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Modeling the Role of Economic Interdependence in Cross-Domain Deterrence

Laura Epifanovskaya, Ph.D
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What is 21st Century Deterrence?

- Russia invades Crimea
- The West is deterred from sanctions (by concerns for its markets)
- The West threatens Russia with exclusion from SWIFT
- Russia responds with threats of a renewed Cold War



Image Credit: <http://english.alarabiya.net/en/News/middle-east/2014/03/14/Crimea-could-join-Russia-within-year-.html>



Image Credit: <http://blogs.nvcc.edu/damiller/category/crimea/>

On Deterring Nuclear War

Do Nuclear Deterrents Deter?

- What prevents one state from initiating military conflict with another?
- How do we know?

Approach:

- Study literature on conflict and the relationship to economic interdependence
- Create a simulated environment for gathering new data

Trade Promotes Peace/Trade Promotes War

Economechanical Entanglement

Two schools of thought:

- The “Realists”: trade ties promote war
 - When one country requires a resource from another, and it is denied them, war breaks out
- The “Liberals”: trade ties promote peace
 - Countries do not want to jeopardize mutually beneficial trade relationships
- Quantitative analysis using linear regressions supports both

Building a Deterrence Model

Counting Events That Do Not Occur

Approach:

- Design a “serious game”
 - Fill gaps in data: much of existing conflict data supplied by a few interstate interactions; nuclear data does not exist (almost)
 - Accelerate time scale of events
 - Track economic data that has not been tracked well historically (trade elasticity, direct foreign investment)
- Use crowdsourcing to generate a large dataset
- Tailor machine-learning algorithms to “learn” correspondences between variables of interest (geography (contiguity), military capability, GDP, trade relationships, conflict outcomes)

Paper Prototype Game

Yes, We Used Risk

- Increase population
- Generate resources (country dependent)
- Build factories and cities
- Trade
- Wage war (local and expeditionary)
- Burn and flee (a la Moscow)
- Build and use nuclear weapons



Image Credit:
<http://imgur.com/gallery/Q7sQr/>

Paper Prototype Data

Scorecard

Round	0	1	2	3	4	5	6	7	8	9
Player 1										
Population	14	14	17	20	22	23	25	29	24	27
Cities	0	0	0	0	0	0	1	1	1	1
Plants	0	9	9	11	11	13	14	14	12	11
Companies	0	0	1	1	2	5	8	8	7	7
Cash	860	200	140	110	260	0	150	0	180	240
Sheep	0	0	0	0	0	0	2	2	4	4
Wheat	0	0	0	0	0	0	0	0	1	0
Coal	0	0	1	3	4	3	0	0	2	2
Brick	0	0	0	1	3	4	2	1	1	1
Logs	0	0	0	0	1	2	0	3	6	6
Total Resources	0	0	1	4	8	9	4	6	14	13
Nuclear Weapons	0	0	0	0	0	0	0	1	1	0
Use of Conventional Force, Local	0	0	0	0	0	0	0	0	TRUE	TRUE
Use of Conventional Force, Expeditionary	0	0	0	0	0	0	0	0	0	0
Use of Nuclear Force	0	0	0	0	0	0	0	0	0	TRUE
Trade Agreements										

Agreed to 5 turns, P1 gives P2 Log
 \$50 for 1 wheat
 Agreed to 5 turns, P1 gives P2 \$50 for 1 wheat
 Agreed to 5 turns, P1 gives P2 \$100 for 1 log
 Agreed to 5 turns, P1 gives P3 \$20 + 1 sheep for 1 log

with Player 2	with Player 3

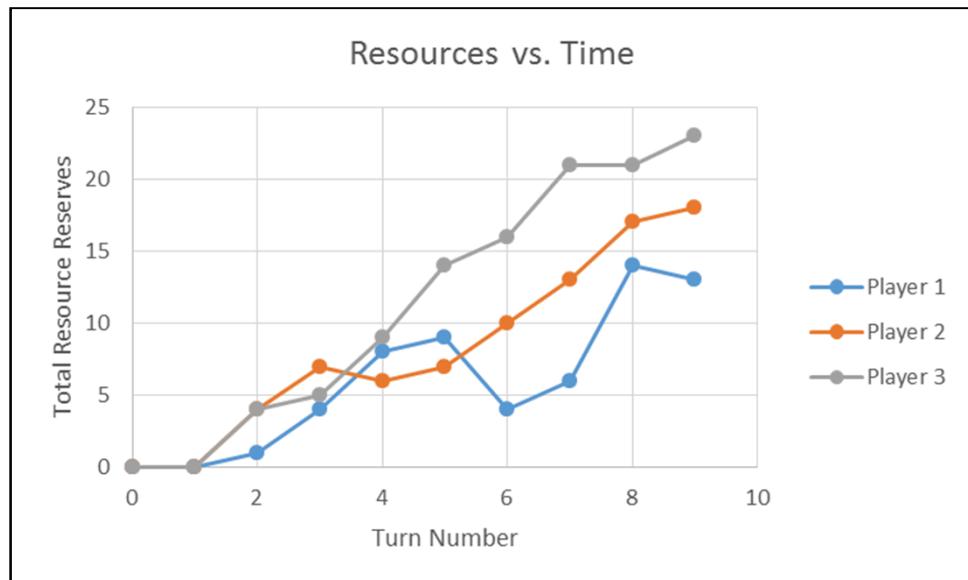
Player 2	Population	14	14	17	21	25	29	35	41	44	51
Cities	0	0	0	0	1	2	2	2	2	2	2
Plants	0	10	11	11	12	13	14	14	14	15	15
Companies	0	0	0	0	0	0	0	0	0	1	1
Cash	860	0	40	210	70	0	270	800	40	230	
Sheep	0	0	0	0	0	1	1	2	5	4	
Wheat	0	0	1	1	1	1	1	1	1	0	
Coal	0	0	1	2	2	2	3	4	4	3	
Brick	0	0	1	2	2	2	3	4	5	7	
Logs	0	0	1	2	1	1	2	2	2	4	
Total Resources	0	0	4	7	6	7	10	13	17	18	
Nuclear Weapons	0	0	0	0	0	0	0	0	1	1	
Use of Conventional Force, Local	0	0	0	0	0	0	0	0	TRUE	TRUE	
Use of Conventional Force, Expeditionary	0	0	0	0	0	0	0	0	0	0	
Use of Nuclear Force	0	0	0	0	0	0	0	0	0	0	
Trade Agreements											

Agreed to 5 turns, P1 gives P2 Log
 \$50 for 1 wheat
 Agreed to 5 turns, P1 gives P2 \$50 for 1 wheat
 Agreed to 5 turns, P1 gives P2 \$100 for 1 log

with Player 1	with Player 3

Agreed to 5 turns, P3 gives P2 1 brick, for one-time payment of \$150 + 2 wheat to execute South African War

Tracking Variables over Time



Next Steps

- We have proof-of-concept, need to make it useful
 - Think carefully about country borders, vectors of attack (geography extremely important in conflict-likelihood), resource allocation
 - Incorporate all variables of interest into the rules, even qualitative ones
 - Streamline data collection
 - Iterate, iterate, iterate
- Build an online game
 - Gather data
- Analysis and V&V
 - Learn correspondences between variables
 - Are our predictions accurate for future sessions?
 - Incorporate qualitative lessons. What unusual approaches did players use?

Thank You!

**QUESTIONS?
SUGGESTIONS?**