 analytical corpus covers all 31 provincial-level administrative units. English translations of the complete search expressions are provided in Table S1.

Table S1. English Translations of the Search Expressions Used for Corpus Retrieval.

No.	Search expression	No.	Search expression	No.	Search expression
1	Territorial spatial security	39	Safety + major hazards	77	Subdistricts + safety
2	Safety planning	40	Gas appliances	78	Safety + Internet + regulatory oversight
3	Safety access requirements	41	Fire + safety	79	Safety + Internet + law enforcement
4	Disaster prevention and mitigation	42	Automatic fire alarm systems	80	Safety + regulatory and law-enforcement effectiveness
5	Chemical industry projects	43	Fire protection facilities	81	Safety + retrospective accountability review
6	Safety risks	44	Fire protection design	82	Emergency rescue forces
7	Hazard sources	45	Amusement rides and facilities + safety	83	Fire and rescue forces
8	Municipal fire hydrants	46	Long-distance coaches + safety	84	Urban emergencies
9	Firefighting water cranes	47	Tour coaches + safety	85	Emergency rescue support capacity
10	Aging water supply networks	48	Dangerous goods	86	Emergency preparedness capacity
11	Aging district heating networks	49	Collision prevention + safety	87	Emergency supply reserves
12	Aging gas pipeline networks	50	Intelligent video surveillance and alarm systems	88	Participation of societal actors in rescue
13	Urban roads	51	Rail transit + safety	89	Safety science and technology
14	Bridges, culverts, and tunnels	52	Operation + safety assessment	90	Safety technology
15	Traffic safety	53	Fire safety assessment	91	Safety products
16	Deteriorated and unsafe highways	54	Urban vessels + safety	92	Safety assurance capacity
17	Bridge and tunnel rehabilitation	55	Densely populated areas	93	Grid-based social safety governance
18	Safety facilities	56	Railway level crossings + safety	94	High-risk industries
19	Transportation infrastructure	57	Aging buildings + safety	95	Safety culture
20	Flood control and drainage	58	Building rooftops	96	Safety outreach and education
21	Urban flood-control levees	59	Exterior-wall attachments	97	Emergency evacuation drills
22	Urban rivers	60	Structural safety	98	Public-service safety campaigns
23	Flood-control projects	61	Safety + accident hazards	99	Safety and emergency education
24	Flood conveyance and drainage	62	Weather-related flooding	100	Safety awareness
25	Urban utility networks	63	Reservoir dams + safety	101	Satisfaction with safety
26	Drainage capacity	64	Urban waterlogging-prone locations	102	Sense of gain in safety

No.	Search expression	No.	Search expression	No.	Search expression
27	Gas explosions	65	Waterlogging mitigation upgrades	103	Safety knowledge
28	High passenger volumes	66	Disaster governance	104	Safety-related accidents
29	Urban waterlogging	67	Earthquakes + safety	105	Safety conditions
30	High-risk construction projects	68	Seismic resistance + safety	106	Safety-related accident mortality rate
31	Building construction	69	Geological fault detection	107	Traffic accidents
32	Pipeline facilities	70	Geological hazards	108	Fire fatalities
33	Building safety	71	Safety supervision	109	Disaster-related deaths
34	Catering establishments + safety	72	Safety regulatory oversight	110	Safe-development demonstration activities
35	Emergency management and control	73	Emerging business forms + safety	111	Institutional framework for safety management
36	Emergency exits	74	Emerging risks + safety	112	Safety management system
37	Evacuation routes	75	Functional zones + safety	113	Safety management approach
38	Major urban safety hazards	76	Townships + safety	114	Comprehensive disaster risk reduction

Note: Corpus retrieval was conducted using the original Chinese search expressions; English translations are provided here for readability.

S2. Annotation Guidelines for Policy-Instrument Identification

Manual annotation followed the project’s predefined guidelines for consistent entity boundaries and semantic granularity. These guidelines were used to construct the training data and were retained in subsequent model iterations. Because the same Chinese expression can serve different semantic functions, annotation decisions were made at the expression-in-context level.

- (1) Core semantic principle. Annotation first identified the shortest expression that captured the core meaning of a policy instrument, such as “inspection” or “standard.” This semantic core served as the anchor for determining the full entity boundary.
- (2) Information-maximization principle. After identifying the semantic core, all modifiers that formed part of the complete policy-instrument expression were included within the same entity. For example, “mandatory standards for engineering construction” was annotated as one entity. Terms equivalent to “system,” “mechanism,” “management,” and “framework” were included only when they functioned as integral complements of an otherwise identifiable policy instrument.

When a policy instrument appeared as a predicate verb, including expressions equivalent to “prohibit,” “strictly prohibit,” “crack down on,” “supervise,” “must not,” “promote,” “guide,” “inspect,” “investigate and punish,” “rectify,” “eliminate,” “order,” “commission,” “screen for risks,” “correct,” or “approve,” the verb and its following object were annotated together. If a sentence followed a “verb + policy actor + verb” structure, the two verbal expressions were annotated separately.

When a policy actor modified a policy instrument, or a policy instrument modified a policy actor, the entity type followed the semantic role of the modified head. Thus, an expression equivalent to “approval department” was annotated as a policy actor because “department” was the head. “Guiyang Municipal Office of the Leading Group for Tourism Development and Reform” was likewise annotated as a policy actor.

- (3) Coupling principle. Expressions denoting a combined policy-instrument arrangement were annotated as one entity. This rule covered compounds and combinations linked by Chinese equivalents of “as well as,” “and,” enumeration punctuation, “together with,” or “and concurrently.” Expressions linked by “or” were annotated separately because “or” generally indicates alternatives rather than a combination.

When several policy instruments had already been organized into separate pairwise combinations, the entire set was not additionally annotated as one larger entity. For

example, an expression equivalent to “combining overt inspection with unannounced inspection, and combining self-inspection with supervisory inspection” was annotated as two separate combinations.

When policy instruments and non-policy-instrument expressions were listed together in the same sentence, the policy instruments were annotated separately, the non-policy-instrument expressions were excluded, and the coupling rule was not applied across the two types of expression.

- (4) Policy-actor maximization principle. Policy actors were defined broadly to include government agencies, state-owned institutions and enterprises, individuals, and other actors participating in policy formulation or implementation. Operational staff were not annotated as policy actors merely because they performed a task; an expression was treated as a policy actor only when it denoted an organizational or individual actor with a policy-related role.
- (5) Expressions excluded from the policy-instrument category. Under the project’s operational coding rules, the following corpus expressions were excluded: division of responsibilities; encouragement; archiving; generic coordination; generic organizational guidance; “strict” or “severe” when used only as an intensifying modifier; data; person in charge; planning; generic safety management; submission; notification by official letter; upward reporting; license renewal; prevention and control system; responsible entity; notification; commitment; law; regulation; procedure; and reporting.
- (6) Expressions included in the policy-instrument category. Expressions confirmed as policy instruments included problem orientation, institutional development, and primary responsibility. Representative policy-instrument expressions further included:
 - ① approval, review, commissioning, application, and record filing;
 - ② testing and inspection;
 - ③ qualification, authorization, and assessment;
 - ④ financial allocation and investment;
 - ⑤ official circulation, public announcement, official approval or reply, official instruction, and issuance;
 - ⑥ rectification, governance, and remediation;
 - ⑦ specific expressions denoting management arrangements, responsibility assignments, or policy actions;
 - ⑧ licenses, funding, and standards; and
 - ⑨ the establishment of an inspection liaison role or arrangement.

Note: These guidelines specify the semantic and boundary rules used to identify policy-instrument expressions during manual annotation. Lexically similar expressions could receive different labels when their syntactic head or contextual function differed. In particular, “safety management” was excluded when used only as a generic organizational label, whereas a longer expression containing “management” was retained when it denoted a specific policy arrangement. Similarly, “inspection liaison” was treated as a policy instrument only when it referred to establishing the liaison role or arrangement; an individual liaison officer was treated as a policy actor.

Table S2. Policy-instrument classification scheme used for category assignment

No.	Major category	Subcategory
1	Authority	Devolution
2	Authority	Evaluation
3	Authority	Examination
4	Authority	Law enforcement supervision
5	Authority	License
6	Authority	Overall coordination
7	Authority	Prohibitions
8	Authority	Punishment
9	Authority	Rules

No.	Major category	Subcategory
10	Authority	Target planning
11	Capacity	Cultivation of talent
12	Capacity	Direct provision
13	Capacity	Infrastructure
14	Capacity	Public services
15	Capacity	Resources
16	Capacity	Risk monitoring
17	Capacity	Scientific and technical
18	Capacity	System innovation
19	Capacity	Talent support
20	Incentive	Awards
21	Incentive	Charges
22	Incentive	Financial
23	Incentive	Funds support
24	Incentive	Market creation
25	Incentive	Procurement
26	Incentive	Service outsource
27	Incentive	Taxation
28	Learning	Group creation
29	Learning	Information disclosure
30	Learning	Information exchange
31	Learning	Information support
32	Learning	Leading demonstrations
33	Learning	Pilot
34	Learning	Policy guidance
35	Learning	Self-regulation
36	Learning	Social participation
37	Symbolic and Hortatory	Labeling
38	Symbolic and Hortatory	Public outreach and education

Note: The classification scheme contains 38 subcategories nested within five major policy-instrument categories.

The five-category policy-instrument classification dataset contained 32,773 labelled records and was divided into training, validation, and test sets at a ratio of 80:10:10. Model performance was evaluated on a held-out test set of 3,278 records, with no exact text overlap with the training or validation sets. Category-specific precision, recall, and F1 scores are reported in Table S3, and the corresponding confusion matrix is presented in Table S4.

Table S3. Classification performance of the five-category policy-instrument model on the held-out test set.

Policy-instrument category	Precision (%)	Recall (%)	F1 (%)	Support
Authority	99.74	99.42	99.58	1,544
Incentive	98.86	98.30	98.58	176
Capacity	99.40	99.10	99.25	999
Symbolic and Hortatory	98.50	98.50	98.50	200
Learning	96.47	98.89	97.66	359
Macro average	98.59	98.84	98.71	3,278
Micro average	99.15	99.15	99.15	3,278

Note: The held-out test set contained 3,278 records and no exact text overlap with the training or validation sets. Macro averages are unweighted across the five categories. In this single-label multiclass task, Micro Precision, Micro Recall, and Micro F1 are equal to overall accuracy.

Table S4. Confusion matrix for the five-category policy-instrument classification model on the held-out test set.

True category / Predicted category	Authority	Incentive	Capacity	Symbolic and Hortatory	Learning
Authority	1,535	0	2	0	7
Incentive	1	173	0	0	2
Capacity	2	1	990	3	3

True category / Predicted category	Authority	Incentive	Capacity	Symbolic and Hortatory	Learning
Symbolic and Hortatory	1	0	1	197	1
Learning	0	1	3	0	355

Note: Rows represent true categories and columns represent predicted categories. Diagonal entries indicate correct classifications.

S3. Annual Corpus Exposure and Exposure Normalization

Annual corpus exposure was summarized using policy-document counts, instrument-containing sentence counts, co-occurrence-contributing sentence counts, and policy-instrument mentions. Policy-instrument mentions are calculated as the sum of the annual node-level frequency values in the final node-frequency file; they therefore represent identified occurrences, not the number of distinct instruments. Unique edges per 1,000 policy-instrument mentions are reported as the primary exposure-normalized network measure.

Table S5. Annual corpus exposure and exposure-normalized network scale, 2004–2023.

Year	Policy documents	Documents with ≥1 policy instrument	Documents contributing ≥1 co-occurrence edge	Instrument-containing sentences	Sentences contributing ≥1 co-occurrence edge	Policy-instrument mentions	Unique edges	Unique edges per 1,000 mentions
2004	124	121	113	2,671	1,500	3,299	3,707	1123.7
2005	198	194	185	3,924	2,464	5,297	7,986	1507.6
2006	287	283	257	5,499	3,304	7,278	11,143	1531.1
2007	410	402	386	8,444	4,843	11,865	14,003	1180.2
2008	582	564	519	10,364	6,155	14,317	20,578	1437.3
2009	531	509	473	11,681	7,586	18,121	24,384	1345.6
2010	663	634	579	13,262	8,365	19,340	27,278	1410.4
2011	579	553	498	11,726	7,415	17,368	28,855	1661.4
2012	775	761	695	25,803	16,108	38,884	47,996	1234.3
2013	744	724	655	14,061	8,176	19,618	28,640	1459.9
2014	736	705	614	12,098	7,236	17,263	26,698	1546.5
2015	783	746	669	11,512	6,830	16,370	24,397	1490.3
2016	893	872	779	15,628	9,638	23,004	35,320	1535.4
2017	1,348	1,276	1,132	26,967	16,654	40,856	60,799	1488.1
2018	1,147	1,084	964	18,072	10,455	26,351	34,830	1321.8
2019	934	885	743	14,019	8,223	20,730	28,134	1357.2
2020	968	922	818	18,108	10,739	25,550	36,080	1412.1
2021	1,007	947	811	17,120	10,107	24,222	34,282	1415.3
2022	967	885	782	19,127	11,496	26,319	37,088	1409.2
2023	826	774	612	13,342	7,818	17,936	27,429	1529.3

Note: The annual corpus includes policy documents that could be assigned to a specific year from 2004 to 2023. Policy-instrument mentions are annual sums of identified policy-instrument occurrences. Unique edges per 1,000 mentions = unique edges / policy-instrument mentions × 1,000.

Table S6. Annual descriptive network statistics, 2004–2023

Year	Nodes	Edges	Density	Degree centralization	Mean node strength	Normalized strength entropy	Global clustering	Weighted-degree assortativity	Communities	Weighted modularity
2004	1,286	3,707	0.004487	0.222	9.855	0.830	0.139	-0.137	83	0.676
2005	2,145	7,986	0.003473	0.230	15.376	0.793	0.134	-0.120	141	0.655
2006	3,175	11,143	0.002211	0.209	11.548	0.814	0.094	-0.139	175	0.623

Year	Nodes	Edges	Density	Degree centralization	Mean node strength	Normalized strength entropy	Global clustering	Weighted- degree assortativity	Communities	Weighted modularity
2007	4,240	14,003	0.001558	0.250	11.606	0.802	0.063	-0.147	251	0.628
2008	5,896	20,578	0.001184	0.248	12.083	0.800	0.054	-0.144	350	0.626
2009	5,880	24,384	0.001411	0.248	17.031	0.776	0.062	-0.127	251	0.597
2010	7,570	27,278	0.000952	0.247	13.351	0.784	0.042	-0.144	426	0.589
2011	7,233	28,855	0.001103	0.230	14.529	0.792	0.049	-0.154	385	0.601
2012	12,970	47,996	0.000571	0.194	13.845	0.783	0.032	-0.149	640	0.592
2013	8,409	28,640	0.000810	0.206	10.738	0.815	0.047	-0.137	481	0.630
2014	7,723	26,698	0.000895	0.230	11.203	0.808	0.044	-0.144	404	0.633
2015	7,255	24,397	0.000927	0.220	10.720	0.824	0.051	-0.119	434	0.666
2016	10,082	35,320	0.000695	0.234	11.506	0.804	0.035	-0.131	551	0.617
2017	16,344	60,799	0.000455	0.245	12.842	0.795	0.025	-0.117	867	0.581
2018	10,585	34,830	0.000622	0.212	10.519	0.822	0.041	-0.105	661	0.652
2019	8,466	28,134	0.000785	0.210	10.572	0.835	0.055	-0.093	551	0.680
2020	10,215	36,080	0.000692	0.221	12.702	0.800	0.055	-0.096	645	0.674
2021	9,767	34,282	0.000719	0.193	12.210	0.808	0.050	-0.119	637	0.680
2022	10,898	37,088	0.000625	0.200	11.926	0.810	0.048	-0.109	690	0.685
2023	7,714	27,429	0.000922	0.216	11.518	0.820	0.062	-0.117	444	0.648

Note: All statistics are calculated from the annual policy-instrument co-occurrence networks following the definitions specified in the descriptive-network analysis.

S4. Processing Workflow

- (1) Corpus retrieval and screening: retrieve policy documents using the specified search expressions and apply the documented corpus-screening rules.
- (2) Policy-instrument identification: identify fine-grained policy-instrument expressions from the retained policy texts using the task-specific named entity recognition pipeline and the annotation rules reported in Supplementary Section 2.
- (3) Quality control: apply the retained quality-control procedure to extracted candidate expressions.
- (4) Category assignment: assign each retained policy-instrument expression to one of the five major policy-instrument categories and one of the corresponding subcategories.
- (5) Annual exposure aggregation: aggregate policy documents, instrument-containing sentences, co-occurrence-contributing sentences, policy-instrument mentions, and active instruments by year.
- (6) Network construction: construct annual weighted sentence-level co-occurrence networks; edge weights equal the number of sentences in which an instrument pair co-occurs. Convert weighted ties to binary presence/absence ties for ERGM estimation.
- (7) Descriptive network analysis: calculate annual network size, density, degree and strength distribution, global clustering, weighted-degree assortativity, community count, and weighted modularity.
- (8) ERGM estimation: estimate Models 1–7 separately for each annual binary network from 2004 to 2023 using the documented model specifications.
- (9) Diagnostics and sensitivity analyses: assess Models 6 and 7 using extended GOF diagnostics, conduct additional structural-specification checks, and evaluate robustness using the strict stable-node set and the alternative co-occurrence threshold.

Note: This workflow summarizes the analytical sequence represented in the manuscript and the Supplementary Materials. Only documented software versions are reported in the software-environment table.

S5. Software Environment

Table S7. Software environment and package versions

Component	Version / setting	Documented use
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Component	Version / setting	Documented use
Operating system	Windows 11 x64, Version 22H2 (OS Build 22621.4317)	NER; descriptive-network analysis; annual ERGM estimation (MPLE); standard GOF; extended GOF
CPU	AMD EPYC 7T83 64-Core Processor	NER
Memory	256 GB RAM	NER
GPU	NVIDIA GeForce RTX 3090 (24 GB)	NER
Python	3.12	NER
PyTorch	2.4.1+cu124	NER
Transformers	4.44.2	NER
scikit-learn	1.5.2	NER
R	4.5.2 (2025-10-31 ucrt)	Descriptive-network analysis; annual ERGM estimation (MPLE); standard GOF; extended GOF
igraph	2.3.3	Descriptive-network analysis; extended GOF
ergm	4.12.0	Annual ERGM estimation (MPLE); standard GOF; extended GOF
network	1.20.0	Annual ERGM estimation (MPLE); standard GOF; extended GOF
statnet.common	4.13.0	Annual ERGM estimation (MPLE); standard GOF; extended GOF
ggplot2	4.0.3	ERGM coefficient plots; extended-GOF plots
dplyr	1.2.1	Descriptive-network analysis; ERGM result processing; standard and extended GOF
readr	2.2.0	Descriptive-network, ERGM, and GOF data import
readxl	1.4.5	Descriptive-network analysis
writexl	1.5.4	Descriptive-network analysis
tidyr	1.3.2	Descriptive-network analysis
sandwich	3.1-2	Descriptive-network analysis
RNG	L'Ecuyer-CMRG	Standard GOF; extended GOF
Time zone	Asia/Shanghai	Descriptive-network analysis; annual ERGM estimation; standard GOF; extended GOF

Note: Hardware and Python-environment entries document the NER implementation environment. The operating-system entry applies to all analyses. R-package, RNG, and time-zone entries are taken from the session-information files accompanying the descriptive-network analysis, annual ERGM estimation (MPLE), standard GOF, and extended GOF analyses.

S6. Complete Annual ERGM Coefficient Estimates

Table S8. Complete annual ERGM coefficient estimates for Model 1, 2004–2023

Year	Edges
2004	-5.402*** (0.016)
2005	-5.659*** (0.011)
2006	-6.112*** (0.009)
2007	-6.463*** (0.008)
2008	-6.738*** (0.007)
2009	-6.562*** (0.006)
2010	-6.956*** (0.006)
2011	-6.808*** (0.006)
2012	-7.468*** (0.005)
2013	-7.117*** (0.006)
2014	-7.017*** (0.006)
2015	-6.982*** (0.006)
2016	-7.271*** (0.005)
2017	-7.694*** (0.004)
2018	-7.382*** (0.005)
2019	-7.149*** (0.006)
2020	-7.276*** (0.005)
2021	-7.237*** (0.005)
2022	-7.378*** (0.005)
2023	-6.988*** (0.006)

Note: Entries are MPLE coefficient estimates with conventional MPLE standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ based on Wald tests.

Table S9. Complete annual ERGM coefficient estimates for Model 2, 2004–2023

Year	Edges	Usage frequency
2004	-5.998*** (0.023)	0.581*** (0.006)
2005	-6.329*** (0.016)	0.573*** (0.004)
2006	-6.815*** (0.013)	0.555*** (0.003)
2007	-7.233*** (0.012)	0.582*** (0.002)
2008	-7.560*** (0.010)	0.580*** (0.002)
2009	-7.419*** (0.010)	0.618*** (0.002)
2010	-7.813*** (0.009)	0.582*** (0.002)
2011	-7.597*** (0.008)	0.559*** (0.001)
2012	-8.441*** (0.007)	0.640*** (0.001)
2013	-7.951*** (0.009)	0.580*** (0.001)
2014	-7.816*** (0.009)	0.552*** (0.001)
2015	-7.721*** (0.009)	0.551*** (0.002)
2016	-8.104*** (0.008)	0.568*** (0.001)
2017	-8.593*** (0.006)	0.577*** (0.001)
2018	-8.190*** (0.008)	0.572*** (0.001)
2019	-7.910*** (0.009)	0.564*** (0.002)
2020	-8.039*** (0.007)	0.554*** (0.001)
2021	-8.034*** (0.008)	0.568*** (0.001)
2022	-8.133*** (0.007)	0.552*** (0.001)
2023	-7.748*** (0.009)	0.563*** (0.002)

Note: Entries are MPLE coefficient estimates with conventional MPLE standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ based on Wald tests.

Table S10. Complete annual ERGM coefficient estimates for Model 3, 2004–2023

Year	Edges	Usage frequency	Capacity	Incentive	Learning	Symbolic & Hortatory
2004	-6.020*** (0.030)	0.582*** (0.006)	0.050 (0.032)	0.051 (0.056)	-0.010 (0.045)	-0.027 (0.068)
2005	-6.334*** (0.020)	0.573*** (0.004)	0.065** (0.022)	-0.054 (0.055)	-0.038 (0.039)	-0.187*** (0.056)
2006	-6.805*** (0.017)	0.554*** (0.003)	0.074*** (0.018)	-0.157*** (0.037)	-0.122*** (0.032)	-0.087* (0.039)
2007	-7.267*** (0.016)	0.582*** (0.002)	0.109*** (0.015)	-0.259*** (0.037)	0.045 (0.024)	-0.007 (0.031)
2008	-7.560*** (0.014)	0.580*** (0.002)	0.095*** (0.013)	-0.168*** (0.029)	-0.151*** (0.021)	0.030 (0.023)
2009	-7.425*** (0.012)	0.618*** (0.002)	0.139*** (0.013)	-0.215*** (0.030)	-0.165*** (0.018)	-0.023 (0.021)
2010	-7.847*** (0.012)	0.584*** (0.002)	0.137*** (0.012)	-0.142*** (0.024)	-0.073*** (0.019)	-0.023 (0.020)
2011	-7.599*** (0.011)	0.559*** (0.001)	0.108*** (0.011)	-0.306*** (0.027)	-0.084*** (0.017)	-0.100*** (0.020)
2012	-8.394*** (0.009)	0.638*** (0.001)	-0.005 (0.008)	-0.098*** (0.019)	-0.140*** (0.013)	-0.116*** (0.016)
2013	-7.924*** (0.011)	0.578*** (0.002)	0.043*** (0.011)	-0.158*** (0.025)	-0.141*** (0.017)	-0.079*** (0.021)
2014	-7.756*** (0.011)	0.550*** (0.001)	-0.016 (0.011)	-0.171*** (0.027)	-0.164*** (0.018)	-0.117*** (0.022)
2015	-7.767*** (0.012)	0.552*** (0.002)	0.130*** (0.012)	0.002 (0.024)	-0.108*** (0.019)	0.012 (0.022)
2016	-8.119*** (0.010)	0.568*** (0.001)	0.094*** (0.010)	-0.116*** (0.022)	-0.050*** (0.015)	-0.104*** (0.022)
2017	-8.639*** (0.008)	0.579*** (0.001)	0.118*** (0.008)	0.026 (0.018)	-0.055*** (0.012)	-0.010 (0.015)
2018	-8.148*** (0.010)	0.571*** (0.001)	-0.063*** (0.010)	0.108*** (0.021)	-0.127*** (0.015)	-0.018 (0.019)
2019	-7.899*** (0.011)	0.563*** (0.002)	0.054*** (0.011)	0.024 (0.025)	-0.125*** (0.017)	-0.101*** (0.021)
2020	-8.146*** (0.011)	0.558*** (0.001)	0.163*** (0.009)	0.276*** (0.018)	-0.068*** (0.015)	0.014 (0.019)
2021	-8.032*** (0.011)	0.568*** (0.001)	0.106*** (0.010)	-0.214*** (0.024)	-0.153*** (0.016)	-0.130*** (0.021)
2022	-8.179*** (0.010)	0.553*** (0.001)	0.136*** (0.009)	-0.109*** (0.023)	-0.124*** (0.015)	0.048** (0.018)
2023	-7.751*** (0.012)	0.562*** (0.002)	0.092*** (0.011)	-0.223*** (0.028)	-0.159*** (0.018)	-0.003 (0.024)

Note: Entries are MPLE coefficient estimates with conventional MPLE standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ based on Wald tests. Authority instruments are the reference category for the four category coefficients.

Table S11. Complete annual ERGM coefficient estimates for Model 4, 2004–2023

Year	Edges	Usage frequency	Capacity	Incentive	Learning	Symbolic & Hortatory	Category homophily
2004	-6.751*** (0.047)	0.585*** (0.006)	0.374*** (0.031)	0.540*** (0.057)	0.433*** (0.046)	0.491*** (0.070)	0.863*** (0.043)
2005	-7.060*** (0.036)	0.575*** (0.004)	0.435*** (0.023)	0.504*** (0.058)	0.480*** (0.042)	0.372*** (0.059)	0.802*** (0.033)
2006	-7.524*** (0.029)	0.556*** (0.003)	0.410*** (0.018)	0.359*** (0.039)	0.371*** (0.033)	0.436*** (0.041)	0.819*** (0.026)
2007	-7.933*** (0.024)	0.584*** (0.002)	0.360*** (0.014)	0.220*** (0.037)	0.454*** (0.024)	0.450*** (0.031)	0.817*** (0.021)
2008	-8.306*** (0.021)	0.583*** (0.002)	0.415*** (0.013)	0.360*** (0.029)	0.320*** (0.021)	0.525*** (0.024)	0.874*** (0.018)
2009	-8.140*** (0.019)	0.621*** (0.002)	0.468*** (0.012)	0.307*** (0.031)	0.283*** (0.019)	0.455*** (0.022)	0.826*** (0.017)
2010	-8.556*** (0.018)	0.587*** (0.002)	0.437*** (0.011)	0.351*** (0.025)	0.382*** (0.019)	0.442*** (0.020)	0.836*** (0.016)
2011	-8.314*** (0.017)	0.562*** (0.002)	0.388*** (0.010)	0.211*** (0.028)	0.364*** (0.017)	0.375*** (0.020)	0.863*** (0.015)
2012	-9.077*** (0.013)	0.640*** (0.001)	0.272*** (0.008)	0.386*** (0.020)	0.295*** (0.014)	0.343*** (0.016)	0.819*** (0.012)
2013	-8.605*** (0.017)	0.580*** (0.002)	0.312*** (0.010)	0.330*** (0.026)	0.292*** (0.018)	0.382*** (0.021)	0.821*** (0.015)
2014	-8.432*** (0.018)	0.552*** (0.001)	0.265*** (0.011)	0.317*** (0.027)	0.271*** (0.019)	0.351*** (0.023)	0.803*** (0.016)
2015	-8.560*** (0.018)	0.555*** (0.002)	0.428*** (0.011)	0.544*** (0.025)	0.389*** (0.019)	0.530*** (0.022)	0.955*** (0.016)
2016	-8.821*** (0.015)	0.571*** (0.001)	0.376*** (0.009)	0.379*** (0.022)	0.384*** (0.015)	0.391*** (0.022)	0.838*** (0.014)
2017	-9.318*** (0.012)	0.581*** (0.001)	0.404*** (0.007)	0.514*** (0.018)	0.373*** (0.012)	0.456*** (0.015)	0.800*** (0.010)
2018	-8.949*** (0.015)	0.573*** (0.001)	0.279*** (0.010)	0.658*** (0.021)	0.360*** (0.015)	0.517*** (0.019)	0.941*** (0.014)
2019	-8.593*** (0.017)	0.565*** (0.002)	0.358*** (0.011)	0.522*** (0.026)	0.308*** (0.017)	0.374*** (0.022)	0.815*** (0.016)
2020	-8.863*** (0.015)	0.561*** (0.001)	0.401*** (0.009)	0.740*** (0.018)	0.355*** (0.014)	0.493*** (0.019)	0.906*** (0.013)
2021	-8.754*** (0.016)	0.571*** (0.001)	0.396*** (0.009)	0.308*** (0.025)	0.304*** (0.016)	0.375*** (0.021)	0.855*** (0.014)
2022	-8.894*** (0.015)	0.556*** (0.001)	0.390*** (0.009)	0.404*** (0.023)	0.317*** (0.015)	0.523*** (0.018)	0.880*** (0.013)
2023	-8.339*** (0.017)	0.564*** (0.002)	0.330*** (0.010)	0.211*** (0.029)	0.230*** (0.019)	0.420*** (0.025)	0.706*** (0.015)

Note: Entries are MPLE coefficient estimates with conventional MPLE standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ based on Wald tests. Authority instruments are the reference category for the four category coefficients.

Table S12. Complete annual ERGM coefficient estimates for Model 5, 2004–2023

Year	Edges	Usage frequency	Capacity	Incentive	Learning	Symbolic & Hortatory	Category homophily	Frequency difference
2004	-6.771*** (0.048)	0.574*** (0.009)	0.373*** (0.031)	0.541*** (0.057)	0.434*** (0.046)	0.492*** (0.070)	0.862*** (0.043)	0.020 (0.011)
2005	-7.050*** (0.036)	0.581*** (0.006)	0.436*** (0.023)	0.505*** (0.058)	0.480*** (0.042)	0.371*** (0.059)	0.800*** (0.033)	-0.009 (0.007)
2006	-7.506*** (0.029)	0.569*** (0.005)	0.410*** (0.018)	0.359*** (0.039)	0.369*** (0.033)	0.435*** (0.041)	0.817*** (0.026)	-0.019*** (0.006)
2007	-7.942*** (0.024)	0.578*** (0.004)	0.360*** (0.014)	0.220*** (0.037)	0.454*** (0.024)	0.451*** (0.031)	0.817*** (0.021)	0.009* (0.005)
2008	-8.324*** (0.021)	0.571*** (0.003)	0.417*** (0.013)	0.362*** (0.029)	0.322*** (0.021)	0.527*** (0.024)	0.875*** (0.018)	0.017*** (0.004)
2009	-8.139*** (0.020)	0.621*** (0.003)	0.468*** (0.013)	0.307*** (0.031)	0.283*** (0.019)	0.455*** (0.022)	0.826*** (0.017)	-0.000 (0.003)
2010	-8.573*** (0.018)	0.576*** (0.003)	0.438*** (0.011)	0.356*** (0.025)	0.386*** (0.019)	0.447*** (0.020)	0.837*** (0.016)	0.016*** (0.003)
2011	-8.313*** (0.017)	0.562*** (0.003)	0.385*** (0.010)	0.211*** (0.028)	0.363*** (0.017)	0.374*** (0.020)	0.863*** (0.015)	-0.001 (0.003)
2012	-9.186*** (0.014)	0.598*** (0.002)	0.282*** (0.008)	0.401*** (0.019)	0.304*** (0.014)	0.364*** (0.016)	0.820*** (0.012)	0.078*** (0.002)
2013	-8.619*** (0.017)	0.571*** (0.003)	0.311*** (0.010)	0.332*** (0.026)	0.294*** (0.018)	0.385*** (0.021)	0.821*** (0.015)	0.014*** (0.003)
2014	-8.435*** (0.018)	0.549*** (0.003)	0.264*** (0.011)	0.317*** (0.027)	0.272*** (0.019)	0.352*** (0.023)	0.803*** (0.016)	0.004 (0.003)
2015	-8.565*** (0.019)	0.552*** (0.003)	0.428*** (0.011)	0.545*** (0.025)	0.390*** (0.019)	0.531*** (0.022)	0.956*** (0.016)	0.006 (0.003)
2016	-8.850*** (0.016)	0.552*** (0.002)	0.375*** (0.009)	0.383*** (0.022)	0.387*** (0.015)	0.396*** (0.022)	0.841*** (0.014)	0.029*** (0.003)
2017	-9.340*** (0.012)	0.568*** (0.002)	0.405*** (0.007)	0.516*** (0.018)	0.375*** (0.012)	0.462*** (0.015)	0.803*** (0.010)	0.020*** (0.002)
2018	-8.964*** (0.016)	0.563*** (0.002)	0.279*** (0.010)	0.659*** (0.021)	0.361*** (0.015)	0.518*** (0.019)	0.941*** (0.014)	0.015*** (0.003)
2019	-8.595*** (0.018)	0.564*** (0.003)	0.358*** (0.011)	0.522*** (0.026)	0.308*** (0.017)	0.374*** (0.022)	0.815*** (0.016)	0.002 (0.003)
2020	-8.850*** (0.015)	0.569*** (0.002)	0.401*** (0.009)	0.739*** (0.018)	0.353*** (0.015)	0.490*** (0.019)	0.905*** (0.013)	-0.012*** (0.003)
2021	-8.762*** (0.016)	0.567*** (0.002)	0.397*** (0.009)	0.310*** (0.025)	0.306*** (0.016)	0.377*** (0.021)	0.856*** (0.014)	0.007** (0.003)
2022	-8.891*** (0.015)	0.558*** (0.002)	0.390*** (0.009)	0.404*** (0.023)	0.316*** (0.015)	0.522*** (0.018)	0.879*** (0.013)	-0.003 (0.003)
2023	-8.341*** (0.018)	0.562*** (0.003)	0.330*** (0.010)	0.212*** (0.029)	0.230*** (0.019)	0.420*** (0.025)	0.706*** (0.015)	0.003 (0.003)

Note: Entries are MPLE coefficient estimates with conventional MPLE standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ based on Wald tests. Authority instruments are the reference category for the four category coefficients.

Table S13. Complete annual ERGM coefficient estimates for Model 6, 2004–2023

Year	Edges	Usage frequency	Capacity	Incentive	Learning	Symbolic & Hortatory	Category homophily	Frequency difference	Degree heterogeneity
2004	-6.725*** (0.053)	0.567*** (0.009)	0.375*** (0.031)	0.537*** (0.057)	0.431*** (0.046)	0.494*** (0.070)	0.863*** (0.043)	0.023* (0.011)	-0.201* (0.096)
2005	-6.848*** (0.038)	0.549*** (0.006)	0.442*** (0.023)	0.524*** (0.058)	0.483*** (0.042)	0.394*** (0.059)	0.803*** (0.033)	0.007 (0.007)	-1.200*** (0.077)
2006	-7.355*** (0.031)	0.547*** (0.005)	0.413*** (0.018)	0.376*** (0.039)	0.373*** (0.033)	0.449*** (0.041)	0.818*** (0.026)	-0.006 (0.006)	-0.855*** (0.062)
2007	-7.865*** (0.026)	0.567*** (0.004)	0.358*** (0.014)	0.228*** (0.037)	0.448*** (0.024)	0.452*** (0.031)	0.817*** (0.021)	0.016*** (0.005)	-0.392*** (0.054)
2008	-8.183*** (0.022)	0.551*** (0.003)	0.417*** (0.013)	0.368*** (0.029)	0.330*** (0.021)	0.533*** (0.024)	0.875*** (0.018)	0.030*** (0.004)	-0.760*** (0.045)
2009	-7.984*** (0.021)	0.596*** (0.003)	0.469*** (0.012)	0.330*** (0.031)	0.284*** (0.019)	0.474*** (0.022)	0.825*** (0.017)	0.017*** (0.004)	-1.087*** (0.047)
2010	-8.431*** (0.019)	0.557*** (0.003)	0.440*** (0.011)	0.358*** (0.025)	0.382*** (0.019)	0.443*** (0.020)	0.837*** (0.016)	0.028*** (0.003)	-0.790*** (0.040)
2011	-8.111*** (0.018)	0.534*** (0.003)	0.383*** (0.010)	0.238*** (0.028)	0.366*** (0.017)	0.375*** (0.020)	0.863*** (0.015)	0.018*** (0.003)	-1.320*** (0.042)
2012	-9.052*** (0.015)	0.582*** (0.002)	0.280*** (0.008)	0.396*** (0.019)	0.308*** (0.014)	0.368*** (0.016)	0.820*** (0.012)	0.086*** (0.002)	-0.726*** (0.031)
2013	-8.507*** (0.018)	0.556*** (0.003)	0.313*** (0.010)	0.334*** (0.026)	0.297*** (0.018)	0.389*** (0.021)	0.821*** (0.015)	0.023*** (0.003)	-0.579*** (0.038)
2014	-8.313*** (0.019)	0.533*** (0.003)	0.266*** (0.011)	0.324*** (0.027)	0.273*** (0.019)	0.356*** (0.023)	0.803*** (0.016)	0.015*** (0.003)	-0.682*** (0.040)
2015	-8.452*** (0.020)	0.537*** (0.003)	0.430*** (0.011)	0.560*** (0.025)	0.397*** (0.019)	0.536*** (0.022)	0.956*** (0.016)	0.015*** (0.003)	-0.635*** (0.041)
2016	-8.721*** (0.017)	0.536*** (0.002)	0.374*** (0.009)	0.381*** (0.022)	0.387*** (0.015)	0.398*** (0.022)	0.841*** (0.014)	0.037*** (0.003)	-0.708*** (0.035)
2017	-9.172*** (0.013)	0.549*** (0.002)	0.404*** (0.007)	0.515*** (0.018)	0.376*** (0.012)	0.469*** (0.015)	0.803*** (0.010)	0.031*** (0.002)	-0.942*** (0.027)
2018	-8.903*** (0.017)	0.556*** (0.002)	0.281*** (0.010)	0.657*** (0.021)	0.361*** (0.015)	0.522*** (0.019)	0.941*** (0.014)	0.020*** (0.003)	-0.320*** (0.034)
2019	-8.487*** (0.019)	0.550*** (0.003)	0.358*** (0.011)	0.525*** (0.026)	0.310*** (0.017)	0.378*** (0.022)	0.815*** (0.016)	0.010** (0.003)	-0.549*** (0.037)
2020	-8.691*** (0.016)	0.549*** (0.002)	0.397*** (0.009)	0.731*** (0.018)	0.351*** (0.014)	0.494*** (0.019)	0.905*** (0.013)	-0.001 (0.003)	-0.816*** (0.034)
2021	-8.618*** (0.017)	0.548*** (0.002)	0.397*** (0.009)	0.318*** (0.025)	0.308*** (0.016)	0.396*** (0.021)	0.856*** (0.014)	0.018*** (0.003)	-0.769*** (0.035)
2022	-8.732*** (0.016)	0.539*** (0.002)	0.390*** (0.009)	0.410*** (0.023)	0.316*** (0.015)	0.521*** (0.018)	0.879*** (0.013)	0.007** (0.003)	-0.799*** (0.033)
2023	-8.154*** (0.019)	0.539*** (0.003)	0.331*** (0.010)	0.220*** (0.029)	0.241*** (0.019)	0.427*** (0.025)	0.705*** (0.015)	0.016*** (0.003)	-0.995*** (0.039)

Note: Entries are MPLE coefficient estimates with conventional MPLE standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ based on Wald tests. Authority instruments are the reference category for the four category coefficients. The geometrically weighted degree term uses a fixed decay parameter of 0.50.

Table S14. Complete annual ERGM coefficient estimates for Model 7, 2004–2023

Year	Edges	Usage frequency	Capacity	Incentive	Learning	Symbolic & Hortatory	Category homophily	Frequency difference	Degree heterogeneity	Triadic closure
2004	-8.629*** (0.073)	0.225*** (0.011)	0.222*** (0.035)	0.365*** (0.061)	-0.047 (0.049)	0.175* (0.076)	0.639*** (0.046)	0.072*** (0.013)	-2.782*** (0.122)	2.973*** (0.036)
2005	-9.912*** (0.063)	0.244*** (0.007)	0.367*** (0.026)	0.500*** (0.063)	0.245*** (0.045)	0.008 (0.063)	0.617*** (0.035)	0.031*** (0.008)	-4.391*** (0.101)	3.675*** (0.033)
2006	-10.796*** (0.054)	0.223*** (0.006)	0.345*** (0.021)	0.210*** (0.041)	0.282*** (0.036)	0.331*** (0.044)	0.589*** (0.028)	0.022*** (0.006)	-5.004*** (0.085)	4.095*** (0.030)
2007	-11.052*** (0.046)	0.244*** (0.005)	0.278*** (0.016)	0.408*** (0.039)	0.282*** (0.026)	0.221*** (0.033)	0.558*** (0.023)	0.059*** (0.005)	-4.922*** (0.074)	3.954*** (0.026)
2008	-11.011*** (0.036)	0.261*** (0.004)	0.268*** (0.014)	0.643*** (0.030)	0.179*** (0.022)	0.385*** (0.025)	0.704*** (0.019)	0.059*** (0.004)	-4.213*** (0.059)	3.592*** (0.020)
2009	-12.092*** (0.039)	0.256*** (0.003)	0.434*** (0.014)	0.618*** (0.033)	0.207*** (0.020)	0.509*** (0.023)	0.626*** (0.018)	0.037*** (0.004)	-6.928*** (0.064)	4.566*** (0.022)
2010	-11.924*** (0.034)	0.264*** (0.003)	0.346*** (0.012)	0.559*** (0.026)	0.393*** (0.020)	0.349*** (0.021)	0.683*** (0.017)	0.051*** (0.004)	-4.897*** (0.055)	4.062*** (0.019)
2011	-12.401*** (0.035)	0.237*** (0.003)	0.379*** (0.011)	0.513*** (0.029)	0.485*** (0.018)	0.390*** (0.022)	0.674*** (0.016)	0.041*** (0.004)	-6.718*** (0.060)	4.611*** (0.021)
2012	-12.404*** (0.025)	0.281*** (0.002)	0.301*** (0.008)	0.440*** (0.021)	0.416*** (0.015)	0.411*** (0.017)	0.661*** (0.012)	0.072*** (0.003)	-5.203*** (0.042)	4.092*** (0.014)
2013	-11.430*** (0.030)	0.257*** (0.003)	0.170*** (0.011)	0.570*** (0.027)	0.318*** (0.019)	0.365*** (0.022)	0.646*** (0.016)	0.039*** (0.003)	-4.761*** (0.051)	3.849*** (0.017)
2014	-11.540*** (0.033)	0.225*** (0.003)	0.212*** (0.012)	0.434*** (0.029)	0.201*** (0.020)	-0.077** (0.024)	0.615*** (0.017)	0.050*** (0.004)	-5.674*** (0.054)	4.080*** (0.019)
2015	-11.652*** (0.034)	0.193*** (0.003)	0.240*** (0.012)	0.683*** (0.026)	0.206*** (0.021)	0.389*** (0.023)	0.734*** (0.017)	0.058*** (0.004)	-5.722*** (0.056)	4.260*** (0.019)
2016	-12.588*** (0.030)	0.219*** (0.003)	0.306*** (0.010)	0.418*** (0.023)	0.252*** (0.016)	0.308*** (0.023)	0.644*** (0.014)	0.062*** (0.003)	-6.656*** (0.049)	4.623*** (0.018)
2017	-13.326*** (0.024)	0.248*** (0.002)	0.339*** (0.008)	0.524*** (0.019)	0.396*** (0.013)	0.416*** (0.016)	0.643*** (0.011)	0.039*** (0.002)	-7.209*** (0.039)	4.812*** (0.014)
2018	-12.007*** (0.028)	0.207*** (0.003)	0.309*** (0.011)	0.631*** (0.023)	0.301*** (0.017)	0.217*** (0.020)	0.747*** (0.015)	0.048*** (0.003)	-5.809*** (0.046)	4.294*** (0.016)
2019	-11.418*** (0.031)	0.188*** (0.003)	0.164*** (0.012)	0.309*** (0.028)	0.207*** (0.019)	-0.023 (0.023)	0.627*** (0.017)	0.042*** (0.004)	-5.611*** (0.051)	4.287*** (0.018)
2020	-11.782*** (0.028)	0.215*** (0.003)	0.269*** (0.009)	0.676*** (0.018)	0.234*** (0.016)	0.085*** (0.020)	0.671*** (0.013)	0.036*** (0.003)	-6.217*** (0.047)	4.317*** (0.016)
2021	-11.798*** (0.029)	0.205*** (0.003)	0.354*** (0.010)	0.422*** (0.026)	0.220*** (0.017)	0.186*** (0.022)	0.683*** (0.015)	0.052*** (0.003)	-6.083*** (0.048)	4.306*** (0.016)
2022	-11.960*** (0.028)	0.194*** (0.003)	0.329*** (0.009)	0.531*** (0.025)	0.246*** (0.016)	0.311*** (0.019)	0.665*** (0.014)	0.045*** (0.003)	-6.373*** (0.046)	4.440*** (0.016)
2023	-11.308*** (0.032)	0.214*** (0.003)	0.213*** (0.011)	0.332*** (0.031)	0.194*** (0.020)	0.135*** (0.026)	0.541*** (0.016)	0.041*** (0.004)	-5.827*** (0.054)	4.182*** (0.018)

Note: Entries are MPLE coefficient estimates with conventional MPLE standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ based on Wald tests. Authority instruments are the reference category for the four category coefficients. The geometrically weighted degree term uses a fixed decay parameter of 0.50. The geometrically weighted edgewise shared-partner term uses a fixed decay parameter of 0.45.

S7. Strict Stable-Node Sensitivity Analysis

To assess whether changes in annual node composition affect the main ERGM results, Model 6 was re-estimated on a fixed set of 77 policy instruments that appeared in the active-node set of every annual network from 2004 to 2023. The stable set represents 0.47%–5.99% of the active nodes in the full annual networks (mean 1.41%) and is strongly concentrated in Authority instruments (Table S15). It therefore represents a persistent core rather than the

full and changing composition of the annual PIM networks. MCMLE estimation was not conducted on this reduced stable-node set, as removing nodes changes network composition and the structural statistics being modeled. Estimates obtained from this reduced network would therefore not be directly comparable with those from the full annual networks.

The stable-node estimates show that usage frequency remains positive and statistically significant in all 20 years. Category homophily remains positive in all 20 years and significant in 11, while degree heterogeneity remains negative in all 20 years and significant in 13. Category-specific coefficients and usage-frequency difference are less stable under the restricted node set (Table **S16**). The fitted-statistic GOF summary shows that 4 of 180 statistics have Monte Carlo p-values below 0.05, 6 fall below 0.10, and the mean p-value is 0.768. Full annual coefficient estimates are reported in Table **S17**.

Table S15. Composition of the strict stable-node set

Policy-instrument category	Number of nodes	Share of stable set (%)
Authority	59	76.6
Capacity	9	11.7
Incentive	1	1.3
Learning	4	5.2
Symbolic and Hortatory	4	5.2
Total	77	100.0

Table S16. Strict stable-node sensitivity analysis

Term	Model 6 Mean	Stable-node Mean	Model 6 Direction	Stable-node Direction	Model 6 Significant years	Stable-node Significant years
Usage frequency	0.552	0.491	+20 / -0	+20 / -0	20/20	20/20
Category: Capacity	0.376	0.387	+20 / -0	+19 / -1	20/20	10/20
Category: Incentive	0.416	-0.592	+20 / -0	+5 / -15	20/20	5/20
Category: Learning	0.351	-0.267	+20 / -0	+3 / -17	20/20	5/20
Category: Symbolic and Hortatory	0.443	0.412	+20 / -0	+17 / -3	20/20	11/20
Category homophily	0.842	0.481	+20 / -0	+20 / -0	20/20	11/20
Usage-frequency difference	0.021	0.012	+18 / -2	+11 / -9	17/20	5/20
Degree heterogeneity	-0.756	-2.444	+0 / -20	+0 / -20	20/20	13/20

Note: Direction reports the number of positive and negative annual coefficients. Significant years report $p < 0.05$. Mean coefficients are descriptive within-term summaries and are not standardized effect sizes.

Table S17. Annual coefficient estimates from the strict stable-node Model 6, 2004–2023

Year	Usage frequency	Capacity	Incentive	Learning	Symbolic & Hortatory	Category homophily	Frequency difference	Degree heterogeneity
2004	0.474*** (0.038)	0.353 (0.243)	-0.554 (0.761)	0.393 (0.300)	0.434 (0.326)	0.277 (0.281)	-0.094 (0.049)	-0.549 (0.357)
2005	0.508*** (0.030)	0.624** (0.225)	0.156 (0.653)	-0.031 (0.329)	0.700* (0.308)	0.387 (0.261)	-0.008 (0.037)	-0.615 (0.445)
2006	0.532*** (0.028)	0.073 (0.230)	0.548 (0.423)	-0.065 (0.291)	0.365 (0.311)	0.317 (0.263)	-0.035 (0.034)	-0.171 (0.514)
2007	0.641*** (0.032)	0.567* (0.224)	-1.336* (0.611)	-0.924** (0.354)	0.740* (0.294)	0.681** (0.260)	-0.022 (0.036)	-0.237 (0.517)
2008	0.521*** (0.026)	0.375 (0.215)	-0.606 (0.503)	0.046 (0.257)	0.701* (0.278)	0.722** (0.241)	0.020 (0.030)	-2.422** (0.818)
2009	0.546*** (0.025)	0.350 (0.185)	-0.603 (0.428)	-0.826** (0.282)	0.488 (0.256)	0.185 (0.216)	-0.051 (0.029)	-2.083* (0.856)
2010	0.490*** (0.023)	0.587** (0.181)	-0.066 (0.375)	-0.419 (0.270)	0.717** (0.226)	0.635** (0.208)	0.083** (0.028)	-8.601*** (1.686)
2011	0.468*** (0.023)	0.576** (0.182)	0.349 (0.529)	-0.383 (0.265)	0.073 (0.234)	0.466* (0.211)	-0.046 (0.027)	-1.722 (0.896)
2012	0.510*** (0.024)	0.774*** (0.172)	-0.810 (0.418)	-0.169 (0.233)	0.472* (0.216)	0.552** (0.196)	0.029 (0.029)	-3.499** (1.078)
2013	0.511*** (0.026)	0.540** (0.197)	-0.645 (0.650)	0.313 (0.245)	0.768** (0.242)	0.823*** (0.221)	0.006 (0.030)	-2.951*** (0.767)
2014	0.479*** (0.025)	-0.160 (0.217)	-1.638** (0.583)	-0.172 (0.263)	0.577* (0.289)	0.322 (0.243)	-0.027 (0.029)	-1.660* (0.707)
2015	0.412*** (0.023)	0.464* (0.191)	-1.176 (1.070)	-0.552* (0.270)	-0.319 (0.291)	0.416 (0.223)	0.072* (0.029)	-3.030*** (0.689)
2016	0.461*** (0.022)	0.140 (0.185)	-1.394** (0.520)	-0.090 (0.238)	0.566* (0.246)	0.447* (0.213)	-0.017 (0.027)	-2.531** (0.818)
2017	0.469*** (0.021)	0.552** (0.181)	-0.962* (0.390)	-0.473* (0.235)	-0.243 (0.246)	0.407* (0.207)	0.038 (0.027)	-4.324** (1.546)
2018	0.454*** (0.022)	0.055 (0.188)	-1.277** (0.440)	-0.111 (0.226)	0.091 (0.246)	0.366 (0.212)	0.028 (0.027)	-4.711*** (1.274)

Year	Usage frequency	Capacity	Incentive	Learning	Symbolic & Hortatory	Category homophily	Frequency difference	Degree heterogeneity
2019	0.487*** (0.025)	0.177 (0.209)	-0.565 (0.502)	-0.387 (0.273)	0.813** (0.260)	0.678** (0.236)	0.084** (0.030)	-1.634 (0.841)
2020	0.499*** (0.024)	0.365* (0.185)	0.199 (0.492)	-0.277 (0.243)	0.772*** (0.228)	0.483* (0.211)	-0.027 (0.029)	-1.261 (0.691)
2021	0.460*** (0.026)	0.128 (0.222)	0.092 (0.455)	-0.266 (0.285)	0.013 (0.316)	0.291 (0.255)	0.107*** (0.031)	-2.649*** (0.591)
2022	0.435*** (0.023)	1.007*** (0.180)	-0.931 (0.571)	-0.006 (0.258)	0.651** (0.245)	0.821*** (0.210)	0.026 (0.029)	-1.604* (0.685)
2023	0.461*** (0.026)	0.192 (0.210)	-0.614 (0.548)	-0.948** (0.357)	-0.137 (0.366)	0.334 (0.249)	0.067* (0.032)	-2.629*** (0.565)

Note: Entries are MPLE coefficient estimates with conventional MPLE standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Authority is the reference category. All models use the same Model 6 specification on the fixed 77-node set.

S8. Extended Goodness-of-Fit Diagnostics

Extended goodness-of-fit diagnostics were conducted for Models 6 and 7 across all 20 annual networks. The diagnostics covered fitted model statistics, degree distributions, edgewise shared-partner distributions, geodesic-distance distributions, component structure, global clustering, and isolated nodes. Component structure was assessed using the total number of components, the number of nontrivial components, and the share of nodes in the largest component. Because each observed annual node set contains only policy instruments participating in at least one observed co-occurrence tie, the observed isolate count is zero by construction and is interpreted separately.

For Model 6, the degree distribution is generally reproduced well outside the low-degree end. The edgewise shared-partner distribution is reproduced more closely at higher shared-partner counts, while larger discrepancies remain at lower counts. The geodesic-distance distribution shows that distances of three or more are overrepresented and disconnected dyads are underrepresented in the simulations, indicating an overestimation of global connectivity. Simulated networks also contain fewer total and nontrivial components than the observed networks, and global clustering is underestimated in every year.

Model 7 improves several out-of-model properties, including portions of the edgewise shared-partner and geodesic-distance distributions, and more closely reproduces global clustering. However, these improvements are accompanied by substantially weaker reproduction of the fitted model statistics, while discrepancies in component structure remain.

Within the theoretically specified candidate model sequence, Model 6 is therefore retained as the primary specification for association-oriented interpretation, while recognizing that it does not fully reproduce all global properties of the observed networks.

Table S18. Summary of extended goodness-of-fit diagnostics for Models 6 and 7 across the 20 annual networks

Diagnostic	Model 6	Model 7
Fitted model statistics within 95% simulation intervals	171/180 (95.0%)	59/200 (29.5%)
Fitted model statistics with Monte Carlo $p < 0.05$	9/180 (5.0%)	141/200 (70.5%)
Fitted model statistics with Monte Carlo $p < 0.10$	17/180 (9.4%)	152/200 (76.0%)
Mean Monte Carlo p-value for fitted model statistics	0.509	0.117
Degree distribution: median annual 95% coverage	88.2%	92.4%
Edgewise shared-partner distribution: median annual 95% coverage	73.0%	79.0%
Geodesic-distance distribution: median annual 95% coverage	20.0%	44.9%
Total components: median observed / median simulated mean	401 / 290.5	401 / 586.1
Nontrivial components: median observed / median simulated mean	401 / 160.5	401 / 358.3
Largest-component share: median observed / median simulated mean	0.871 / 0.936	0.871 / 0.848

Diagnostic	Model 6	Model 7
Global clustering: median observed / median simulated mean	0.050 / 0.044	0.050 / 0.051
Isolates: median observed / median simulated mean	0.0 / 124.7	0.0 / 220.2

Note: All extended GOF diagnostics are based on 500 simulated networks per annual model. For degree, edgewise shared partners, and geodesic distance, coverage is the median across annual proportions of categories with positive observed counts that fall within pointwise 95% simulation intervals. For component structure, global clustering, and isolates, slash-separated values report the median annual observed statistic and the median annual simulated mean. Observed isolates are zero by construction because annual observed networks include only active nodes.

Because 2017 contains the largest observed annual network, the diagnostic plots below use 2017 as a representative high-scale case, while Table S18 summarizes the corresponding diagnostics across all 20 years.

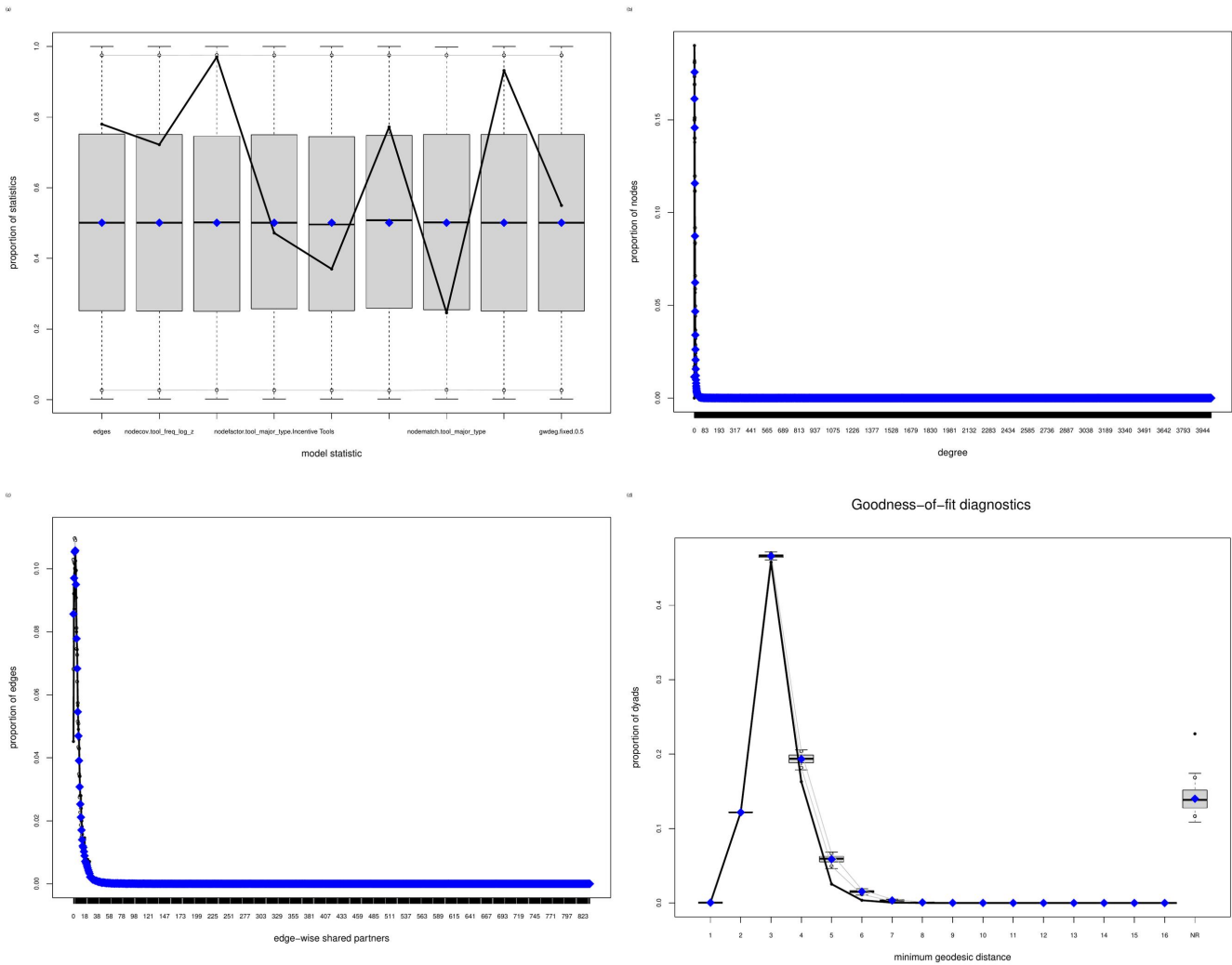


Figure S1. Standard GOF diagnostics for Model 6 in 2017. Panels show (a) fitted model statistics, (b) degree distribution, (c) edgewise shared-partner distribution, and (d) geodesic-distance distribution. Observed values are compared with distributions from 500 networks simulated from the fitted annual ERGM.

Custom structural GOF: M6 2017

Solid = observed; hollow = simulated mean; bar = pointwise 95% simulation interval

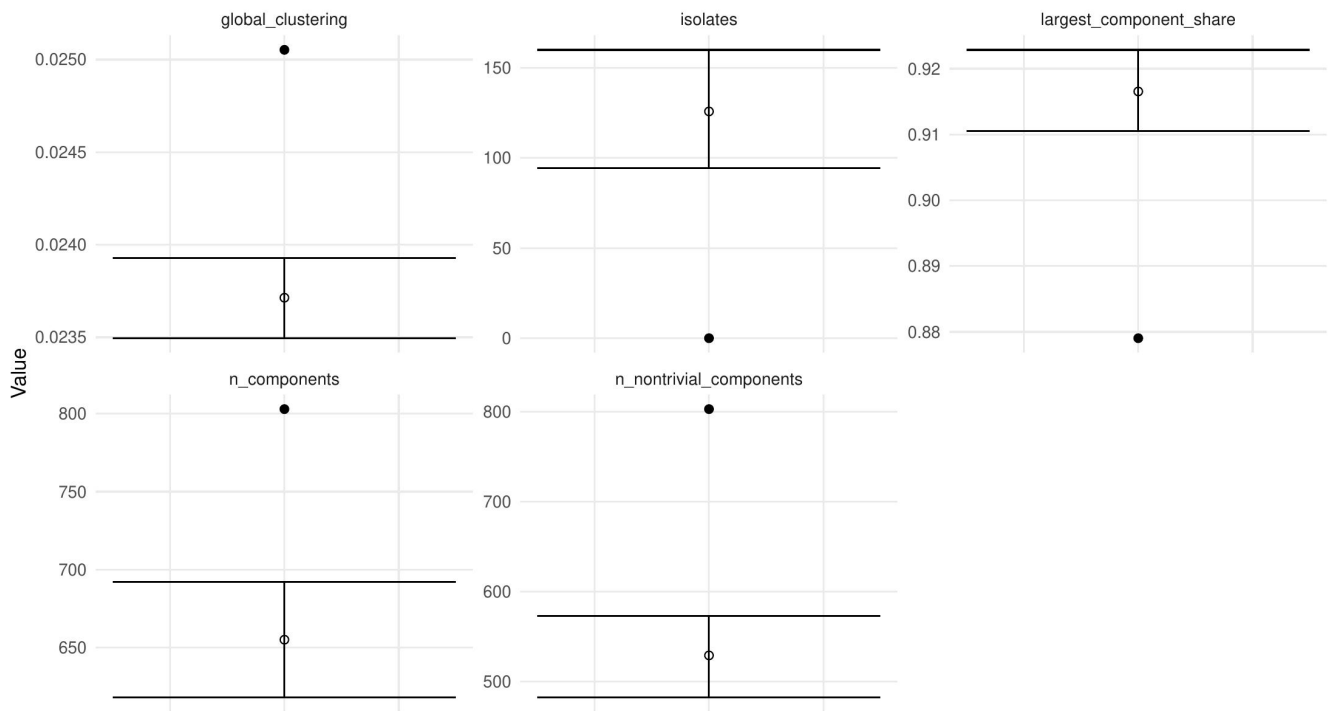


Figure S2. Additional structural GOF diagnostics for Model 6 in 2017. Solid points denote observed statistics, hollow points denote simulated means, and interval bars denote pointwise 95% simulation intervals based on 500 simulated networks. Component structure is represented by the total number of components, number of nontrivial components, and largest-component share; global clustering and isolated nodes are shown separately.

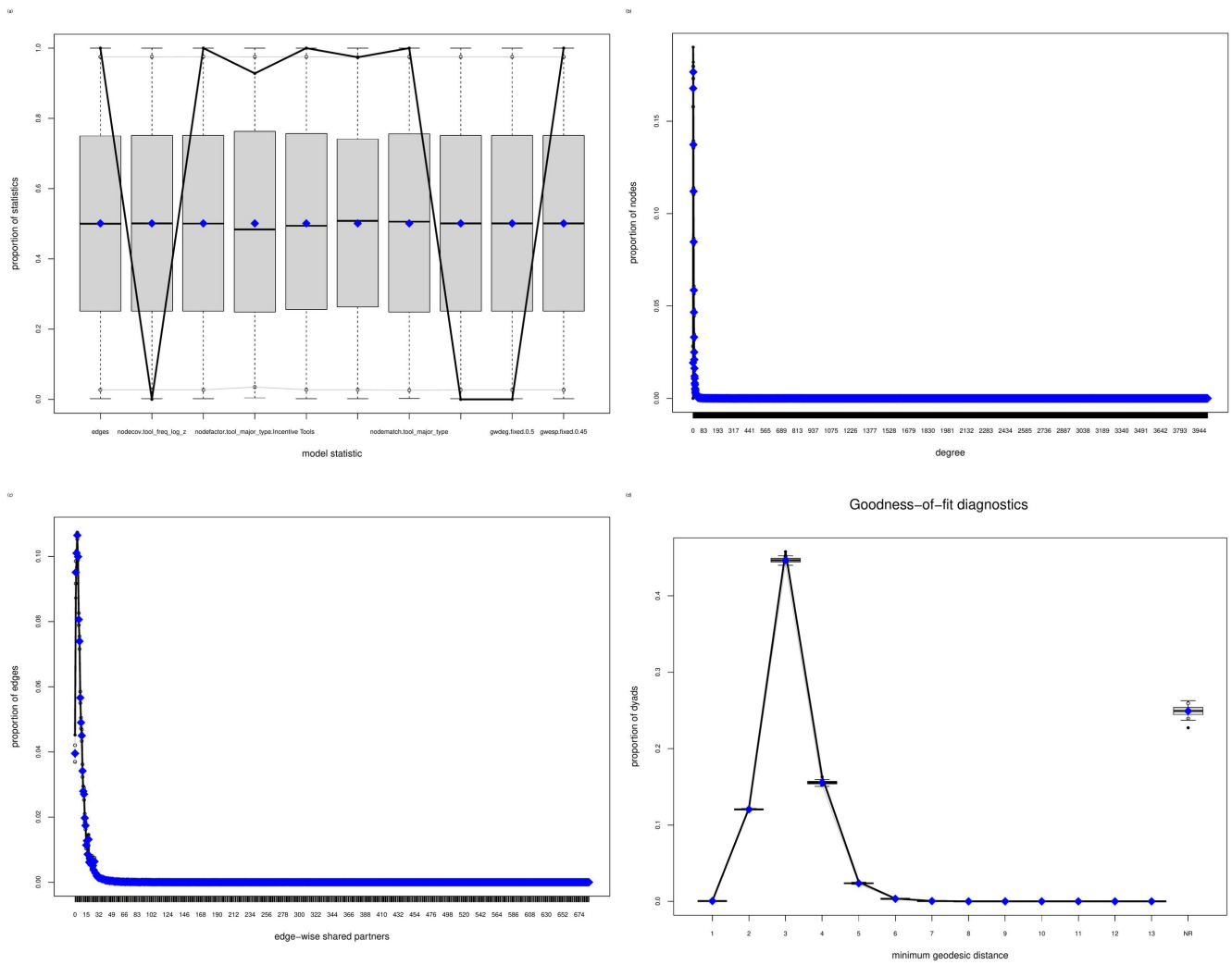


Figure S3. Standard GOF diagnostics for Model 7 in 2017. Panels show (a) fitted model statistics, (b) degree distribution, (c) edgewise shared-partner distribution, and (d) geodesic-distance distribution. Observed values are compared with distributions from 500 networks simulated from the fitted annual ERGM.

Custom structural GOF: M7 2017

Solid = observed; hollow = simulated mean; bar = pointwise 95% simulation interval

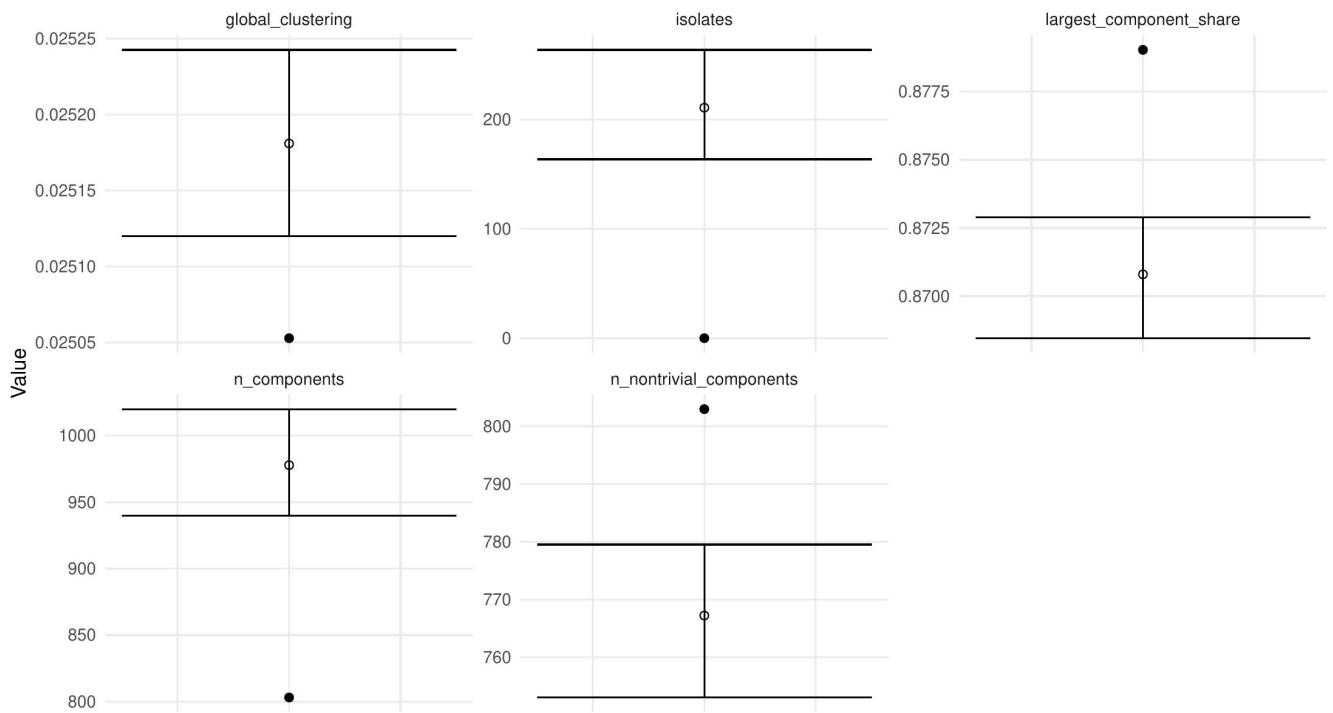


Figure S4. Additional structural GOF diagnostics for Model 7 in 2017. Solid points denote observed statistics, hollow points denote simulated means, and interval bars denote pointwise 95% simulation intervals based on 500 simulated networks. Component structure is represented by the total number of components, number of nontrivial components, and largest-component share; global clustering and isolated nodes are shown separately.