

LET'S SAY AMEN FOR LATENT SPACE MODELS

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Response to Cranmer et al. (2016).

popularity of network approaches in recent years isq special issue...

notable work by cranmer on ergms re lsm

set of important challenges for lsm

relation to actual literature on lsm

we show...

1. REPLICATION RESULTS

	Logit	MRQAP	LSM	ERGM	AME
Intercept/Edges	-4.44* (0.34)	-4.24*	0.94* [0.09; 1.82]	-12.17* (1.40)	-3.39* [-4.38; -2.50]
Conflicting policy preferences					
Business vs. NGO	-0.86 (0.46)	-0.87*	-1.37* [-2.42; -0.41]	-1.11* (0.51)	-1.37* [-2.44; -0.47]
Opposition/alliance	1.21* (0.20)	1.14*	0.00 [-0.40; 0.39]	1.22* (0.20)	1.08* [0.72; 1.47]
Preference dissimilarity	-0.07 (0.37)	-0.60	-1.76* [-2.62; -0.90]	-0.44 (0.39)	-0.79* [-1.55; -0.08]
Transaction costs					
Joint forum participation	0.88* (0.27)	0.75*	1.51* [0.86; 2.17]	0.90* (0.28)	0.92* [0.40; 1.47]
Influence					
Influence attribution	1.20* (0.22)	1.29*	0.08 [-0.40; 0.55]	1.00* (0.21)	1.09* [0.69; 1.53]
Alter's influence indegree	0.10* (0.02)	0.11*	0.01 [-0.03; 0.04]	0.21* (0.04)	0.11* [0.07; 0.15]
Influence absolute diff.	-0.03* (0.02)	-0.06*	0.04 [-0.01; 0.09]	-0.05* (0.01)	-0.07* [-0.11; -0.03]
Alter = Government actor	0.63* (0.25)	0.68	-0.46 [-1.08; 0.14]	1.04* (0.34)	0.55 [-0.07; 1.15]
Functional requirements					
Ego = Environmental NGO	0.88* (0.26)	0.99	-0.60 [-1.32; 0.09]	0.79* (0.17)	0.67 [-0.38; 1.71]
Same actor type	0.74* (0.22)	1.12*	1.17* [0.63; 1.71]	0.99* (0.23)	1.04* [0.63; 1.50]
Endogenous dependencies					
Mutuality	1.22* (0.21)	1.00*		0.81* (0.25)	
Outdegree popularity				0.95* (0.09)	
Twopaths				-0.04* (0.02)	
GWdegree (2.0)				3.42* (1.47)	
GWESP (1.0)				0.58* (0.16)	
GWdegree (0.5)				8.42* (2.11)	

Table 1. * $p < 0.05$ (or 0 outside the 95% confidence interval).

2. CAPTURING NETWORK STUFF

Figure 2 give posterior predictive goodness of fit summaries for four network statistics: (1) the empirical standard deviation of the row means; (2) the empirical standard deviation of the column means; (3) the empirical within-dyad correlation; (4) a normalized measure of triadic dependence

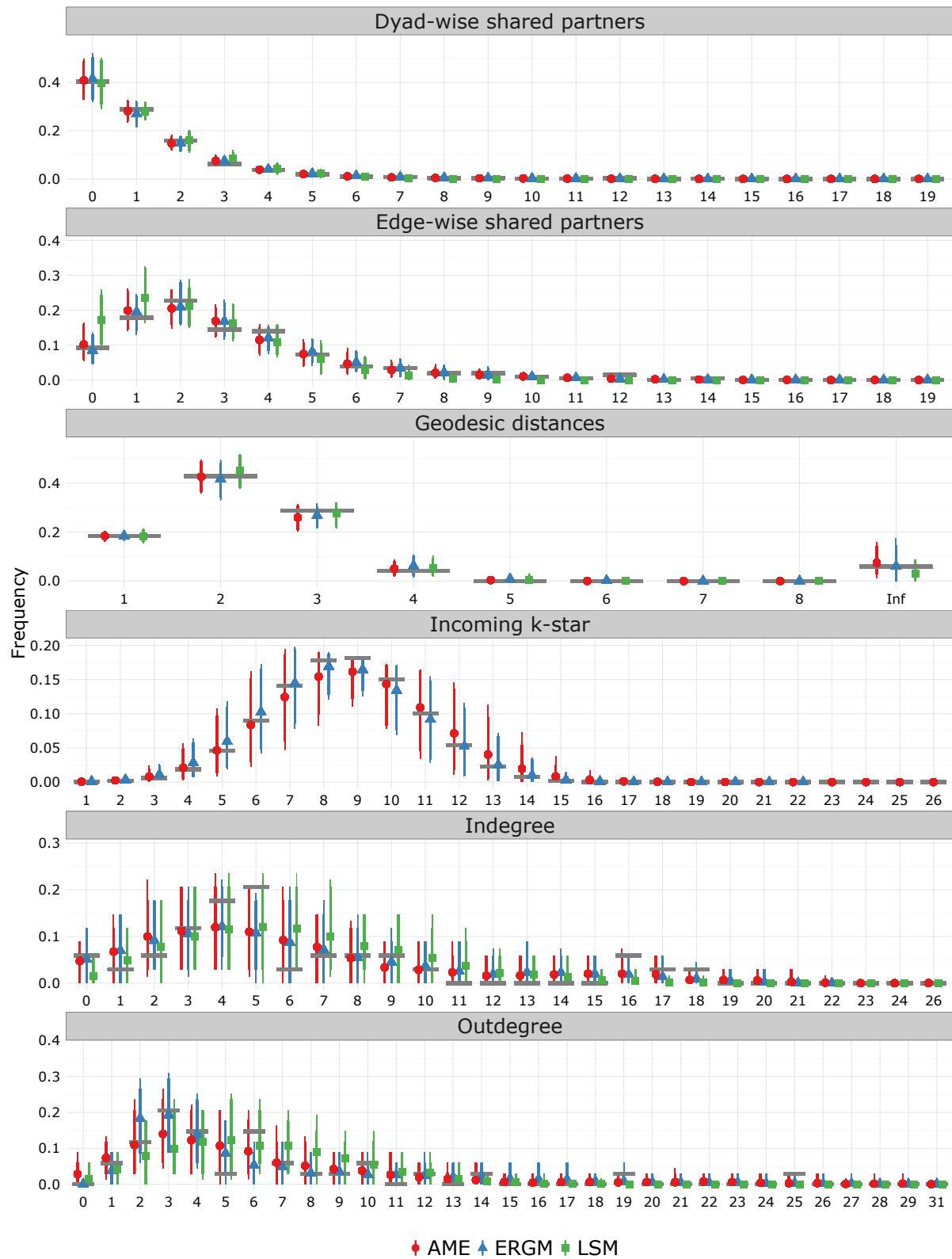


Figure 1. network stats

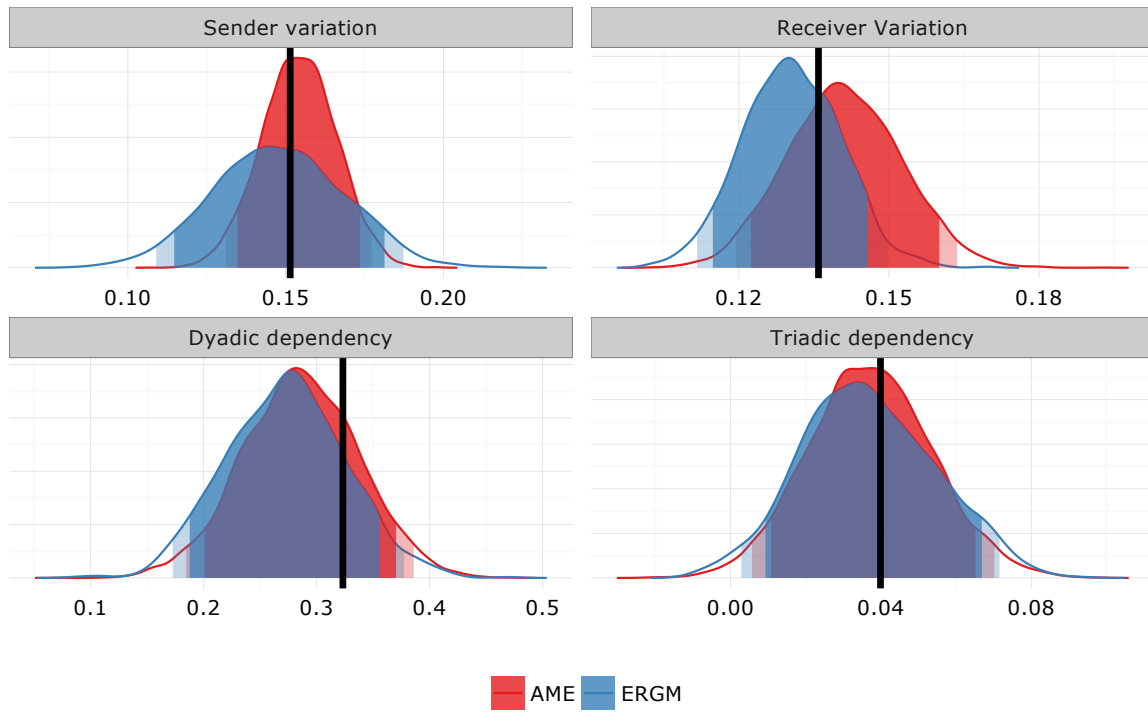
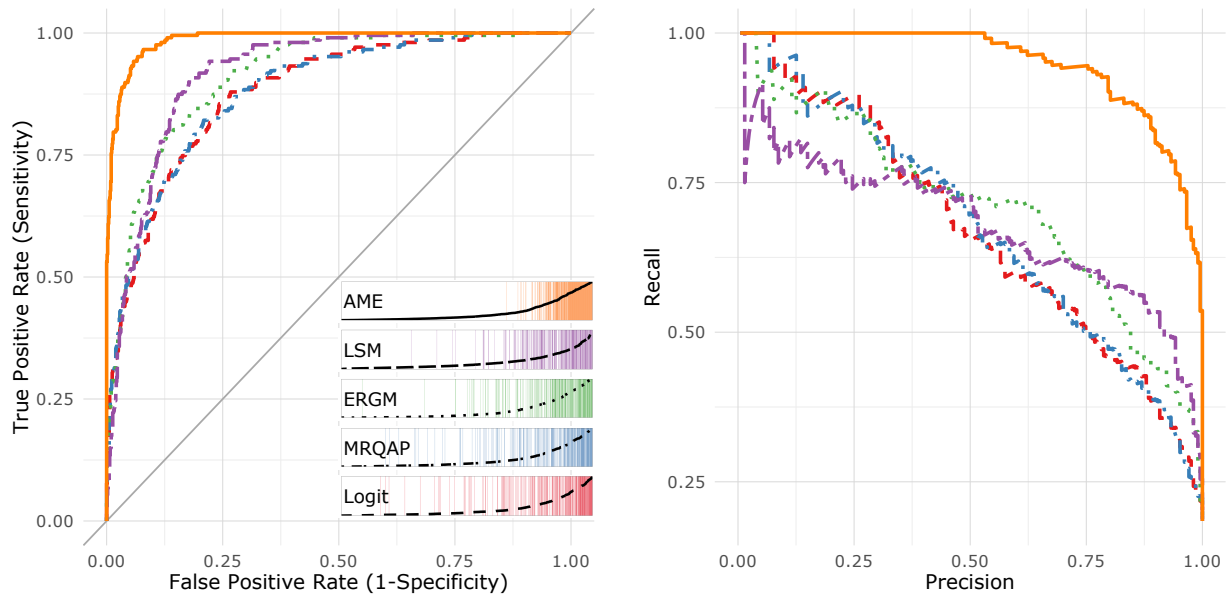


Figure 2. Posterior predictive goodness of fit summary

3. TIE FORMATION PREDICTION

	AUC	AUC (PR)
AME	0.99	0.94
LSM	0.92	0.68
ERGM	0.91	0.70
MRQAP	0.88	0.67
Logit	0.88	0.67

Table 2. Area under the curve (AUC) comparison.**Figure 3.** ROC and separation plots

4. CONCLUSION

5. APPENDIX

6. AMEN MODEL CONVERGENCE

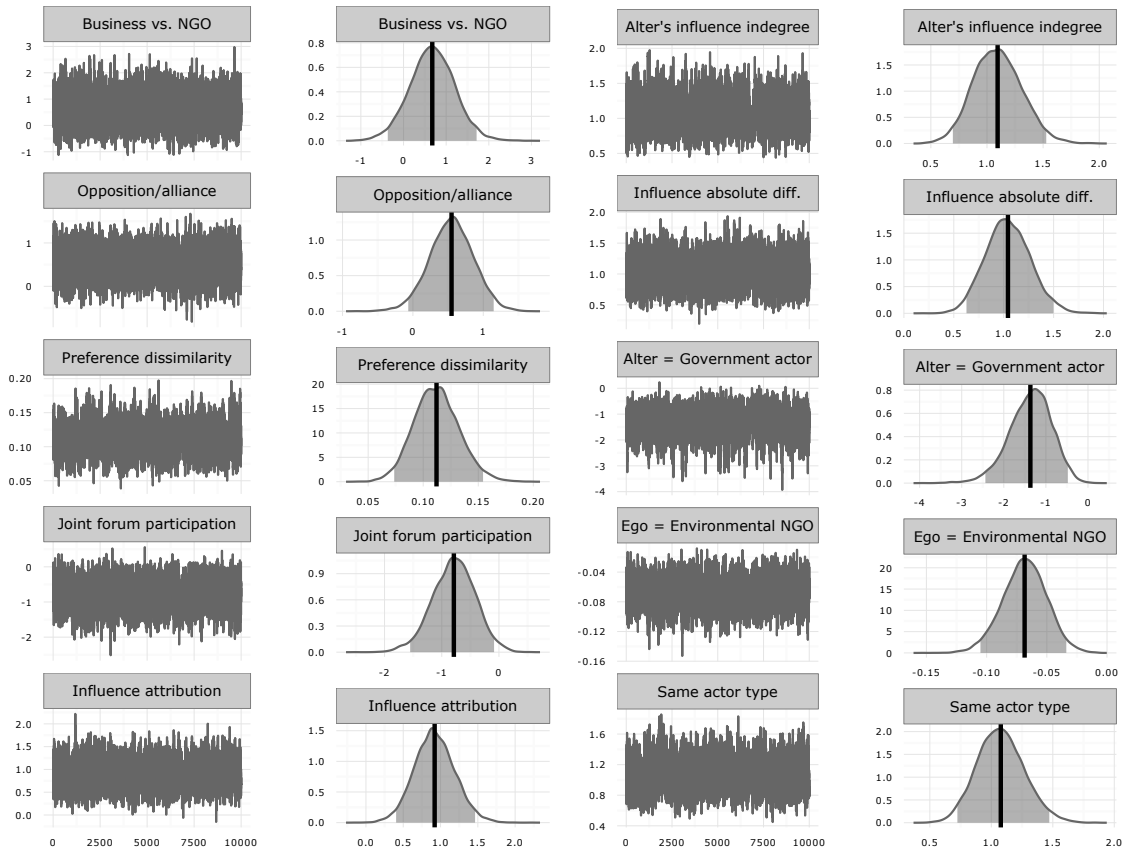


Figure 4. ame convergence

7. COMPARISON WITH OTHER AME PARAMETERIZATIONS

	AME (k=0)	AME (k=1)	AME (k=2)	AME (k=3)	AME (k=4)
Intercept/Edges	-2.19* [-2.55; -1.85]	-2.72* [-3.41; -1.82]	-2.75* [-3.59; -1.88]	-2.92* [-3.81; -2.04]	-3.03* [-4.03; -1.99]
Conflicting policy preferences					
Business vs. NGO	-0.46 [-0.95; -0.01]	-0.88* [-1.64; -0.22]	-0.96* [-1.86; -0.22]	-1.03* [-1.96; -0.24]	-1.12* [-2.15; -0.25]
Opposition/alliance	0.65* [0.44; 0.86]	0.79* [0.53; 1.07]	0.86* [0.56; 1.16]	0.95* [0.62; 1.32]	1.03* [0.67; 1.42]
Preference dissimilarity	-0.52* [-0.95; -0.10]	-0.49 [-1.03; 0.04]	-0.57 [-1.17; 0.02]	-0.65 [-1.34; 0.00]	-0.75* [-1.47; -0.07]
Transaction costs					
Joint forum participation	0.49* [0.18; 0.79]	0.68* [0.30; 1.06]	0.72* [0.30; 1.13]	0.77* [0.30; 1.24]	0.81* [0.31; 1.32]
Influence					
Influence attribution	0.76* [0.52; 0.99]	0.86* [0.56; 1.16]	0.93* [0.59; 1.29]	1.01* [0.64; 1.41]	1.08* [0.68; 1.52]
Alter's influence indegree	0.06* [0.04; 0.08]	0.08* [0.05; 0.10]	0.08* [0.05; 0.11]	0.09* [0.06; 0.12]	0.10* [0.06; 0.14]
Influence absolute diff.	-0.03* [-0.05; -0.01]	-0.04* [-0.07; -0.02]	-0.05* [-0.08; -0.02]	-0.05* [-0.09; -0.02]	-0.06* [-0.09; -0.02]
Alter = Government actor	0.38* [0.10; 0.64]	0.51* [0.13; 0.88]	0.56* [0.11; 1.01]	0.62* [0.13; 1.14]	0.67* [0.10; 1.27]
Functional requirements					
Ego = Environmental NGO	0.49* [0.22; 0.77]	0.50 [-0.24; 1.18]	0.54 [-0.27; 1.32]	0.61 [-0.31; 1.50]	0.72 [-0.27; 1.78]
Same actor type	0.74* [0.49; 1.00]	0.89* [0.58; 1.21]	0.93* [0.58; 1.28]	0.98* [0.60; 1.36]	1.02* [0.62; 1.45]

Table 3. * $p < 0.05$ (or 0 outside the 95% confidence interval).

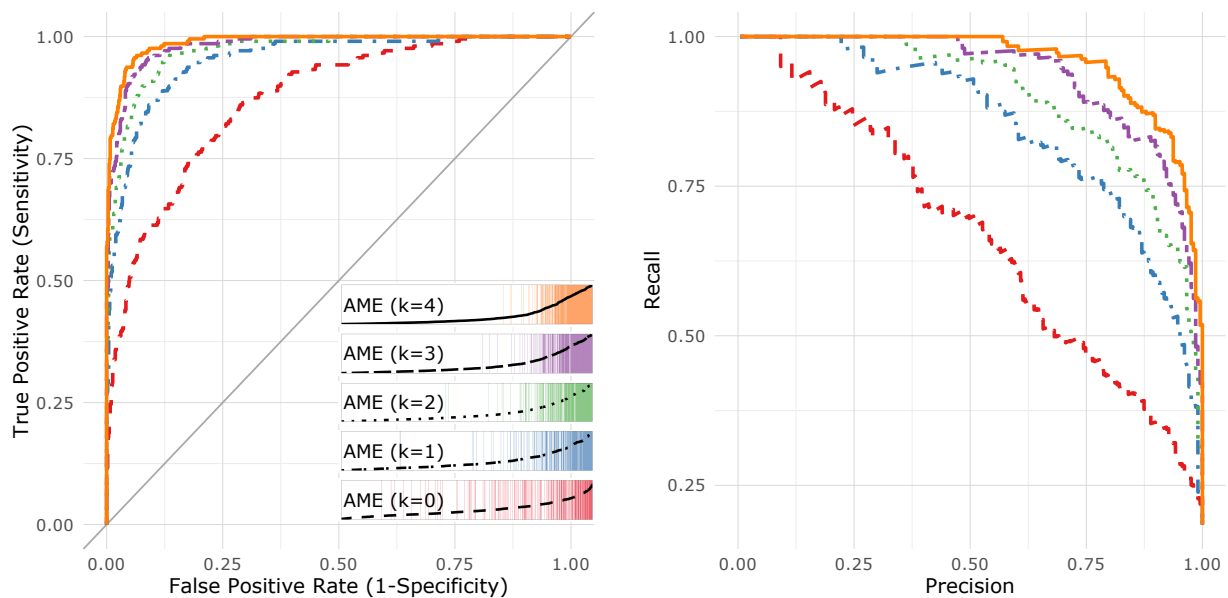


Figure 5. ROC and separation plots

	AME SR (k=0)	AME SR (k=1)	AME SR (k=2)	AME SR (k=3)	AME SR (k=4)
Intercept/Edges	-2.75* [-3.43; -2.09]	-3.08* [-3.91; -2.30]	-3.39* [-4.38; -2.50]	-3.72* [-4.84; -2.73]	-3.93* [-5.12; -2.87]
Conflicting policy preferences					
Business vs. NGO	-1.08* [-1.82; -0.41]	-1.28* [-2.20; -0.47]	-1.37* [-2.44; -0.47]	-1.48* [-2.63; -0.49]	-1.51* [-2.69; -0.47]
Opposition/alliance	0.83* [0.57; 1.10]	0.95* [0.64; 1.27]	1.08* [0.72; 1.47]	1.19* [0.80; 1.64]	1.28* [0.86; 1.77]
Preference dissimilarity	-0.49 [-1.06; 0.06]	-0.65* [-1.30; -0.03]	-0.79* [-1.55; -0.08]	-0.89* [-1.71; -0.12]	-0.95* [-1.80; -0.14]
Transaction costs					
Joint forum participation	0.73* [0.34; 1.12]	0.84* [0.38; 1.31]	0.92* [0.40; 1.47]	1.01* [0.44; 1.62]	1.06* [0.43; 1.72]
Influence					
Influence attribution	0.88* [0.57; 1.19]	1.00* [0.63; 1.39]	1.09* [0.69; 1.53]	1.21* [0.75; 1.71]	1.28* [0.80; 1.84]
Alter's influence indegree	0.09* [0.06; 0.12]	0.10* [0.07; 0.14]	0.11* [0.07; 0.15]	0.12* [0.08; 0.17]	0.13* [0.09; 0.18]
Influence absolute diff.	-0.06* [-0.08; -0.03]	-0.06* [-0.10; -0.03]	-0.07* [-0.11; -0.03]	-0.07* [-0.12; -0.04]	-0.08* [-0.12; -0.04]
Alter = Government actor	0.49 [-0.01; 0.99]	0.52 [-0.04; 1.07]	0.55 [-0.07; 1.15]	0.60 [-0.07; 1.27]	0.64 [-0.07; 1.35]
Functional requirements					
Ego = Environmental NGO	0.54 [-0.28; 1.36]	0.61 [-0.31; 1.56]	0.67 [-0.38; 1.71]	0.76 [-0.38; 1.90]	0.80 [-0.40; 2.04]
Same actor type	0.88* [0.55; 1.21]	0.97* [0.60; 1.35]	1.04* [0.63; 1.50]	1.11* [0.64; 1.59]	1.17* [0.68; 1.68]

Table 4. * $p < 0.05$ (or 0 outside the 95% confidence interval).

	AUC	AUC (PR)
AME (k=4)	0.99	0.95
AME (k=3)	0.98	0.93
AME (k=2)	0.97	0.89
AME (k=1)	0.95	0.85
AME (k=0)	0.87	0.66

Table 5. Area under the curve (AUC) comparison for latent space approaches.

	AUC	AUC (PR)
AME SR (k=4)	1.00	0.98
AME SR (k=3)	0.99	0.97
AME SR (k=2)	0.99	0.94
AME SR (k=1)	0.97	0.90
AME SR (k=0)	0.95	0.83

Table 6. Area under the curve (AUC) comparison for latent space approaches.

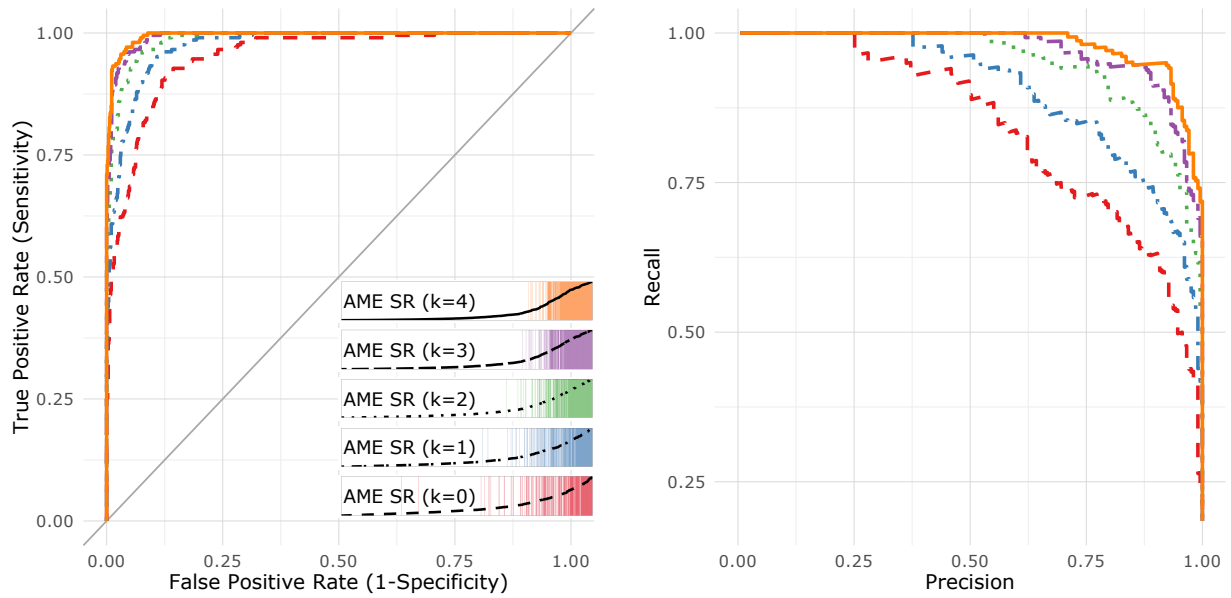


Figure 6. ROC and separation plots

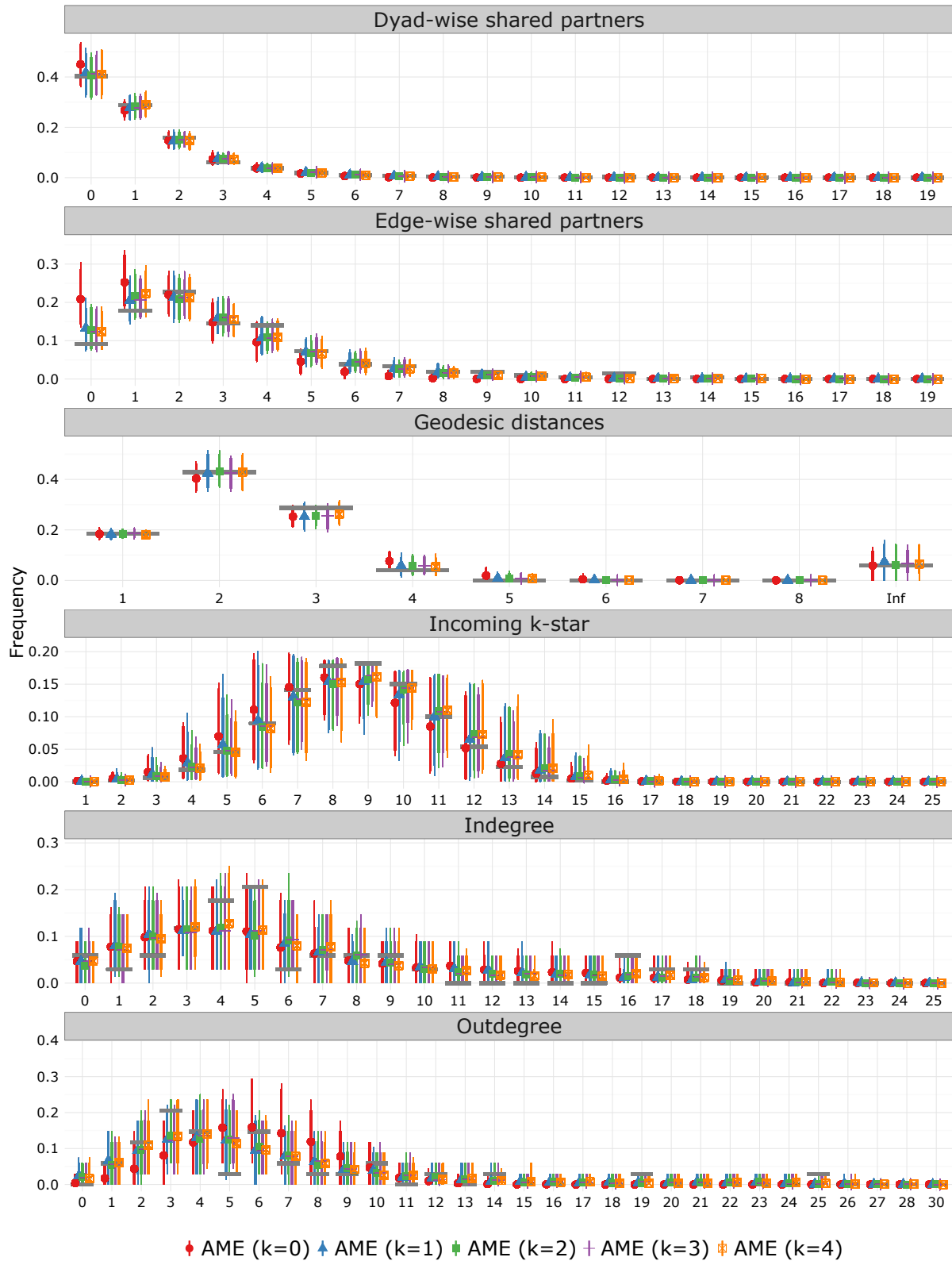


Figure 7. network stats

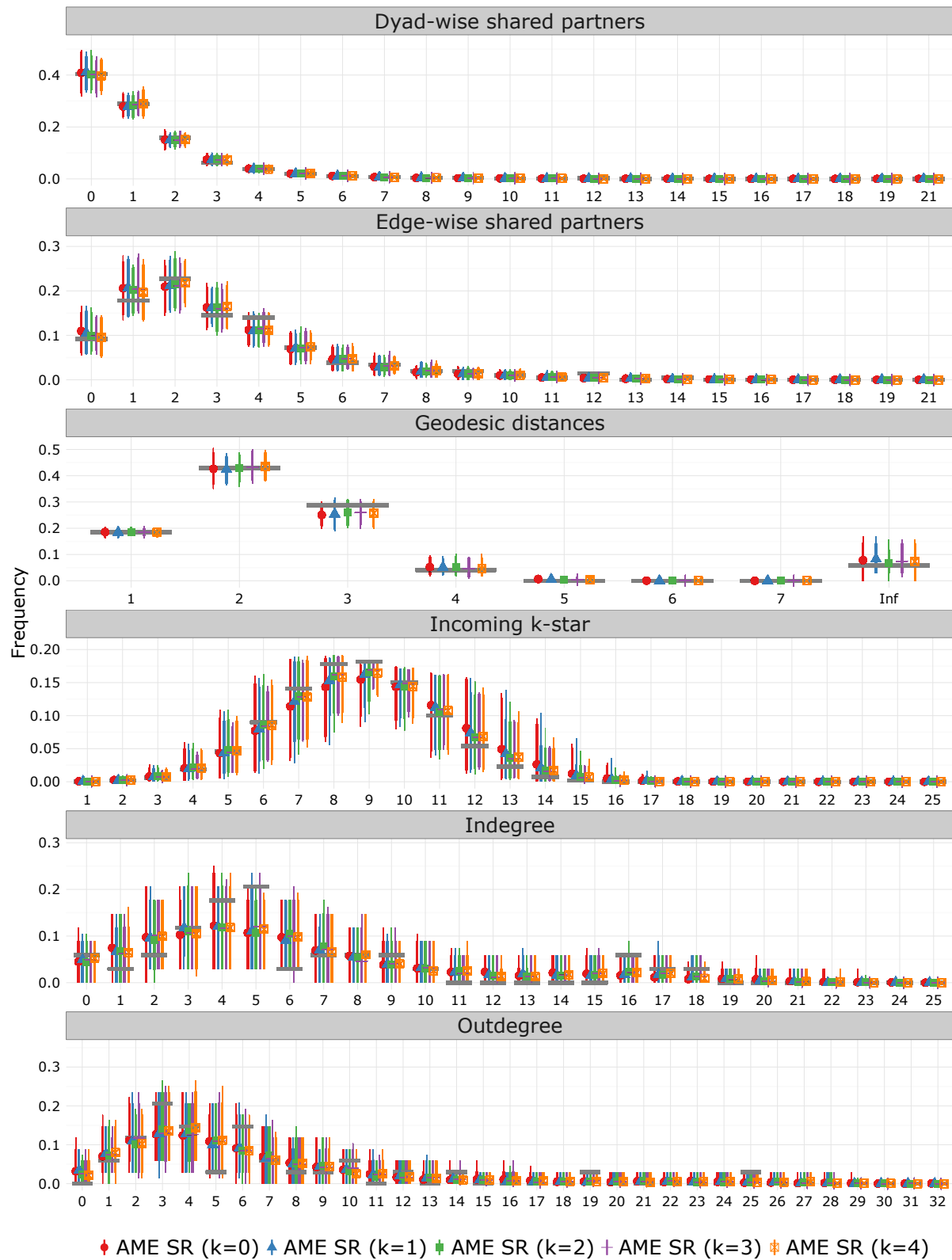


Figure 8. network stats

8. AMEN & LATENT NET COMPARISON

	LSM	LSM (Bilinear)	LSM (SR)	LSM (Bilinear + SR)	AME
Intercept/Edges	0.94* [0.09; 1.82]	-2.66* [-3.53; -1.87]	0.60 [-1.10; 2.37]	-2.50* [-4.14; -0.88]	-3.39* [-4.38; -2.50]
Conflicting policy preferences					
Business vs. NGO	-1.37* [-2.42; -0.41]	-2.64* [-4.61; -0.96]	-3.07* [-4.77; -1.56]	-2.87* [-4.63; -1.29]	-1.37* [-2.44; -0.47]
Opposition/alliance	0.00 [-0.40; 0.39]	0.04 [-0.44; 0.54]	0.31 [-0.24; 0.86]	0.24 [-0.36; 0.82]	1.08* [0.72; 1.47]
Preference dissimilarity	-1.76* [-2.62; -0.90]	-2.00* [-3.01; -1.03]	-1.88* [-3.07; -0.68]	-2.20* [-3.46; -0.96]	-0.79* [-1.55; -0.08]
Transaction costs					
Joint forum participation	1.51* [0.86; 2.17]	1.24* [0.53; 1.93]	1.56* [0.69; 2.41]	1.62* [0.70; 2.52]	0.92* [0.40; 1.47]
Influence					
Influence attribution	0.08 [-0.40; 0.55]	-0.08 [-0.62; 0.46]	0.30 [-0.37; 0.96]	0.28 [-0.42; 0.97]	1.09* [0.69; 1.53]
Alter's influence indegree	0.01 [-0.03; 0.04]	-0.05* [-0.09; -0.01]	0.06 [-0.03; 0.14]	0.05 [-0.04; 0.13]	0.11* [0.07; 0.15]
Influence absolute diff.	0.04 [-0.01; 0.09]	0.02 [-0.03; 0.07]	-0.08* [-0.14; -0.02]	-0.08* [-0.14; -0.02]	-0.07* [-0.11; -0.03]
Alter = Government actor	-0.46 [-1.08; 0.14]	-0.80 [-1.67; 0.04]	-0.11 [-1.91; 1.76]	-0.20 [-2.14; 1.74]	0.55 [-0.07; 1.15]
Functional requirements					
Ego = Environmental NGO	-0.60 [-1.32; 0.09]	-1.90* [-3.10; -0.86]	-1.69 [-3.74; 0.23]	-1.84 [-4.02; 0.11]	0.67 [-0.38; 1.71]
Same actor type	1.17* [0.63; 1.71]	1.40* [0.85; 1.95]	1.82* [1.10; 2.54]	1.90* [1.19; 2.62]	1.04* [0.63; 1.50]

Table 7. * p < 0.05 (or 0 outside the 95% confidence interval).

	AUC	AUC (PR)
AME	0.99	0.94
LSM (Bilinear + SR)	0.97	0.91
LSM (SR)	0.97	0.90
LSM (Bilinear)	0.93	0.77
LSM	0.92	0.68

Table 8. Area under the curve (AUC) comparison for latent space approaches.

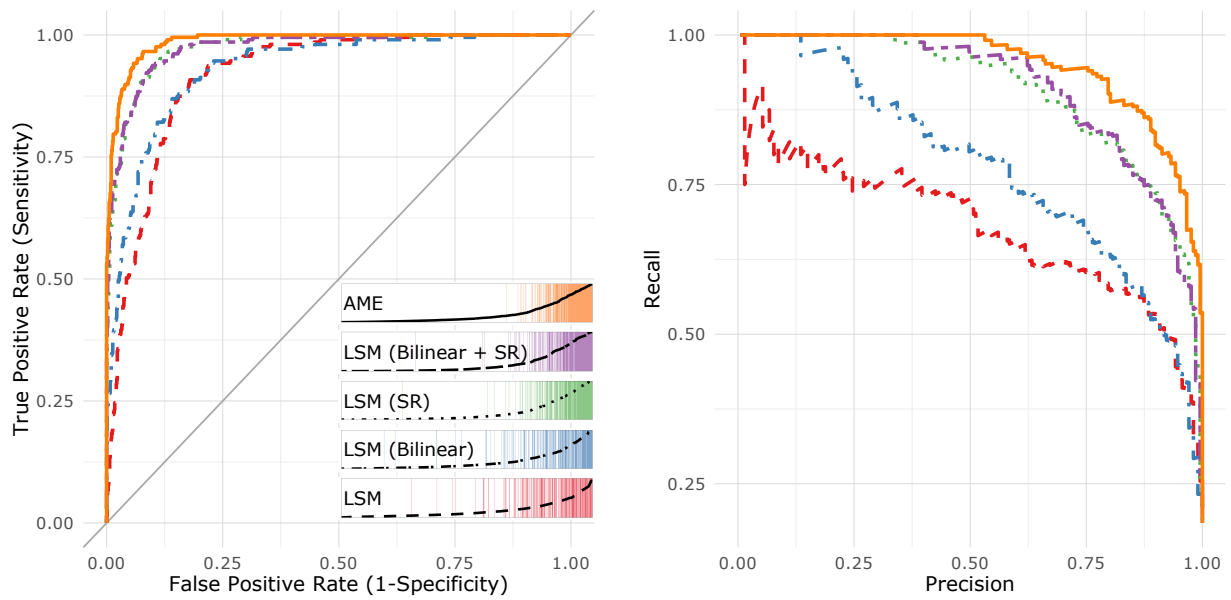


Figure 9. ROC and separation plots

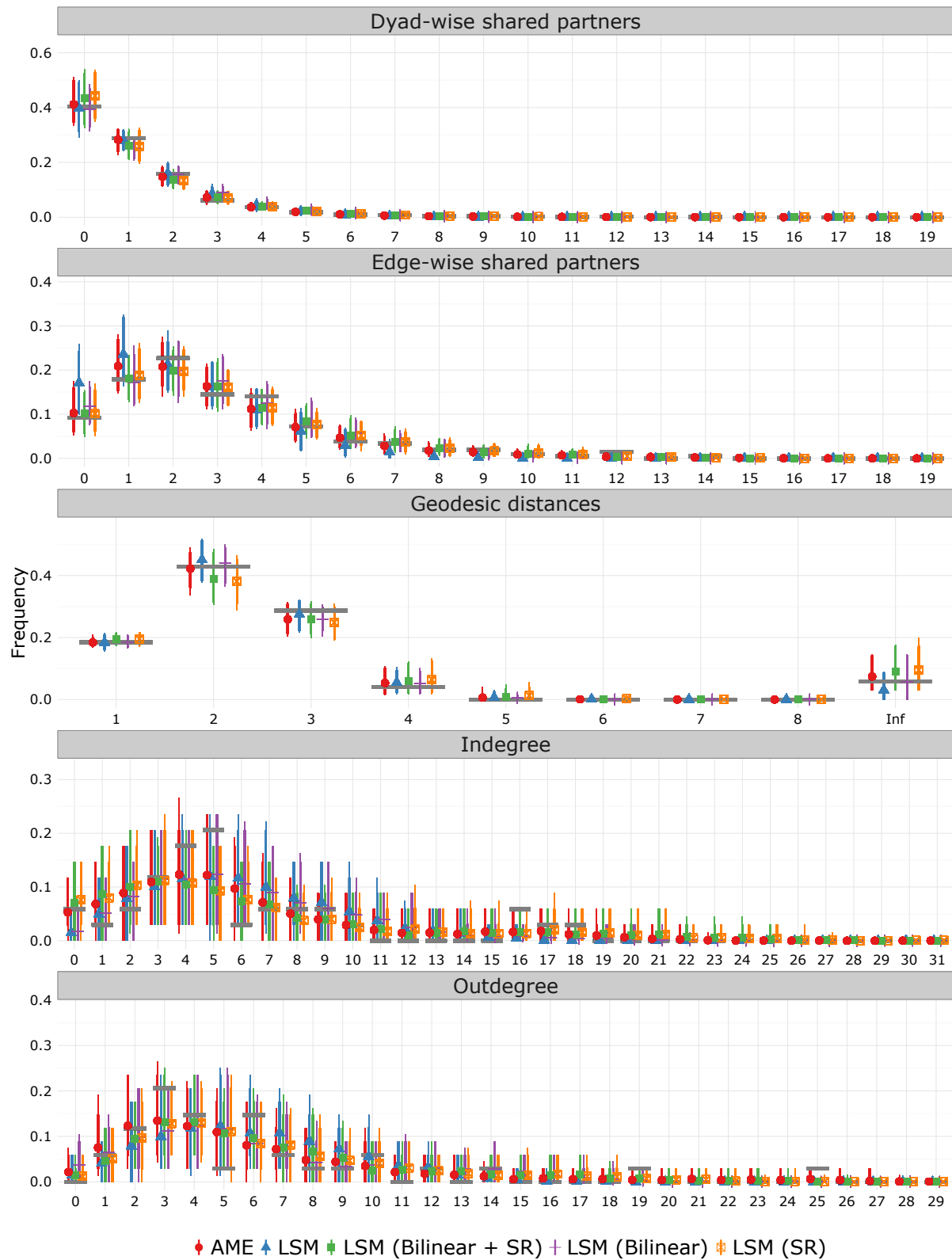


Figure 10. network stats

REFERENCES

Cranmer, Skyler; Philip Leifeld; Scott McClurg & Meredith Rolfe (2016) Navigating the range of statistical tools for inferential network analysis. *American Journal of Political Science*.

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