A Framework for Geoeconomics

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Geoeconomics, Economic Statecraft, and Coercion

- Governments use their countries' economic strength from existing financial and trade relationships to achieve geopolitical and economic goals
- Fundamental questions:
  - Is geoeconomic power effective? In which dimensions?
  - What are the origins of this power and how is it wielded?
  - Is it zero-sum or positive sum globally?
  - Which sectors are strategic?
  - Government role: national security externalities, official lending (Belt & Road), anticoercion tools

A Theoretical Framework

- Ingredients:
  - A collection of countries
  - Global production network (capital, technology, goods)
  - Limited enforceability of contracts (both private and public)
  - Externalities on producers and consumers
- Main Mechanism:
  - Geoeconomic power arises from the ability to form joint threats from different economic activities. It is wielded to manipulate world equilibrium in hegemon's favor
- How the framework works:
  - **Pressure:** repeated game with punishment among multiple relationships
  - **Extraction:** hegemons extract costly actions, e.g. mark-ups, tariffs, quantity caps
  - Pressure is positive sum, but extraction can be negative sum

Literature

- **International Political Economy:** Baldwin (1985), Frieden (1994), Drezner (2003), Farrell and Newman (2019), Camboni and Porcellacchia (2021), Mangini (2022), Parks et al. (2022)
- **Industrial Policy and Trade Theory:** Hirschman (1945,59), Berger, Easterly, Nunn and Satyanath (2013), Bagwell and Staiger (2017), Liu (2019), Baqaee and Farhi (2022), Bartelme, Costinot, Donaldson and Rodriguez-Clare (2019), Bocola and Bornstein (2023), Juhasz, Lane, Oehlsen and Perez (2022), Kleinman, Liu, Redding (2023)
- **Networks:** Gabaix (2011), Acemoglu, Carvalho, Ozdaglar and Tahbaz-Salehi (2012), Chaney (2014), Baqaee and Farhi (2019), Liu (2019), Elliott, Golub and Leduc (2022), Antras and Chor (2022)
- **Theory Tools: Trigger Strategies, Multitask Contracting, Externalities.** Abreu, Pierece, and Stacchetti (1986,1990), Holmstrom and Milgrom (1991), Greenwald and Stiglitz (1986), Geanakoplos and Polemarchakis (1985), Bernheim and Whinston (1990), Farhi and Werning (2016)

Outline of Talk

1. Model Set-Up
2. Individual Firm Optimal Production
3. Joint Threats and Pressure Points
4. Hegemon Problem: optimal threats and costly actions imposed on friends and enemies
5. Efficiency and Externalities
6. Application 1: National Security
7. Application 2: Belt and Road Initiative

Model Set-Up

- Infinite horizon: $t = 0, 1, \ldots$
- N countries, a set $\mathcal{I}$ of productive sectors, a set of productive factors $\mathcal{F}$
- Each sector is located in one country. $\mathcal{I}_n$ is the set of sectors of country n.
- $\mathcal{F}_n$ is the set of local factors of country n.
- Unit mass of firms in sector i produces a differentiated good y_i using:
  - Intermediate goods x_{ij}, where j is the source sector
  - Local factors of production ℓ_{if}, where f indexes factor
- Each country n has a representative consumer
- Vector z of aggregate quantities, tracks externalities
- Repeated stage game, discount factor β

Representative Consumer of Country n

- Utility function:

$$U_n(C_n) + u_n(z)$$

  C_n vector of consumption of each good (C_{ni})

- Consumer owns domestic sectors and factor endowments $\bar{\ell}_i$ in their country

- Budget constraint:

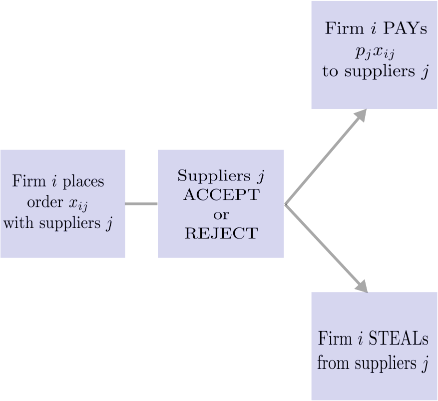
$$\sum_{i \in \mathcal{I}} p_i C_{ni} \leq \sum_{i \in \mathcal{I}_n} \Pi_i + \sum_{f \in \mathcal{F}_n} p_f^{\ell} \bar{\ell}_f$$

  Sector i profits Π_i, good price p_i, factor price p_f^{ℓ}

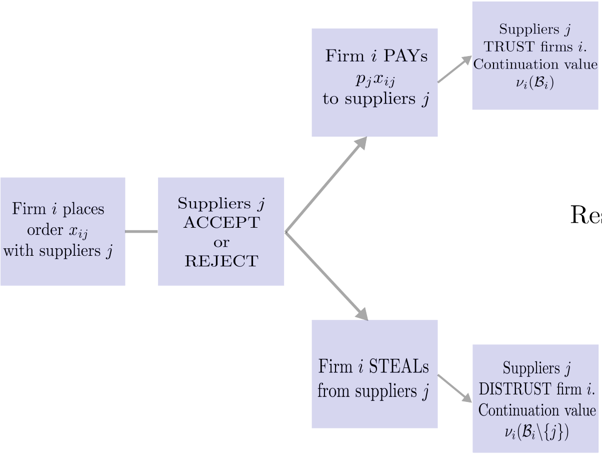
- Marshallian demand $C_n(p, w_n)$

- Indirect utility from consumption $W_n(p, w_n) = U_n(C_n(p, w_n))$

Firm-Suppliers Stage Game



Firm-Supplier Stage Game: Continuation Values



Total Net Payoffs

Individual Firm i	Suppliers in j
$\Pi_i + \beta\nu_i(\mathcal{B}_i)$	0
$\Pi_i + \theta_{ij} p_j x_{ij} + \beta\nu_i(\mathcal{B}_i \backslash \{j\})$	$-\theta_{ij} p_j x_{ij}$

Resulting Incentive Compatibility Constraint:

$$\theta_{ij} p_j x_{ij} \leq \beta \left[\nu_i(\mathcal{B}_i) - \nu_i(\mathcal{B}_i \backslash \{j\}) \right]$$

Firm i Maximization Problem

$$\max_{x_i, \ell_i} \quad \Pi_i(x_i, \ell_i, \mathcal{B}_i) = p_i f_i(x_i, \ell_i, z) - \sum_{j \in \mathcal{B}_i} p_j x_{ij} - \sum_{f \in \mathcal{F}_n} p_f^{\ell} \ell_{if}$$

$$s.t. \quad \sum_{j \in S} \theta_{ij} p_j x_{ij} \leq \beta \left[\nu_i(\mathcal{B}_i) - \nu_i(\mathcal{B}_i \backslash S) \right] \qquad \forall S \in \Sigma(\mathcal{S}_i(\mathcal{B}_i))$$

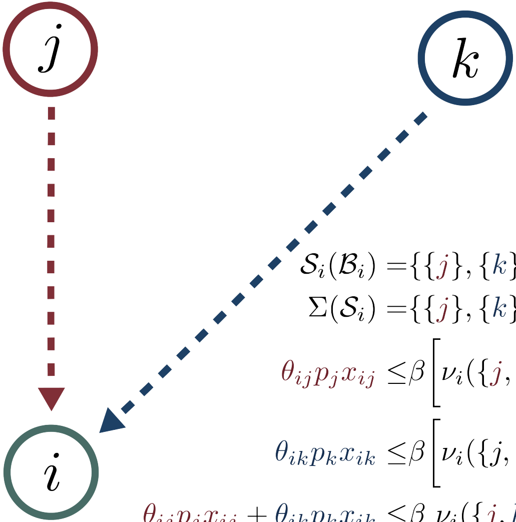
$\mathcal{B}_i$: set of supplying sectors that Trust firm i

$\mathcal{B}_i \backslash S$ reduced set following firm i Stealing from sectors in S

$\mathcal{S}_i = \{\{j\}\}_{j \in \mathcal{J}_i}$ set of individual stealing actions, Σ set of supersets

▸ Trigger Strategies and IC

Example: IC Constraints Under Individual Triggers



$$\mathcal{S}_i(\mathcal{B}_i) = \{\{j\},\{k\}\}$$

$$\Sigma(\mathcal{S}_i) = \{\{j\},\{k\},\{j,k\}\}$$

$$\theta_{ij} p_j x_{ij} \leq \beta \Big[\nu_i(\{j,k\}) - \nu_i(\{k\}) \Big]$$

$$\theta_{ik} p_k x_{ik} \leq \beta \Big[\nu_i(\{j,k\}) - \nu_i(\{j\}) \Big]$$

$$\theta_{ij} p_j x_{ij} + \theta_{ik} p_k x_{ik} \leq \beta \, \nu_i(\{j,k\})$$

▸ Nested CES Production & Substitutability

Building a SPE: Value Function $\mathcal{V}(\mathcal{B}_i)$

- Fix action sets $\mathcal{S}_i$, take as given aggregates z and prices
- Start from $\mathcal{V}_i(\emptyset) = 0$
- Construct the value function $\mathcal{V}_i(\mathcal{B}_i)$ iteratively as a fixed point of

$$\mathcal{V}_i(\mathcal{B}_i) = \max_{x_i, \ell_i} \quad \Pi_i(x_i, \ell_i, \mathcal{B}_i) + \beta \mathcal{V}_i(\mathcal{B}_i)$$

$$s.t. \quad \sum_{j \in S} \theta_{ij} p_j x_{ij} \leq \beta \Big[\mathcal{V}_i(\mathcal{B}_i) - \mathcal{V}_i(\mathcal{B}_i \backslash S) \Big] \quad \forall S \in \Sigma(\mathcal{S}_i(\mathcal{B}_i)),$$

- At each step: constructing $\mathcal{V}_i(\mathcal{B}_i)$ uses the continuation value $\mathcal{V}_i(B_i/S)$ in the previous steps. Last step when $\mathcal{B}_i = \mathcal{J}_i$, firm i is Trusted by all suppliers

Market Clearing

- Market clearing for good j:

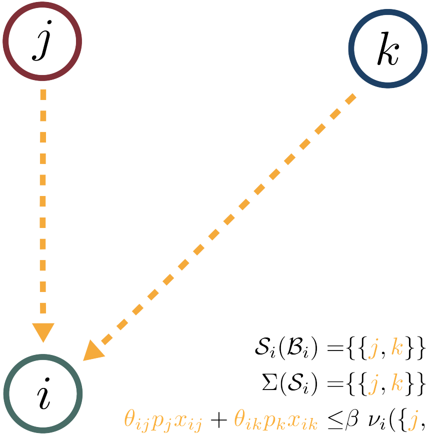
$$\sum_{n=1}^{N} C_{nj} + \sum_{i \in D_j} x_{ij} = y_j$$

$D_j = \{i \in \mathcal{I} | j \in \mathcal{J}_i\}$ the set of sectors that source from sector j

- Market clearing for factor f:

$$\sum_{i \in \mathcal{I}_n} \ell_{if} = \bar{\ell}_f$$

Joint Threats



$$\mathcal{S}_i(\mathcal{B}_i) = \{\{j, k\}\}$$
$$\Sigma(\mathcal{S}_i) = \{\{j, k\}\}$$
$$\theta_{ij} p_j x_{ij} + \theta_{ik} p_k x_{ik} \leq \beta\ \nu_i(\{j, k\})$$

Definition

A **joint threat** $\mathcal{S}_i'$ is a partition of $\mathcal{J}_i$ such that $\mathcal{S}_i'$ is coarser than $\mathcal{S}_i$.

When a Joint Threat Generates Value

Definition

A **pressure point** of firm i is a joint threat $\mathcal{S}_i'$ that strictly increases firm i's profits, that is $V_i(\mathcal{S}_i') > V_i(\mathcal{S}_i)$.

$V_i(\mathcal{S}_i)$ is value of firm i under optimal production given action set $\mathcal{S}_i$,

$$V_i(\mathcal{S}_i) = \max_{x_i, \ell_i} \quad \Pi_i(x_i, \ell_i, \mathcal{J}_i)$$

$$s.t. \quad \sum_{j \in S} \theta_{ij} p_j x_{ij} \leq \beta \left[\nu_i(\mathcal{J}_i) - \nu_i(\mathcal{J}_i \backslash S) \right] \quad \forall S \in \Sigma(\mathcal{S}_i)$$

Note: here, $\mathcal{B}_i = \mathcal{J}_i$, i.e. all suppliers trust firm i ex ante

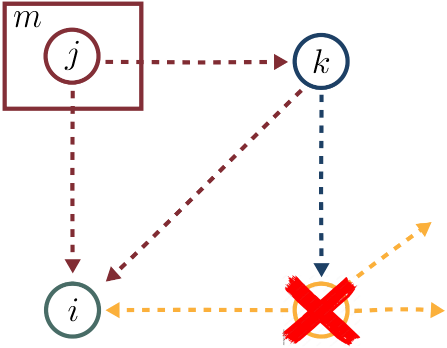
Introducing a Hegemon

- Country m can become a hegemon by paying fixed utility cost F_m
- Hegemon can coordinates its domestic sectors and induce their immediately downstream sectors to make joint threats:
  - Sectors hegemon can contract with: $\mathcal{C}_m = \mathcal{I}_m \cup \bigcup_{i \in \mathcal{I}_m} D_i$
- Terms of the contract offered to sector $i \in \mathcal{C}_m$
  - **Joint threats** $\mathcal{S}_i'$ that are *feasible*
  - **Transfers** $T_{ij} \geq 0$ to hegemon's representative consumer
  - Revenue neutral **wedges** on inputs τ_{ij} and factors τ_{if}^{ℓ}
  - Hegemon only contracts with firms that are fully trusted ($\mathcal{B}_i = \mathcal{J}_i$)
- Local rejection of contract: if firm i rejects contract, reverts to outside option
- Hegemon's problem is identical in each period, and contracts only last one period

Feasible Joint Threats

Definition

Hegemon m can consolidate $S \in \mathcal{S}_i$ under direct transmission if $\exists j \in S$ with either $j \in \mathcal{I}_m$ (direct control) or $j \in \mathcal{D}_m$ (indirect control). A joint threat is **feasible** if it can be achieved under direct transmission.



▸ Example: Lithuania

Timing of Payments, Wedges, and Lump-Sum Rebates

- Firm i only makes transfer T_{ij} if chooses Pay
- Firm i faces price for input j of $p_j + \tau_{ij}$, factor f of $p_f^{\ell} + \tau_{if}^{\ell}$
- Rebates $\tau_{ij} x_{ij}^{*}$ are pro-rated on fraction paid θ_{ij} following Steal
- Factor rebates $\tau_{if}^{\ell} \ell_{if}^{*}$
- Revenue-neutral wedges similar to quantity restrictions
- Define $\mathcal{T}_i = \{T_{ij}\}_{j \in \mathcal{J}_{im}}$, and $\overline{T}_i$ is the sum of the transfers made by firm i
- Define $\tau_i = \{\{\tau_{ij}\}_{j \in \mathcal{J}_i}, \{\tau_{if}^{\ell}\}_{f \in \mathcal{F}_n}\}$, the set of wedges faced by firm i
- Summarize hegemon's contract: $\Gamma_i = \{\mathcal{S}_i', \mathcal{T}_i, \tau_i\}$

Firm Participation Constraint

- Firm i value function is

$$V_i(\Gamma_i) = \max_{x_i, \ell_i} \Pi_i(x_i, \ell_i, \mathcal{J}_i) - \sum_{j \in \mathcal{J}_i} [\tau_{ij}(x_{ij} - x_{ij}^*) + T_{ij}] - \sum_{f \in \mathcal{F}_m} \tau_{ij}^{\ell}(\ell_{if} - \ell_{if}^*) + \beta \nu_i(\mathcal{J}_i)$$

$$s.t. \sum_{j \in S} \left[\theta_{ij}[p_j x_{ij} + \tau_{ij}(x_{ij} - x_{ij}^*)] + T_{ij}\right] \leq \beta \left[\nu_i(\mathcal{J}_i) - \nu_i(\mathcal{J}_i \backslash S)\right] \quad \forall S \in \Sigma(\mathcal{S}_i')$$

- If firm rejects contract, gets outside option $V_i(\mathcal{S}_i)$
- **Participation constraint:** $V_i(\Gamma_i) \geq V_i(\mathcal{S}_i)$
- Slack in the participation constraint comes from the hegemon having a *pressure point* on sector i. This pressure is the source of hegemonic **Micro-Power**.

The Hegemon Maximization Problem

Hegemon chooses feasible contract $\Gamma = \{\mathcal{S}_i', \mathcal{T}_i, \tau_i\}_{i \in \mathcal{C}_m}$ to maximize representative consumer m welfare,

$$W_m(p, w_m) + u_m(z)$$

where consumer wealth is:

$$w_m = \underbrace{\sum_{i \in \mathcal{I}_m} \Pi_i(\Gamma_i) + \sum_{f \in \mathcal{F}_m} p_f^{\ell} \bar{\ell}_f}_{\text{Profits of Domestic Firms and Factor Payments}} + \underbrace{\sum_{i \in \mathcal{D}_m} \sum_{j \in \mathcal{J}_{im}} T_{ij}}_{\text{Transfers from Foreign Entities}}$$

subject to firms' participation constraints $V_i(\Gamma_i) \geq V_i(\mathcal{S}_i)$, and feasibility of joint threats

The Hegemon Maximization Problem

Hegemon chooses feasible contract $\Gamma = \{\mathcal{S}'_i, \mathcal{T}_i, \tau_i\}_{i \in \mathcal{C}_m}$ to maximize representative consumer m welfare,

$$W_m(p, w_m) + u_m(z)$$

where consumer wealth is:

$$w_m = \underbrace{\sum_{i \in \mathcal{I}_m} \Pi_i(\Gamma_i) + \sum_{f \in \mathcal{F}_m} p_f^{\ell} \bar{\ell}_f}_{\text{Profits of Domestic Firms and Factor Payments}} + \underbrace{\sum_{i \in \mathcal{D}_m} \sum_{j \in \mathcal{J}_{im}} T_{ij}}_{\text{Transfers from Foreign Entities}}$$

subject to firms' participation constraints $V_i(\Gamma_i) \geq V_i(\mathcal{S}_i)$, and feasibility of joint threats

Lemma

It is weakly optimal for the hegemon to offer a contract with maximal joint threats to every firm it contracts with, that is $\mathcal{S}'_i = \overline{\mathcal{S}}'_i$ for all $i \in \mathcal{C}_m$.

First Pass: Hegemon Optimal Contract

Proposition

Conditional on entry, with constant prices and no z-externalities, an optimal contract of the hegemon has the following terms:

1. *All wedges are zero on all sectors,* $\tau_{ij}^{*} = \tau_{if}^{\ell *} = 0$ *for all* $i \in \mathcal{C}_m,\ j \in \mathcal{J}_i,\ f \in \mathcal{F}_n$.
2. *All transfers are zero for domestic sectors, that is* $\overline{T}_i^{*} = 0$ *for all* $i \in \mathcal{I}_m$.
3. *Foreign sector i is charged a positive transfer* $\overline{T}_i^{*} > 0$ *if and only if* $\overline{\mathcal{S}}_i'$ *is a pressure point on i. The transfers are then set so that the participation constraint binds,* $V_i(\Gamma_i) = V_i(\mathcal{S}_i)$ *and* $\Gamma_i = \{\overline{\mathcal{S}}_i', \overline{T}_i^{*}, 0\}$.

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- Given all aggregates and prices are constant, hegemon has only **Micro-Power**. Extracts it via monetary transfers.
- A sector is **strategic** if it let's the hegemon form valuable threats on other sectors.

Externalities and Input-Output Amplification

- Some sectors have larger impact on the economy
- Production externalities and prices lead to endogenous amplification
- Recall: $f_i(x_i, \ell_i, z)$ where z is a vector that includes all x_k
- Derive a Leontief Inverse matrix based on externalities

Proposition

The aggregate response of z^* to a perturbation in exogenous variable e is

$$\frac{dz^*}{de} = \Psi^z \left(\frac{\partial x^*}{\partial e} + \frac{\partial x^*}{\partial P} \frac{dP}{de} \right)$$

where $\Psi^z = \left(\mathbb{I} - \frac{\partial x^*}{\partial z^*} \right)^{-1}$, $\frac{dP}{de} = -\left(\frac{\partial ED}{\partial P} + \frac{\partial ED}{\partial z^*} \Psi^z \frac{\partial x^*}{\partial P} \right)^{-1} \left(\frac{\partial ED}{\partial e} + \frac{\partial ED}{\partial z^*} \Psi^z \frac{\partial x^*}{\partial e} \right)$

ED a vector tracking excess demand in each good/factor market

Hegemon Optimal Contract

Proposition

Conditional on entry, an optimal contract is:

1. *For domestic sectors $i \in \mathcal{I}_m$, if $\overline{\mathcal{S}}_i'$ is a pressure point,*
   - (a) *Input wedges satisfy:* $\left(\frac{\partial W_m}{\partial w_m} + \eta_i + \theta_{ij}\overline{\Lambda}_{ij}\right)\tau_{ij}^* = -\mathcal{E}_{ij}$.
   - (b) *Transfers are zero:* $\overline{T}_i^* = 0$.
2. *For foreign sector $i \in \mathcal{D}_m$ in country n, if $\overline{\mathcal{S}}_i'$ is a pressure point,*
   - (a) *Input wedges satisfy:* $(\eta_i + \theta_{ij}\overline{\Lambda}_{ij})\tau_{ij}^* = -\mathcal{E}_{ij}$.
   - (b) *Transfers satisfy:* $\overline{\Lambda}_{iS_i^D} + \eta_i \geq \frac{\partial W_m}{\partial w_m} + \Xi_{mn}$, *with equality if* $\overline{T}_i^* > 0$.
3. *If $\overline{\mathcal{S}}_i'$ is not a pressure point on i, then wedges and transfers are zero*

Lagrange multipliers: Λ_{iS} on IC for action S, and η_i PC. Define $\overline{\Lambda}_{ij} = \sum_{S \in \Sigma(\overline{\mathcal{S}}_i') | j \in S} \Lambda_{iS}$

$\mathcal{E}_{ij} \equiv \frac{\partial \mathcal{L}_m}{\partial z_{ij}^*}$ tracks effects of externalities and amplification on hegemon problem, Ξ_{mn} tracks same for transfer from consumer n to m

Interpreting the Tax Formula

$$\tau_{ij}^* = -\frac{1}{\eta_i + \theta_{ij}\overline{\Lambda}_{ij}}\mathcal{E}_{ij}$$

- $\eta_i + \theta_{ij}\overline{\Lambda}_{ij}$ measures the marginal cost of altering activity x_{ij}
- $\mathcal{E}_{ij}$ measures the marginal benefit of altering activity x_{ij}

Interpreting the Tax Formula

$$\tau_{ij}^{*} = -\frac{1}{\eta_i + \theta_{ij}\overline{\Lambda}_{ij}} \left[\underbrace{\varepsilon_{ij}^{z}}_{\text{Direct Impact}} + \underbrace{\overbrace{\varepsilon^{zNC} \frac{dz^{*NC}}{dz_{ij}}}^{\text{Aggregate Quantities}} + \overbrace{\varepsilon^{P^m} \frac{dP^m}{dz_{ij}}}^{\text{Prices}}}_{\text{Indirect Impact: Input-Output Amplification}} \right]$$

- $\eta_i + \theta_{ij}\overline{\Lambda}_{ij}$ measures the marginal cost of altering activity x_{ij}
- $\mathcal{E}_{ij}$ measures the marginal benefit of altering activity x_{ij}
  - Direct impact: effect of setting x_{ij} to a new level
  - Indirect impact: transmission of changes x_{ij} to other aggregate production and prices

Strategic Sectors

- **Micro-Power:** a sector is **strategic** if it let's the hegemon form valuable threats on other sectors
  - Strategic is not an ex-ante characteristic, but to be assessed in an equilibrium
  - Many threats not valuable: e.g. substitutable inputs not controlled by hegemon
- **Macro-Power:** a sector is **strategic** if it let's the hegemon manipulate aggregate quantities and prices in its favor
  - Some sectors have high indirect influence in the Leontief inverse sense
  - Hegemon exploits difference between private cost of actions to targeted entities and the social benefit to itself via manipulating the equilibrium

Marginal value of power over sector i: Lagrange multiplier on participation constraint η_i

Friends and Enemies

- Theory-based definition of friend and enemies
- Under the hegemon's optimal contract, foreign sector i is:
  1. **Unfriendly** if $\mathcal{E}_{ij} \leq 0$ for all $j \in \mathcal{J}_i$, with strict inequality for at least one j.
  2. **Neutral** if $\mathcal{E}_{ij} = 0$ for all $j \in \mathcal{J}_i$.
  3. **Friendly** if $\mathcal{E}_{ij} \geq 0$ for all $j \in \mathcal{J}_i$, with strict inequality for at least one j.
- Hegemon treats these sectors differently:
  - Unfriendly: taxed (positive wedges), mitigate externality
  - Neutral: untaxed (zero wedges)
  - Friendly: subsidized (negative wedges), boost externality
- Leading special case: no z externalities + exogenous prices, all sectors are neutral, participation constraint binds.

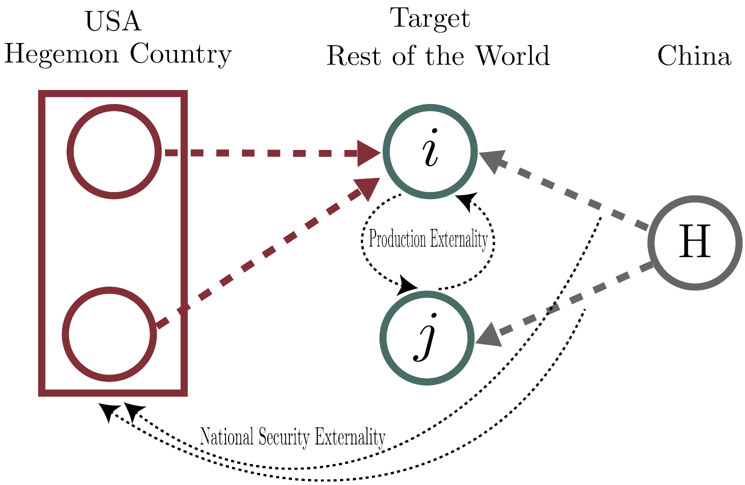
Geoeconomics Power: Positive or Negative Sum?

Proposition

An optimal contract of the hegemon from the global planner's perspective features maximal joint threats $\mathcal{S}_i' = \overline{\mathcal{S}}_i'$, *zero transfers* $\overline{T}_i = 0$, *and wedges given by* $(\Omega_n \frac{\partial W_n}{\partial w_n} + \eta_i + \theta_{ij}\overline{\Lambda}_{ij})\tau_{ij}^* = -\mathcal{E}_{ij}^p$ *for all firms* $i \in \mathcal{C}_m$ *on which the hegemon has a pressure point. Wedges and transfers are zero if* $\overline{\mathcal{S}}_i'$ *is not a pressure point on* i.

- Hegemon and global planner agree:
  - maximal joint threats are *positive sum*
  - transfers are *negative sum*
- Hegemon and global planner have different objectives
  - Hegemon values transfers
  - Different values from externalities: $\mathcal{E}_{ij}^P \neq \mathcal{E}_{ij}$
- Role for anti-coercion tools that reduce distortionary surplus extraction

Application 1: National Security Externalities



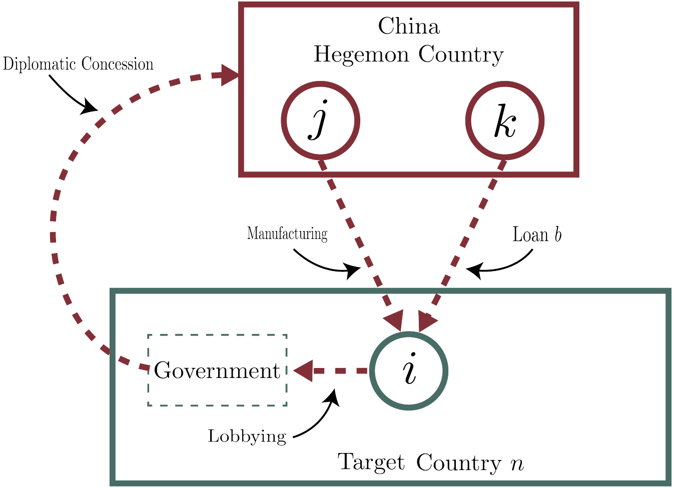
Import Restrictions On National Security Concerns

- Hegemon asks third party countries to curb imports of tech from hostile country on the basis of national-security

$$\tau_{iH} = - \overbrace{\frac{1}{\eta_i}\frac{\partial u_m}{\partial z_{iH}}}^{\text{Direct Externality}} - \overbrace{\frac{1}{\eta_i}\frac{\partial u_m}{\partial z_{jH}}\frac{\xi_{ji}}{\gamma_j - \xi_{jj}}\frac{z_{jH}}{z_{iH}}}^{\text{Network Amplification}}$$
$$+ \underbrace{p_i A_{iH}(z^H)\left[g_{iH}(x^*_{iH}(z^H)) - g_{iH}(x_{iH})\right]\left(\xi_{ii} + \xi_{ij}\frac{\xi_{ji}}{\gamma_j - \xi_{jj}}\right)\frac{1}{z_{iH}}}_{\text{Indirect Effect on Participation Constraint}}$$

- **Strategic sector:** Network amplification increases incentives to impose restriction
- Restrictions are costly for targeted firms, tightens participation constraint
- Network amplification reduces costs to firms if successful

Application 2: China's Belt and Road Initiative



Joint Threats As Endogenous Cost of Default

- Sector i has a separable production function in inputs j and k
- Sector k is lending to i: $x_{ik} = b$, interest rate $p_k = R$
- No enforeceability of loan, $\theta_{ik} = 1$, perfect enforceability of manufacturing $\theta_{ij} = 0$
- Under isolated threats the IC is:

$$Rb \leq \beta \nu_i(\{b\}) = \beta \frac{p_i f_{ik}(b^*) - Rb^*}{1-\beta}$$

- Under joint threats the IC is:

$$Rb \leq \beta \left[\frac{p_i f_{ik}(b^*) - Rb^*}{1-\beta} + \frac{p_i f_{ij}(x_{ij}^*) - p_j x_{ij}^*}{1-\beta} \right]$$

- Manufacturing export act as endogenous cost of default, increases debt capacity

Our Ongoing Agenda

- Empirics:
  - Measuring strategic sectors
  - Measuring returns to hegemonic power
- Geopolitical Competition:
  - Escalating rivalry between US and China
  - Ongoing work: equilibrium with multiple hegemons
  - Existance of an alternative as a limit to power
- Countering Economic Coercion:
  - G7 Partnership for Global Infrastructure and Investment as an alternative to BRI
  - EU ongoing pursuit of an "Anti-Coercion Instrument"
  - Ongoing work: Characterizing optimal policy in targeted countries
- Geopolitics of International Currency Competition

Conclusion

- A framework to understand geoeconomic power arising from joint threats across disparate economic activities
- Geoeconomic power can be positive-sum, but scope for government intervention
- Starting point for rich set of future research

Trigger Strategy Details

- Trigger strategies of suppliers in j in their relationship with firm i:

$$B'_{ij}(S) = \begin{cases} B_{ij}, & S \cap K_{ij} = \emptyset \\ 0, & o.w. \end{cases}, \quad K_{ij} = \{j\} \cup \bigcup_{k \in M_{ij}} K_{ik} \tag{1}$$

  M_{ij}: joint trigger set. Symmetric: $k \in M_{ij} \iff j \in M_{ik}$

- Take smallest sets K_i consistent with (1)

Lemma

Let $\mathcal{S}_i(\mathcal{B}_i) = \bigcup_{j \in \mathcal{B}_i} \{K_{ij}\}$ and $\Sigma(\mathcal{S}_i) = \{\bigcup_{X \in \mathcal{X}} X \mid \emptyset \neq \mathcal{X} \subset \mathcal{S}_i\}$. The order (x_i, ℓ_i) is incentive compatible with respect to all stealing actions, $P(\mathcal{B}_i)$, if and only if it is incentive compatible with respect to $\Sigma(\mathcal{S}_i(\mathcal{B}_i))$. The incentive compatibility constraint for $S_i \in \Sigma(\mathcal{S}_i(\mathcal{B}_i))$ is

$$\sum_{j \in S} \theta_{ij} p_j x_{ij} \leq \beta \left[\nu_i(\mathcal{B}_i) - \nu_i(\mathcal{B}_i \backslash S_i) \right] \tag{2}$$

An Example: Lithuania

In the lead-up to the Lithuanian government's decision to open a TRO in Vilnius, China had been slowly applying economic pressure, first by cutting off credit insurance for Lithuanian counterparts of Chinese firms and then by blocking timber and grain exports. After the offending office finally opened, China intensified the pressure by effectively cutting off all trade with Lithuania. However, China's initial punitive measures exerted little economic pain owing to the minimal amount of direct trade between the two countries: Lithuania's exports to China account for just 1 percent of its total exports, and its imports from China make up just 3 percent of total imports. **Beijing adapted by threatening informal secondary sanctions-a novel tactic-on European, primarily German, firms that sourced products from Lithuanian suppliers. This tactic led some European voices to call for Lithuania to back down and prompted the Lithuanian president to express regret over the name choice.** [Emphasis added]

Source: Reynolds and Goodman (2023)

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BRI Example

- AidData's dataset of individual project finance by China's lenders
- Loan from the China Export-Import Bank to Ethiopia providing $171 million in preferential buyer's credit to the Government of Ethiopia to complete a section of the Modjo-Hawassa Expressway
- For this project, the China Railway Group Co. Ltd (CRSG) is the contractor
  - Parent firm of this contractor is the China Railway Group Limited, who in turn is owned by the China Railway Engineering Corporation, a state-owned enterprise.

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Example: The Power of Substitutability

- Two periods, second period unconstrained
- CES production: $f_i(x_i) = \left(\sum_{\tilde{x}\in\tilde{X}_i} \tilde{\alpha}_{i\tilde{x}} \left(\sum_{j\in\tilde{x}} \alpha_{ij} x_{ij}^{\chi_{i\tilde{x}}}\right)^{\frac{\rho_i}{\chi_{i\tilde{x}}}}\right)^{\frac{\xi_i}{\rho_i}}$
- $\Omega_{i\tilde{x}_k}$: firm i expenditure on the bundle containing input k
- $\omega_{i\tilde{x}_k}$: firm i expenditure share on input k within its bundle
- Cost of losing variety k is

$$\log \nu_i(\mathcal{B}_i) - \log \nu_i(\mathcal{B}_i \backslash \{k\}) = -\frac{\xi_i}{1-\xi_i}\frac{1-\rho_i}{\rho_i}\log\left[1 - \Omega_{i\tilde{x}_k}\left(1 - \left(1-\omega_{ik}\right)^{\frac{1-\chi_{i\tilde{x}_k}}{\chi_{i\tilde{x}_k}}\frac{\rho_i}{1-\rho_i}}\right)\right]$$

- All else equal, higher loss when:
  - Higher expenditure shares
  - Constant returns production (higher ξ)
  - Lower within-basket substitutability χ

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