A Framework for Geoeconomics

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Abstract

We introduce a framework for analyzing geopolitical and economic competition around the world. Geopolitical power arises from the ability to jointly exercise threats arising from separate economic activities. Being able to retaliate against a deviating country across multiple arenas, often involving indirect threats from third parties also being pressured, increases the off equilibrium threats and, thus, helps in equilibrium to alleviate incentive compatibility constraints in global trade and production. A world hegemon, like the United States, can extract the benefits arising from relaxing these constraints. We characterize strategic industries, enforcement externalities, and the increasing returns to scale in strategic sectors that lead to the emergence of hegemons. We formalize the idea of economic coercion as a combination of strategic pressure points and extraction points. We then apply the framework to make sense of both modern and historical episodes. We explore the structure of China’s Belt and Road Initiative and China’s attempts at utilizing economic power for non-economic aims, and recent attempts by western countries to introduce measures to limit this influence.

Keywords: Geopolitics, Economic Coercion, Economic Statecraft, Belt and Road Initiative, Dollar Diplomacy, Input-Output Networks.
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1 Introduction

We build a framework to understand the role of geopolitical power and economic coercion in shaping global real and financial activity. In this era of geopolitical competition between US and China, we aim to provide a model to conceptualize how the great powers use their financial and economic might to extract economic and political surplus from countries around the world.

In our framework, geopolitical power arises from the ability of a country to consolidate disparate threats across multiple economic domains, often with some of the threats carried out by third party entities also being pressured, to induce a target to take a desired action. We start by considering production taking place in a small open economy (SOE) that is constrained by that country’s firms’ temptation to walk away with the intermediate goods they use to produce, at the expense of their suppliers. This gives rise to good-specific incentive compatibility constraints that limit the SOE’s productive capacity. We set up a network of firms and sectors, each potentially using the others’ goods as intermediate inputs. The extent to which production is constrained, in equilibrium, differs across sectors. In order to raise aggregate production, the SOE would want to share slackness between firms that are differentially constrained to shift production towards more productive inputs. It is, generally, unable to do so given the economic structure.

Geopolitical power arises when a hegemon is able to join together various incentive compatibility constraints into a consolidated constraint. A hegemon can do this because it can threaten to punish a country for violating a constraint not just in the domain that it deviated, but across various markets that it controls. This can be done via supplying multiple goods to a given country and committing to revoke the supply of all the goods in the event the country walks away with even one of them. More generally, a hegemon can compel a supplier, either another firm in a given country or one from another country, to cut off inputs to a firm that dares to steal from the hegemon. By joining these threats together, the hegemon generates surplus by allowing the SOE to increase its production. However, the hegemon can extract this entire surplus via take-it-or-leave it offers.

We begin by presenting the general framework in which a small open economy has a number of domestic firms that can each produce a differentiated good using a subset of domestic and foreign goods. Each firm has a separable linear production technology. Production is limited by a contracting friction: firms receive a fraction of inputs purchased before paying, and are tempted to steal those goods rather than make the payment to receive the remaining shipment. When goods can be stolen in isolation – that is, firms can steal one input while paying for another – the scale of each input is pinned down by its own incentive compatibility constraint.

We next introduce the notion of joint threats: suppliers of a firm might coordinate threats to cut off input sales to a firm if that firm steals from any one of them. Joint threats are potentially valuable because they expand the set of incentive compatible production choices by forcing a firm to choose to default on multiple suppliers simultaneously. We characterize the existence of pressure points on a firm: sets of threats that, when consolidated into a joint threat, lead to a worse outside option for the firm off equilibrium, relax the incentive problem, and in equilibrium lead to a strict
increase in that firms’ profits through an expansion in its production. We show that a necessary and sufficient condition for identifying pressure points on a firm are the ex-ante differences in the values of Lagrange multipliers on that firms’ incentive constraints. Pressure points can therefore be identified directly from the competitive outcome.

We then study how a hegemon, which supplies a good to multiple firms, can extract value by creating joint threats at pressure points. The hegemon can threaten not only to cut off supply to a firm that steals from it (a direct threat), but can also threaten to cut off supply to another of that firms’ suppliers unless it also cuts off supply to the deviating firm. The hegemon can propose take-it-or-leave-it contracts to all firms it supplies to in the SOE. Hegemon contracts specify required joint threats, goods imported from the hegemon, and side payments (“markups”) made from the firm to the hegemon. These side payments could include monetary transfers, purchases of goods at a mark-up, but also political or diplomatic actions that the hegemon values. We identify extraction points for the hegemon as firms in the SOE that the hegemon is able to charge a positive side payment when exerting joint threats. We show that extraction points are firms with pressure points that can be consolidated by the hegemon into a joint threat. Moreover, we show that the value created by the hegemon in terms of expanding production is exactly captured by the size of the side payment charged in equilibrium.

The presence of geopolitical power in our framework is not a zero-sum game. Geopolitical power can improve global outcomes, but the benefits accrue disproportionately to the hegemon. Firms in the SOE face an enforcement externality in the spirit of the Coase theorem. Each firm sells the hegemons its willingness to threaten other firms too cheaply because it does not internalize the increase in power that accrues to the hegemon. Intuitively, each firm sells threats on other firms without realizing that other firms are selling threats on itself.\footnote{When firms are spread among multiple SOEs even local government face the same problem with respect to each other at a global scale.} The hegemon plays a “divide et impera” strategy to extract the surplus. Still, firms find it attractive to source goods from the hegemon since on the margin, they perceive them to be cheap and with high enforceability.

We show that strategic industries tend to have some common characteristics. Goods that are portable worldwide with low transport costs tend to be more commonly used inputs in many sectors. These characteristics are likely to generate pressure points from controlling these industries. Finance and information technology are good example of such industries. Rare-earths and oil extraction are another. If the same industry output is used in both upstream and downstream industries, then that industry is also likely to generate extraction points. Firms in these industries have incentives to scale up and generate joint threats, thus leading to endogenous emergence of hegemons. Finance and information technology are good examples, but rare-earths and oil are not. Government interventions in the hegemon country are needed to connect pressure points and extraction points: even if one controls rare earths, which gives raise to the ability to pressure, one might have to extract surplus via other industries. We also characterize the extent to which the presence of alternative
providers limits the strategic values of some industries, e.g. a threat not to supply oil is not valuable if there are other willing suppliers.

Our framework provides a lens to understand a number of important developments today. Most prominently, we show that China’s Belt and Road Initiative can be understood as a sovereign lending program that aims to join borrowing and trade decisions. We illustrate how sovereign debt can be represented in the form of a productive input in our framework, and show that a country’s borrowing capacity increases when the hegemon lender is able to consolidate threats in the sovereign lending arena with activity in export markets. Because China’s lending is done by state-controlled banks, and much of the importing and exporting is done by Chinese state-owned enterprises, we argue this consolidation of financial and trade threats is more feasible for China than the United States. The hegemon is happy to earn below market returns on its lending because it gives it power to extract economic and political rents elsewhere. The marginal firm or country wants to join the Belt and Road Initiative because the debt is perceived to be cheap. We further demonstrate that this economic framework can understand not just a hegemon’s ability to extract economic rents, but also non-economic goals including military cooperation and diplomatic aims.

In the final section of the paper, we explore how hegemons compete geopolitically. We show how changing the SOE’s outside option can affect a hegemon’s ability to extract rents via threat consolidation. By raising a country’s outside options, the rents a hegemon can extract falls and moreover production in the SOE may rise. We argue this helps understand recent actions of the United States and G7 to combat China’s influence, such as the formation of the "Coordination Platform on Economic Coercion" to respond to perceived instances of economic coercion, the European Union’s Anti-Coercion Instrument, and the formation of the Partnership for Global Infrastructure and Investment (PGII) to reduce dependence on Chinese development finance. Finally, we highlight ways in which the framework could be extended to consider full-blown competition between two rival hegemons.

1.1 Literature Review

This paper connects to four broad strands of literature. First, the paper connects to the literature in political science on economic statecraft. The notion of economic statecraft, or the use of economic means for political ends, was explored in depth by Baldwin (1985) and the subsequent literature. A particular tool of economic statecraft, economic and financial sanctions, is a focus of this political science literature, including such contributions as Lindsay (1986), Kirshner (1997), Drezner (2003), and Mulder (2022). Blackwill and Harris (2016) explore the rise of geoeconomics, that is the use of economic power for geopolitical goals. In recent work, Farrell and Newman (2019) and Drezner et al. (2021) introduce the idea of “weaponized interdependence” whereby states can use the increasingly complex global economic network to influence and coerce other states.² Mangini (2022) studies how states’ attempts to use economic coercion interact with domestic political constraints.
Second, the paper relates to the literature on industrial policy and trade. The seminal contribution of Hirschman (1945) relates the structure of international trade to international power dynamics. At the intersection with political economy, Berger, Easterly, Nunn and Satyanath (2013) demonstrate that countries where the CIA intervened during the Cold War imported more from the United States. Antràs and Miquel (2011, 2023) explore how foreign influence affects tariff and capital taxation policy. Kleinman, Liu and Redding (2020) explore whether countries become more politically aligned as they trade more with each other. Liu (2019) and Baqaee and Farhi (2020, 2022) explore the effects of policy interventions in general network structures. Bartelme, Costinot, Donaldson and Rodriguez-Clare (2019) estimate sector-level economies of scale to quantify the expected gains from industrial policy. Juhász, Lane, Oehlsen and Pérez (2022) use textual analysis to measure industrial policy interventions around the world. Juhász, Lane and Rodrik (2023) surveys the recent literature on industrial policy.

Third, the paper is related to the growing literature on networks in economics including Acemoglu, Carvalho, Ozdaglar and Tahbaz-Salehi (2012), Baqaee and Farhi (2019) and Elliott, Golub and Leduc (2022). As our focus is on the open-economy, our paper also relates to the literature on global value chains (Antràs and Chor (2022)). Finally, our paper relates to the literature on game theory in networks, including contributions such as Jackson and Yariv (2005), Jackson and Yariv (2007), and Galeotti, Goyal, Jackson, Vega-Renondo and Yariv (2010).

Our paper is also related to the literature that documents and analyzes the rise of China as a global economic power (Dreher et al. (2022); Gelpern et al. (2022); Horn et al. (2021, 2023); Liu (2023)) and the use of sovereign wealth funds and state controlled entities to further China’s global ambitions.

2 General Framework

Consider a small open economy (SOE) consisting of a set of sectors \( i \in \mathcal{I} = \{1, \ldots, I\} \), each producing a differentiated good. Each sector represents a continuum of small firms and we therefore focus on a representative firm. We denote \( \mathcal{J} = \{1, \ldots, J\} \) the set of all goods, with \( \mathcal{J} \setminus \mathcal{I} \) being goods produced by the rest of the world. All goods are bought and sold competitively at world price vector \( p = (p_1, \ldots, p_J) \) set in a world numeraire. Firms are owned locally. There is also a local factor of production in each sector in the SOE (e.g. local labor), with \( \ell_i \) units of local factor available to sector \( i \) at price \( w_i \).

Firm \( i \) can use the local factor as well as a subset \( \mathcal{J}_i \subset \mathcal{J} \) of all domestic and foreign goods in order to produce good \( i \), where we denote \( J_i = |\mathcal{J}_i| \) the cardinality of \( \mathcal{J}_i \). Firm \( i \) produces good \( i \) out of a separable linear technology,

\[
\begin{equation}
 y_i = \sum_{j \in \mathcal{J}_i} z_{ij} x_{ij} + z_i \ell_{ii},
\end{equation}
\]

\(^3\text{Camboni and Porcellacchia (2021) use a gravity framework to test for geopolitical competition.}\)
where $y_i$ is total output, $x_{ij}$ is inputs of good $j$ used by firm $i$, $z_{ij}$ is productivity of input $j$, $\ell_{ii}$ is the quantity of the local factor used in production, and $z_{i\ell}$ its productivity. If $i$ purchases a quantity of input $x'_{ij}$ from $j$, we assume that $i$ only receives a fraction $0 \leq \tau_{ij} \leq 1$ of each unit that is shipped and the rest is depleted in transport. This is equivalent to firm $i$ facing price $p_{ij} = \tau_{ij}p_j$ for input $j$ on the net quantity received $x_{ij}$.

Firm $i$’s profits are given by

$$p_i y_i - \sum_{j \in J_i} p_{ij} x_{ij} - w_i \ell_{ii}.$$  

We denote $Y_{ij} = z_{ij}X_{ij}$ to be the sector level output produced using total inputs $X_{ij}$ of good $j$, and denote $\pi_{ij} = p_i - \frac{\tau_{ij}}{z_{ij}}p_j$ the per-unit profit earned from production $Y_{ij}$. Thus there is a threshold $\tau_{ij} = z_{ij}\frac{p_i}{p_j}$ for nonnegative profits. Now we are ready to define the set $J_i$: we say that $j \in J_i$ if $\tau_{ij} \leq \tau_{ij}$. Firm $i$ only has a relationship with firm $j$ if per-unit profits are nonnegative, or equivalently transport costs are sufficiently small. Total profits at the sector level are

$$\sum_{j \in J_i} \pi_{ij} Y_{ij} + \pi_{i\ell} Y_{i\ell}.$$  

(1)

We assume that the local factor of production is purchased and sold competitively within the sector and that it faces no incentives problem. We then have $w_i = z_{i\ell}p_i$. Thus firms earn zero profits from the local factor of production, $\pi_{i\ell} = 0$. Market clearing for this factor is $\ell_{ii} = \bar{\ell}_i$, yielding $Y_{i\ell} = z_{i\ell}\bar{\ell}_i$. From here on, we focus on the firm production decision out of other inputs, with production $Y_{i\ell}$ entering as a component of market clearing.

### 2.1 Incentives and Limited Contracting Problems

The timing of decisions in the model is that inputs are purchased first and promises are made for future payment. If the promises are fulfilled, production then occurs with the full set of inputs. If the promises are not fulfilled, then production occurs with a limited set of inputs that the suppliers have no ability to recover from the purchasing firm.

Representative firm $i$ purchases a vector of inputs $X_i = \{X_{ij}\}_{j \in J_i}$ by promising payment $p_j X_{ij}$ to firm $j \in J_i$. Firm $i$ receives an immediate shipment of a fraction $\theta_{ij}(Y_{ij}) \in [0, 1]$ of input goods, meaning that feasible production using the inputs received is $\theta_{ij}(Y_{ij})Y_{ij}$. We assume that $\theta_{ij}$ is positive and continuous, that $\theta'_{ij}(Y_{ij}) > 0$, and that $\theta_{ij}(Y_{ij})Y_{ij}$ is convex.

After receiving the initial delivery of inputs, firm $i$ can either pay firm $j$ the required amount $p_jX_{ij}$ to receive the remaining input goods, yielding additional production $(1 - \theta_{ij}(Y_{ij}))Y_{ij}$, or can refuse payment and “steal” the inputs that were initially delivered. After the payment and stealing decision, the firm produces using whatever inputs are at its disposal and sells the final output. Therefore, full payment to the supplier yields final profits of $\pi_{ij}Y_{ij}$ from production using good $j$, while stealing yields firms profits of $p_i\theta_{ij}(Y_{ij})Y_{ij}$. If good $j$ can be stolen without any further
repercussion on firm $i$, then firm $i$ prefers payment to firm $j$ rather than stealing if

$$p_i\theta_{ij}(Y_{ij}) Y_{ij} \leq \pi_{ij} Y_{ij}.$$  

**Incentive Compatibility.** Since firm $i$ is (potentially) purchasing multiple inputs from different sectors, it can engage in a set of possible stealing decisions. Denote $P(J_i)$ to be the power set of set $J_i$, that is the set of subsets of $J_i$. Then, stealing action $s \in P(J_i)$, that is $s \subset J_i$, denotes the action by firm $i$ of stealing goods $j \in s$ and not stealing goods $j \notin s$. The action $s = \emptyset$ indicates that firm $i$ does not steal any of its inputs.\(^4\)

We say that a production vector $Y_i \in \mathbb{R}^J_+$ is **incentive compatible** for firm $i$ with respect to stealing action $s \in P(J_i)$ if firm $i$ prefers not to steal over stealing action $s$, that is

$$\sum_{j \in s} p_i \theta_{ij}(Y_{ij}) Y_{ij} \leq \sum_{j \in s} \pi_{ij} Y_{ij}. \quad (2)$$

Note that profits $\pi_{ij} Y_{ij}$ for $j \notin s$ drop out from both sides, since such goods are not stolen. Rearranging, we obtain the equivalent representation

$$\sum_{j \in s} \left[ p_i \theta_{ij}(Y_{ij}) - \pi_{ij} \right] Y_{ij} \leq 0.$$  

We define the **incentive compatible set** $\mathcal{Y}_i(s) = \{ Y_i \in \mathbb{R}^J_+ | \sum_{j \in s} [p_i \theta_{ij}(Y_{ij}) - \pi_{ij}] Y_{ij} \leq 0 \}$ as the set of production allocations for firm $i$ that are incentive compatible with respect to action $s$. For any $S \subset P(J_i)$, we say that $Y_i$ is incentive compatible with respect to $S$ if $Y_i \in \mathcal{Y}_i(S) \equiv \cap_{s \in S} \mathcal{Y}_i(s)$.

A key point of tractability of our model is that many incentive compatibility constraints are redundant. In particular, we define the set of **isolated threats** by $S_i^\circ = \{ \emptyset \} \cup \{ \{j\} \}_{j \in J_i}$. We call these isolated threats because if firm $i$ steals from only firm $j$, firm $j$ refuses to supply the remaining shipment but all other firms provide the remaining shipment. Observe that

$$\mathcal{Y}_i(S_i^\circ) = \mathcal{Y}_i(P(J_i)),$$

and hence all joint stealing decisions are redundant with isolated stealing decisions.\(^5\) This observation motivates the following definition.

**Definition 1** A **nonredundant action set** $S_i \subset P(J_i)$ is a set of actions such that for every (nonempty) $s \in S_i$, $\mathcal{Y}_i(S_i \setminus \{s\}) \notin \mathcal{Y}_i(s)$. In other words, incentive compatibility with respect to $s$ is

\(^4\)For example, $s = \{1, 2\}$ indicates the action of stealing goods 1 and 2.

\(^5\)Suppose that $Y_i \in \mathcal{Y}_i(S_i^\circ)$ and let $s \in P(J_i)$. For any $j \in s$, since $Y_i \in \mathcal{Y}_i(S_i^\circ)$ then $[p_i \theta_{ij}(Y_{ij}) - \pi_{ij}] Y_{ij} \leq 0$. Hence summing over $j \in s$ gives $\sum_{j \in s} [p_i \theta_{ij}(Y_{ij}) - \pi_{ij}] Y_{ij} \leq 0$, and hence $Y_i \in \mathcal{Y}_i(s)$. Hence $\mathcal{Y}_i(S_i^\circ) \subset \mathcal{Y}_i(s)$ for any $s \in P(J_i)$, and hence $\mathcal{Y}_i(S_i^\circ) \subset \mathcal{Y}_i(P(J_i))$. Since $S_i^\circ \subset P(J_i)$, then $\mathcal{Y}_i(P(J_i)) \subset \mathcal{Y}_i(S_i^\circ)$, and hence $\mathcal{Y}_i(S_i^\circ) = \mathcal{Y}_i(P(J_i))$. 

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not implied by incentive compatibility with respect to $S_i \setminus \{s\}$.

A nonredundant action set captures the intuition of the example above: no action $s \in S_i$ can be discarded without expanding the set of incentive compatible production decisions.

We finally add the following two assumptions, which we maintain for the remainder of the paper.

**Assumption 1** $\pi_{ij} - p_i \theta_{ij}(0) \geq 0$ and $\pi_{ij} - p_i \theta_{ij}(+\infty) < 0$.

**Assumption 2** Any nonredundant action set $S_i$ studied has disjoint elements, that is for any $s, s' \in S_i$, $s \cap s' = \emptyset$.

Assumption 1, combined with the prior assumptions on $\theta$, ensures a crossing point so that nonnegative and finite production is incentive compatible. The second assumption is made for tractability.

### 2.2 Market Clearing and Equilibrium

We assume that the rest of the world has perfectly elastic demand for all goods at price vector $p$, subject to nonnegativity constraints on goods $i \in I$. We further assume that $Y_{i\ell}$ is sufficiently large that country $i$ has positive exports of every good $i \in I$ at this price vector. Formally, we are assuming that all model solutions satisfy $\sum_{i' \in \mathcal{I}} X_{i'i} < Y_{i\ell} \quad \forall i \in \mathcal{I}$. Given these assumptions, the competitive price vector will be $p$.

### 2.3 Model Solution with Isolated Threats

We begin by studying the competitive allocation if there are no restrictions on stealing actions, that is each firm $i \in I$ can undertake any action $s \in P(J_i)$. As discussed above, we have $\mathcal{Y}_i(S_i^0) = \mathcal{Y}_i(P(J_i))$, and therefore this reduces to the model solution with isolated threats. The nonredundant action set is therefore $S_i^0$, representing the system of incentive compatibility constraints

$$p_i \theta_{ij}(Y_{ij}) Y_{ij} \leq \pi_{ij} Y_{ij} \quad \forall j \in J_i, i \in I.$$

We obtain the following solution.

**Proposition 1** In the competitive model with $S_i = S_i^0$ for all $i \in I$, allocations are

$$Y_{ij}^0 = \theta_{ij}^{-1} \left( \frac{\pi_{ij}}{p_i} \right).$$

Proposition 1 characterizes the competitive allocations under isolated threats, or equivalently when there are no restrictions on stealing decisions. Since $\theta_{ij}$ is an increasing function, then production

\[\text{For example, this rules out a nonredundant action set with elements } \{1,2\} \text{ and } \{2,3\}, \text{ which are not disjoint.}\]
$Y^\circ_{ij}$ is increasing in profits relative to sales price, $\pi_{ij}/p_i$. Intuitively, higher (relative) profits sustain higher production by reducing incentive to steal. Since $\pi_{ij} = p_i - \frac{\tau_{ij}}{z_{ij}}p_j$, then production is larger when transport costs $1/\tau_{ij}$ are lower, when productivity $z_{ij}$ is higher, and when the relative price $p_i/p_j$ is higher.

**Example 1** When stealing fractions are linear, $\theta_{ij}(Y_{ij}) = \theta_{ij}Y_{ij}$, production is given by $Y_{ij} = \frac{1}{\theta_{ij} \pi_{ij} p_i}$. Thus production by firm $i$ using input good $j$ is larger when less can be stolen (low $\theta_{ij}$).

### 3 Pressure Points and Extraction Points

Our main analysis focuses on when and how value can be created by generating joint threats in stealing decisions. We begin this section by defining and characterizing pressure points on firms, which heuristically denote a set of off the equilibrium threats on a firm that, when consolidated into a single joint threat, generate on the equilibrium path an increase in profits earned by that firm. We then introduce the problem of a hegemon that is able to join together threats, and ask when and how the hegemon can create and extract value by doing so.

#### 3.1 Joint Threats and Pressure Points

Suppose that firm $i$ faces a nonredundant action set $S_i$ in a competitive environment. Firm $i$’s value function is given by

$$V_i(S_i) = \sup_{Y_i \in \mathbb{R}^+_{Y}} \sum_{j \in J_i} \pi_{ij}Y_{ij} \quad \text{s.t.} \quad \sum_{j \in s} \left[ p_i\theta_{ij}(Y_{ij})Y_{ij} - \pi_{ij}Y_{ij} \right] Y_{ij} \leq 0 \quad \forall s \in S_i,$$

which defines the profit level firm $i$ achieves when faced with $S_i$. Observe that because elements of $S_i$ are disjoint, we can equivalently write

$$V_i(S_i) = \sum_{s \in S_i} v_i(s), \quad v_i(s) = \sup_{\{Y_{ij}\}_{s}} \sum_{j \in s} \pi_{ij}Y_{ij} \quad \text{s.t.} \quad \sum_{j \in s} \left[ p_i\theta_{ij}(Y_{ij}) - \pi_{ij} \right] Y_{ij} \leq 0.$$  

This representation buys us considerable tractability.

We are now ready to define a joint threat, which will be central in the analysis to come.

**Definition 2** A **joint threat** $S'_i$ formed from elements $s_1, \ldots, s_n \in S_i$ is the action set

$$S'_i = \left\{ \bigcup_{x=1}^n s_x \right\} \cup (S_i \setminus \{s_1, \ldots, s_n\}).$$

Intuitively, a joint threat reflects a consolidation of stealing decisions: if a firm steals a good $j \in s_1$, it not only must steal every other good $k \in s_1$, but must also steal every good $k \in \bigcup_{x=2}^n s_x$. We
refer to this as a joint threat because it reflects a coordinated decision by all suppliers \( j \in \bigcup_{x=1}^{n} s_x \) to refuse the second goods shipment to firm \( i \) if firm \( i \) steals from any individual supplier in \( \bigcup_{x=1}^{n} s_x \). This reflects a joint threat in the sense that stealing from one such firm leads to all associated suppliers to terminate their relationship with firm \( i \). Since the other suppliers are not delivering the second shipment of goods, the firm steals the related initial shipments. For example, one can think of this as a cross-default clause on debt contracts that prevents selective default.

Observe that any joint threat \( S_i' \) is a nonredundant action set with disjoint elements.\(^7\) Furthermore, observe that for any joint threat \( S_i' \) formed from \( S_i \),

\[
V_i(S_i') \geq V_i(S_i),
\]

that is a joint threat weakly increases profits of firm \( i \). To understand why this is the case, observe that a joint threat weakly expands the set of incentive compatible allocations: if \( Y_i \in \mathcal{Y}_i(s) \) and \( Y_i \in \mathcal{Y}_i(s') \), then \( Y_i \in \mathcal{Y}_i(s \cup s') \). Thus \( \mathcal{Y}_i(S_i) \subseteq \mathcal{Y}_i(S_i') \) and hence \( V_i(S_i') \geq V_i(S_i) \). Economically, forming a joint threat expands the incentive compatible set and so weakly increases profits.

We are now ready to define a pressure point as a joint threat that strictly increases the profits of firm \( i \).

**Definition 3** A pressure point of firm \( i \) is a collection of stealing actions \( s_1, \ldots, s_n \in S_i \) that, when used to form a joint threat \( S_i' \), strictly increases profits, that is,

\[
V_i(S_i') > V_i(S_i).
\]

Although joint threats always weakly increase profits, pressure points are defined as cases where a joint threat strictly increases profits. We now prove a necessary and sufficient condition for identifying pressure points. As the preliminary to this condition, observe that the firm \( i \) optimization problem has a Lagrangian representation,

\[
\mathcal{L}(Y_i, \lambda^* | S_i) \equiv \sum_{j \in J \setminus i} \pi_{ij} Y_{ij} - \sum_{s \in S_i} \lambda_s^* \sum_{j \in s} \left[ p_{ij} \theta_{ij}(Y_{ij}) Y_{ij} - \pi_{ij} \right] Y_{ij},
\]

where \( \lambda_s^* \geq 0 \) is the Lagrange multiplier on the incentive compatibility constraint associated with \( s \in S_i \). We obtain the following result.

**Proposition 2** For any \( s_1, \ldots, s_n \in S_i \), \( (s_1, \ldots, s_n) \) is a pressure point of firm \( i \) if and only if \( \lambda_s^* \neq \lambda_s'^* \) for some \( s, s' \in \{ s_1, \ldots, s_n \} \).

Proposition 2 proves that a necessary and sufficient condition for a pressure point is that the Lagrange multipliers of the competitive model differ. To build intuition, consider the case of two

\(^7\)This follows from Definitions 1 and 2.
isolated threats: $\mathcal{J}_i = \{j, k\}$ and $S_i = \{\emptyset, \{j\}, \{k\}\}$. Suppose that $\lambda_j > \lambda_k$ for firm $i$. Economically, this means that slack in the incentive compatibility constraint for (production using) good $j$ is more valuable than slack in the incentive compatibility constraint for good $k$. The joint threat creates value by consolidating the two constraints and altering relative production of the two goods, a means of redistributing slack. Heuristically, the joint threat facilitates a decrease in production of $k$ in order to create slack that allows for an increase in production of $j$ under the joint threat. By contrast if $\lambda_j = \lambda_k$, then slack is equally valuable across goods $j$ and $k$. In this case, no value is created by forming a joint threat: production under the joint threat is precisely the same as under isolated threats. The proof of Proposition 2 formalizes these intuitions for more general action sets $S_i$.

This result is both intuitive and powerful. Intuitive, in the sense that combining disparate threats into a joint one, creates value by allowing perturbations of the original allocation that are now feasible. The ex-ante Langrange multipliers indicate whether adding slack to a particular input relationship is more valuable, and therefore guide the perturbation to increase that allocation and decrease the rest to preserve joint incentive compatibility. Powerful, in the sense that figuring out pressure points only requires knowing the tightness of the constraints in the ex-ante competitive setting, before introducing a hegemenon which we turn to next.

### 3.2 Hegemon Problem

We now study whether and how a hegemon can generate value by creating joint threats. We assume that the hegemon is located outside the SOE, and supplies good $m \not\in \mathcal{I}$. Results of this section are readily extend to the case where a hegemon can supply a subset $M \subset \mathcal{J}\setminus\mathcal{I}$ of goods, and we consider applications of this form in later sections. We assume that the hegemon has a sufficiently large endowment of good $m$ that demand from the SOE does not exhaust hegemon supply of good $m$. Thus given perfectly elastic rest of world demand, the hegemon sells good $m$ at price $p_m$.

#### 3.2.1 A Hegemon Contract

The hegemon is able to make a simultaneous take-it-or-leave-it offer to the subset $\mathcal{I}_m \equiv \{i \in \mathcal{I} | m \in \mathcal{J}_i\}$ of firms in the SOE that use good $m$ in production. The offer specifies quantities $X_{im}$ purchased by firm $i$ at world market price $p_m$, transfers $T_i$ between firm $i$ and the hegemon (with $T_i > 0$ representing a payment to the hegemon by firm $i$), and joint threats $S'_i$ for all $i \in \mathcal{I}_m$. The take-it-or-leave-it offer is rejected for all firms if any individual firm rejects it.\(^8\) Transfers $T_i$ can cover different interpretations: direct monetary payments, a firm-specific markup (potentially negative) charged by the hegemon on its sales of good $m$, or the extraction of value in some other action the firm takes on behalf of the hegemon (see later section on non-economic objectives).\(^8\)

\(^8\)Observe that there is no holdout problem because the offer is take-it-or-leave-it and is rejected if any individual firm rejects it.
Observe that the hegemon can propose the competitive allocation by offering the contract \( S'_i = S_i, T_i = 0, \) and \( Y_{im} = Y_{im}^o \) to all \( i \in \mathcal{I}_m. \)

### 3.2.2 Firm Participation Constraints

Firm \( i \in \mathcal{I}_m \) chooses whether or not to accept the take-it-or-leave it offer, taking as given that all other firms will accept the offer. If firm \( i \) rejects the hegemon’s offer, the contract is rejected and firm \( i \) receives the competitive outside option \( V_i(S_i). \)

If instead firm \( i \) accepts the offer, firm \( i \) takes as given the joint threat \( S'_i, \) the side payment \( T_i, \) and the allocation \( Y_{im}, \) and optimally chooses the remaining quantities \( Y_{ij}, j \in \mathcal{J}_i \setminus \{m\}, \) to maximize its profits, subject to incentive compatibility. Let us define \( s_m \in S'_i \) as the unique element of \( S'_i \) with \( m \in s_m. \) This decision problem is represented by the value function

\[
V_i(S'_i, Y_{im}, T_i) = \sum_{s \in S'_i \setminus \{s_m\}} v_i(s) + v_i(s_m, Y_{im}, T_i)
\]

where

\[
v_i(s_m, Y_{im}, T_i) = \sup_{\{Y_{ij}\} \in s_m \setminus \{m\}} \sum_{j \in s_m} \pi_{ij} Y_{ij} - T_i \quad s.t. \quad \sum_{j \in s_m} p_{ij}(Y_{ij}) - \pi_{ij} \leq 0.
\]

This representation of firm \( i \)'s decision problem reflects the familiar separability of \( i \)'s optimization problem across elements \( s \in S'_i, \) and further reflects that the hegemon contract terms \((T_i, Y_{im})\) only affect firm \( i \)'s choices in the context of \( s_m. \)

We can now define firm \( i \)'s participation constraint,

\[
V_i(S'_i, Y_{im}, T_i) - V_i(S_i) \geq 0. \tag{4}
\]

The hegemon must propose contracts that respect the participation constraint (4) for all firms \( i \in \mathcal{I}_m, \) else the hegemon’s contract is rejected.

When the joint threat \( S'_i \) is formed by consolidating a subset \( S_{im} \subset S_i \) with \( m \in \cup_{s \in S_{im}} s \) that includes the hegemon’s good, the participation constraint reduces to an even simpler form.\(^9\)

Given the separability of \( V_i \), in this case we can write \( V_i(S'_i, Y_{im}, T_i) - V_i(S_i) = v_i(s_m, Y_{im}, T_i) - \sum_{s \in S_{im}} v_i(s), \) and the participation constraint 4 reduces to

\[
v_i(s_m, Y_{im}, T_i) \geq \sum_{s \in S_{im}} v_i(s).
\]

\(^9\)Lemma 1 further below shows that the optimal contract always takes this form.
3.2.3 Feasible Joint Threats with Direct Transmission

The hegemon’s contract includes specifying a joint threat $S'_i$ for each firm $i \in \mathcal{I}_m$. We now specify what joint threats are feasible for the hegemon. We refer to the act of creating a joint threat from $s_1, s_2 \in S_i$ as **consolidating** $s_1$ and $s_2$, and define **direct transmission** of threats as follows.

**Definition 4** Hegemon $m$ can consolidate $s \in S_i$ under **direct transmission** if either $m \in s$ (direct control) or $\exists j \in s$ with $j \in \mathcal{I}_m$ (indirect control).

Intuitively, Definition 4 says that the hegemon can create a joint threat if either the hegemon’s good is directly in $s$, or if the hegemon sells to a firm $j \in s$. The latter is a case of indirect control, whereby the hegemon creates a joint threat by threatening to stop supplying to firm $j$ unless firm $j$ stops supplying to firm $i$ in the event when $i$ steals from the hegemon. The existence of the joint threat then optimally leads firm $i$ to steal simultaneously from all goods within the joint threat.

We say a joint threat is **feasible** under direct transmission if it can be achieved by direct transmission. For each $i \in \mathcal{I}_m$, it is helpful to define the set of **direct transmission links** $S^D_i \subset S_i$ by: $s \in S^D_i$ iff $s$ can be consolidated under direct transmission by the hegemon.\(^{10}\)

3.2.4 Equilibrium of the Hegemon Problem

We can now define an equilibrium of the hegemon problem. An equilibrium of the hegemon problem with direct transmission is a hegemon contract and firm allocations such that: (i) all firms’ participation constraints are satisfied; (ii) all firms maximize profits under contract terms $(S'_i, Y_{im}, T_i)$; (iii) the hegemon maximizes its profits; (iv) all joint threats are feasible under direct transmission.

3.3 Extraction Points

We turn next to solving the problem of the hegemon and defining extraction points. Intuitively, we think of extraction points as the firms that the hegemon can extract positive side payments from.

We begin with an intermediate result. Define the maximal joint threat that is feasible under direct transmission as $S'^{max}_i = \{ \cup_{s \in S^D_i} s \} \cup (S \setminus S^D_i)$, which consolidates all $s \in S^D_i$ into a single joint threat.

**Lemma 1** It is weakly optimal for the hegemon to offer a contract with joint threat $S'^{max}_i$.

\(^{10}\)One can imagine threats being passed on over more than direct links, for example each firm passing on the threat to the next one over a chain. Further, one could imagine stipulating that the threats are agreed to be carried on with some probability less than one, so that at each link the threat becomes weaker in probability (decaying over the length of the chain). For now, we keep the length of the chain to be 1 and the threat to be carried out for sure.
Lemma 1 is useful because it provides an optimal contract in which the hegemon consolidates all threats possible under direct transmission. Intuitively, Lemma 1 follows from the observation that joint threats expand the set of feasible allocations, and so weakly increase firm profits. Thus a hegemon that did not offer the maximal joint threat could always implement the same allocations \((T_i, Y_{im})\) while offering the maximal joint threat. Lemma 1 affords considerable tractability because once the joint threat \(S'_{i,\max}\) is known, the decision problem of the hegemon in fact becomes separable across firms in the SOE. Formally, this decision problem is represented as

\[
W_m (\{S'^{\max}_i\}_{i \in I_m}) = \sum_{i \in I_m} W_{mi}(S'^{\max}_i)
\]

where

\[
W_{mi}(S'^{\max}_i) = \sup_{T_i, Y_{im}} T_i \text{ s.t. } V_i(S'^{\max}_i, Y_{im}, T_i) \geq V_i(S_i).
\]

The fact that the hegemon’s objective is represented as maximizing side payments arises because the world price \(p_m\) is fixed (elastic foreign demand), hence it is costless to the hegemon to redirect resources to or from firms in the SOE.

We are now ready to define an extraction point.

**Definition 5** An extraction point for the hegemon is a firm \(i\) for which the hegemon extracts a positive side payment \(T_i > 0\) under joint threat \(S'^{\max}_i\).

There is an interesting interaction between extraction and pressure points. For the hegemon to extract surplus from firm \(i\), the set of optimal joint threats that the hegemon can carry out needs to generate a pressure point on firm \(i\). This highlights the nature of geopolitical power, it is not just the ability to threaten, it is that ability combined with the capacity to extract surplus from these economic relationships.

**Proposition 3** Firm \(i\) is an extraction point for the hegemon if and only if the set of direct transmission links \(S^D_i\) is a pressure point on \(i\).

Observe that a firm for which \(S^D_i\) is not a pressure point is not an extraction point for the monopolist. This arises from the observation that \(V_i(S'^{\max}_i) = V_i(S_i)\) for such a firm, and hence a positive side payment would violate the firm’s participation constraint. Consider by contrast a firm for which \(S^D_i\) is a pressure point. In this case, \(V_i(S'^{\max}_i) > V_i(S_i)\). Hence, heuristically, by continuity there is a sufficiently small side payment \(T_i = \epsilon > 0\) such that firm \(i\) is still better off relative to the outside option. The proof of Proposition 3 formalizes this heuristic argument.

Proposition 3 formalizes that the hegemon extracts value from a firm \(i\) for which \(S^D_i\) is a pressure point, and does so by creating a joint threat using \(S'^{\max}_i\). This joint threat expands the set of incentive
compatible allocations and allows the firm to increase profits. We now tie this expansion of profits concretely to the value extracted by the hegemon.

**Proposition 4** Let $\Delta Y_{ij}$ denote the change in production by firm $i$ under the hegemon’s optimal contract. Then,

$$T_i = \sum_{j \in J_i} \pi_{ij} \Delta Y_{ij}.$$  

Therefore, the value added of production increases at every extraction point under the hegemon’s contract by exactly the amount extracted by the hegemon.

Proposition 4 clarifies that the hegemon is able to extract positive side payments by bolstering the total surplus from production at extraction points. Intuitively, joint threats involving pressure points are valuable because they increase the set of incentive compatible production allocations. This allows firm $i$ to expand profitable production opportunities, leading to an increase in value. The hegemon extracts the entire increase in value in the form of a positive side payment, manifesting as a binding participation constraint. Therefore, the side payment $T_i$ precisely captures the value added from increases in production achieved by the hegemon’s contract. The fact that the hegemon extracts the entire surplus is due to the assumption that the hegemon has all the bargaining power, something that we relax later in this paper.

Propositions 3 and 4 highlight some crucial features of our model. The presence of geopolitical power in our framework is not a zero-sum game. Geopolitical power improves global outcomes, making everyone weakly better off, but the benefits accrue disproportionately to the hegemon. This framework is different from the typical zero-sum models of industrial policy or trade tariffs in which each country tries to get an advantage to the detriment of others. Many economists have been skeptical of such policies as they can lead to retaliation and all countries being worse off. By contrast, in our framework, geopolitical power arises from incentive problems and enforcement externalities and can generate global surplus. However, this surplus tends to accrue entirely to the hegemon if its power is unchecked. This creates a role for policies to redistribute the surplus.

Similarly, geopolitical power is not something that occurs only because government are involved and use policies to generate it. Some industries, which we define below to be strategic industries, have private incentives to generate a global hegemon. It is the nature of global trade and finance that such hegemonic outcomes arise, and the role for government policy is to improve on the outcomes.

It is perhaps surprising that firms in the SOE voluntarily submit to hegemonic power. To understand why they do so, consider that firms in the SOE face an enforcement externality in the spirit of the Coase theorem. Each firm sells the hegemon a promise to threaten other firms too cheaply because it does not internalize the increase in power that accrues to the hegemon by doing so. Intuitively, each firm sells threats on other firms without realizing that other firms are
selling threats on itself.\textsuperscript{11} The hegemon plays a “divide et impera” strategy to extract the surplus. Still, firms find it attractive to source goods from the hegemon since on the margin, they perceive hegemon-provided goods to be cheap and highly enforceable. The hegemon, for its part, is happy to earn below market returns on some of its goods because it gives it power to extract economic and political rents elsewhere.

3.4 Which industries and goods are strategic?

Our results provide guidance on how to think about what types of goods or industries are “strategic”. We think of strategic goods in our model as being goods that are critical to creating extraction points by way of joint threats.

Global Reach and Transport Costs. Extraction points rely on creating pressure points via joint threats. In our framework, joint threats are created from consolidating multiple firm stealing decisions with either direct or indirect threats, which is enhanced by widespread linkages of the hegemon’s good, \( m \), to many firms in the SOE. In our model, linkages arise when \( \pi_{im} \geq 0 \), or equivalently when \( \tau_{im} \leq \bar{\tau}_{im} \) and hence transport costs are low. This helps to shed light on why goods with low transport costs, such as finance or information technology, are more likely to emerge as strategic goods than goods with high transport costs, such as concrete. Rare-earths and oil extraction are another example of relatively easily portable goods worldwide.

Strategic Goods: Upstream or Downstream? A strategic good needs to be widely used by firms in order to generate joint threats, but we showed that not every firm needs to use it (the more so if we allow for indirect influence to occur over multiple steps in a chain). This helps generate pressure points. However, pressure alone is not sufficient, since the goal of the hegemon is to extract the value generated by the pressure. Interestingly, if the good is used both upstream and downstream, then firms in these industries have incentives to scale up and generate joint threats, thus leading to endogenous emergence of hegemons. Finance and information technology are good examples, in the sense that these industries internalize the value of their pressure points since they can also extract the value themselves. Rare-earths and oil, which are just upstream, are different. Government interventions in the hegemon country, or conglomerate firms that produce both these goods and some downstream ones, are needed to connect pressure points and extraction points. Even if one controls rare earths, which gives raise to the ability to pressure, one might have to extract surplus via other industries.

\textsuperscript{11}When firms are spread among multiple SOEs even local governments face the same problem with respect to each other at a global scale.
3.5 Can Countries Actually Consolidate Threats?

In our framework, even though the hegemon only produces a single input, it is able to consolidate its threats under direct transmission through its indirect control: threatening to cut off its supply to other suppliers unless they also impose the joint threat. It may be natural to think that a hegemon that supplied two goods to one firm in an SOE would be able to impose a joint threat to withdraw both goods if either is stolen, consolidating threats that operate indirectly through the production network may appear harder to imagine. While clearly this use of power requires a less straightforward strategy, there are examples where China has attempted to pursue such a strategy.

A particularly prominent example is China’s use of economic power to attempt to deter countries from recognizing Taiwan as an independent country rather than referring to “Chinese Taipei.” In July 2021, Taiwan opened a Taiwanese Representative Office (TRO) in Vilnius, Lithuania, operating under the name Taiwan rather than Taipei, and China immediately sought to persuade, or coerce, Lithuania into reversing course. As discussed at length in a recent report by the Center for Strategic and International Studies (Reynolds and Goodman (2023)),

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]

In addition, Lucas (2021) reports that China pressured Thermo Fisher Scientific, a particularly important foreign investor in Lithuania to pressure the Lithuanian government to reverse course or to risk its own relationship with China. In all of these instances, China denies instituting these policies, and there is not a formal record of a government action. While these consolidated threats are not seen in every instance of Chinese economic statecraft or coercion, in our framework as in the real world, if actors believe that such pressure will be forthcoming in the event of a deviation, the threat of this coordinated threat is enough to deter these deviations before they materialize.\footnote{Indeed, when surveying the episodes of economic coercion reviewed in Reynolds and Goodman (2023), it is clear that many prominent applications of economic and geopolitical power are observed towards Chinese adversaries. These threats, instead, are likely to be most effective in countries with the closest political and economic ties to China, and therefore we are least likely to see China actually instituting them if they are successful in preventing policies they do not like in the first place.}
4 Understanding the Mechanism

In this section, we provide two complementary examples to illustrate how our model operates. In our first example, a hegemon is able to sell two inputs to a firm in the SOE. In our second example, we build upon this framework to illustrate the main mechanism of our framework: a hegemon selling only a single input can create similar (in this case, identical) joint threats by interacting with multiple firms in a network.

4.1 Sourcing Two Inputs from a Single Supplier

We first consider a simple case in which the small open economy has a single sector, \( i = e \), which can produce electronics from batteries, \( j = b \), and chips, \( j = c \). We have \( \mathcal{I} = \{e\} \) and \( \mathcal{J}_e = \{b, c\} \).

Firm \( e \) earns profits \( \pi_{eb} = p_e - \frac{1}{z_{eb}}p_b \) and \( \pi_{ec} = p_e - \frac{1}{z_{ec}}p_c \) from producing electronics out of batteries and chips, respectively, with \( \pi_{eb}, \pi_{ec} > 0 \). Figure 1 provides a simple illustration of how \( \pi_{eb} \) is constructed: firm \( e \) imports \( 1/z_{eb} \) units of good \( b \), uses them to produce 1 unit of good \( c \), and then sells that unit at price \( p_c \) while repayment the battery firm \( -1/z_{eb}p_b \).

For expositional simplicity, we will assume that \( \theta_{ec}(Y_{ec}) = \theta_{ec} Y_{ec}^{\alpha_{ec}} \) and \( \theta_{eb} = \theta_{eb} Y_{eb}^{\alpha_{eb}} \). Finally, the set of stealing actions for firm \( e \) is \( S_e = S_e^0 = \{\emptyset, \{b\}, \{c\}\} \), which contains only isolated threats. This means that \( e \) can steal no goods (\( s = \emptyset \), can steal only good \( b \) (\( s = \{b\}\)), or can steal only good \( c \) (\( s = \{c\}\)). As above, the stealing action \( \{b, c\} \) is redundant for incentive compatibility with the separate decisions \( \{b\} \) and \( \{c\} \), and so can be omitted.

We begin by characterizing the outcome of the competitive model with isolated threats.
Corollary 1 In the competitive model with isolated threats, firm $e$’s production choices are

$$Y_{ej}^\circ = \left( \frac{1}{\theta_{ej}} \frac{\pi_{ej}}{p_e} \right)^{1/\alpha_{ej}}, \quad j \in \{c, b\}. $$

Characterizing Pressure Points. We next characterize pressure points of firm $e$. Observe that the only possible pressure point of firm $e$ is $\{b\}, \{c\}$ since there are only two inputs. We obtain the following result.

Corollary 2 $\{b\}, \{c\}$ is a pressure point of firm $e$ if and only if $\alpha_{eb} \neq \alpha_{ec}$.

The proof of Corollary 2 connects the pressure point to differences in the stealing elasticity

$$\frac{\theta_{ej}(Y_{ej})}{Y_{ej}} \frac{\partial \theta_{ej}(Y_{ej})}{\partial Y_{ej}} = \alpha_{ej}. $$

Intuitively, with isolated threats the electronics firm is overproducing the high stealing elasticity good and underproducing the low elasticity good. A small reduction in production of the higher elasticity good leads to a substantial slackening of incentive compatibility, allowing for a more substantial increase in production of the lower elasticity good. When instead elasticities are the same, the slack created for both goods is the same, and the firm is unable to increase profits.

The Hegemon Problem. We suppose now that a hegemon supplies both $b$ and $c$ to the SOE. When $\alpha_{eb} \neq \alpha_{ec}$, $\{b\}, \{c\}$ is a pressure point of firm $e$. We therefore ask what contract the hegemon would offer to the SOE.\footnote{While we assume a unitary decision-maker in the hegemon, in reality political economy forces are important. See Francois, Trebbi and Xiao (2023) for an analysis of factions and power dynamics in China.}

The hegemon has direct control over $\{b\}$ and $\{c\}$, and therefore can create a joint threat $\{b, c\}$ under direct transmission. Formally, $S'_e = \{\emptyset, \{b, c\}\}$ is a feasible joint threat under direct transmission. We thus study a hegemon proposing a contract featuring: (i) joint threat $S'_e = \{\emptyset, \{b, c\}\}$; (ii) side payment $T_e$; and, (iii) allocation $(Y_{eb}, Y_{ec})$. The contract must respect incentive compatibility,

$$p_e \theta_{eb}(Y_{eb}) Y_{eb} + p_e \theta_{ec}(Y_{ec}) Y_{ec} \leq \pi_{eb} Y_{eb} + \pi_{ec} Y_{ec} - T_e$$

as well as the firm participation constraint,

$$\pi_{eb} Y_{eb}^\circ + \pi_{ec} Y_{ec}^\circ \leq \pi_{eb} Y_{eb} + \pi_{ec} Y_{ec} - T_e.$$ 

The hegemon’s objective is to maximize $T_e$.

If $\{b\}, \{c\}$ is not a pressure point, then the hegemon cannot improve upon the competitive outcome. We obtain the following result.
**Proposition 5** Firm $e$ is an extraction point, that is $T_e > 0$, if and only if $\alpha_{eb} \neq \alpha_{ec}$. When firm $e$ is an extraction point, then the hegemon’s contract has allocations:

1. If $\alpha_{eb} > \alpha_{ec}$, then $Y_{ec} > Y_{eb}^\circ$ and $Y_{eb} < Y_{eb}^\circ$.
2. If $\alpha_{eb} < \alpha_{ec}$, then $Y_{eb} > Y_{eb}^\circ$ and $Y_{ec} < Y_{ec}^\circ$.

Following from Proposition 3, in Proposition 5 we first relate firm $e$ being an extraction point to the joint threat $\{b\}, \{c\}$ being a pressure point on this firm. If firm $e$ is not an extraction point, then the hegemon can do no better than offering the competitive outcome. Proposition 5 further characterizes how the hegemon contract alters production when firm $e$ is an extraction point. In particular, consistent with the intuition of Corollary 2, the hegemon increases production out of the good with lower stealing elasticity $\alpha$. In turn, the hegemon also decreases production out of the higher elasticity good. Although this shifting of production means that firm $e$ does not increase production using all inputs, Proposition 4 tells us that total profits from production by firm $e$ rise. Thus, surplus from production has risen. However, all surplus is extracted by the hegemon in the side payment $T_e$, leaving firm $e$ no better or worse off than under competitive pricing without joint threats.

### 4.2 Consolidating Threats Through the Production Network

We consider a new set up that is closely related the example of Section 4.1. Batteries are now produced by a sector within the SOE, meaning the SOE has two sectors, $\mathcal{I} = \{e, b\}$. Chips $j = c$ are still produced abroad.

Firm $e$’s problem is the same as in Section 4.1. The battery firm $i = b$ produces batteries using chips, $\mathcal{J}_b = \{c\}$, with profit $\pi_{bc} = p_b - \frac{1}{z_{bc}} p_c$. We assume that $\theta_{bc}(Y_{bc}) = \theta_{bc} Y_{bc}^{\alpha_{bc}}$. The action set of the battery firm is $S_b = \{\emptyset, \{c\}\}$. The structure of this economy is represented in Figure 2.

In the competitive model with isolated threats, production choices of firm $e$ are the same as before. Following the same steps, the production choice of firm $b$ is

$$Y_{bc}^\circ = \left(\frac{1}{\theta_{bc} p_b} \pi_{bc}^{1/\alpha_{bc}}\right).$$

**Pressure Points.** Observe that firm $b$ has no pressure points, as it only uses a single input. However, as in Section 4.1, firm $e$ has a pressure point $\{b\}, \{c\}$ if and only if $\alpha_{eb} \neq \alpha_{ec}$.

**The Hegemon Problem.** When $\alpha_{eb} \neq \alpha_{ec}$, $\{b\}, \{c\}$ is a pressure point of firm $e$, while firm $b$ has no pressure point. Thus the hegemon selling $c$ can only use firm $e$ as a potential extraction point. However, the hegemon is no longer a supplier of good $b$.

Nevertheless, the hegemon can still consolidate $\{b, c\}$ under direct transmission. In particular, the hegemon has direct control over $\{c\}$ at firm $e$. Since the hegemon $c$ is a supplier to firm $b$, and
Figure 2: Triangle Production Structure

Notes: The figure represents the flow of imported intermediates $c$ from the hegemon to battery and electronics producers, and the flow of batteries for intermediate use by firm $e$ described in Section 4.2.

firm $b$ is in turn a supplier to $e$ (as illustrated in Figure 2), then the hegemon also has indirect control over $\{b\}$ at firm $e$ (see Definition 4). Therefore, $S'_e = \{\emptyset, \{b, c\}\}$ is a feasible joint threat under direct transmission. We thus study a hegemon proposing a contract featuring: (i) joint threats $S'_e = \{\emptyset, \{b, c\}\}$ and $S'_b = S_b$; (ii) side payments $T_e$ and $T_b$; and, (iii) allocations $(Y_{eb}, Y_{ec})$ and $Y_{bc}$. The contract must respect incentive compatibility and participation constraints of both firms. The hegemon’s goal is to maximize $T_e + T_b$.

We obtain the following result.

**Proposition 6** Firm $b$ is not an extraction point, while firm $e$ is an extraction point if and only if $\alpha_{1b} \neq \alpha_{1c}$. The hegemon’s contract sets $T_b = 0$ and $Y_{bc} = Y_{bc}^0$, and sets the terms for firm $e$ the same as in Proposition 5.

Proposition 6 provides a simple illustration of one of the main messages of our paper: even if a hegemon supplies only a single good, the hegemon can extract value by coordinating joint threats through the production network. In this environment, the hegemon sells only good $c$ and does not sell good $b$. Therefore the hegemon cannot directly threaten to cut off supply of both goods if firm $e$ steals either. However, the hegemon can create a joint threat through the chain: if firm $e$ steals from the hegemon, the hegemon threatens to cut off supply of $c$ to firm $b$ unless firm $b$ cuts off supply to firm $e$. Firm $e$ thus faces a joint stealing constraint on $\{b, c\}$ achieved indirectly by the hegemon’s threat passed on through $b$. Proposition 6 highlights that such threats achieve precisely the same allocating and surplus as if the hegemon supplied both goods $b$ and $c$.  

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Proposition 6 also highlights the respective roles played by the upstream firm \((b)\) and the downstream firm \((c)\) in creating an extraction point at \(e\). The hegemon approaches firm \(e\) with an offer of a joint threat, \(\{b, c\}\), that allows for expanded production. The hegemon pairs this joint threat with a required side payment \(T_e > 0\). However, the hegemon also must contract with the upstream firm to create the joint threat in the first place. Because stealing is off the equilibrium path, there is no cost to the upstream firm of accepting a contract that requires the joint threat. Equivalently, we can think of the hegemon as providing a tiny subsidy \(T_b = -\epsilon\) for small \(\epsilon\) to firm \(b\) in exchange for agreeing to enforce the joint threat, which firm \(b\) is willing to accept.

Proposition 6 reveals another important phenomenon: firm \(b\) is selling a joint threat that is extremely valuable to firm \(e\) to the hegemon, but as the joint threat has no direct value to firm \(b\) it is willing to sell this joint threat for a pittance. This is an example of the enforcement externality we discussed earlier and suggests potential room for SOE government interventions to increase the surplus retained by firms in the SOE. We revisit this issue in Section 7.

4.3 Implementations with the Core Tools of Economic Statecraft

Baldwin (1985) outlines a number of the key tools of economic statecraft. The most prominent tools are economic sanctions, foreign aid, and tariffs. Before turning to the more intricate ways in which states can exert their geopolitical power through the global economic production network, we begin by briefly illustrating how these classical tools fit into our framework.

Sanctions The threat of an economic sanction serves as a penalty against a firm or a country in response to a particular action. Sanctions are one way in which joint threats are implemented. In our example sourcing two goods from a single supplier (Section 4.1), the hegemon could implement the joint threat via an exports sanction across both goods against the firm if the firm steals either good. In our example of the Triangle Production structure (Section 4.2), the hegemon could implement the joint threat by threatening exports sanction against the electronics firm, and by also threatening an exports sanction against the battery firm if the battery firm did not punish a deviating electronics firm. When we turn to non-economic objectives in Section 6, sanctions can be understood more broadly as cutting off supplies to firms in a country who takes a diplomatic, military, or other action that the hegemon disagrees with.

Foreign Aid One can think of Foreign Aid as a positive sanction that provides a reward rather than a penalty. Foreign aid is a transfer from a government to a foreign country, potentially conditional on the firms and/or government of the recipient country acting in accordance some set of requirements. Here we conceptualize foreign aid as a negative side payment to the hegemon (i.e. a positive transfer from the hegemon to the SOE) conditional on the SOE firms not deviating from their contracts. The promise of foreign aid serves to loosen the IC constraint as the potential loss
of aid serves to make a deviation more painful. In Section 6, we show that negative side payments can arise from a hegemon’s pursuit of non-economic objectives.\footnote{For evidence that foreign aid is used as a tool of geopolitical influence, see Kuziemko and Werker (2006) on the increase of U.S. aid to country’s with a rotating seat on the UN Security Council and Dreher et al. (2022) for evidence that China provides less foreign aid to countries that recognize Taiwan.}

**Tariffs and Export Controls** Tariffs can play a similar role to sanctions or foreign aid in our framework. A threat of positive tariffs for firms or countries that steal can be used to form joint threats similarly to sanctions, while negative tariffs (subsidies) can provide benefits similar to foreign aid. For example, a hegemon could incentivize the SOE to abide by the terms of the contract by offering a tariff below the rate offered to other countries via a preferential trade agreement below most-favored nation (MFN) rates, but with the implicit threat to revert to the MFN rate or higher conditional on a deviation. Similarly, an export control can be thought of as an infinite tariff and another way of implementing a joint threat.

In our framework, tariffs can serve both as a way for a hegemon to extract revenue from extraction points and also provide joint threats. A hegemon could apply a positive but finite tariff generating total revenue equal to $T_i$ under the terms of its contract, with the threat to increase tariffs (or impose an export control/infinite tariff) following a deviation. Interestingly, the key distinction in the implementation is that the export controls lose the benefit of revenue collection. This suggests tariffs can achieve both the revenue extraction and joint threat roles of the hegemon.\footnote{This is related to the observation that governments can achieve efficient regulation in a global setting using Pigouvian taxes due to the combination of revenue collection and incentive provision (Clayton and Schaab 2022).} In this sense, a tariff may be additionally valuable in our framework as a way to extract surplus at an extraction point. Of course, in reality, countries may be prefer stricter export controls because of their more credible implementation.\footnote{See Miller (2022) and Palmer (2023) and on the competition for control of computer chips and recent US-led export controls to China.}

### 5 Sovereign Financing and Global Trade as Joint Threats

In this section, we demonstrate how sovereign financing fits into our general framework and use it to explore joint threats between sovereign financing and trade relations. We use this to understand the strategy China is pursuing in its Belt and Road Initiative.

#### 5.1 The Belt and Road: Background

As discussed in the introduction, the past decade has seen an explosion of lending from the Chinese government and state-owned policy banks to developing and emerging market borrowers. Rather than taking the form of sovereign bond debt, where dispersed creditors purchase bonds issued...
directly by the sovereign on the open market, China’s lending has taken the form of direct lending.\textsuperscript{17} The primary recipient of these Chinese loans are state-owned enterprises in developing countries. Even when the lending is not directly towards a state-owned enterprise or the sovereign, it is often towards a special purpose vehicle the owner/beneficiary of which is a state-owned enterprise or the state itself.

Another important difference of this form of sovereign lending relative to the market-based finance that dominated previous decades is that this lending takes the form of project finance. Importantly, these projects often specify that the funds are to be spent on importing goods and expertise from China for the project’s completion. For instance, in AidData’s dataset of individual project finance by China’s lenders, they describe a loan from the China Export-Import Bank to Ethiopia as the China Eximbank 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 (Custer et al. (2021)). The 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. In terms of being able to consolidate threats in event of non-compliance, therefore both the financing and real side of this project are being performed by entities that are owned by the Chinese government.

In this section, we apply our framework to capture many of the salient features of the Belt and Road Initiative. In particular, we show that sovereign debt that allows for reallocating consumption intertemporally, as is standard in sovereign debt models, is a special case of our production technology. We then rationalize the BRI as a joint threat on behalf of the Chinese government that links together sovereign finance with intermediate good imports.

5.2 The Belt and Road: Connected Sovereign Debt and Intermediates

To begin to consider sovereign debt, we first need to introduce an intertemporal dimension to the problem. We employ a standard interpretation that some goods correspond to a consumption good at different periods of time. Concretely, denote good $0$ as a good being produced today and good $1$ as being produced in the next period. The idea is that sovereign debt, which allows for borrowing across periods, can be represented as a production technology that allows a government to convert period 1 consumption goods into period 0 consumption goods.

We begin by setting up a simple sovereign borrowing model, and then map it into our framework. We normalize the price of period 0 consumption to 1, $p_0 = 1$. Let $0 < \beta < 1$ be the SOE government’s subjective discount factor and let $w$ denote national wealth, measured at period 0.

\textsuperscript{17}See Dreher et al. (2022), Gelpern et al. (2022), Horn et al. (2021), and Malik et al. (2021) for studies on China’s lending.
prices. The government’s intertemporal consumption problem in autarky is

$$\max_{c_0, c_1} c_0 + \beta c_1 \quad s.t. \quad c_0 + \frac{c_1}{R} \leq w$$

(5)

where $R = \frac{1}{\beta}$ denotes the domestic risk-free interest rate between periods.

As is standard in many sovereign debt models, we assume that the government is less patient than foreign investors, $\beta < \beta'$, thereby creating a gain from the government borrowing to finance period 0 consumption. The world gross risk-free interest rate $R'$ is pinned down by the preferences of foreign lenders, and so we have

$$R' = \frac{1}{\beta'}.$$

**Borrowing as a Production Technology.** Sovereign debt is effectively buying a good at time 0 in exchange for a promise to sell good 1. In Figure 3, we demonstrate precisely how sovereign borrowing can be represented in terms of the simple economy in Section 4.1. In the production framework, we can represent this as the SOE having a technology

$$Y_{10} = RX_{10}$$

which allows the SOE to convert date 0 consumption into date 1 consumption at its autarky interest rate.\textsuperscript{18} By contrast, the world interest rate is $R' = \frac{1}{\beta'}$ or equivalently, the world price of date 1 consumption is

$$p_1 = \frac{1}{R'} = \beta'.$$

Figure 3 parallels Figure 1 in constructing the profits $\pi_{10}$ associated with borrowing in the sovereign debt case. The SOE buys $1/z_{10} = \beta$ units of date 0 consumption from the rest of world at price $p_0 = 1$. It then uses its domestic technology to produce $R\beta = 1$ units of the consumption good at date 1, which are then sold at price $p_1 = \beta'$. Thus, the profits per unit of date 1 consumption sold (i.e., per unit of face value of debt) are

$$\pi_{10} = p_1 - \frac{p_0}{z_{10}} = \beta' - \beta.$$

Intuitively, $\pi_{10}$ reflects the gains from trade from borrowing from the perspective of the SOE. The SOE is willing to sell debt at a price $\beta$, while foreign investors are willing to purchase debt at price $\beta'$. The SOE thus earns implied profits $\beta' - \beta$ by selling debt to the world to finance date 0 consumption. This makes clear that the gains from trade in finance are bigger as the gap between the time preferences of the domestic and foreign economy grows.

A key point of the sovereign debt literature, is that repayment by governments is particularly

\textsuperscript{18}Because we can consider the SOE being endowed with both of these goods, we do not require that the country to have access to a physical storage technology. Instead, we can think of $R$ as the interest rate that clears the domestic capital market in autarky.
Notes: The figure represents the flow of imported good 0 that are used for producing good 1.

hard to enforce. There are no formal seniority structures, bankruptcy courts, or effective legal regimes that prevent borrowing governments from effectively walking away with the borrowed sums. In our context, we can model this as the no-stealing constraint being linear,

\[ \theta_{10}(Y_{10}) = \theta_{10}Y_{10}, \]

with a high value of \( \theta_{10} \) corresponding to large incentives to walk away. Sovereign finance is easy to renege on, or steal, when \( \theta_{10} \) is high. Using the results from a world of isolated threats characterized in Section 2.3, we can write the amount of sovereign borrowing that a country can sustain as

\[ Y_{10} = \frac{1}{\theta_{10}} \frac{\pi_{10}}{p_1} = \frac{1}{\theta_{10}} \left( 1 - \frac{\beta}{\beta'} \right). \]

More borrowing is therefore sustained when discount rates vary substantially (\( \beta \ll \beta' \)) and when incentives to walk away are not too large (low \( \theta_{10} \)).

**Sovereign Financing with Intermediate Inputs.** As in Section 4.1, we assume that good 1 can also be produced with an intermediate good. Here, we assume that it can be produced with imported chips. Following our simple case, the profits per unit of good 1 produced with chips can be written as

\[ \pi_{1c} = p_1 - \frac{1}{z_{1c}} p_c. \]
We then assume that the incentive compatibility constraint for producing good 1 with chips is quadratic,
\[ \theta_{1c}(Y_{1c}) = \theta_{1c}Y_{1c}^2. \]

In a world of isolated threats, production of good 1 produced via chips would be given by
\[ Y_{1c} = \sqrt{\frac{1}{\theta_{1c}} \frac{\pi_{1c}}{p_1}}. \]

**The Impact of Joint Threats.** As in Section 4.1, a hegemon that can provide both sovereign lending and chips (trade exports) to the SOE can create a joint threat. Since \( \alpha_{10} = 1 < \alpha_{1c} = 2 \), we know from Proposition 5 that the joint threat features \( Y_{10} > Y_{10}^0 \), and hence the borrowing capacity of the SOE is increased by the joint threat. This corresponds to one of the ways in which the Belt and Road is different than standard sovereign lending: that the loans and intermediate good provision are connected.

We now further document how combining the threats in sovereign debt with intermediate good provision changes the nature of sovereign borrowing and how this effect scales with the extent of trade linkages. We suppose that the hegemon now controls a set \( C \geq 1 \) input goods that have identical production technologies and stealing technologies as “chips,” but can each be used separately in production in the SOE. Under isolated threats, each input good is used in production in the same amount as above. When both sovereign lending and all input goods can be consolidated into a single joint threat by the hegemon, we obtain the following result.

**Proposition 7**  Suppose that the hegemon can provide sovereign lending and also the \( C \) intermediate inputs to the SOE. Then, total sovereign borrowing \( Y_{10} \) and surplus extracted \( T_1 \) are increasing in \( C \).

The core idea underlying this result is that if an SOE always relies on intermediate goods from the country it borrows from, and the lender country is able to consolidate the threats, the borrowing country’s debt capacity increases.\(^ {19} \) The reason is straightforward: sourcing intermediate goods from your lender gives them a credible way to punish you in event of default by cutting you off from intermediate good provision. The idea that sovereign debt is sustained by the degree of punishment has long been important in the literature, but is generally specified as an exogenous

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\(^{19}\) An implication of this section is that if a hegemon is able to link sovereign lending to its intermediate good provision, it will create a tight relationship between bilateral financing and the bilateral trade relationship. In the case of the Belt and Road, if the large amount of sovereign borrowing is only sustained because of the link created between the lending and import decision, then we would expect to see a tighter connection between borrowing and import decisions when the lending is being done by arms of the Chinese state. While anecdotal evidence seems to support this, a system examination of the relationship between the nature of bilateral sovereign financing and bilateral trade exposure would be a natural empirical application of this framework.
deadweight costs. Our mechanism is related to that proposed in Bulow and Rogoff (1989), whereby lenders seize your exports conditional on you defaulting, thereby generating a cost. More recently, Mendoza and Yue (2012) consider a quantitative sovereign debt model where country’s face an endogenous productivity cost of default that arises because a defaulting country loses access to trade finance, losing the ability to import intermediate goods, and is forced to switch to imperfect domestic substitutes for production.

In the context of the sovereign debt literature, this framework can be understood not only as providing a micro-foundation for the cost of default but, most importantly, it makes the costs of sovereign default a choice of the borrower and lender. Proposition 7 naturally sheds light on an important question about the Belt and Road Initiative: how do these low income countries carry this much debt? Reinhart et al. (2003) document the striking fact they dub "debt intolerance": low income developing countries tend to default on very low levels of sovereign debt, with a safe external debt threshold for developing countries being as low as potentially 15% of GDP. In light of this, it is quite remarkable to note that according to Horn et al. (2021), 18 countries owed Chinese official creditors alone more than 15% of their GDP, with 14 more owing at least 10% of their GDP. Through the lens of Proposition 7, we can understand China’s willingness to lend so much to development countries because it believed that by linking the lending and import decisions, and the Chinese government effectively consolidating the threats, the cost of defaulting on bilateral lending to China became sufficiently higher that it increased the countries’ debt carrying capacity. As an increasing number of countries are approaching debt distress today, we will see whether this belief was merited, particularly as discussed in the next section, the United States and other G7 countries work to make it less costly for countries to default on China.20

One question of crucial importance in policy is whether Chinese sovereign lending has been cheap or dear. Our model provides a nuanced but relevant answer. From the perspective of each borrower, Chinese sovereign financing is cheap and borrowers voluntarily enter into the contracts. Each borrower does not internalize the growing power of China as more and more borrowers enter its network. From the Chinese perspective, lending at cheaper rates is compensated by the surplus it extracts in other activities. Overall, from a systemic perspective, the question is whether the surplus generated should have been distributed more toward the borrowing economies, but the model points out that the global outcome has improved. Intuitively, the ability of countries to receive more financing and create infrastructure and jobs does generate surplus, it is not a zero sum-game, but China might be extracting most (all) of the surplus.

20 Debt capacity only increases when a lender is able to connect lending and intermediate good provision threats. This might not always be the case. For instance, much sovereign lending done by the United States takes the form of private sector investment in sovereign bond markets. This naturally leads to a large group of dispersed creditors. It is far less clear that in the event of a sovereign default on American bondholders the United States would be in a position to compel its firms to stop, say, exporting micro-chips. Exploring the link between the form of sovereign finance, import patterns, and debt capacity should be a promising avenue for an empirical application of this framework.
6 Non-Economic Objectives

We now extend our framework to study how a hegemon can use joint threats to pursue non-economic objectives. In addition to the retaliation against Lithuania discussed above, Reynolds and Goodman (2023) highlight how China dramatically cut salmon imports from Norway following Liu Xiaobo’s Nobel Prize, halted lending negotiations and infrastructure investments with Mongolia following the Dalai’s Lama’s visit, and several other instances. While economic tools were applied towards countries, China’s goal in these instances was fundamentally non-economic.

6.1 Diplomatic Concessions

We consider allowing for diplomatic concessions as part of the hegemon’s contract. Formally, let us suppose that the hegemon receives a private benefit $\chi > 0$ from a diplomatic concession from the SOE. The SOE incurs a private loss $L \geq 0$ from the concession.

If $L < \chi$, then there are bilateral gains from the diplomatic concession. The hegemon’s otherwise identical contract can then propose a lower side payment, $T_i^* - L$, in exchange for the diplomatic concession. It follows immediately that this is an optimal contract and that it is accepted by the SOE. By contrast if $L > \chi$, the hegemon finds it optimal not to require the diplomatic concession, which costs the hegemon $L$ in side payments to receive value $\chi < L$. Already this highlights that a hegemon may not always find it optimal to require such concessions when providing joint threats.

In general, this framework does not rule out the possibility that $T_i^* - L < 0$, and hence the diplomatic concession requires a negative side payment (i.e., the hegemon bribes the SOE). In practice, outright monetary bribes for diplomatic concessions are politically difficult. We therefore study the realistic restriction that the diplomatic concession is only feasible if the contract’s side payment is positive. We obtain the following result.

**Proposition 8** If diplomatic concessions must be accompanied by nonnegative side payments, then there exists a threshold $\overline{C}$ of number of traded goods such that the hegemon’s optimal contract forces the diplomatic concession if $C \geq \overline{C}$.

6.2 Hegemon Private Benefits from SOE Output

We next study noneconomic private benefits that the hegemon receives from SOE output. A leading example would be that, if the hegemon and the SOE share a defense treaty, the hegemon receives

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21In March of this year, Honduras ended diplomatic relations with Taiwan and established diplomatic relationships with China. Taiwan’s foreign minister claimed that the Honduran government requested $2.5 billion in aid from Taiwan to avoid switching recognition to China (https://www.reuters.com/world/honduras-government-says-ending-diplomatic-ties-with-taiwan-2023-03-26/). The Taiwanese government subsequently accused China of giving bribes to Honduran officials to generate the policy change. (https://focustaiwan.tw/politics/202303230006)
a private benefit from the SOE increasing its military capacity as its output expands.

The SOE has the sovereign debt technology with profits $\pi_{10} = \beta' - \beta$, price $p_1 = \beta'$, and stealing function $\theta_{10}(Y_{10}) = \theta_{10}Y_{10}$. The SOE can also purchase chips, $c$, which can be used to build up the SOE’s military, $m$. SOE military strength has efficiency $z_{mc}$ and has date 0 consumption equivalent value of $p_m$. Thus, the surplus (“profits”) the SOE earns from strengthening its military is $\pi_{mc} = p_m - \frac{1}{z_{ma}}p_a$. Lastly, we assume that the SOE’s ability to steal chips is $\theta_{mc}(Y_{mc}) = \theta_{mc}Y_{mc}^{\alpha_{mc}}$. Thus under isolated threats, the size of the SOE’s military is $Y_{mc}^o = \left(\frac{\pi_{mc}}{p_m\theta_{mc}}\right)^{1/\alpha_{mc}}$.

**Hegemon Problem.** We assume that the hegemon is a strategic ally of the SOE, and receives a private benefit $B_{mc} \geq 0$ per unit of scale of SOE military. This means the hegemon’s objective function is now $B_{mc}Y_{mc} + T_m$.

We suppose that the hegemon sells both chips and sovereign debt to the SOE, and so can consolidate a joint threat. We obtain the following result.

**Proposition 9** There is a $\overline{B} > 0$ such that if $B_{mc} \geq \overline{B}$, then $Y_{mc} > Y_{mc}^o$ and $T_m < 0$, that is the hegemon makes a negative side payment to the SOE and requires larger military spending than under isolated threats.

Intuitively, Proposition 9 tells us that if the private benefit of military is high enough to the hegemon, then the hegemon actually subsidizes the SOE to maintain a larger military. We interpret $T_m < 0$ as the hegemon buying the SOE’s debt at an inflated price in exchange for the SOE agreeing to spend more on its military. The joint threat that enforces this contract is that the hegemon will stop buying SOE debt at an inflated price if the SOE reneges on its military obligations, and conversely will stop selling chips if the SOE defaults on its debt.

## 7 Countering Economic Coercion

We have thus far focused on how a single great power can utilize economic interconnectedness to extract political and economic rents from a small open economy. As a price-taker in world markets, the SOE effectively has no tools with which to claim any of the surplus that is achieved by slackening some of its incentive compatibility constraints and shifting production towards high value activities that were previously underutilized. Recently, the question of how to counter such actions, in particular from China, has gained increasing policy attention and was a focus of the the recent G7 Hiroshima Leaders’ Communique. Shortly after the G7 meetings, the White House released a statement saying
The world has encountered a disturbing rise in incidents of economic coercion that seek to exploit economic vulnerabilities and dependencies and undermine the foreign and domestic policies and positions of G7 members as well as partners around the world... we will enhance collaboration by launching the Coordination Platform on Economic Coercion to increase our collective assessment, preparedness, deterrence and response to economic coercion.\(^{22}\)

While the recent focus on economic coercion has garnered headlines, the United States its allies have more broadly been pursuing policies to explicitly combat China’s growing influence via the Belt and Road. Most prominent is the G7 Partnership for Global Infrastructure and Investment (PGII), spearheaded by the Biden Administration.\(^{23}\) This attempt to bolster development lending to low and middle income countries reflects the fact that China has become the world’s largest bilateral lender, and now rivals the World Bank for development finance. Most recently on June 6, 2023, the European Commission and European Parliament reached an agreement to pursue an "Anti-Coercion Instrument." While the details are still being worked out, the European Commission announced the policy is expected to go into effect in fall 2023.\(^{24}\) Similar concerns about linking of threats can apply from the perspectives of China and other countries about the “weaponization” of the U.S. dollar via financial sanctions.\(^{25}\)

In this section, we aim to make sense of these changes. We begin by demonstrating how raising a country’s outside option weakens the power of consolidated threats. The better off a country is conditional on abandoning a relationship, the less a hegemon can extract from a given SOE by utilizing its leverage across input markets. Finally, we turn to how the framework can be extended to consider full-fledged competition between rival hegemons.

### 7.1 Countering Coercion by a Hegemon

Consider a third party country that wishes to counteract the power of the hegemon to extract surplus from the SOE. For simplicity, we focus on the case in which the hegemon seeks to maximize total side payments, as in Section 4.

We consider two ways that the third country could seek to combat coercion. First, it could look to raise the outside option of the SOE by pledging a side payment \(B_i \geq 0\) to each firm \(i \in \mathcal{I}_m\) to refuse the hegemon’s offered contract. In the recent "G7 Leaders’ Statement on Economic Resilience...\(^{22}\)https://www.whitehouse.gov/briefing-room/statements-releases/2023/05/20/g7-leaders-statement-on-economic-resilience-and-economic-security\(^{23}\)https://www.whitehouse.gov/briefing-room/statements-releases/2023/05/20/fact-sheet-partnership-for-global-infrastructure-and-investment-at-the-g7-summit/\(^{24}\)European Commission.

25More generally, one can argue that the United States and its allies are combating China's influence by effectively aiming to make it easier for debtor countries to reduce dependence or default on China. We saw a major push of public diplomacy in the negotiation of the Debt Service Suspension Initiative (DSSI) and the G20 Common Framework in 2020 that called for generous terms from bilateral creditors to low income countries in sovereign debt negotiations.
and Economic Security” from May 20, 2023, we can think of this representing proposals to "build resilient global supply chains" to make it easier to switch in the event of an import cutoff, and other components of the policy to make transfers to firms harmed by actions deemed to be economic coercion from China.\textsuperscript{26}

Formally, the side payment $B_i$ transforms the participation constraint of firm $i$ into

$$V_i(S'_i, Y_{im}, T_i) \geq V_i(S_i) + B_i,$$

which effectively increases the bargaining power of each firm in the SOE against the hegemon. The following result characterizes the effect of increases in $B_i$ on the optimal contract offered by the hegemon.

**Proposition 10** Let $i$ be an extraction point for the hegemon. Then, an increase in the outside option $B_i$ increases output $Y_{ij}$ for all $j \in s_m$ and decreases the side payment $T_i$ under the hegemon's optimal contract. Output $Y_{ij}$ is unaffected for $j \notin s_m$. The optimal joint threat is unaffected.

Proposition 10 reveals that raising the outside option of extraction points in the SOE not only counteracts side payments from the hegemon, but also bolsters output among the joint threats created by the hegemon. Intuitively by raising the outside option of a firm that serves as an extraction point, the third country raises the value of that firm refusing the hegemon’s contract. This forces the hegemon to make a concession in the form of a lower side payment. Moreover because the side payment is lower, incentive compatibility is slackened and the firm can maintain higher production levels.

### 7.1.1 Countering Coercion: Carrots versus Sticks

Proposition 10 considers an anti-coercion measure of raising the outside option of firms in the SOE. We now consider instead a different anti-coercion measure: taxing firms in the SOE for operating under the hegemon’s contract. Such measures impose punishments on the SOE for engaging with the hegemon (sticks), rather than rewarding the SOE for not engaging with the hegemon (carrots).

Formally, we model this as a required transfer $G_i$ to the third party country in the event that firm $i$ accepts the hegemon’s contract and maintains that relationship without stealing.\textsuperscript{27} For example, this might take the form of markups (tariffs) on SOE imports from the third country, or as sanctions. This transforms the participation constraint of firm $i$ into

$$V_i(S'_i, Y_{im}, T_i + G_i) \geq V_i(S_i).$$

\textsuperscript{26}https://www.whitehouse.gov/briefing-room/statements-releases/2023/05/20/g7-leaders-statement-on-economic-resilience-and-economic-security/

\textsuperscript{27}Therefore, the transfer $G_i$ is only enforced if $i$ makes its payment to the hegemon, that is the relationship with the hegemon is maintained.
Denote $T_i^*, Y_{im}^*$ the solution to the hegemon’s contract with $G_i = 0$. We obtain the following result.

**Proposition 11** Let $i$ be an extraction point for the hegemon. Then, the hegemon’s optimal contract sets $T_i = T_i^* - G_i$ and $Y_{ij} = Y_{ij}^*$ for all $j \in J_i$. An increase in the punishment $G_i$ reduces the side payment $T_i$ to the hegemon but does not affect output.

Similar to carrots (Proposition 10), sticks in the form of punishments for engaging with the hegemon are able to reduce the size of the side payment to the hegemon by reducing the value the firm gains from contracting with the hegemon. The hegemon must therefore offer a lower side payment for the firm to be willing to offer the contract. However unlike carrots which were able to raise output, punishments for continued engagement with the hegemon only reduce side payments to the hegemon but do not bolster output. The reason is that the firm is tempted to steal from the hegemon in order to avoid punishments from the third country, which in turn tightens incentive compatibility. Taken together, Propositions 10 and 11 suggest a possible advantage to bolstering resilience of countries to coercion over punitive measures.

### 7.2 Hegemonic Competition

We next set up the problem of competition between hegemons. For simplicity, we will assume there are two hegemons, $m_1, m_2 \in J \setminus I$.

Hegemons play a Nash game offering contracts as follows. We denote hegemon $m \in \{m_1, m_2\}$ as offering the contract $(S'_{im}, X_{im}, T_{im})$. The problem is as in Section 3 if the firm only accepts one contract. On the other hand if firm $i$ accepts both contracts, the joint threats $S'_{im_1}$ and $S'_{im_2}$ are consolidated into a single joint threat. This joint threat is constructed by consolidated threats of the two hegemons: if a joint threat $(s_1, \ldots, s_n)$ used to form $S'_{im_1}$ and a joint threat $(\hat{s}_1, \ldots, \hat{s}_n)$ used to form $S'_{im_2}$ have a comment element $s$, then they consolidate to a single threat $(s_1, \ldots, s_n, \hat{s}_1, \ldots, \hat{s}_n)$, with this process iterating unless no more joint threats can be formed. We denote $S'_i$ the joint threat formed from this process. Observe therefore that $S'_i$ is a joint threat of both $S'_{im_1}$ and $S'_{im_2}$.

The firm receives value $V_i(S'_i, \{X_{im}\}, \{T_{im}\})$ when accepting both contracts, value $V_i(S'_{im_1}, X_{im}, T_{im})$ from accepting only the contract of hegemon $m$, and value $V_i(S_i)$ from refusing both contracts. Without loss of generality, we can restrict attention to the case where the firm accepts both contracts.

The firm chooses to accept both contracts if the following three constraints hold:

$$V_i(S'_i, \{X_{im}\}, \{T_{im}\}) \geq V_i(S'_{im_1}, X_{im_1}, T_{im_1}).$$

$$V_i(S'_i, \{X_{im}\}, \{T_{im}\}) \geq V_i(S'_{im_2}, X_{im_2}, T_{im_2}).$$

\[28\] If the firm accepted only one contract, we could instead define the other hegemon as proposing a contract featuring the same allocation as arose in that case.
\[ V_i(S'_i, \{X_{im}\}, \{T_{im}\})) \geq V_i(S_i). \]

**Disjoint Hegemonic Threats** We begin with a benchmark irrelevance result under which competition is irrelevant. Hegemons’ direct transmission sets are disjoint if \( S_{im1}^D \cap S_{im2}^D = \emptyset \), that is there is no action \( s \) that can be consolidated under direct transmission by both hegemons. In this case, there is no competition between hegemons.

**Proposition 12** Suppose the hegemons’ direct transmission sets are disjoint, that is \( S_{im1}^D \cap S_{im2}^D = \emptyset \). Then, each hegemon’s contract is the same as in the single hegemon problem.

Proposition 12 provides a simple benchmark case in the competition model: if two hegemons have no overlap in their direct transmission links, then they simply “divide and conquer,” each taking their own surplus from the joint threats created. At the same time, there is no joint surplus created. Proposition 12 arises out of the separability property of firm optimization across threats.

Analyzing the full case of overlapping hegemonic threats, where there is more scope for strategic competition, is part of our ongoing work.

### 8 Conclusion

Geopolitical competition between China and the United States is a major development in the global international order. We present a framework that allows for the analysis of how geopolitical power through the financial and trade network can be exerted, how the consolidation of disparate threats helps understand major developments like the Belt and Road, and the desire of the United States to win back some of this influence explains recent policy developments like the PGII. This framework is a starting point for a host of future theoretical and empirical analysis.
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A Proofs

A.1 Proof of Proposition 1

Under isolated threats, incentive compatibility is

\[ p_i \theta_{ij}(Y_{ij}) Y_{ij} \leq \pi_{ij} Y_{ij}. \]

From Assumption 1 and that \( \theta_{ij} \) is increasing, incentive compatibility binds, and hence we have

\[ \theta_{ij}(Y_{ij}) = \frac{\pi_{ij}}{p_i} \]

from which the result follows.

A.2 Proof of Proposition 2

We break the proof into the if and only if statements.

If. Suppose therefore that there exist \( s', s'' \in \{s_1, \ldots, s_n\} \) such that \( \lambda_{s'} > \lambda_{s''} \) (without loss of generality). Let us define incentive compatibility for \( s \in S_i \) as

\[ \sum_{j \in s} \left[ p_i \theta_{ij}(Y_{ij}) Y_{ij} - \pi_{ij} \right] Y_{ij} \leq \tau_s \]

where \( \tau_s \) is a constant that is set equal to zero in the competitive model. Observe that a joint threat constructed from \( s' \) and \( s'' \) creates a constraint

\[ \sum_{j \in s' \cup s''} \left[ p_i \theta_{ij}(Y_{ij}) Y_{ij} - \pi_{ij} \right] Y_{ij} \leq \tau'_s + \tau'_{s''}. \]

Therefore, a weaker expansion of the incentive compatible set than creating a joint threat is to instead increase \( \tau'_{s'} \) and decrease \( \tau'_{s''} \) in such a manner that \( \tau'_{s'} + \tau'_{s''} = 0 \). If this perturbation strictly raises value, then creating a joint threat also strictly increases value.

The Lagrangian of firm \( i \) is given by

\[ \mathcal{L}(Y_i, \lambda^*|S_i, \tau) = \sum_{j \in J_i} \pi_{ij} Y_{ij} - \sum_{s \in S_i} \lambda_s^* \sum_{j \in s} \left[ p_i \theta_{ij}(Y_{ij}) Y_{ij} - \pi_{ij} \right] Y_{ij} - \tau_s \]

Therefore, we have

\[ \frac{\partial \mathcal{L}(Y_i, \lambda^*|S_i, \tau)}{\partial \tau_s} \bigg|_{\tau=0} = \lambda_s^*. \]

As a result, we can write

\[ \frac{\partial \mathcal{L}(Y_i, \lambda^*|S_i, \tau)}{\partial \tau_{s'}} \bigg|_{\tau=0} - \frac{\partial \mathcal{L}(Y_i, \lambda^*|S_i, \tau)}{\partial \tau_{s''}} \bigg|_{\tau=0} = \lambda_{s'}^* - \lambda_{s''}^* > 0. \]

Hence, there is an \( \epsilon > 0 \) such that if we define \( \tau_s \) by \( \tau_{s'} = \epsilon, \tau_{s''} = -\epsilon \), and \( \tau_s = 0 \) for \( s \neq s', s'' \), then

\[ V_i(S_i, \tau_e) > V_i(S_i, 0) = V_i(S_i). \]
Moreover as above, \( V_i(S_i''') \geq V_i(S_i'') \geq V_i(S_i', \tau_e) \) when \( S_i' \) is a joint threat formed from \((s', s'')\) and \( S_i'' \) is a joint threat formed from \((s_1, \ldots, s_n)\).

Therefore, \( V_i(S_i''') > V_i(S_i) \), and hence \((s_1, \ldots, s_n)\) is a pressure point of \( i \).

**Only If.** Suppose that \( \lambda^*_s = \ldots = \lambda^*_n \). Denote \( Y^*_i \) the optimal allocation under action set \( S_i \). Observe that the firm’s objective function is concave while each constraint is convex. Denoting \( \mathcal{L}(Y_i, \lambda|S_i) \) the Lagrangian associated with \( S_i \), then there exists a \( \lambda^* \in \mathbb{R}_+^{\left|S_i\right|} \) such that \( \mathcal{L}(Y_i^*, \lambda^*|S) \geq \mathcal{L}(Y_i, \lambda^*|S) \) for all \( Y_i \in \mathbb{R}_+^f \) (Luenberger Section 8.3 Corollary 1), which are precisely the Lagrange multipliers highlighted. Now, consider the relaxed problem achieved by defining a pressure point \((s_1, \ldots, s_n)\) and joint threat \( S_i' \). For \( \mu \in \mathbb{R}_+^{\left|S_i\right|} \), define

\[
\mathcal{L}(Y_i, \mu|S_i') = \sum_j \pi_{ij} Y_{ij} - \sum_{s \in S_i'} \mu_{s} \sum_{j \in s} \left[p_i \theta_{ij}(Y_{ij}) - \pi_{ij}\right] Y_{ij}.
\]

Let us define in particular the multiplier \( \mu^*_s = \lambda^*_s \) for \( s \in S_i \setminus \{s_1, \ldots, s_n\} \) and \( \mu^*_{\cup_{s=1}^n s} = \lambda^*_{s_1} = \ldots = \lambda^*_{s_n} \). Then,

\[
\mathcal{L}(Y_i, \mu^*|S_i') = \sum_j \pi_{ij} Y_{ij} - \sum_{s \in S_i \setminus \{s_1, \ldots, s_n\}} \mu^*_{s} \sum_{j \in s} \left[p_i \theta_{ij}(Y_{ij}) - \pi_{ij}\right] Y_{ij} - \mu^*_{\cup_{s=1}^n s} \sum_{j \in \cup_{s=1}^n s} \left[p_i \theta_{ij}(Y_{ij}) - \pi_{ij}\right] Y_{ij}.
\]

Using Assumption 2, \( s' \cap s'' = \emptyset \) for any \( s', s'' \in \{s_1, \ldots, s_n\} \), and therefore

\[
\mu^*_{\cup_{s=1}^n s} \sum_{j \in \cup_{s=1}^n s} \left[p_i \theta_{ij}(Y_{ij}) - \pi_{ij}\right] Y_{ij} = \sum_{s \in \{s_1, \ldots, s_n\}} \lambda^*_{s} \sum_{j \in s} \left[p_i \theta_{ij}(Y_{ij}) - \pi_{ij}\right] Y_{ij},
\]

which follows since \( \mu^*_{\cup_{s=1}^n s} = \lambda^*_{s} \) for all \( s \in \{s_1, \ldots, s_n\} \) by construction. Thus substituting in above, we have

\[
\mathcal{L}(Y_i, \mu^*|S_i') = \sum_j \pi_{ij} Y_{ij} - \sum_{s \in S_i} \lambda^*_{s} \sum_{j \in s} \left[p_i \theta_{ij}(Y_{ij}) - \pi_{ij}\right] Y_{ij} = \mathcal{L}(Y_i, \lambda^*|S_i).
\]

Therefore since \( \mathcal{L}(Y_i^*, \lambda^*|S_i) \geq \mathcal{L}(Y_i, \lambda^*|S_i) \) for all \( Y_i \in \mathbb{R}_+^f \), we have found a \( \mu^* \geq 0 \) such that

\[
\mathcal{L}(Y_i^*, \mu^*|S_i') \geq \mathcal{L}(Y_i, \mu^*|S_i') \quad \forall Y_i \in \mathbb{R}_+^f.
\]

Therefore, \( Y_i^* \) is also an optimal policy under joint threat \( S_i' \) (Luenberger Section 8.4 Theorem 1). Therefore, \( V_i(S_i') = V_i(S_i) \) and hence \((s_1, \ldots, s_n)\) is not a pressure point. This concludes the proof.

**A.3 Proof of Lemma 1**

Suppose by way of contradiction the hegemon offered any other feasible (under direct transmission) joint threats \( S_i' \), with productions \( Y_{im} \) and side payments \( T_i \). Then \( S_i'^{\text{max}} \) is a joint threat from \( S_i' \), and hence

\[
V_i(S_i'^{\text{max}}, Y_{im}, T_i) \geq V_i(S_i', Y_{im}, T_i).
\]

Hence the contract \((S_i'^{\text{max}}, Y_{im}, T_i)\) satisfies all participation constraints and yields the same payoff to the hegemon. Therefore, the hegemon finds it weakly optimal to offer a contract with \( S_i'^{\text{max}} \).
A.4 Proof of Proposition 3

Suppose first that $S^D_i$ is not a pressure point of $i$. Then, $V_i(S_i) = V_i(S_i^{t,\max}) > V_i(S_i^{t,\max}, Y_{im}, T_i)$ for any $T_{im} > 0$. But this violates the participation constraint (4), hence $i$ is not an extraction point.

Suppose next that $S^D_i$ is a pressure point, and hence $V_i(S_i^{t,\max})$ is a pressure point. Propose the allocation $T_i = \epsilon$ and propose $Y_{im}$ such that $\pi_{im} Y_{im} - \theta_{im}(Y_{im}) Y_{im} = \pi_{im} Y_{im}^{\max} - \theta_{im}(Y_{im}) Y_{im}^{\max} + \epsilon$, where $Y_{im}^{\max}$ is the allocation under $S_i^{t,\max}$. Observe that $Y_{im} < Y_{im}^{\max}$. Therefore, $\pi_{im} Y_{im} - \theta_{im}(Y_{im}) Y_{im} - T_i = \pi_{im} Y_{im}^{\max} - \theta_{im}(Y_{im}) Y_{im}^{\max}$. Thus the firm $i$ optimization problem yields $Y_{ij} = Y_{ij}^{\max}$ for all $j \neq m$. Observe further that profit gain to the firm from this allocation is

$$V_i(S_i^{t,\max}, Y_{im}, T_i) - V_i(S_i) = V_i(S_i^{t,\max}) - V_i(S_i) + \pi_{im}(Y_{im} - Y_{im}^{\max}) - \epsilon$$

Hence since $S^D_i$ is a pressure point with $V_i(S_i^{t,\max}) - V_i(S_i) > 0$, by continuity there exists a $\epsilon > 0$ such that the participation constraint binds and $T_i = \epsilon > 0$. But as this was an arbitrarily chosen contract, the optimal hegemon contract has $T_i^* \geq \epsilon > 0$, and hence firm $i$ is an extraction point.

A.5 Proof of Proposition 4

Observe from the hegemon’s problem that the participation constraint binds, since if it did not then the hegemon could increase $T_i$ and increase surplus. Thus, we have

$$V_i(S_i^{t,\max}, Y_{im}, T_i) = V_i(S_i)$$

$$\sum_{j \in J_i} \pi_i \Delta Y_{ij} - T_i = 0$$

from which the result follows.

A.6 Proof of Proposition 7

The hegemon problem is

$$\max_{\{Y_{10}, Y_{1c}, \theta_{1c}\} \in \{1, \ldots, c\}} T_1$$

subject to

$$\theta_{10} Y_{10}^2 + \sum_{c=1}^C \theta_{1c} Y_{1c}^3 \leq \pi_{10} Y_{10} + \sum_{c=1}^C \pi_{1c} Y_{1c} - T_1$$

$$\pi_{10} Y_{10}^\circ + C \pi_{10} Y_{1c}^\circ \leq \pi_{10} Y_{10} + \sum_{c=1}^C \pi_{1c} Y_{1c} - T_1$$

Since all inputs $c$ are identical, the hegemon’s contract thus features $Y_{0c} = Y_{0C}$ for all $c$. Thus we can rewrite this as

$$\max_{\{Y_{10}, Y_{1c}\}} T_1$$

subject to

$$\theta_{10} Y_{10}^2 + C \theta_{1C} Y_{1C}^3 \leq \pi_{10} Y_{10} + C \pi_{1C} Y_{1C} - T_1$$

$$\pi_{10} Y_{10}^\circ + C \pi_{10} Y_{1c}^\circ \leq \pi_{10} Y_{10} + C \pi_{1C} Y_{1C} - T_1$$

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Suppose that the incentive constraint did not bind. Then the hegemon could increase production, relax the participation constraint, and increase the side payment marginally. Thus the incentive constraint binds. The participation constraint also binds by the usual logic. Therefore, we can define $T_1$ from binding IC as

$$\theta_{10} Y_{10}^2 + C\theta_{1C} Y_{1C}^3 = \pi_{10} Y_{10} + C\pi_{1C} Y_{1C} - T_1.$$ 

Substituting into both the objective function and the participation constraint, we obtain the optimization problem

$$\max_{\{y_{10}, y_{1C}\}} \pi_{10} Y_{10} + C\pi_{1C} Y_{1C} - \left(\theta_{10} Y_{10}^2 + C\theta_{1C} Y_{1C}^3\right)$$

subject to

$$\theta_{10} Y_{10}^2 + C\theta_{1C} Y_{1C}^3 = \pi_{10} Y_{10} + C\pi_{10} Y_{1C}^C$$

Defining the associated Lagrangian with lagrange multiplier $\lambda$ on the constraint, we obtain the optimality conditions

$$0 = \pi_{10} - (1 + \lambda) 2\theta_{10} Y_{10}$$

$$0 = \pi_{1C} - (1 + \lambda) 3\theta_{1C} Y_{1C}^2$$

Thus consolidating and using the definitions of $Y_{10}^C$ and $Y_{1C}^C$, we have

$$\frac{Y_{1C}^2}{Y_{1C}^C} = \frac{2}{3} \frac{Y_{10}}{Y_{10}^C}.$$

Therefore, we must have $Y_{10} > Y_{10}^C$ and $Y_{1C} < Y_{1C}^C$ under the hegemon’s contract.

Finally, we show that $Y_{10}$ increases in $C$. Totally differentiating the constraint in $C$, we have

$$2\theta_{10} Y_{10} \frac{\partial Y_{10}}{\partial C} + 3C\theta_{1C} Y_{1C}^2 \frac{\partial Y_{1C}}{\partial C} + \theta_{1C} Y_{1C}^3 = \pi_{10} Y_{1C}^C,$$

since $Y_{1C}^C$ and $Y_{10}^C$ are invariant to $C$. From the optimality condition above, we have

$$\frac{\partial Y_{1C}}{\partial C} = \frac{1}{3} \frac{Y_{10}}{Y_{1C}} \frac{\partial Y_{10}}{\partial C}$$

and so substituting in above we obtain

$$\left[2\theta_{10} Y_{10} + 3C\theta_{1C} Y_{1C}^2 \frac{1}{Y_{1C}} \frac{Y_{10}}{Y_{1C}}\right] \frac{\partial Y_{10}}{\partial C} = \pi_{10} Y_{1C}^C - \theta_{1C} Y_{1C}^3.$$ 

Finally observe that because $Y_{1C} < Y_{1C}^C$, then we have

$$\pi_{10} Y_{1C}^C - \theta_{1C} Y_{1C}^C > \pi_{10} Y_{1C}^C - \theta_{1C} Y_{1C}^C = 0$$

and hence we have $\frac{\partial Y_{10}}{\partial C} > 0$, completing the proof.

A.7 Proof of Proposition 8

Proposition 8 follows from the proof of Proposition 7. Observe that $\frac{\partial T}{\partial C} > 0$. To see why, observe that with $C + 1$ varieties, the hegemon could achieve the $C$ variety contract and side payment by offering the competitive allocation on the $C + 1$-th variety and the $C$-variety side payment and
allocation on varieties 1, . . . , C. Thus, $T_i$ is increasing in $C$, hence the existence of the threshold.

### A.8 Proof of Proposition 9

Following the usual logic, the incentive constraint must bind, else the hegemon can increase military capacity, relax the participation constraint, and improve welfare. Hence,

$$T_m = \pi_{mc}Y_{mc} - p_m\theta_{mc}(Y_{mc})Y_{mc} + \pi_{10}Y_{10} - p_1\theta_{10}(Y_{10})Y_{10}.$$ 

Therefore, we can represent the hegemon’s problem as

$$\max_{Y_{ma}, Y_{10}} B_{mc}Y_{mc} + \pi_{mc}Y_{mc} - p_m\theta_{mc}(Y_{mc})Y_{mc} + \pi_{10}Y_{10} - p_1\theta_{10}(Y_{10})Y_{10}$$

subject to

$$\pi_{mc}Y^\circ_{mc} + \pi_{10}Y^\circ_{10} \leq p_m\theta_{mc}(Y_{mc})Y_{mc} + p_1\theta_{10}(Y_{10})Y_{10}.$$ 

Unlike previous examples, the hegemon’s problem need not feature a binding participation constraint. We study solutions in which the participation constraint does not, and characterize conditions under which these solutions are valid. When the participation constraint does not bind, we have separable solutions,

$$\theta'_{mc}(Y_{mc})Y_{mc} + \theta_{mc}(Y_{mc}) = \frac{B_{mc} + \pi_{mc}}{p_m},$$

$$\theta'_{10}(Y_{10})Y_{10} + \theta_{10}(Y_{10}) = \frac{\pi_{10}}{p_1}.$$ 

Given the chosen functional form, this yields solutions $Y_{10} = \frac{1}{2} \frac{\pi_{10}}{p_1} = \frac{1}{2} Y^\circ_{10}$ and

$$Y^\alpha_{mc} = \frac{B_{mc} + \pi_{mc}}{(1 + \alpha_{mc})\pi_{mc}Y^\circ_{mc}}.$$ 

Therefore, for sufficiently large $B_{mc}$, $Y_{mc} > Y^\circ_{mc}$. Moreover note that $p_m\theta_{mc}(Y_{mc})Y_{mc}Y_{mc} - \pi_{mc}Y_{mc}$ grows in $B$, and hence $T_m$ decreases in $B_{mc}$, eventually turning negative, while $\pi_{mc}Y_{mc} - T_m + \pi_{10}Y_{10}$ increases in $B_{mc}$. Thus, there exists a threshold $\overline{B}$ such that $Y_{mc} > Y^\circ_{mc}$, $T_m < 0$, and the participation constraint is slack if $B_{mc} > \overline{B}$.

### A.9 Proof of Proposition 10

Observe that $S_i^{t, \text{max}}$ remains the optimal joint threat and that the optimization problem of the hegemon remains separable across firms. We can write the hegemon’s optimization problem then as

$$\sup_{T_i, Y_{im}} T_i \text{ s.t. } V_i(S_i^{t, \text{max}}, Y_{im}, T_i) \geq V_i(S_i) + B_i$$

Observe that the participation constraint must bind, else the hegemon could increase surplus by increase $T_i$. Writing the hegemon’s Lagrangian as $\mathcal{L} = T_i + \lambda \left[ V_i(S_i^{t, \text{max}}, Y_{im}, T_i) - V_i(S_i) - B_i \right]$, then by Envelope Theorem we have

$$\frac{\partial T_i}{\partial B_i} = -\lambda < 0.$$ 

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thus the transfer decreases in the outside option $B_i$.

Next, observe that the hegemon chooses $Y_{im}$ optimally from the perspective of firm $i$, conditional on the side payment, in order to maximize the side payment. Thus we can write $\{Y_{ij}\}_{j \in s_m}$ as solving

$$\max_{j \in s_m} \pi_{ij} Y_{ij} \quad s.t. \quad \sum_{j \in s_m} p_i \theta_{ij}(Y_{ij}) Y_{ij} \leq \sum_{j \in s_m} \pi_{ij} Y_{ij} - T_i.$$ 

From here, the FOC for optimality of allocation is

$$0 = \pi_{ij} + \lambda_{s_m} \left[ \frac{d \theta_{im}(Y_{im}) Y_{im}}{d Y_{im}} \right],$$

which in turn yields

$$\frac{\pi_{ij}}{\pi_{im}} = \frac{\pi_{im} - p_i \frac{d \theta_{im}(Y_{im}) Y_{im}}{d Y_{im}}}{\pi_{im} - p_i \frac{d \theta_{im}(Y_{im}) Y_{im}}{d Y_{im}}},$$

or rearranging,

$$\pi_{ij} \frac{d \theta_{im}(Y_{im}) Y_{im}}{d Y_{im}} = \pi_{im} p_i \frac{d \theta_{ij}(Y_{ij}) Y_{ij}}{d Y_{ij}}.$$

Since $\theta_{ij}(Y_{ij}) Y_{ij}$ is increasing and convex by assumption, then a decrease in $T_i$ increases $Y_{ij}$ for all $j \in s_m$.

Finally for any $j \not\in s_m$, the associated firm $i$ optimization problem is

$$\max_{j \in s} \pi_{ij} Y_{ij} \quad s.t. \quad \sum_{j \in s} p_i \theta_{ij}(Y_{ij}) Y_{ij} \leq \sum_{j \in s} \pi_{ij} Y_{ij}.$$ 

This optimization problem is invariant to $T_i$, and so is unaffected by the outside option.

### A.10 Proof of Proposition 11

Define $\hat{T}_i = T_i + G_i$. Then, the hegemon’s decision problem is equivalently represented as

$$\sup \hat{T}_i - G_i \quad s.t. \quad V_i(S_{i}^{\text{max}}, Y_{im}, \hat{T}_i) \geq V_i(S_i)$$

Therefore, we have an optimization problem that is invariant to $G_i$, yielding solutions $\hat{T}_i = T_i^*$ and $Y_{im} = Y_{im}^*$. Thus $T_i = T_i^* - G_i$ and output (across all $j \in J_i$) is invariant to $G_i$.

### A.11 Proof of Proposition 12

Since $S_{im_1}^D \cap S_{im_2}^D = \emptyset$, then $S_i' = \{S_i \setminus S_{im_1}^D, S_{im_2}^D, S_{im_1}^D, S_{im_2}^D\}$ (where $S_{im}^D$ represents their individual maximal joint threat) and hence we can write

$$V_i(S_i', \{X_{im}\}, \{T_{im}\}) = \sum_{s \in S_{im_1}^D \cup S_{im_2}^D} v_i(s) + v_i(S_{im_1}^D, X_{im_1}, T_{im_1}) + v_i(S_{im_2}^D, X_{im_2}, T_{im_2}).$$

Therefore, the three constraints are equivalently written as

$$v_i(S_{im_1}^D, X_{im_1}, T_{im_1}) \geq \sum_{s \in S_{im_1}^D} v_i(s)$$
\[ v_i(S_{im_2}', X_{im_2}, T_{im_2}) \geq \sum_{s \in S_{im_2}'} v_i(s) \]

\[ v_i(S_{im_1}', X_{im_1}, T_{im_1}) + v_i(S_{im_2}', X_{im_2}, T_{im_2}) \geq \sum_{s \in S_{im_1}'} v_i(s) + \sum_{s \in S_{im_2}'} v_i(s) \]

The first two constraints holding implies the third also holds, and hence we can drop the third constraint. But then the decision problem of the two hegemons collapses to separable problems of maximizing their individual side payment subject to the same participation constraint as in the single hegemon model. Hence the solution is the same.