IHDP Open Science Meeting 2009 (Bonn, April 27)

Session:A230 Comparing Climate change Policy Networks (II)

# Dynamic Social Network Analysis On The Formation Of International Environmental Regimes

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# Outline

- Background on international environmental regimes
- Review empirical studies
- Object of analysis & hypotheses
- Analysis
  - Application of dynamic social network
  - Econometric approach
- Conclusion

# The background

- In 1992, the Earth Summit in Rio de Janeiro marked the maturing of ecological awareness on a global scale. The world made a shift to ecological sustainability.
- During last 30 years, more than 900 international environmental treaties were established.
- The ratification of international environmental treaties has risen dramatically.

# Conventional methodology in International Relations Research

- Studies on international relations (IR) require a systemic approach to identifying fundamental processes and forces of change
- In contrast, most analyses focus on countries or individual treaties
  - Game theory; agent based simulation
  - Case studies

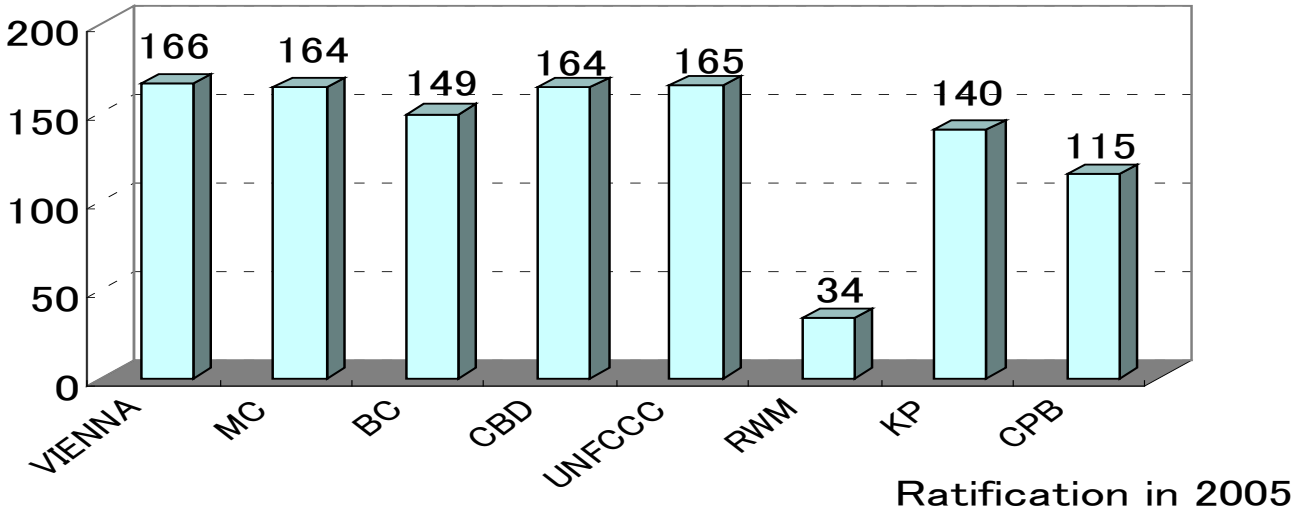
# Empirical Studies ratification of treaties

- Democratic freedoms
  (Congleton,1992; Murdoch & Sandler, 1997)
- Interests and powers of the dominant actors (Meyer,1997)
- The presence of civil liberties (Fredriksson, and Gaston, 2000)
- GDP per capita, Lobby groups, Relationships and influence between (Boockmann, 2001;Frank, 1999)
- The international position of the country
  (von Stein, 2008)

# The scope of this analysis

- International environmental regime

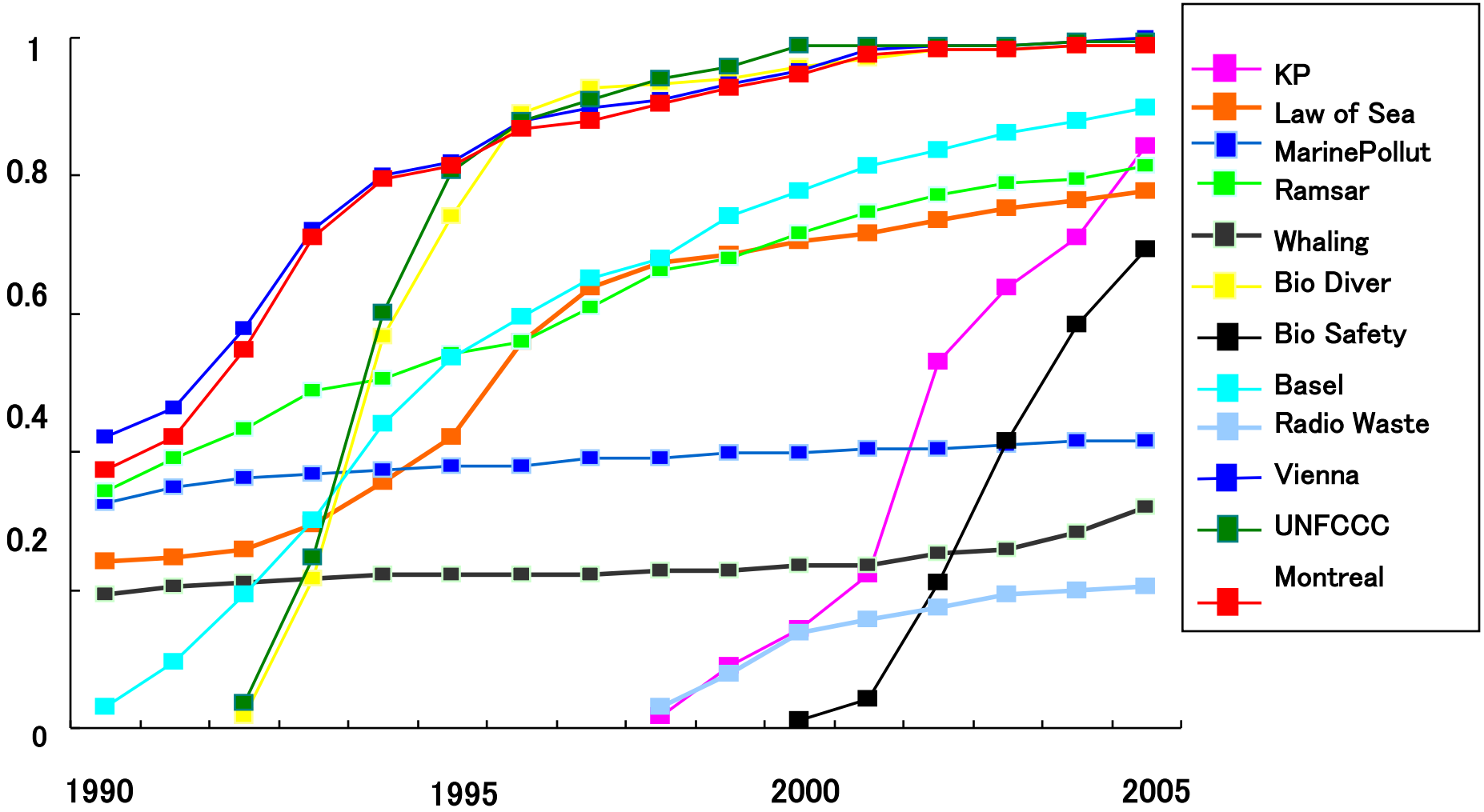
  The environmental regime in this study refers to the environmental treaties and the countries that ratified the treaties.
- Especially, we focus on the ratifications of 8 treaties that were agreed upon after 1989 by166 countries



# 12 Environmental Treaties

| Abbreviation | Formal Name | Date of Adoption |
|---|---|---|
| ICRW | International Convention for the Regulation of Whaling | 1948 |
| RAMSAR | The Ramsar Convention on Wetlands | 1971 |
| LDC | Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter | 1972 |
| LOS | UN Convention on the Law of the Sea | 1982 |
| VIENNA | Vienna Convention for the Protection of the Ozone Layer | 1985 |
| MC | Montreal Convention on Substances that Deplete the Ozone Layer | 1987 |
| BC | Basel Convention on the Control of Tran boundary Movements of Hazardous Wastes and Their Disposal | 1989 |
| CBD | The Convention on Biological Diversity | 1992 |
| UNFCCC | UN Framework Convention on Climate Change | 1992 |
| RWM | Convention on the Safety of Spent. Fuel Management and on the Safety of Radioactive Waste Management | 1997 |
| KP | Kyoto Protocol | 1997 |
| CPB | Cartagena Protocol on Bio-safety | 2000 |

# Change of ratification ratios since 1990

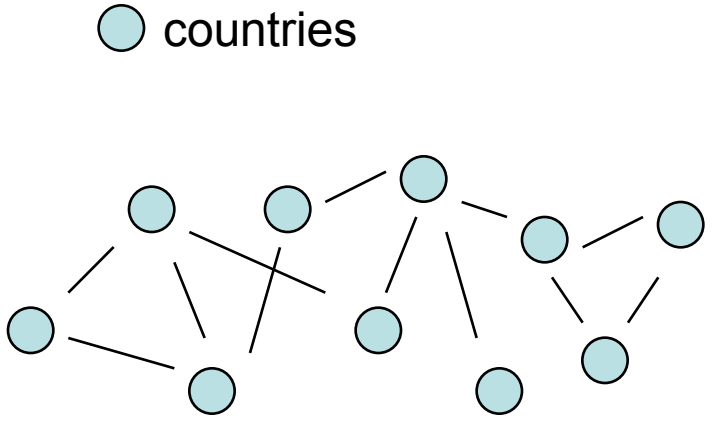


# Hypotheses and Model

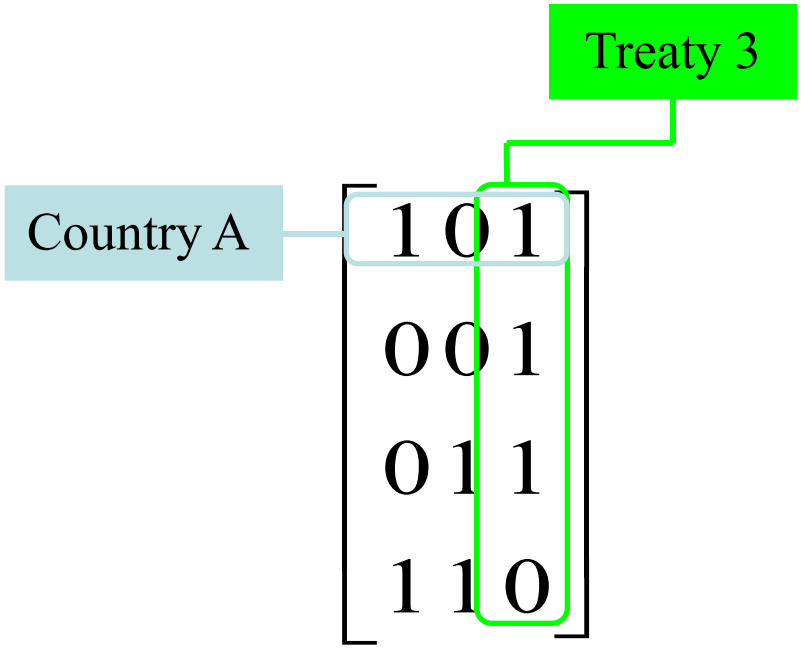
- Hypothesis:
  - Countries that have ratified environmental treaties with other group countries are more likely to ratify a new treaty
- Model:
  - Combining two-modes social network structural measure (centrality) and country-level socio economic data to regress the ratification behaviors
  - Test the significance of the social network parameters

# Social network analysis

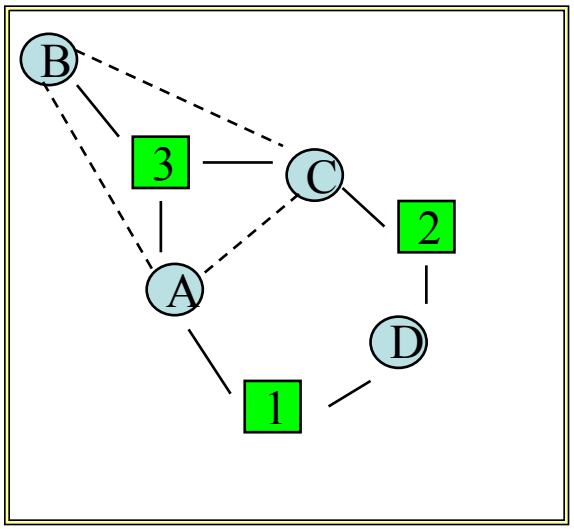
- SNA provides both a visual and a mathematical analysis of human relationships.
- The nodes in the network are the people and groups while the links show relationships or flows between the nodes

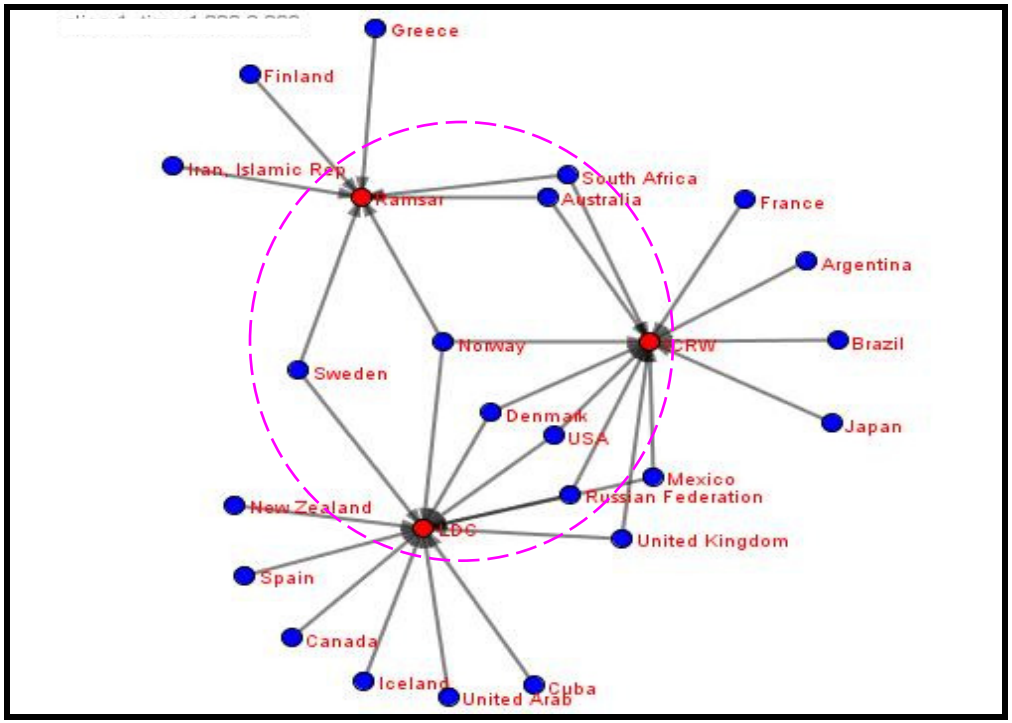


# Affiliation matrix and two modes network




- Affiliation matrix consists of actors (countries) and events (treaties).




environmental treatise's two modes network (1975)

# Changes of country ratification behavior

| Proportion Treaties Ratified (T=7) | | Proportion Treaties Ratified (T=11) | | Proportion Treaties Ratified (T=12) | |
|---|---|---|---|---|---|
| Switzeland | 0.857 | Norway | 0.909 | Japan | 1.000 |
| Kenya | 0.857 | Germany | 0.909 | Germany | 1.000 |
| Mexico | 0.857 | Mexico | 0.818 | Norway | 0.917 |
| Norway | 0.857 | Japan | 0.818 | Mexico | 0.917 |
| USA | 0.714 | Australia | 0.818 | Italy | 0.917 |
| Japan | 0.714 | Italy | 0.818 | Argentina | 0.917 |
| Australia | 0.714 | Argentina | 0.818 | China | 0.917 |
| Germany | 0.714 | China | 0.818 | Switzeland | 0.917 |
| Italy | 0.571 | Switzeland | 0.727 | Kenya | 0.917 |
| Argentina | 0.571 | Kenya | 0.727 | Australia | 0.833 |
| China | 0.429 | Austria | 0.727 | Austria | 0.833 |
| Austria | 0.429 | USA | 0.545 | USA | 0.583 |

The countries are picked from different groups of each year.

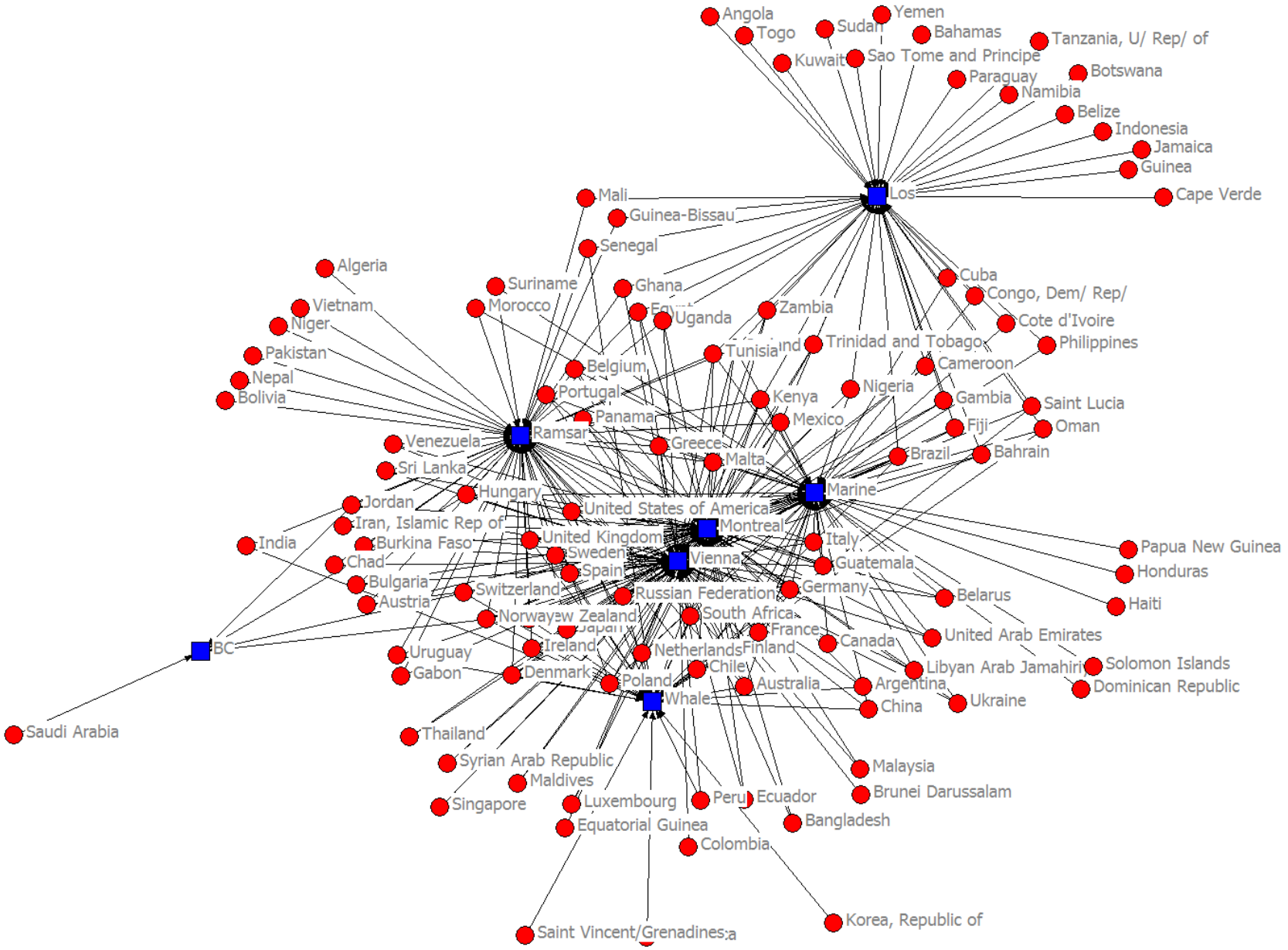
# Dynamics of Environmental Treaties

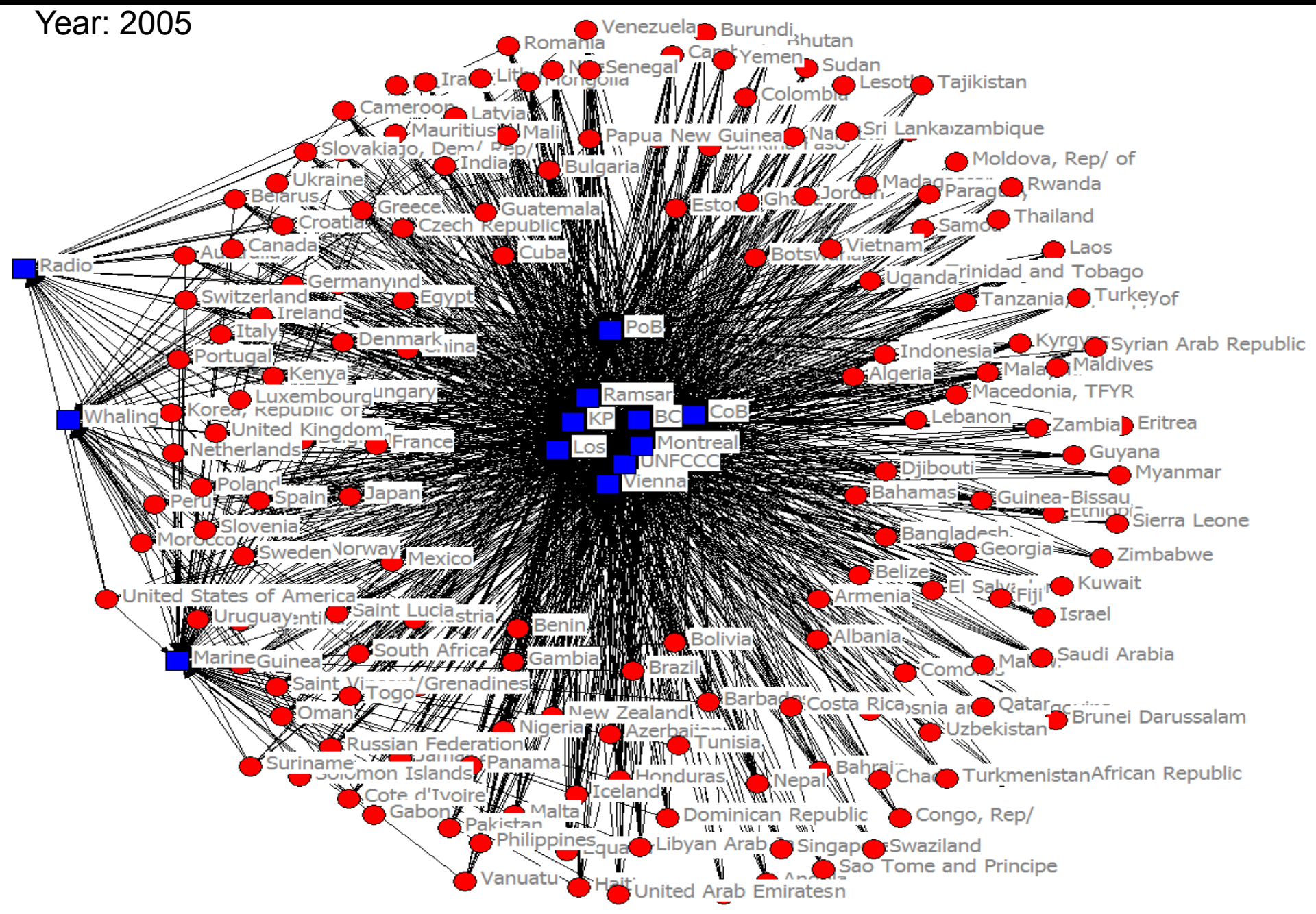
- In order to look at the dynamics of international environmental regimes, we have created movies using the 2 modes network data.
  - 1990 to 2005
  - using the software “SoNIA”
  - Each treaty is color coded
  - Countries and treaties ‘fly in’ during the transitions between years
  - Two movies:
    - “Flow” shows only new ratifications
    - “Stock” shows accumulated ratifications

# Observations

- There was a distinct movement towards more countries signing these treaties
- Not all treaties were ratified at the same rate
- Seems that it's moved from a Balkanized to a centralized pattern with EU and Japan in center
  - Treaties in the center moved to the periphery
  - New treaties and countries emerged in the center

Year: 1990


Angola
Yemen
Togo
Sudan
Bahamas
Tanzania, U/ Rep/ of
Kuwait
Sao Tome and Principe
Botswana
Paraguay
Namibia
Belize
Indonesia
Jamaica
Guinea
Los
Cape Verde
Mali
Guinea-Bissau
Senegal
Algeria
Suriname
Ghana
Cuba
Congo, Dem/ Rep/
Vietnam
Morocco
Uganda
Zambia
Cote d'Ivoire
Niger
Trinidad and Tobago
Philippines
Pakistan
Tunisia
Belgium
Cameroon
Nepal
Portugal
Nigeria
Bolivia
Kenya
Gambia
Saint Lucia
Panama
Mexico
Fiji
Oman
Ramsar
Venezuela
Greece
Brazil
Bahrain
Sri Lanka
Malta
Hungary
Marine
Jordan
United States of America
Iran, Islamic Rep of
Montreal
India
Burkina Faso
United Kingdom
Italy
Papua New Guinea
Sweden
Chad
Vienna
Guatemala
Honduras
Spain
Bulgaria
Germany
Switzerland
Russian Federation
Belarus
Austria
Haiti
Norway
New Zealand
South Africa
France
Canada
United Arab Emirates
BC
Ireland
Netherlands
Finland
Uruguay
Chile
Libyan Arab Jamahiriya
Solomon Islands
Gabon
Denmark
Poland
Australia
Argentina
Dominican Republic
Whale
China
Ukraine
Saudi Arabia
Thailand
Syrian Arab Republic
Malaysia
Maldives
Brunei Darussalam
Singapore
Luxembourg
Peru
Ecuador
Bangladesh
Equatorial Guinea
Colombia
Korea, Republic of
Saint Vincent/Grenadines


Year: 2005
Venezuela
Burundi
Romania
Yemen
Sudan
Senegal
Tajikistan
Colombia
Cameroon
Latvia
Mauritius
Mali
Papua New Guinea
Sri Lanka
Moldova, Rep/ of
Slovakia
India
Bulgaria
Ukraine
Rwanda
Belarus
Guatemala
Thailand
Croatia
Czech Republic
Canada
Cuba
Vietnam
Laos
Radio
Germany
Egypt
Switzerland
Ireland
Italy
Denmark
PoB
Portugal
Kenya
Indonesia
Syrian Arab Republic
Algeria
Maldives
Luxembourg
Ramsar
Macedonia, TFYR
Whaling
KP
BC
CoB
Lebanon
Zambia
Eritrea
United Kingdom
France
Netherlands
Los
Montreal
Guyana
UNFCCC
Djibouti
Myanmar
Vienna
Bahamas
Guinea-Bissau
Poland
Spain
Japan
Peru
Sierra Leone
Slovenia
Bangladesh
Morocco
Sweden
Norway
Mexico
Georgia
Zimbabwe
Belize
Kuwait
United States of America
Armenia
Fiji
Uruguay
Saint Lucia
Israel
Benin
Bolivia
Albania
Marine
South Africa
Guinea
Gambia
Saudi Arabia
Brazil
Saint Vincent/Grenadines
Togo
Barbados
Costa Rica
Qatar
Oman
New Zealand
Brunei Darussalam
Nigeria
Azerbaijan
Uzbekistan
Russian Federation
Tunisia
Suriname
Panama
Bahrain
Honduras
Nepal
Turkmenistan
African Republic
Iceland
Cote d'Ivoire
Gabon
Malta
Dominican Republic
Congo, Rep/
Pakistan
Philippines
Libyan Arab
Singapore
Swaziland
Sao Tome and Principe
Vanuatu
United Arab Emirates

# Results for Kyoto Protocol, 1997-2005

*Without Social network data*

*With Social network data*

| Variables | Model Ⅰ (Without SND) | | Model Ⅱ (With SND) | |
|---|---|---|---|---|
| Freedom | 0.194 | 2.880 | 0.012 | 0.150 |
| energyconsumption | −0.060 | −1.310 | 0.021 | 0.360 |
| GDPpercapita | 0.000 | 0.250 | 0.000 | −0.660 |
| cropland1000ha | 0.000 | 0.790 | 0.000 | −0.480 |
| urbanpopulationrate | 0.136 | 0.980 | 0.397 | 2.400 |
| gdpgrowthrate | 0.083 | 1.560 | 0.064 | 1.080 |
| _cons | −0.546 | −0.760 | −5.221 | −3.820 |
| Degree | | | 0.157 | 4.740 |
| Log likelihood | −69.359 | | −52.767 | |
| N | 164.000 | | 164.000 | |
| Pseudo−$R^2$ | 0.094 | | 0.310 | |

Notes: *, *** represents significance at the 10, 1%levels; z-value in parentheses.

# Conclusion and Discussion

- The position of countries can effect their decision of ratification
- Seems that it's moved from a Balkanized to a centralized pattern with EU and Japan in center
- **Further Investigations**
  - Visualizing using Geographic Information Modeling
  - Since the treaties that we choose for social network analysis is limited, more treaties are needed.
  - More sophisticated social influence models
  - The characteristics of treaties should be included into analysis

# Thank You Very Much